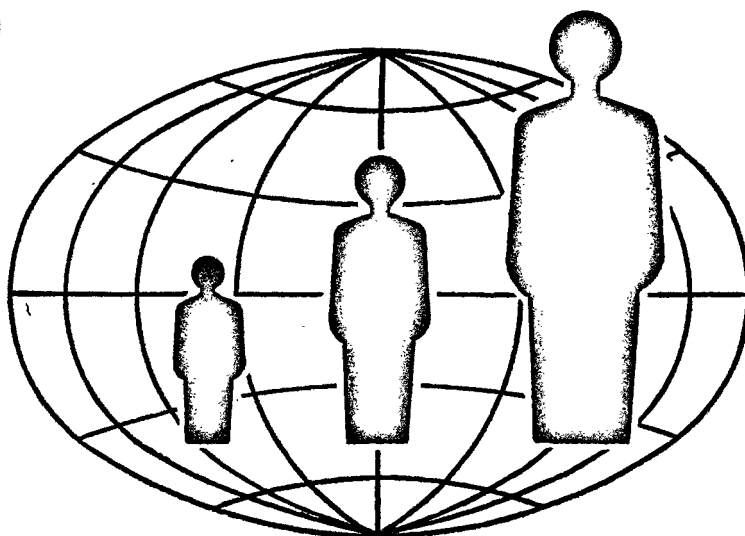




WORLD POPULATION CONFERENCE, 1965

Volume II: FERTILITY

FAMILY PLANNING

MORTALITY

UNITED NATIONS



Department of Economic and Social Affairs

PROCEEDINGS OF THE WORLD POPULATION CONFERENCE

Belgrade, 30 August - 10 September 1965

**Volume II: SELECTED PAPERS
AND SUMMARIES**

FERTILITY

FAMILY PLANNING

MORTALITY

UNITED NATIONS

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PREFACE

The *Proceedings of the World Population Conference, 1965*, are published in four volumes, arranged as follows:

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Summary report

Organization of the Conference
Programme of meetings
Summary report of meetings
Officers of the Conference and members of committees
List of participants and observers

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Selected papers and summaries of the papers for meetings

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- A.1. Fertility
 - B.1. Factors and patterns of fertility in areas where fertility is relatively high
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- A.9. Demographic aspects of savings, investments, technological development and industrialization
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- B.11. Definition and measurement of economically active population, employment, unemployment and underemployment
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All papers contributed by authors invited by the organizers for their meetings and a few selected volunteered papers are published in the alphabetical order of their authors within each meeting. Only summaries of the other volunteered papers contributed by participants are included in the *Proceedings*.

In addition, twenty-six background papers were prepared to summarize the state and recent developments of knowledge on the topics of almost all meetings and to provide a basis for discussion at the Conference. Most of these background papers prepared for topical meetings of the Conference will form the basis of chapters on the revised edition of *The Determinants and Consequences of Population Trends* and hence are not included in the Conference *Proceedings*.

All cross-references to papers contained in these volumes are given in the following form:

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Meeting A.4

FUTURE POPULATION TRENDS AND PROSPECTS

PAPERS

Future population of the Argentine Republic

JORGE V. ARÉVALO

[Translated from Spanish]

1. For the past fifty years Argentina has had a lower birth rate than most Latin American countries. The rate has changed relatively little in the last thirty years, fluctuating around 25 per 1,000 population, while mortality has declined to about 8 per 1,000. These two factors have served to produce a relatively old age structure—31 per cent between ages 0 and 14 years and 6 per cent of ages 65 years and over. In addition, the large number of immigrants who have entered Argentina at various times has affected the size of the population and its sex and age structure.

2. A single projection of mortality was made by a method developed by Arthur A. Campbell¹ and adapted to the structure and level of mortality in 1960. The resultant expectations of life at birth for males and females respectively were 64.8 and 70.5 for the five-year period 1960-1965, 70.2 and 75.0 for the period 1975-1980, and 72.4 and 76.3 for the period 1995-2000.

3. Two assumptions were made concerning fertility, one of constant fertility and the other of decreasing fertility. In the former, a 1.46 value for the gross reproduction rate was maintained to the year 2000. In the latter, the observed decline in the gross reproduction rate from 1.54 in 1955 to 1.46 in 1960 was projected linearly to 1975, by which time it amounted to 1.22; it was then held constant at 1.22 to the year 2000.

4. As regards migration, it is well known that this is a highly variable phenomenon. Two extreme assumptions were therefore made: one

of zero migration from 1960 onwards and the other of an annual net balance to the year 2000 of 45,000 migrants, this being the figure for 1961-1962.

5. The projections made with the constant and declining fertility assumptions will hereafter be called projections *A* and *B* respectively, and those made without and with migration will be called, respectively, projections 1^a and 2^a.

6. The masculinity ratio (males/females, per 100 population), which was 103.1 in 1960, remains above 100 although a decline is noted. In the two projections with zero migration, the average figure by 1980 is 100.5, while in the projections including migration it is 101.3. The figures for 1980 remain virtually unchanged up to the year 2000. This demonstrates the strong residual effect of past migrations, in which males predominated and which more than offset the mortality differences between the sexes. While the masculinity ratios in the projections including migration are obviously higher than in the case of zero migration, they do not maintain the 1960 level for the simple reason that the migratory movements which gave rise to that year's level were considerably greater than the migration assumed in the projections.

7. Comparison of the age and sex structures in table 1 shows an increase, varying with the projection and the period, in the extent of the differences. The differences in the sex structure become greater in all age groups. An increasing proportion of females is found in the 65 years and over group, and although the proportion of males in this age group also increases, the rate is not as high because of differential mortality and the larger male immigration, which has a diminishing effect on the

¹A. A. Campbell, *A method of projecting mortality rates based on postwar international experience* (U.S. Bureau of the Census, U.S. Government Printing Office, International Population Reports, Series P-91, No. 5, Washington, D.C. 1958).

size of the 65 years and over group. What is clearly seen is the process of population aging.

8. Table 2 shows the birth rates corresponding to the four projections, and it is to be noted that in general they decline uninterruptedly to the very end. It will be well to analyse them separately. Projection 1^a, as will be recalled, is based on the assumption of constant fertility. The slight decrease in the birth rate is due to the declining size of the female 15-49-year age group as a proportion of the total population and to the changes in the internal structure of this group, which determines the general fertility rate or, in other words, the ratio of live births to the total number of females in this group. The importance of the first factor decreases steadily until 1980; it then makes a slight recovery but afterwards declines again to the year 2000. By contrast, the general fertility rate fluctuates in both directions and is in fact responsible for the slight increase in the birth rate during the periods 1970-1975 and 1975-1980. In the other cases, even where the general fertility rate is higher than in 1960, the first factor is the decisive one. This means that the influence of changes in the group as a whole in relation to the total population are more significant than the changes within the group. In projection 2^a the decisive factor in the declining crude birth rate is the decreasing fertility assumption, which causes the age-specific fertility rates to fall to substantially below the initial rates.

9. The death rates in table 3 are obviously quite similar for the different projections, since there was only one mortality assumption. Nevertheless, the difference between projections 1^a and 2^a is worth noting. Because of the different behaviour of fertility, projection 2^a presents an "older" structure, with the death rate rising even higher than the initial rate.

10. The rates of increase in table 4 are derived from the rates described above. In the series corresponding to projection 1^a the rates change little up to 1980, but then there is a steady decline to the year 2000, which is more pronounced in projection B. In the series corresponding to projection 2^a there are marked declines to the year 1980, which then become even more pronounced to the year 2000. In projection A the rate drops below 1 per cent, which means that the population would fail to double in seventy years.

11. The demographic variables examined so far affect to a greater or less extent the sex and age structure of the population, which is ultimately determined by them. Attention must

next be focused on the structure of the population as a whole.

12. The term "dependency ratio" as used here means the quotient of total population divided by the population between 15 and 64 years of age, expressed in terms of 100 population (table 5). Its variations give a true reflection of changes in the age structure, or more specifically in the proportion of persons between 15 and 64 years of age. These variations are relatively slight throughout all the projections, since the proportional increase in the 65 years and over group is nearly offset by the decrease in the 0-14-year group. This indicates that the working-age population has reached a level which will undergo little change in the future. Such change will in turn have little or no effect on social and economic conditions, at least in principle, except as noted in paragraph 13. Apart from Uruguay and Chile, which in 1960 had dependency ratios of approximately 152 and 166 respectively, the situation in other Latin American countries differs appreciably from that in Argentina. In the same year, viz., 1960, the dependency ratio in Brazil was 185, in Mexico 196 and in the Caribbean area 180. In all these latter, 40 per cent or more of the population is in the 0-14-year age group, and a change in the age structure can be expected to produce a sizable reduction in the dependency ratio.

13. Internal variations in the structure of the working-age group can be more accurately measured through the activity rate, which is defined as the ratio of the economically active population in an age group to the total population in that group. When, however, sex-specific activity rates for 1960 were applied throughout the projections, no significant differences became apparent. It is nevertheless beyond question that over the longer term the proportion of older persons with lower activity rates will increase within the group, thus eventually causing a reduction in the labour force.

14. In the foregoing analyses it was seen that the change in the population structure in so far as the working-age group is concerned will have virtually no effect on economic and social conditions. It is in the older and the younger groups that the impact of such change will be felt. As the proportion of persons 65 years and older increases, there must be a concomitant expansion of social services, and this will have economic implications. Pensions of various kinds, medical care and the like will have to be increased to meet the growing needs of this group. At the other extreme, the decrease in the size of 0-14-year age group will mean that a smaller proportion of funds will be

needed for the support and education of the persons in that group and that there will be a smaller supply of manpower by comparison with earlier levels.

15. A somewhat more detailed examination of the 5-14 and the 15-19-year age groups is in order, in the former case as regards primary school enrolment and in the latter as regards secondary schooling and manpower supply. For this purpose, the mean annual rates of increase of these groups was computed (table 6), by five-year periods, in the same way as was done for the population as a whole but using only projections 1^aB and 2^aB.

16. It will be noted that the rates of increase for the 5-14-year age group are generally lower than those for the general population (in projection 2^aB they are in every instance lower). It is clear that the demand for educational facilities will not be great during the early five-year periods. Thus, if the education budget increases at the same rate as the total population, there will be more funds available for meeting the additional needs of persons not yet incorporated in primary schooling or for investment in new school buildings, teacher training and the like for subsequent genera-

tions. In the case of Argentina, these additional needs are not likely to be great, for the proportion of persons from 5 to 14 years of age receiving primary education was already about 73 per cent in 1960. As compulsory school attendance begins at the age of 6 years and as primary education consists of seven grades, the upper limit would be about 80 per cent (in the United States enrolment was 85 per cent in 1950). The situation is different for the 15-19-year age group, at least during the first two five-year periods. During the first period the rate of increase is very high, in fact appreciably higher than that for the general population. Attention is drawn, in passing, to the temporary rise in the birth rate during the five-year period 1946-1950, the survivors among those born in that period representing the 15-19-year age group in 1965. This cohort will place a burden on the educational system and will, in addition, increase the manpower supply at a time when the country will probably still be in a period of economic stagnation. In this concluding analysis, the aim has been to focus attention on the short-term effects of changes in small segments of the age structure, effects which remain hidden when examined within larger contexts or by some other standard of measurement.

Table 1. Relative distribution of population by sex and broad age groups in four projections, years 1960, 1980 and 2000 (per 100 population)

Projection	Year	Male				Female			
		0-14	15-64	65 and +	Total	0-14	15-64	65 and +	Total
	1960	31.03	63.51	5.46	(10,492)	30.90	63.38	5.72	(10,175)
1 ^a A	1980	29.34	63.01	7.65	(13,797)	28.29	62.55	9.16	(13,714)
	2000	29.06	62.05	8.89	(18,042)	28.00	61.17	10.83	(17,922)
1 ^a B	1980	29.21	63.47	7.32	(14,404)	28.35	62.72	8.93	(14,214)
	2000	28.78	62.70	8.52	(19,405)	28.00	61.48	10.52	(19,092)
2 ^a A	1980	26.57	65.45	7.98	(13,233)	25.58	64.88	9.54	(13,174)
	2000	25.40	64.61	9.99	(16,051)	24.38	63.50	12.12	(16,013)
2 ^a B	1980	26.55	65.83	7.62	(13,840)	25.74	64.98	9.28	(13,674)
	2000	25.37	65.13	9.50	(17,415)	24.61	63.70	11.69	(17,183)

NOTE: the figures in parentheses represent the absolute population in thousands.

Table 2. Mean annual crude birth rates for five-year periods in four projections, 1960-2000 (per 1,000 population)

Projection	1960-1965	1965-1970	1970-1975	1975-1980	1995-2000
1 ^a A	22.31	22.02	22.07	22.09	21.25
1 ^a B	22.31	22.07	22.12	22.11	21.23
2 ^a A	21.72	20.33	19.37	19.10	17.64
2 ^a B	21.72	20.41	19.50	19.18	17.86

Table 3. Mean annual crude death rates for five-year periods in four projections, 1960-2000 (per 1,000 population)

<i>Projection</i>	<i>1960-1965</i>	<i>1965-1970</i>	<i>1970-1975</i>	<i>1975-1980</i>	<i>1995-2000</i>
1 ^a A	8.12	7.77	7.67	7.74	8.20
1 ^a B	8.08	7.68	7.57	7.64	8.15
2 ^a A	8.10	7.75	7.71	7.96	8.98
2 ^a B	8.05	7.68	7.62	7.79	8.85

Table 4. Mean annual crude rates of increase for five-year periods in four projections, 1960-2000 (per 1,000 population)

<i>Projection</i>	<i>1960-1965</i>	<i>1965-1970</i>	<i>1970-1975</i>	<i>1975-1980</i>	<i>1995-2000</i>
1 ^a A	14.19	14.25	14.40	14.35	13.05
1 ^a B	16.32	16.31	16.32	16.11	14.29
2 ^a A	13.62	12.58	11.66	11.14	8.66
2 ^a B	15.76	14.67	13.69	13.08	10.34

Table 5. Dependency ratio (total population of both sexes/population of ages 15-64 years of both sexes) in four projections, 1960-2000 (per 100 population)

<i>Projection</i>	<i>1960</i>	<i>1980</i>	<i>2000</i>
1 ^a A	158	159	162
1 ^a B	158	159	161
2 ^a A	158	154	156
2 ^a B	158	153	155

Table 6. Mean annual rates of increase of the 5-14-year age group and the 15-19-year age group for five-year periods in two projections, 1960-2000 (per 1,000 population)

<i>Projection</i>	<i>1960-1965</i>	<i>1965-1970</i>	<i>1970-1975</i>	<i>1975-1980</i>	<i>1980-1985</i>	<i>1985-1990</i>	<i>1990-1995</i>	<i>1995-2000</i>
<i>5-14</i>								
1 ^a B	14.57	6.12	9.76	17.93	17.74	15.30	12.89	12.45
2 ^a B	14.57	3.30	1.28	6.46	9.00	11.75	10.23	7.24
<i>15-19</i>								
1 ^a B	25.18	19.19	10.43	2.08	16.89	18.40	16.85	13.63
2 ^a B	25.18	19.19	10.43	-3.42	5.92	6.83	10.89	12.19

A contribution to the problem of the world population in the year 2000

A. Y. BOYARSKY

[Translated from Russian]

I. THE SIGNIFICANCE AND NATURE OF THE PROBLEM

1. In the minds of many, population forecasts are associated with the fundamental questions of population theory. The customary simplified, not to say vulgar, approach to this subject is that if a great increase in population is to be anticipated in the next few decades, then the Malthusians are right; if not, then some of their opponents, in particular the Marxists, are right.

2. In reality, the roots of the absolute incompatibility between these doctrines reach much deeper than the quantitative evaluation of population growth. The crux of the argument lies not in the arithmetical calculation of rates of population growth tomorrow or the day after, but in determining the causes of the poverty which exists today. The opponents of Malthus maintain that if resources and technology were properly used and goods were properly distributed, the entire population of the world could enjoy an adequate food supply and a sufficiently high general standard of living. The Malthusians, on the other hand, substitute the population problem for the problem of the structure of society and indulge in speculative calculations.

3. In this sense, Marxism does in fact deny the "population problem", although it by no means closes its eyes to the problems connected with population growth. But the relative overpopulation caused in capitalist society not by a shortage of productive forces but by the system of production tends to spread the view that existing ills have a single cause—the population problem. Hence, the hopes and fears connected with the results of demographic forecasts are predicted.

4. In point of fact, the solution lies in the harmonious development of population and productive forces which can be achieved when the sole purpose served by the productive forces is to ensure the welfare of the population—that is, under conditions of socialism. The socialization of industry is not, of course, enough by itself. To achieve the necessary industrial

growth not only labour is required, but also adequate development of the production of the means of production; without that there can be no industrialization or, in the final analysis, improvement in the welfare of people; and a further condition for the latter is that the fruit of the people's labour goes to them and not to a handful of owners. And in this process, if production is to be maintained at the necessary level without lengthening the working day, there must be a corresponding increase in the productivity of labour at the proper level of economic activity of the population.

5. The Malthusians see only one way out: a reduction in population growth. The opponents of Malthus, while not disregarding rates of population growth, believe that all the interdependent aspects of the question must be taken into account; and this means that a solution of the problem can be found through increasing the productivity of labour and ensuring the proper distribution of efforts and resources, on the one hand, between production and other aspects of socially useful activity, and on the other hand, within the sphere of production itself, between the production of the means of production and the production of consumer goods.

6. Long-term population forecasts have been attempted many times. It is not difficult to see, however, that they have been not so much forecasts as reflections of the existing situation.

7. Let us turn to the history of the question. The first two thirds of the last century in Europe and the United States of America were marked by rapid population growth. The population seemed to be running wild in growth. In that situation, the theory that population doubles every twenty-five years seemed convincing. That would mean an increase by a factor of 256 over a period of two centuries; during that time, to cite the well-known story of the grains and the chess-board, only one of the eight rows of the board would have been covered.

8. At the end of the nineteenth century population growth began to slow down marked-

ly in the developed countries. In the sphere of long-term forecasting this was soon reflected in a radical change in conceptions of the very nature of the laws of population growth. The irresistible geometrical progression of Malthus was now replaced by the Pearl logistic curve.

9. Then came the twentieth century. Population growth continued to slow down. In the tables of natural growth negative years began to appear. Bertillon and many others raised the alarm of imminent depopulation; subsequently, during the years of the depression, the slow-down was intensified. This was immediately reflected in the predictions. For a number of countries, the year and size of maximum population were "fixed precisely", and the turning point was set for the not very far distant future.

10. Thus, population forecasting passed through three successive stages. There was no unchecked growth, with population doubling every twenty-five years. There was no cessation of growth at a maximum figure, followed by a stationary population. There was no transition from growth to decline. That, surely, makes it clear that all these predictions were not really predictions at all, but merely the characteristic expression of successive actual situations.

11. After the Second World War the situation in a number of countries changed once more. Surely, the failures of previous predictions should serve as a warning against making any relatively hasty and far-reaching forecasts on the basis of the post-war situation, which is in all probability no less transitory than previous ones. In any event, anyone in this field should realize the limitations of any possible results.

II. APPROACHES TO A SOLUTION

12. Thus, it is not exaggerating to say that the whole record of long-term population forecasting is a record of failures. That is tacitly accepted by those who forecast the population for the distant future not in exact figures but in the form of a range of possibilities "from x to y ", or, to use engineers' language, within certain "tolerances". Thus if we combine the pronouncements of various students we obtain a population estimate for the year 2000 of 4,000 to 10,000 million.

13. But to speak in those terms is to say nothing. The fact that by the year 2000 the world population will exceed 4,000 million is quite clear even without calculation. The fact that it cannot exceed 10,000 million is also

clear enough; for even to reach a figure of 10,000 million the population would have to double every twenty-five years, that is to grow at about the same rate as in the Malthusian fantasy.

14. The calculations carried out in the United Nations¹ give a range for the year 2000 of 4,900 million to 6,900 million. A "medium" assumption is also given—6,300 million—but this merely expresses the fact that the actual population in the year 2000 is considered more likely to be nearer the upper than the lower of the two extreme figures. The great care with which the work was carried out, with the use of the most advanced methods of population projection, deserves note. However, it is surely not justified simply to arrive at the range of estimates referred to. There is too great a disproportion between the accuracy achieved through the use of refined methods and the changes which the use of a slightly different "model" may make in the totals.

15. The longest period for any realistic estimation of future population, beyond which we enter the sphere of guesswork rather than calculation, may be taken to be twenty years. After twenty years, those born will be predominantly children whose parents themselves had still to be born at the beginning of the period. The size of the working population, too, can be estimated much more accurately for the next period of twenty years than for a longer period. Until the end of the twenty-year period, the working population will consist principally of persons already in the present population, whose numbers can change only through the operation of mortality.

16. While estimates for periods of fifteen to twenty years can be made by the most accurate mathematical methods, with the help of electronic computing techniques, the contrast in the work under discussion between the power and refinement of "precision" methods and the indeterminate and dubious nature of the initial premises is too great. Moreover, the precise mathematical methods of estimation used may here tend to obscure the vagueness of the initial data. Different methods would be more appropriate. A much more important task, in an exercise of this kind, is to define the most general methodological principles involved. And the most important of these is the principle of the social and economic determination of demographic processes.

¹ United Nations, *The Future Growth of World Population* (United Nations publication, Sales No.: 58.XIII.2).

17. Thus, the substantial changes which have taken place in the natural movement of population, often referred to in demographic literature as "the demographic revolution of the twentieth century", cannot possibly be explained by any changes in the biological nature of man. Biological limits have never been reached either in fertility or, *a fortiori*, in the length of life.

18. It may be noted that even when countries are formally grouped according to the indicators of natural movement of population, the groups obtained are always, in the final analysis, based on social and economic conditions. The authors of the United Nations report referred to above, although they group countries according to their demographic situation, must speak of "technologically developed" countries. But social and economic conditions cannot be equivalent to the level of technology. On the basis of the principle mentioned above, countries should be grouped primarily according to their social system, as is done below.

19. Thus, a socio-economic approach implies, firstly, dividing the world into large groups of socio-economically similar countries. A formal division of the world into continents cannot be used for this purpose: countries at similar stages of development can be found in various continents, while there are countries on the same continent with very different socio-economic structures. To develop our observations (a much more suitable term here than "estimates") we shall therefore use the following grouping, which takes into account not only the social system but also its stage of development: (1) the USSR; (2) the European socialist countries; (3) China and the Asian socialist countries; (4) the European capitalist countries; (5) the United States and Canada; (6) Japan; (7) the Arab East, Turkey, Iran and Afghanistan; (8) India; (9) other Asian countries; (10) other African countries; (11) other American countries;² (12) Australia and Oceania.

20. The demographic characteristics of these groups shown in the first columns of table 1 must be regarded as only approximations.

21. It is an important fact that in the coming decades the developing countries will move into the category of developed countries. It is therefore of particular interest to determine how characteristic the average levels of fertility, mortality and population increase are for the development of countries, even if only of those in group 4. To this end, we have drawn up a

diagram for all three indicators (see fig. I). The countries in question form a really compact group on the diagramme; the various points have been joined by lines. If the Netherlands, Spain and Portugal, which have maintained a relatively greater increase, are excluded, then the group becomes still more compact.

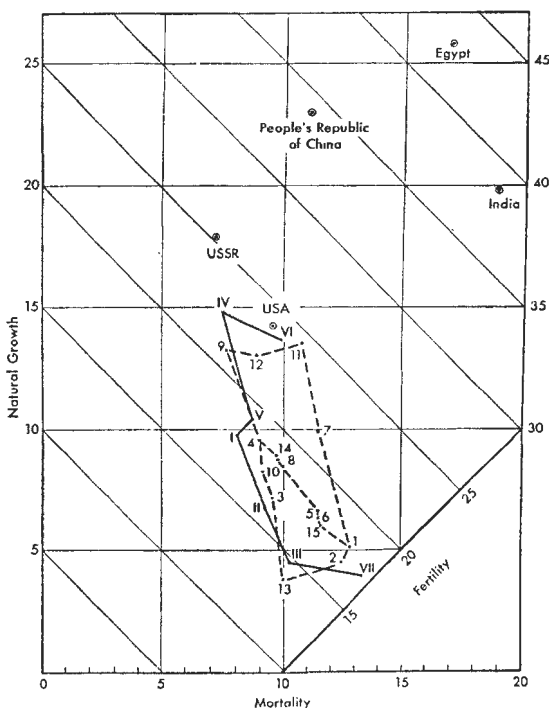


Figure I

Group 2: I, Bulgaria; II, Czechoslovakia; III, Hungary; IV, Poland; V, Romania; VI, Yugoslavia; VII, German Democratic Republic.

Group 4: 1, Austria; 2, Belgium; 3, Denmark; 4, Finland; 5, France; 6, Federal Republic of Germany; 7, Ireland; 8, Italy; 9, Netherlands; 10, Norway; 11, Portugal; 12, Spain; 13, Sweden; 14, Switzerland; 15, United Kingdom

22. The European socialist countries are also shown on the same diagramme. It should not be considered surprising that they lie so close (dotted line) to group 4. The great socialist changes which have taken place in these countries are too recent to have radically altered their traditional demographic characteristics. However, two features of this group may be noted: (a) the points are mostly situated near the left boundary of group 4, indicating a lower mortality level; (b) they tend to lie along a vertical axis, showing that the main feature which these countries have in common is their low mortality level.

23. The diagramme also shows, for purposes of comparison, the figures for the USSR, where

² In view of its small population Cuba has not been excluded from this group.

the high increase results from a high fertility and a low mortality level, and Egypt, representing group 7, where the high natural increase results from extraordinarily high fertility despite a very high mortality level.

III. THE INFLUENCE OF MORTALITY

24. In the countries of groups 1, 2, 4 and 12, the mean length of life has reached about seventy years. In countries where it has reached seventy, the potential for any further rapid increase has almost worked itself out, and the process has slowed down considerably. In the last decade, the mean length of life in these countries (the Scandinavian countries, the Netherlands, the United Kingdom, France and the United States) has increased by three to four years. In view of the clear trend towards a slow-down, it may be expected that a mean length of life of about eighty years will be reached in the capitalist countries of these groups.

25. A different hypothesis must be applied to the European socialist countries. Here, a completely different social and economic system exists, and this has far-reaching consequences for all the factors affecting mortality. Apart from the general trends in the development of the economy and of the people's welfare, we need only mention the completely different principles on which public health is organized as compared with Western countries, the actual scale of medical services and the unprecedentedly rapid development of education. It would be a conservative estimate to say that the length of life in these countries will reach eighty-five.

26. The coming decades are bound to be a period of very sharp changes in the social and economic structures of the countries inhabited by the greater part of the world population. For that reason, changes in the size of the world population during this period will depend not so much on patterns of reproduction as such as on the process of transition from one pattern to another. That lends extreme interest to study of patterns of transition and of the consequences of transition itself. For example, the age-structure of the population of Europe has for some time reflected not so much the characteristics of the existing or previous pattern of reproduction of the population as the consequences of the transition from the previous pattern to the present.

27. The significance of this fact for our task is easily grasped. In accordance with the elementary postulates of the mathematical theory of population, a stationary population is equal

to the product of the number of births and the mean length of life. Consequently, the population, provided that it is stationary, must (given a constant number of births) be proportionate to the mean length of life.

28. It may be noted that in Europe the decline in fertility which took place in the last century concurrently with the growth in the population led to some stability, naturally of a very relative character, in the absolute number of births. In Italy, for example, the annual number of births over almost the whole of the century remained at the level of 930,000 to 1 million. And in the countries of group 4 as a whole the annual number of births was 3.4 million at the beginning of the 1840's, 3.4 million again on the eve of the "great depression" of 1928, and 3.8 million in 1960 (of course, there were also fluctuations).

29. Given a constant number of births over a fairly long period, the problem of total population, if we disregard migration, becomes simple, depending on the length of life alone. That, however, does not mean that the population, as in the stationary population theory, is the product of the number of births and the mean length of life. For the mean length of life merely reflects the existing level of mortality by age at the given time, whereas if the stationary population formula is to be used the process of attrition has to be maintained at the appropriate level for almost a century.

30. Let us consider a transition from attrition level *B* to *A* (see fig. II) taking place over a period of a century. The diagramme also shows

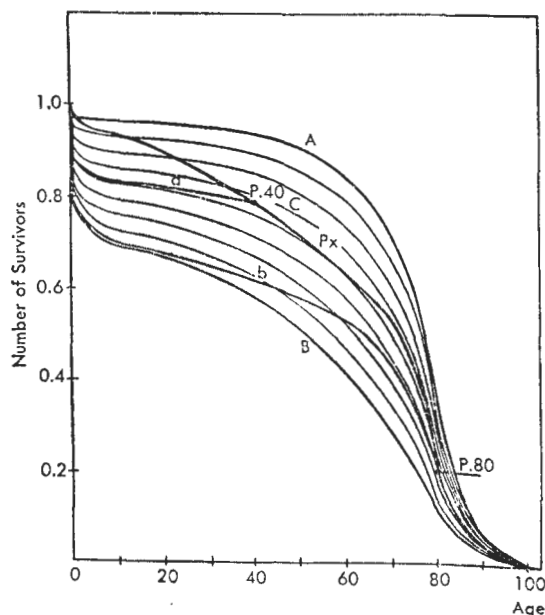


Figure II

the intermediate attrition levels. For the total population aged 40 at the end of the period, relative declines have taken place corresponding approximately to attrition level *C* for transition period zero to ten years, to the next higher level for the period ten to twenty years, to the next higher level for the period twenty to thirty years, and to attrition level *A* for the period thirty to forty years. By this process, we arrive on curve *a* at point *P.40*. Applying a similar process to the population aged eighty, we arrive on curve *b* to point *P.80*. If we do this for all ages, the points obtained form the line *Px*. The area below this line, which will be proportional to the total population at the end of the period under review, must be close to the average of the areas below *A* and *B*.

31. In order to be able to treat the area below the line *Px* as half of the sum of the areas below *A* and *B*, we assume that it is correct to place these boundary lines about eighty years apart. On that basis, given a constant number of births and no emigration, the population of Europe for the forty-year period 1920-1960 should then change in the ratio

$$\left(e_o^{1960} + e_o^{1880} \right) : \left(e_o^{1920} + e_o^{1840} \right)$$

where e_o is the length of life. To see how far this corresponds to the facts, let us take a few countries for which appropriate figures are available (table 2).

32. Taking the mortality tables nearest the required dates and rounding off the figures, we obtained columns (2-7) and (10) for the first four countries. For the next three countries, we entered in column (5) figures obtained by applying to Italy and Belgium the increase in length of life recorded in France and to Germany the increase in the Netherlands. We obtained the 1920 population of Germany within its present boundaries by reducing the population of its former territory by the necessary percentage.

33. The figures show excellent agreement between the relative increases.

34. It would accordingly seem useful first of all to make an analogous calculation for our groups of countries. To do this, we need only advance all the figures by forty years, i.e., find the coefficients

$$K = \left(e_o^{2000} + e_o^{1920} \right) : \left(e_o^{1960} + e_o^{1880} \right)$$

35. Since we lack the necessary statistics, we can reasonably accept for the various groups of developing countries an initial figure of $e_o^{1880} = 25$ and a final figure of $e_o^{2000} = 60$. We

may then consider four types of transition (see fig. III).

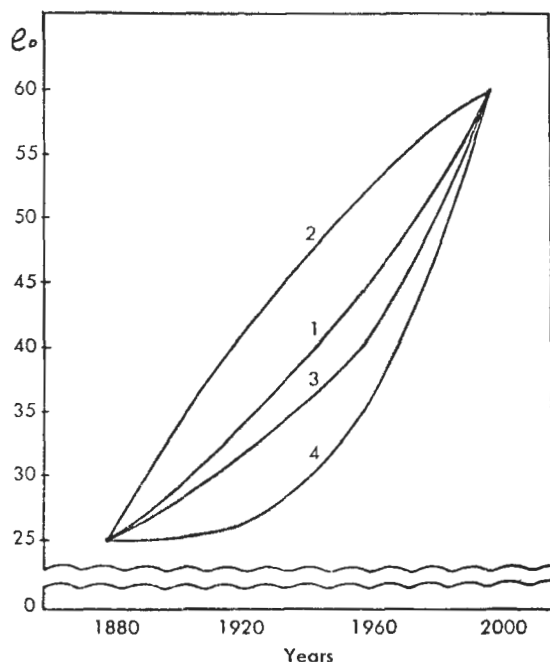


Figure III

(1) Steady transition, with an increase of approximately one third every forty years, i.e.,

$$\begin{array}{cc} 1920 & 1960 \\ e_o = 33; & e_o = 45; \quad (K = 1.33) \end{array}$$

(2) Slow transition:

$$\begin{array}{cc} 1920 & 1960 \\ e_o = 40; & e_o = 52; \quad (K = 1.3) \end{array}$$

(3) Rapid transition:

$$\begin{array}{cc} 1920 & 1960 \\ e_o = 31; & e_o = 40; \quad (K = 1.4) \end{array}$$

(4) Very rapid transition:

$$\begin{array}{ccc} 1920 & 1880 & 1960 \\ e_o = e_o; & e_o = 35; & (K = 1.43) \end{array}$$

36. It will be seen that regardless of type coefficient *K* does not vary greatly. For groups 1, 2, 4, 5 and 6, taking $e_o^{1880} = 40$, it may be calculated more or less directly. For each of the other groups, one or other of the variants used has been taken; which one can be seen from table 1 (for group 12 the coefficient for group 4 is repeated). Multiplying the initial population by *K*, we obtain the total "hypothetical stationary population" (see table 1). The grand total is 4,070, or a little more than 4,000 million.

IV. FERTILITY

37. The most difficult task, or rather, the most easy task remains: an estimate of the

number of births, or fertility. The most difficult because we lack adequate data for a clear prediction; the easiest because, for that very reason any hypothesis may be used.

38. The most fundamental factors for change in fertility, in our view, are social and economic factors. At the same time, we do not consider that improvements in well-being as such can reduce fertility. There is no cogent evidence for the existence of such a direct correlation; parallel trends often have quite different origins. Studies of sharp fluctuations in well-being—useful because for short periods of time other factors can be regarded as constant—point if anything to a direct link with the level of fertility (reduced fertility in bad harvest years, crisis years, etc.).

39. Particularly important socio-economic factors are the employment of labour in family farms, the effects of the fragmentation of family farms through inheritance, the employment of women outside the home—a factor linked with the reduction in the proportion of agricultural to total population and with the structure of agriculture itself—the relation between levels of needs and their satisfaction, and cultural, psychological and other factors. Table 1 shows the percentage of the active population employed in agriculture. In the developed countries the proportion of the population engaged in agriculture declined over the eight-year period 1954-1962 alone as follows: France, from 28 per cent to 21 per cent, Italy from 40 per cent to 28 per cent, and so on.³

40. Turning to the groups of countries, we have to bear in mind that the agreement between the population increases and coefficient *K* for all European countries mentioned above is somewhat deceptive: we must not overlook the facts of emigration and two devastating wars. We shall disregard emigration, since what principally interests us is total world population. With regard to wars, we proceed from the premise that mankind, summoning up its inner resources, will find means of excluding such phenomena from its future history, and that in that respect, the future will be very different from the past. All that means that we must make certain increases in the hypothetical stationary population figures.

Group 1

41. For the USSR, the Central Statistical Board gives an estimate for 1980 of 280 million, assuming some increase in fertility. With the growth in population, the result must *a fortiori*

be a rapid rise in the number of births. Moreover, in the social conditions of the USSR as it draws nearer to communism there will be fewer and fewer material and social disincentives operating to reduce the number of children; and agriculture, although it employs approximately one third of the active population, is already organized as a large-scale public enterprise. Nevertheless, the growth in population should not be regarded as excessive. From about 1980 onwards, however, the relatively small wartime generation will begin to disappear from the age-group which is the most important for fertility, and the consequences of the war losses will move to age-groups with a lower specific weight in the population. In view of all these factors we feel that the "hypothetical stationary population" can be increased by a further 20 per cent. To the result obtained we shall add a "tolerance".

Group 2

42. The feature at present characteristic of the European socialist countries is a relatively low fertility level, on the average, and (undoubtedly linked with rapid industrialization) a tendency for it to fall further. As the economic and social structures of these countries approximate more closely to the present structures of the USSR, that tendency will no doubt become less marked. In addition, it has to be remembered that the populations of the countries in question suffered greatly during the war, and that this will affect their age structure in the same way as in the USSR. Bearing in mind that growth in these countries is more than one and one half times smaller, we shall increase their "hypothetical stationary population" by only 10 per cent.

Group 3

43. The socialist countries of Asia: this means basically the People's Republic of China. Here we may expect a decline in fertility relatively not less than the increase in population. In other words, we can work on the assumption of a roughly constant absolute number of births, that is of a situation similar to that obtaining in Europe from the middle of the nineteenth century. We therefore increase the hypothetical stationary population for group 3 by a minimal figure of 5 per cent.

Group 4

44. Compared with the pre-war period, fertility in this group has increased, and the absolute number of births has risen appreciably. The proportion of the agricultural to the total population is already rather low, and the conti-

³ *Population*, No. 1 (Paris, Institut national d'études démographiques, 1964), p. 141.

ning elimination of small property is in any event reducing the relative size of the class particularly interested in limiting the number of heirs. The populations of these countries, with the exception of the Federal Republic of Germany, did not suffer very greatly during the war years. For this group the hypothetical stationary population may be increased by 10 per cent.

Group 5

45. The same applies to the United States, which constitutes the greater part of this group. We shall make the same increase of 10 per cent.

Group 6

46. With regard to Japan, we have to bear in mind the low and rapidly falling level of fertility, which is leading to a rapid decline in the absolute number of births. In addition, the birth cohorts of the last few years will set off a new decline in the number of births in the 1970's and 1980's. We also have to anticipate a reduction in the proportion of the agricultural population. Because of these factors, we shall make no addition to the hypothetical stationary population for Japan.

Groups 7-11

47. In these groups, development towards industrialization is not proceeding very rapidly. The initial level of fertility is extremely high. Traditions militating against any reduction in fertility are deeply embedded. For these groups we shall add 20 per cent to the hypothetical stationary populations and shall allow a relatively wider "tolerance".

Group 12

48. Australia and Oceania will be treated in the same way as group 5; we add 10 per cent.

49. We have obtained a world grand total of $4,626 \pm 410$ million, or, to put it in more suitable form, 4.2 to 5.0 thousand million.

50. Does that mean 5,000 million mouths to feed? Yes, but also 3,000 million workers! And if we equip them with the achievements of modern science and technology and save them and that technology from the senseless waste of war, we shall undoubtedly be able not only to feed all these mouths well, but also, given a proper distribution of wealth, to ensure for all people on earth prosperity and a happy life.

Table 1

Groups of countries	Population in 1960 (millions) ^a	Ferti- lity	Mortal- ity	Natural growth	c ¹⁹⁶⁰ v	K	Hypothetical stationary population P × K	Percentage engaged in agriculture	Population in the year 2000 (millions)
1. USSR	214	25	7	18	70	1.30	278	35	333 ± 25
2. Europe (socialist countries)	117	19	9	10	66	1.35	158	53	174 ± 15
3. China and socialist countries of Asia	714	37	17	20	—	1.43	1,021	75	1,072 ± 100
4. Europe (capitalist countries)	309	19	11	8	70	1.22	377	21	415 ± 20
5. United States and Canada	199	24	9	15	70	1.23	245	7	269 ± 15
6. Japan	93	17	7	10	68	1.31	122	33	122 ± 10
7. Arab, Middle East, Turkey, Iran and Afghanistan	141	44	19	25	—	1.40	197	64	236 ± 20
8. India	432	39	19	20	46	1.33	574	70	689 ± 70
9. Other Asian countries	369	35	10	25	—	1.43	528	68	634 ± 65
10. Other African countries	191	48	23	25	—	1.43	273	62	328 ± 35
11. Other American countries	212	38	10	28	49	1.30	276	52	331 ± 35
12. Australia and Oceania	17	23	9	14	70	1.22	21	13	23
	3,008						4,070		4,626 ± 410

^a United Nations, *Demographic Yearbook, 1962* (United Nations publication, Sales No. 63.XIII.1)

Table 2

Country (1)	Expectation of life at birth				Col. 2 + col. 4 (6)	Col. 3 + col. 5 (7)	Population (millions)		Col. 6 Col. 7 (10)	Col. 8 Col. 9 (11)
	1960 (2)	1920 (3)	1880 (4)	1840 (5)			1960 (8)	1920 (9)		
England and Wales	71	58	45	40	116	98	46	38	1.2	1.2
France	71	54	42	39	113	93	46	39	1.2	1.2
Sweden	73	62	49	42	121	104	7.5	6	1.2	1.2
Netherlands	73	63	44	30	117	93	6.8	11.5	1.3	1.7
Italy	68	50	35	32	103	82	48	37	1.3	1.3
Belgium	65	58	45	42	110	100	8.5	7.4	1.1	1.1
Germany	61	57	39	25	110	82	72	57	1.2	1.3

Population projections for Thailand and a study of the elements and criteria

AJIT DAS GUPTA and SURANJAN SEN GUPTA

I. AVAILABLE PROJECTIONS

1. At least five sets of recent medium-range population projections are available for Thailand. The earlier three, published by the United Nations in *Survey Final Report* (1958) and *Population Estimates* (1959),¹ and by Sak Pasukniran in his *Population of Thailand* (1960),² had to rely on the older (1947) census bases and estimates. The first set of projections using the census 1960 population base (suitably adjusted) was prepared by one of the authors (Das Gupta) in collaboration with Samruay Chotechanapibal, Thip Chalothorn and Wiwit Siripak, in *Population Perspective of Thailand* (1963).³ Sets of projections using the same adjusted population bases were next published by Halvor Gille and Thip Chalothorn in *The Demographic Outlook of Thailand and Some Implications* (1963).⁴

2. In *Population Perspective of Thailand*, the population base of census 1960 was adjusted for defects in enumeration of young children; in the first instance, by fitting a second degree curve to the natural logarithms of the numbers reported at individual ages five to ten, on the basis of a theoretical simplified growth model, which needed no assumption as to the actual levels of mortality and fertility. The adjustment was later refined by working back to the expected population from corrected values of

defective birth and death registration records of the past five years.

3. For projection purposes, the current (1960) growth, birth and death rates were first estimated independently from the census source, then refined by use of the vital registration source, with the help of simplified, but realistic structural models. The estimated current birth rate of 45 per 1,000 and death rate of 13 per 1,000 implied about 25 per cent deficiency in birth registration and 40 per cent overall deficiency in death registration. Only one set of projections was prepared, with future assumed courses of decline of the components along exponential lines; with mortality declining, to raise life expectancy (from the current estimate of fifty-four years) to sixty-seven years by 1980; and with fertility declining to 32 per 1,000 by 1980. For illustrative purposes, computation was made of the population that would result if fertility held constant, instead of declining, as assumed. The factor of international migration was small enough to be ignored.

4. Basic projections in *Population Perspective* were done separately by sexes in five-year age groups, at five-year intervals until 1980. An abridged form of the projections is presented in table 1.

5. To emphasize the impact of population change on educational programmes, projection of the student population was presented in *Population Perspective* for individual ages in the range 5—19. One interesting consequence of the change in age composition, relevant to the contemplated extension of compulsory elementary education from current Pratom 4 to Pratom 7 standard, was that the ratio of population aged 7—13 (to be covered) to the population aged 7—10 (currently covered) rose from the current level of 1.64 to 1.72 by 1980. The changes in composition were significant, but not obvious until detailed projections were made.

6. The *Population Perspective* projections are quoted above in some detail, as they developed and took into account the latest estimates

¹ C. Chandrasekaran, *Final Report of the Demographic and Economic Survey of Thailand, 1954*, vol. 2 (New York, 1958); *Future Population Estimates by Sex and Age*, report IV (United Nations publication, Sales No. 59.XIII.3).

² *Journal of Public Administration*, part I, No. 2 (Bangkok, Thammasat University, 1960). Sak made aggregate projections only by curve fitting.

³ *Population Perspective of Thailand*, circulated in mimeographed form since 1962; now under publication in Sankhya (series B, vol. 27). Apart from general population projections in age groups, projections were also done in school age, labour force, urban and retired segments. A number of component supporting papers was prepared by the co-authors in this connexion.

⁴ *The Demographic Outlook of Thailand and Some Implications*, paper presented to the National Seminar on the Population of Thailand (Bangkok, 1963). Revised mimeograph version circulated, November 1963.

and trends. For the year 1977, the *Survey Final Report* and Sak projections ranged between 33.9 and 40.7 million, as compared to the *Population Perspective* projection of 44.9 million; only the highest projection given in the United Nations *Population Estimates* fell a little beyond the *Population Perspective* projection by 1977. In *Demographic Outlook*, a spread of four projections was presented, imputing a number of alternative assumptions about the effect of the future course of components upon the adjusted population base and current estimates of the components developed in *Population Perspective*. Two of the four *Demographic Outlook* projections were new; they assumed a relatively more rapid mortality decline (as compared to the *Population Perspective* projections) and gave 48.88 to 45.71 million as a population figure for 1977.⁵

II. ELEMENTS OF PROJECTIONS

7. Projections start from a set of initial conditions, usually the sex-age distribution of a population at a given point of time. The levels and trends of the components of population growth, at the same point of time, also provide the initial conditions for the subsequent future evolution of these variables; in a similar sense, the current socio-economic environment, which influences the course of the components, ranks with the initial conditions. Projections thus rest on facts at the base, but they build with the assumed courses of the components, in accordance with the mathematical framework adopted. The three elements of the projection procedure could be called: (a) fact estimation of the initial condition base; (b) judgement of assumptions about future course; and (c) mathematical framework. The projections become increasingly dependent on the assumptions, and they move farther away from the fact base as the distance of the projection date increases.

8. *Fact base.* Evaluation of initial conditions is, therefore, an integral function of the projection procedure. When it is realized that even at the present time, the age distributions and the levels of the components are not known accurately for about two thirds of the world population, the importance of this element

becomes obvious. Realistic quantitative estimation of the fact base (unlike that of the future course of components) is feasible. Since these factors are not independent, but inter-related in various degrees, testing of the initial conditions for internal consistency is imperative.⁶ Instances of the neglect of this simple principle are available among the known projections. Adoption of improved estimates of the starting levels of the components, together with the retention of a non-adjusted census population base which is not consistent with the improved estimates, can introduce such an anomaly.

9. Some general comments will be relevant on estimation techniques of initial conditions which are not known accurately. Properly designed and organized demographic sample surveys are naturally best for estimation of initial conditions, when censuses, vital registration and other routine statistics prove to be inadequate. For the last decade, estimation of the age structure and the components of growth from the National Sample Surveys of India could be cited as continued application of this approach.

10. When results of properly organized sample surveys are not available, techniques of estimation should be next best, using all available information and specific models appropriate to the particular population formations. Adjustment of the census population base and estimation of the components by the application of simple specific models to the available census, vital registration and other inadequate statistical material, as done in *Population Perspective of Thailand*,⁷ can be cited as an example of the second approach.

11. Use of generalized stable or quasi-stable models will be justified when resources and data are lacking for application of the specific approaches. Stable and quasi-stable models presume monotonic patterns of behavior of the components for the indefinite long past, but a break is envisaged at present between the monotonic past of the model and the changing future of the projection; thus, the use of stable models

⁵ United Nations, *World Population Prospects, as Assessed in 1963* (United Nations publication, Sales No. 66.XIII.2), also quotes a projection for Thailand, which was the same as the *Population Perspective* projection, with the initial population pro-rated to the non-adjusted census 1960 reporting. By having to adopt the official census figures, while accepting the improved current estimates of the components, *World Population Prospects* encountered the anomaly of inconsistency within initial conditions.

⁶ One of the authors (Das Gupta), in his joint paper with M. Majumdar, *India, 1951-2001, Population Projections* (Indian Statistical Institute, W.P. No. 9/RU7.1), faced the problem of anomaly between the census age structure, life table and current fertility estimate, and adopted a higher general fertility rate which was consistent with the remaining initial conditions.

⁷ Apart from the general population projections in age groups, projections of school age, labour force, urban and retired segments, were also done. A number of component supporting papers was prepared in this connexion, by the co-authors.

is obviously logically incompatible with population projections. The elegance and status of the stable population theory have led to the framing of theoretical models on generalized stable age structure for application to particular population formations, in disregard of the actual age structure; the models of age distribution of deaths, based on the generalized stable age structure applied earlier, and the estimator model, based on the specific (adjusted) census age structure in *Population Perspective*, provide an example. Such applications run counter to the general scientific principle that theory should fit facts, rather than *vice versa*.⁸

12. *Future course of components.* The problem of judging the future course of the components is approached in a number of different ways. Adopting the targets set for modification of the components of population growth in national programmes of population policy, where available (for example, as India had for the mortality component a decade ago, and has for the fertility component now),⁹ is independent of operator's judgement. Such projections on target are directly relevant to planning and they are meaningful.

13. A common approach has been to fit trend lines to the recent course of the components. It is difficult, however, to distinguish early enough between chance fluctuations and secular changes; and judgement is involved. The uncertainties attendant on interpretation of time series analysis are all there. Moreover, the future is not just a smooth continuation of recent trends, but sharp changes, not yet indicated in past trends, are also visualized in making the projections. Such sharp, unforeseen changes occurred to the mortality component in a number of developing countries during the 1950-1960 decade; to the fertility component in Japan about the same time; and to a few Eastern European countries a little later. The sustained post-war rise in fertility in the United States provides an instance of an unforeseen

change. To give effect to such sharp changes of course, it is necessary to borrow experiences from other societies in a similar (though a little more advanced) transitional phase of development. A larger margin of arbitrary judgement is involved in this approach.

14. Another common approach has been that of assuming a decrease in mortality in accordance with the averaged international experience, as done in the United Nations system of model life tables (with suitable adjustments warranted by the particular population formation in question). The systems of model tables are deficient, in the experience of the less developed countries, and the changing patterns of mortality of individual countries could differ significantly from the averaged experience.¹⁰ Attempts to adapt the future course of fertility to similar model systems has not yet been successful.¹¹

15. The correlation between the components of population growth and socio-economic development furnishes a quantitative basis for judging the future course of the components. The correlations observed so far within societies at different levels of development, however, lacked uniformity, and the targets or projections of socio-economic development themselves contain margins of arbitrariness. In the *Population Perspective*, the assumed future course of the components was judged in relation to socio-economic development anticipated, only in a qualitative way. More and more sophistication is going into the judgement as to the probable future course of the components of population growth in relation to changes in proximate socio-economic factors, and such exercise is essential to the projection procedure.

16. Judging future course of migration has not yet emerged beyond the speculative stage. For a country like Hong Kong, where net immigration accounts for as much as two thirds of the natural population growth, some judgement is necessary. In "Population Projections for Hong Kong, 1961-1971", alternative assumptions of future levels of net migration were adopted in light of recent experience.¹²

17. *Mathematical framework.* The mathematical framework of projections by the compo-

⁸ Examples of the use of growth-survivorship or other simple models in adjustment and estimation of demographic variables were summed up in Ajit Das Gupta, "Estimation of Vital Rates for Developing Countries", *International Population Conference, Ottawa, 1963* (Grevignée, IUSSP, 1964).

⁹ During the second and third Five-Year Plan periods, the target of reducing mortality by a third was set in India; in a personal communication to one of the authors in 1955, J. C. Ghosh, member in charge of health programmes in the Indian Planning Commission, suggested modification of their projections, in conformity with this target (which was eventually realized). Presently, as stated in B. L. Raina, *Family Planning Programme, Report for 1962-63* (New Delhi, 1964), the target is the reduction of the birth rate by about 40 per cent in the next decade, to achieve 25 per 1,000 by 1973.

¹⁰ United Nations, *Methods of Population Projections by Sex and Age* (United Nations publication, Sales No. 56.XIII.3). Systems of life tables have also been developed recently by the Office of Population Research, Princeton University, which recognize four significantly variant mortality patterns.

¹¹ Ajit Das Gupta, "Estimation of Vital Rates for Developing Countries", *International Population Conference, Ottawa, 1963* IUSSP, Grévigée, 1964).

¹² Benjamin N. H. Mok (Hong Kong, Government Press, 1963).

nent method is basically the same, and straightforward. Automatic data processing systems have made continuous updating of projections possible.

18. Mention, however, may be made of the new technique introduced in the *Population Perspective*, for estimation of the future (student) population at individual ages from projected population in five-year age groups, by fitting a quadratic to the natural logarithms of the projected age group population. The new technique, resting on the exponential growth-survivorship model of the population formation is more specific, and at least as efficient as the Sprague's osculatory interpolation technique which relied on a general polynomial of fifth degree.¹³ The new formula required only three age groups for interpolation with similar continuity between adjacent groups, as compared to five for Sprague's, and was thus simpler and relatively less disturbed by abnormal features of the population formation.

19. *Criteria for choice.* The question as to which of a number of available sets of population projections to choose, may be an issue before the planners. It is worthwhile therefore to explore the criteria for choice, even in a

preliminary simplified way. The mathematical framework of projections by the component method being basically the same, the criteria have to rest on the other two elements of projection.

20. The element of future course of the components can make a material difference between projections, and for medium or long-range projections the major part of the difference comes from this source. The element of future course, however, involves judgement. Those judged in relation to realistic future programmes of socio-economic development in the country, with reference to experience of societies in similar phase of transition, should be preferred. Population projections, inter-related in this manner with economic and other social projections, are valid for use in balanced planning. In spite of increasing sophistication, from structural changes in regression relationships themselves and progressive compression along the time dimension of the response curve, quantitative estimation of future course will contain a margin of arbitrariness.

21. A definite estimate of the fact base is possible, and a major criterion will be choice of the set of projections which develop and use an improved and consistent fact base of initial conditions. Since estimates of fact base are likely to improve with passage of time, a corollary of the criterion is that projections should be revised frequently, whenever some significant revision of the initial conditions or disclosed trends, or the socio-economic prospects or the regression relationships, are established.

¹³ The efficiency of the two formulas, as tested by the sum of absolute values of relative deviations between the reported and interpolated individual age population, for census 1960 population of Japan (1 per cent sample tabulation) aged 5:24, turned out of same level (7 per cent in aggregate), though the reported individual age population was fairly irregular.

Table 1. Projected population of Thailand, 1960-1980 (in millions)

Age group (0)	Calendar year (ending in April)								
	BE 2503 (A.D. 1960)			BE 2153 (A.D. 1970)			BE 2523 (A.D. 1980)		
	Male (1)	Female (2)	Total (3)	Male (4)	Female (5)	Total (6)	Male (7)	Female (8)	Total (9)
0—4	2.51	2.46	4.97	3.21	3.13	6.34	3.59	3.47	7.06
5—14	3.61	3.54	7.15	5.22	5.14	10.36	6.38	6.25	12.63
15—59	6.85	6.81	13.66	9.33	9.27	18.60	13.17	13.10	26.27
60+	0.56	0.65	1.21	0.82	0.97	1.79	1.16	1.39	2.55
TOTAL	13.53	13.46	26.99	18.58	18.51	37.09	24.30	24.21	48.51

World population estimates, 1750-2000

J. D. DURAND

1. Long-range trends of world population are commonly represented by linking United Nations current estimates and future projections with Carr-Saunders'¹ or Willcox's² historical estimates. This is not fully satisfactory because some of the Willcox and Carr-Saunders estimates are inconsistent with recent data and others can be improved by taking account of the findings of recent historical studies. The margins of error about the historical estimates also need to be considered. For much of the world, there is no less uncertainty in estimates of population trends over the last century or two than in forecasts half a century ahead.

2. New estimates of world population from 1750 to 1900, together with the latest United Nations estimates for 1960 and projections to 2000,³ are given in table 1. Except where a single estimate can be relied on as substantially accurate, low and high, as well as medium, variants of the historical estimates are given, corresponding to the variants of the future projections. Although there is considerable room for variation in the 1960 estimates for China, the "remainder" of Asia and Africa, no low and high variants are shown for this date because the United Nations single estimates of the 1960 population are the starting points for all variants of the future projections and also of the retrospective estimates for some areas.

3. Wide gaps are left between the low and high estimates of world population in 1750, 1800 and 1850, mainly because of the uncertainty in estimates for China, India-Pakistan and Africa. Although the variants for these and several other areas depend on rather arbitrary assumptions, they do not exaggerate the extent of uncertainty. There are severe limitations upon inferences that can safely be drawn from such estimates with regard to

the forms of long-range population trends and their differences among regions.

4. The extraordinary proliferation of humanity which marks the modern epoch of world history appears to have begun during the 18th century in widely separated regions, and nearly all the world's peoples have since become involved in it. The rate of growth of the world population during the late 18th and the 19th century was distinctly higher than the range which must have been normal in earlier centuries, though moderate in comparison with what was to follow. It is not clear whether the growth rate of the world total was accelerating continuously during 1750-1900, but it has definitely quickened since 1900 and a further great acceleration is indicated by the projections to 2000 (see table 2). World population multiplied three- to five-fold between 1750 and 1960, according to these estimates, and if the projections to 2000 are borne out, the population will then be six to twelve times as large as it was 200 years ago.

5. Contrary to the impression created by some writings on the "demographic transition," the estimates do not imply that this burgeoning of world population has been, at any stage, primarily a European affair, nor that its causes in the initial phase can be identified mainly with the evolution of industrial civilization. The growth of Europe's population did not reach a very high rate even at its peak in the latter half of the 19th century and it is doubtful that it exceeded the world average rate before 1850. Europe's population growth has been more remarkable for its steadiness than for its speed in modern times. Higher rates of increase are found when estimates for the USSR, USA, Canada, Latin America and Oceania are added to those for Europe to obtain totals for an expanding area of European culture and settlement. But it is hardly warranted to consider the growth of population in this combination of areas as a dominant factor in the world population trend over the last two centuries. Together they received about one third of the addition to the world population between 1750 and 1850, slightly over one

¹A. M. Carr-Saunders, *World Population: Past Growth and Present Trends* (Oxford, 1936).

²Walter F. Willcox, *Studies in American Demography* (Ithaca, 1940).

³United Nations, *World Population Prospects, as Assessed in 1963* (United Nations publication, Sales No.: 66.XIII.2).

half during 1850-1900, and a little more than one third during 1900-1960, according to the medium estimates.

6. Several areas long delayed in industrialization were among the early leaders in population increase: examples are the USSR, Latin America, Indonesia and probably China before 1850. It is in the more recent phase, since 1900 and especially since World War II, that factors closely linked with the evolution of industrial civilization (particularly the advances in medical science and technology of protection against diseases and famine) have played the greatest part in the accelerating multiplication of the human species. Their impact is apparent, not so much in the increase of the industrially developed nations themselves, as in the recent quickening growth of the Asian, African and Latin American populations and the phenomenal increases forecast for the latter in the decades ahead. But the factors of diminishing mortality have also counteracted the effects of falling birth rates in the more industrialized areas, so that the process of demographic transition associated with industrialization has not led to stabilized numbers, nor does such stability appear to be in store for the near future in the areas at most advanced stages of this transition. On the contrary, the 1960-2000 projections indicate a rate of growth for Europe about as high as that of any past period except 1850-1900, a rate for the USSR which may well surpass that of all past periods, and little, if any, diminution of the 1900-1960 rates for the USA, Canada and Oceania. Only in Japan is a distinct moderation of the growth rate foreseen.

BASIS OF HISTORICAL ESTIMATES

7. *China.* The population of Mainland China in 1900 was estimated by backward projection from the 1953 census figure at various rates chosen to represent the limits of plausible assumptions: average of 5 per 1,000 per annum for medium, 8 for low, and 3 for high estimates. Estimates for 1750-1850 were based on the official population statistics of the former Chinese Empire, ostensibly derived from the *pao-chia* system of local registers. Although it has been shown that these statistics probably understated the population size, at least up to 1775,⁴ and that afterwards the annual increments of the figures reported for provinces were largely fictitious,⁵ no better basis for esti-

mates is available. The medium estimates for 1850 and 1800 correspond to the reported population totals (interpolated for 1800 to eliminate erratic variations) and for 1750, to the result of a speculative calculation⁶ suggesting that the number reported at that date was too low by perhaps 35 million (16 per cent). These medium estimates are in general agreement with Ho Ping-ti's conclusions from his detailed study of the statistical records and other historical information.⁷ For 1900 and 1950, they also agree with Carr-Saunders' estimates (Willcox's now appear to have been too low) and with the consensus of historians that China made little, if any, gain in population during the last half of the 19th century.

8. The low variant was calculated by assuming that the recorded totals were only 10 per cent too low in 1750 and were approximately correct by 1775, and that they exaggerated somewhat the increase between 1775 and 1850. The results imply an annual growth rate of about 4 per 1,000 for 1800-1850, instead of 8 per 1,000 indicated by the official statistics. The high variant corresponds to the assumption that the recorded totals were too low by 30 per cent in 1750, 10 per cent in 1800 and 15 per cent in 1850. While the specific assumptions are arbitrary, these variants are representative of the kinds and degrees of uncertainty in Chinese population estimates for this period.

9. *India and Pakistan.* Prior to the first census, taken in 1871, little better basis exists for estimates of the population in the present areas of India and Pakistan than the remote and dubious benchmark of Moreland's estimate⁸ for 1605, and growth rates assumed to be fitting with the history of various periods in the interval. Different estimators have made radically different judgements as to the form of the population trend in the 17th and 18th centuries. Davis,⁹ for example, assumed that the population remained stationary from 1600 to 1750 and then increased at a gradually accelerating rate under the British colonial rule, so as to double by 1871. Datta,¹⁰ on the other hand, argued persuasively that the population

⁴ John D. Durand, "The Population Statistics of China, A.D. 2-1953," *Population Studies*, vol. XIII, No. 3 (March, 1960).

⁷ Ho Ping-ti, op. cit.

⁸ W. H. Moreland, *India at the Death of Akbar* (London, 1920).

⁹ Kingsley Davis, *The Population of India and Pakistan* (Princeton, 1951).

¹⁰ Jatindra Mohan Datta, "A Re-examination of Moreland's Estimate of Population of India at the Death of Akbar," *Indian Population Bulletin*, Vol. I, No. 1 (April, 1960).

⁴ Ho Ping-ti, *Studies on the Population of China, 1368-1953* (Cambridge, Massachusetts, 1959).

⁵ Irene B. Taeuber and Nai-chi Wang, "Population Reports in the Ch'ing Dynasty," *Journal of Asian Studies*, vol. XIX, No. 4 (August, 1960).

probably grew relatively vigorously in the 17th and 19th centuries, less in the early 18th century, and perhaps not at all between 1750 and 1800.

10. The estimates for India-Pakistan in 1750, 1800 and 1850 were made by backward projection of hypothetical growth trends from Davis's corrected total of 255 million in 1871. (Willcox's and Carr-Saunders' estimates were predicted upon an earlier official correction of the 1871 census total, which now appears too low.) For the low variant, a trend of the form suggested by Davis was assumed: this implies an average annual growth rate of about 6 per 1,000 for 1750-1871. The high variant was modelled on the pattern suggested by Datta with an annual increase rate of 3 per 1,000 for 1800-1871 (slightly less than the average of 3.6 for 1871-1921) and no increase from 1750 to 1800. A further backward projection of the high variant assuming growth at 1.5 per 1,000 during 1700-50 and 3 per 1,000 before 1700 would come to about 140 million in 1605, which is probably not beyond the margin of error in Moreland's estimate of 100 million. The medium estimates for 1750-1850 follow a middle course between the low and high. These speculative calculations only serve to illustrate the extent of uncertainty in historical population estimates for India and Pakistan.

11. *Indonesia*. The basis for estimates of Indonesia's population before 1930 is weak, as the first comprehensive census, taken in 1920, failed of complete coverage. Official estimates going back to 1815 for Java and Madura, and 1905 for the outer islands, understated the size of the population and exaggerated its growth.¹¹ For Java and Madura, they imply that the population grew between 1815 and 1900 at an average annual rate exceeding 20 per 1,000, which is hardly credible.

12. The annual growth rate of Indonesia's population during the 1920's and 1930's appears to have been about 15 per 1,000 and a rate of about 10 per 1,000 is suggested by adjusted population estimates for 1900-1920. It is likely that the 1900-1920 rate was abnormally low in Indonesia, as in India, owing to the 1918 influenza pandemic. The low variant was therefore projected back from 1900 by assuming 15 per 1,000 as the highest plausible average growth rate for 1800-1900 and 10 per 1,000 for 1750-1800. The rates for the high variant were set at 10 per 1,000 for

1800-1900 and 5 per 1,000 for 1750-1800 and 1900-1920. Medium estimates were placed halfway between the high and low. For Java and Madura, the range of low and high estimates so obtained for 1815 is about 8 to 14 million, whereas the official estimate of the population at that date was 4.5 million. It seems difficult to believe that the population could have been much more than three times larger than the Dutch colonial authorities estimated. Again, the variants serve to indicate the wide range of uncertainty.

13. *Japan*. The trend of the Japanese population can be traced with considerable confidence since the early 18th century, thanks to the record of the Tokugawa censuses of commoners, taken periodically from 1721 to 1852. In spite of some misgivings as to their reliability,¹³ these statistics have enough continuity with more recent data to justify a degree of confidence which is lacking in the contemporary Chinese statistics. The numbers of *samurai* and other social classes, not included in the Tokugawa censuses have been estimated in the range of 1.5 to 4.0 million (estimates by Honjo and Sekiyama, quoted by Taeuber).¹⁴ The range of the low and high variants was set accordingly. The medium series shown here for 1750 to 1850 does not differ much from the one used by Willcox and Carr-Saunders or from Ishii's estimates.¹⁵

14. *Remainder of Asia*. Little confidence can be placed in any long-range historical estimates for the remainder of Asia. Some of the countries lack reliable measures even of the present population and few have any census records antedating 1900. Conjectural estimates were calculated by backward projection from the United Nations 1920 estimate of 136 million, using for the low variant the same growth rates assumed for the Indonesian high estimates, and for the high variant, those of the India-Pakistan high variant. The faster growth rates are probably more appropriate to the Southeast Asian countries and the slower rates to those of Southwestern Asia as a group. The medium was placed nearer the low than the high. All estimates for this area exclude the Asian part of the USSR, but include European Turkey, in accordance with the definition of the United Nations estimates.

15. *Africa*. The trend of Africa's population cannot be reconstructed with any confidence even over the last few decades, as recent

¹¹ H. de Meel, "Demographic Dilemma in Indonesia," *Pacific Affairs*, vol. XXIV No. 3, (September, 1951).

¹² N. Keyfitz, "The Population of Indonesia," *Ekonomi dan Keuangan Indonesia* (October, 1953).

¹³ Irene B. Taeuber, *The Population of Japan* (Princeton, 1958).

¹⁴ *Ibid.*

¹⁵ R. Ishii, *Population Pressure and Economic Life in Japan* (Chicago, 1937).

censuses of many of the newly-independent African states have revealed the presence of greater numbers of people than could be reconciled with earlier estimates. For the 19th and 18th centuries, not only are statistics almost completely non-existent, but written history itself is lacking in large areas of the continent. At best, hypothetical calculations may serve to show that a wide range of past population magnitudes and trends would not be beyond the limits of plausibility.

16. The United Nations estimate of 143 million for Africa's population in 1920 was taken as a starting point for calculating a low variant for earlier dates. This, compared with the 1960 estimate, implies an annual growth rate of approximately 16 per 1,000 during 1920-1960, which seems near the maximum of plausibility, in view of indications of high contemporary mortality levels in much of Africa. If the population could grow at this rate during 1920-1960, it seems possible that it might have grown at as high a rate as 10 per 1,000 during 1850-1920 (the same as the high variant for Indonesia); the low variant for Africa was projected back to 1850 on that basis. For the high variant, rates of 10 per 1,000 for 1920-1960 and 5 per 1,000 for 1850-1920 were assumed.

17. In speculating about the trend before 1850, the effect of the slave trade on Africa's population has to be taken into account. It was assumed for high estimates that the slave trade caused a continuous decrease of population between 1750 and 1850. (Carr-Saunders' assumption was similar, except that he put the nadir of population about 1800 and postulated a slight increase during 1800-1850.) The low variant, on the other hand, was constructed on the hypothesis that the population increased, in spite of the slave trade, at 5 per 1,000 during 1750-1850. This does not appear implausible in view of the historical facts: while large areas of West Africa were considerably depopulated, the demographic effects in East Africa were probably much less important,¹⁶ North Africa was unaffected, and South Africa's population growth was enhanced by migrations from the north, possibly spurred by the slave raids. According to one estimate,¹⁷ exports of slaves from Africa reached a peak of 135,000 annually during 1835-1840, which would be less than 2 per 1,000 of the population as estimated on the low variant. If this loss was doubled as a

result of deaths of slaves en route to the ships, birth deficits due to disruption of families, tribal disorganization, etc., natural increase might still have been sufficient to keep the population growing at the moderate rate assumed.

18. The low and high variants for Africa in 1750 define a range of 50 to 160 million, which is not too wide to represent the extent of uncertainty. As the direction of the population trend between 1750 and 1850 is indeterminate, the medium estimates for this period were put at a constant figure of 100 million—the same as Willcox's guess.

19. *Europe (excluding the USSR)*. While estimates of Europe's population since 1850 can be considered nearly exact, the quality and scope of data are less satisfactory for the early 19th century and much less satisfactory for the 18th. In the low variant, the estimate for 1800 was obtained by deducting the medium estimate for the USSR (see below) from Willcox's total for Europe (also accepted by Carr-Saunders). The increase from 1750 to 1800 was calculated with reference to estimates compiled by Kuczynski¹⁸ and Reinhard and Armengaud¹⁹ for ten European countries, not including Russia: these suggested an annual growth rate of about 7 per 1,000 during 1750-1800, which was assumed to apply to all Europe. In calculations for the high variant, following Mombert's line of reasoning,²⁰ the 1800 low estimate was raised by 10 million to allow for possible understatement due to incomplete enumeration in some early 19th century censuses and underestimation of the population in countries where census data were lacking. On this basis, the annual rate of increase during 1800-1850 would be about 4.2 per 1,000, instead of 6.2 indicated by the low variant. Supposing that population growth would have been slower on account of higher death rates in 1750-1800, the growth rate of 1750-1800 in the high variant was put at 3.5 per 1,000. Medium estimates were placed halfway between the low and the high.

20. *USSR*. The only comprehensive census of the former Russian Empire was taken in 1897; in addition to the question of its accuracy, there is some uncertainty in the adjustments for territorial changes whereby the 1897 population in the present area of the Soviet Union has

¹⁸ R. R. Kuczynski, "Population," *Encyclopedia of Social Sciences* (New York, 1934).

¹⁹ Marcel R. Reinhard and André Armengaud, *Histoire générale de la population mondiale* (Paris, 1961).

²⁰ Paul Mombert, "Die Entwicklung der Bevölkerung Europas seit der Mitte des 17. Jahrhunderts," *Zeitschrift für Nationalökonomie*, No. 7 (1936).

¹⁶ R. R. Kuczynski, *Demographic Survey of the British Colonial Empire*, (Oxford, 1948-49), vol. I, p. 14, vol. II, pp. 121-122, respectively.

¹⁷ "Report of a Select Committee for the House of Commons, 1848," quoted in *The Nigerian Handbook* (1953).

been officially estimated. Estimates of the prior long-range trend depend on the record of enumerations of taxable males at various dates since the 17th century. Such estimates are subject to considerable error, owing to the possibility of varying degrees of incompleteness in the enumerations and to the fact that the earlier enumerations did not include large areas not under effective control of the Russian Czars in those times. For the medium estimates, the population in the present European area of the Soviet Union was assumed to have increased in proportion to Lorimer's estimate²¹ for 1724 and 1859 and the increase in number of taxable males recorded between 1724 and 1796.²² For the Asian area, the largely conjectural estimates of 4 million in 1750, 5 million in 1800, 8 million in 1850, and 22.5 million in 1900²³ were adopted. In calculating the low and high variants, generous margins of error were allowed, especially on the high side of the medium.

21. *Latin America*. It was not until late in the 19th century that the record of censuses in Latin America began to afford a fairly definite

²¹ Frank Lorimer, *Population of the Soviet Union: History and Prospects* (Geneva, League of Nations, 1946).

²² Marcel R. Reinhard and André Armengaud, *op. cit.*

²³ United Nations, *The Determinants and Consequences of Population Trends* (United Nations publication, Sales No.: 53.XIII.3), p. 11.

indication of the magnitude of population in the whole region. Willcox, attempting to estimate this magnitude as of 1750 and 1800, could find little other basis than Humboldt's data for Mexico and statistics for some Caribbean islands. Carr-Saunders' estimates, although no more firmly based than Willcox's, are preferable, as they exhibit a more regular trend: these were rounded and taken as medium estimates for the period 1750-1900. The 1800 and 1850 figures are also in line with Rosenblat's estimate²⁴ for 1825, based on Humboldt's calculation. These medium estimates indicate annual growth rates of 11 to 13 per 1,000 in successive periods from 1750 to 1900, whereas the rate is estimated at 18 per 1,000 for 1900-1920 and 22 per 1,000 for 1920-1960. The low and high variants correspond to steady growth from 1750 to 1900 at rates of approximately 15 and 8 per 1,000 respectively.

22. *USA, Canada and Oceania*. The figures shown for these areas are Willcox's estimates, which Carr-Saunders also adopted. Although there is considerable uncertainty in estimates for the United States and Canada in 1750 and for Oceania up to 1850, the magnitude of possible errors is too small to affect the world picture.

²⁴ Angel Rosenblat, "La Población Indígena, 1492-1950," *La Población Indígena y el Mestizaje en América* (Buenos Aires, 1954).

Table 1. World population estimates, 1750-2000 (in millions)

Area	1750	1800	1850	1900	1960	2000
A. Medium estimates						
WORLD TOTAL ^a	750	960	1,240	1,650	2,990	5,965
Asia, excl. USSR ^a	480	630	810	930	1,651	3,307
China, mainland	215	325	430	430	650	1,034
India and Pakistan	170	190	235	285	525	1,135
Indonesia	10	14	22	45	94	246
Japan	29	29	30	44	93	122
Remainder	60	70	90	125	289	770
Africa	100	100	100	150	273	768
Europe, excl. USSR	120	155	195	293	425	527
USSR	30	45	70	130	214	353
Latin America	12	20	35	65	212	624
USA and Canada	1	6	26	81	199	354
Oceania	2	2	2	6	16	32
Total, European settlement areas ^b	165	230	330	575	1,066	1,890

Table 1. World population estimates, 1750-2000 (in millions) (*continued*)

<i>Area</i>	<i>1750</i>	<i>1800</i>	<i>1850</i>	<i>1900</i>	<i>1960</i>	<i>2000</i>
<i>B. Range of low and high variants</i>						
WORLD TOTAL ^a	590-950	800-1,130	1,100-1,400	1,570-1,770	2,990	5,296-6,828
Asia, excl. USSR ^a	395-595	530-720	700-910	880-1,010	1,651	2,969-3,914
China, mainland	200-250	300-365	365-500	390-500	650	882-1,385
India and Pakistan	125-210	150-210	215-240	285	525	1,047-1,226
Indonesia	6-14	10-18	15-30	43-47	94	220-265
Japan	27-30	27-30	28-31	44	93	115-139
Remainder	35-90	45-95	75-110	120-130	289	705-899
Africa	50-160	60-150	80-140	125-175	273	684-864
Europe, excl. USSR	110-130	150-160	195	293	425	491-563
USSR	25-45	40-55	65-80	125-135	214	316-403
Latin America	7-20	15-35	30-50	60-70	212	514-673
USA and Canada	1	6	26	81	199	294-376
Oceania	2	2	2	6	16	28-35
Total, European settlement areas ^b	145-200	210-260	320-350	565-585	1,066	1,643-2,050

^a Because of rounding, totals may not agree with sums of component items.^b Europe, USSR, Latin America, USA and Canada, and Oceania.

Table 2. Average annual rates of growth per 1,000 population, 1750-2000

<i>Area</i>	<i>Medium estimates</i>					<i>Range of low and high variants ^a</i>		
	<i>1750-1800</i>	<i>1800-1850</i>	<i>1850-1900</i>	<i>1900-1960</i>	<i>1960-2000</i>	<i>1750-1900</i>	<i>1900-1960</i>	<i>1960-2000</i>
WORLD TOTAL	5	5	6	10	17	3-7	9-11	14-21
Asia, excl. USSR	5	5	3	10	18	3-5	8-10	15-22
China, mainland	8	6	0	8	12	3-6	4-9	8-19
India and Pakistan	2	4	4	10	19	2-5	10	17-21
Indonesia	7	9	14	12	24	7-14	12-13	21-26
Japan	0	1	8	13	7	3	13	5-10
Remainder	3	5	7	14	25	2-9	14-15	22-29
Africa	...	...	8	10	26	...	7-13	23-29
Europe, excl. USSR	5	5	8	6	5	5-7	6	4-7
USSR	8	9	12	8	13	7-11	8-9	10-16
Latin America	10	11	12	20	27	8-15	19-21	22-29
USA and Canada	...	30	23	15	15	...	15	10-16
Oceania	...	...	...	16	17	...	16	14-20
Total, European settlement areas	7	7	11	10	14	7-9	10-11	11-16

^a Rates calculated from extreme combinations of low and high variant estimates.

Influence of economic development on migration in Yugoslavia

SAVA OBRADOVIĆ

[Translated from French]

1. It is generally accepted that internal migration is determined mainly by economic factors. Other factors—demographic, social, cultural, political—also affect the movement of individuals and families, but they are rarely as important as the economic ones. Even where they are fundamentally of an economic nature, however, migratory movements may differ greatly from each other. We submit here the results of some research into the migratory movements set off in Yugoslavia by the post-war industrialization.

2. Internal migration in Yugoslavia was relatively large even between the two world wars. According to the 1931 population census, one person out of five was not living in his place of birth. The census taken three decades later, however, showed a considerable increase in the proportion of migrants: in 1961 one person out of three was no longer living in his place of birth.

3. By analysing the results of the successive censuses of 1948, 1953 and 1961, we have been able to establish the extent of migration between these dates. Between 1948 and 1953 nearly 248,000 persons changed residence every year, while between 1953 and 1961 the annual figure rose to about 500,000. It is estimated that pre-war annual migration was lower than the average 1948-1953 level, but it is impossible to establish how large it was, in the absence of data from successive censuses, the 1921 census results for place of birth not having been published.

4. Yugoslavia's economic development between the two wars was not such as to produce large-scale migration. Rural over-population, due to the fact that the rate of population growth was high (1.6 per cent) in relation to the development of the productive forces, was a problem which the Government only partially succeeded in solving by means of agrarian reform and a policy encouraging the expansion of mining and industry. The relatively high proportion of migrants during this period is largely explained by the influence of political, administrative and cultural factors in a new

national community and by the effect of earlier population movements. The fact that the principal flow of migration was towards Serbia, which played the most active political role in the liberation of the Yugoslavs but which made much slower economic progress than Slovenia and Croatia, confirms this interpretation.

5. The social revolution after the Second World War imparted an extraordinary impetus to the process of economic construction while at the same time giving rise to unprecedented migration. The population pressure which was formerly characteristic of the Yugoslav economy (push factors) fell off rapidly as the expansion of industry and services increased tenfold the demand for labour.

As a result of the reform of social institutions and the channelling of the efforts of the masses towards productive ends, the economy developed rapidly. Some statistical indicators will give an idea of the progress achieved in the course of the last twenty years. The population of Yugoslavia rose from 15.8 million in 1948 to 18.6 million in 1961, giving a rate of growth of 1.4 per cent. The agricultural population, which in 1948 represented 72 per cent of the economically active population, accounted for only 57.8 per cent in 1961. Real income (at 1960 prices) rose from 1,281,000 million dinars in 1952 to 2,950,000 million in 1962, giving a rate of growth of 10.1 per cent (between 1923 and 1939 the rate was less than 3 per cent). The index of industrial production rose from 100 in 1939 to 242 in 1955 and 596 in 1961. As examples of industrial progress, we may note the growth in the output of electric power from 1,173 million kWh in 1939 to 13,600 million in 1963, in the output of steel from 235,000 to 1,580,000 tons, in the output of canned meat from 1,300 to 38,000 tons, and so on.

6. The process of industrialization required a mass movement of labour from the rural areas for the construction of dams, roads, factories, housing etc. Migration to the towns and other industrial centres led to a considerable concentration of the population, through the de-

velopment of existing urban agglomerations and the establishment of new ones. In 1948 there were only 206 agglomerations classified as urban; by 1953, their number had risen to 241 and by 1961 to 348. In 1948 Yugoslavia's urban population amounted to only 3.1 million; by 1953 it had risen to 3.7 million and by 1961 to 5.3 million. The population of towns of more than 20,000 residents represented 11.3 per cent of the total population in 1953 and 18.9 per cent in 1961, while the total urban population rose from 22.1 per cent to 28.4 per cent of the total. It may be observed that the growth in urban population accounts for the total increase in the country's population between the 1953 and 1961 censuses. Migration took place mainly among those aged fifteen to forty-five. It rejuvenated the urban population without creating manpower problems in the country. Mechanization, particularly on state farms, of which there were 3,600 in 1963, considerably reduced the demand for labour in agriculture.

7. The post-war economic development likewise influenced interregional migration, although in a special way. On the basis of the indicators for the economic growth of the several republics a movement of the population from the less advanced regions (republics) to the more advanced, where growth is more rapid, might have been expected. The results of the 1948, 1953 and 1961 censuses show that the process is much more complex. The figures for regional migration established from those censuses, on the basis of residence and place of birth, show a positive balance only in the case of Serbia. According to the 1961 census, the interregional migratory balances, established on the basis of place of birth, were as follows:

MIGRATION AND MIGRATORY BALANCE IN YUGOSLAVIA
(1961)

<i>Federal Republic</i>	<i>Immigration</i>	<i>Emigration</i>	<i>Net migration</i>
Serbia	568,198	182,956	+ 385,242
Croatia	255,813	301,001	— 45,188
Slovenia	66,073	67,267	— 1,194
Bosnia	109,511	368,783	— 259,272
Macedonia	66,127	70,955	— 4,828
Montenegro	24,297	99,057	— 74,760

Although migratory movements in the more or less distant past affect such data, it has been established, by comparing the above figures with those for 1953 and 1948, that Bosnia, a region of agricultural overpopulation, provides the largest numbers of interregional emigrants, that net migration in Slovenia, despite the latter's very rapid economic progress, is small,

because Slovenia's geographical, climatic and cultural situation keeps it rather out of the mainstream, and that the flow of migrants is mainly towards Serbia, because of the attraction of the capital, Belgrade, and the prospects for the development of the Pannonian Basin (Vojvodina). Yugoslavia's experience confirms Ravenstein's thesis that migration is primarily a short distance process. Intraregional movements are much more extensive than interregional movements.

8. The changes in the economic structure of the population during the development process also affect migration. Here we shall confine ourselves to a rapid review of the development of the three main sectors of economic activity and their relation to internal migration. Yugoslavia's post-war economic development has been characterized by the expansion of the secondary and tertiary sectors. The tertiary sector, however, has grown relatively more rapidly than the secondary. Thus the secondary sector's share of the total active population rose from 15.2 per cent in 1953 to 22.0 per cent in 1961, whereas the share of the tertiary sector grew over the same period from 18.0 per cent to 21.1 per cent. The particularly rapid development of the tertiary sector is due essentially to the expansion of the economic infra-structure (communications, trade networks, municipal services, and even training), but it is probably also due in part to excessive expansion of the administration in the different fields of activity of the State and the communes. Studies of the relation between the expansion of the secondary and tertiary sectors and migration have revealed some significant facts. In Yugoslavia, the coefficient of correlation between the proportion of secondary activities and the percentage of migrants in seventy-nine demographic regions¹ is lower (0.622) than that between tertiary activities and migration (0.706). It should also be noted that the ratio between the proportion of tertiary activities and the percentage of interregional migrants (excluding local migrants) is 0.829 as against 0.613 for the coefficient of correlation between the proportion of secondary activities and interregional migrants. It seems that migrants are attracted by jobs in services rather than in industry proper. A more detailed analysis would have to be made of these relationships, however, before a proper interpretation could be given.

¹ To facilitate the analysis of demographic phenomena and trends, seventy-nine "permanent regions" have been formed in Yugoslavia, that is, regions used for the presentation of data in successive censuses regardless of any territorial changes for administrative purposes.

Migration in relation to future growth of population and its distribution; internal migration and population distribution—Japan

YOICHI OKAZAKI

1. In order to analyse the effects of internal migration upon the future growth of population and its distribution, it is necessary to study the present trends of internal migration, in the hope that some stable relationships may be observed which could be of use in the determination of the future state. Due to the drastically changing socio-economic conditions, it is expected that the future pattern of internal migration will be quite different from that of the past as well as the present. Nevertheless, a considerable part of the paper is devoted to the analysis of the current situation.

2. Internal migration in Japan is not a recent phenomenon. Since the middle of the Meiji era, the last fifty years have seen a constant stream of internal migration, interrupted only by cycles of economic fluctuation.¹ In recent years, the increased pace of economic development has also increased the amount of internal migration, both in absolute as well as relative volume of total population. The direction of the stream was invariably the inflow of inhabitants into the six biggest prefectures from the other prefectures, except during the years of the second world war. Consequently, the proportion of inhabitants in these prefectures to the total population of Japan has increased from 24.1 per cent in 1920 to 30.8 per cent in 1960.² One of the important characteristics of migration is the age distribution of migrants. As shown in table 1, most of the migrants are rather young. This table was made from the 1960 census report which includes useful information about migration during just a year before the census date. This characteristic is very significant (as will be pointed out later) in considering the effects of migration upon the birth rate, death rate and rate of increase of total population.

3. The fertility of Japan began to decline

around 1920 or a little earlier.³ But the rate of decline was not so high in the pre-war period as in the post-war period. That is, the crude birth rate declined at a speed rate of 1.6 per cent per annum in twenty pre-war years from 36.3 per 1,000 in 1920 to 26.6 per 1,000 in 1939; it declined at much higher rate of 4.2 per cent per annum in fifteen post-war years from 34.3 per 1,000 in 1947 to 17.2 per 1,000 in 1963. Differences in fertility trends between the pre-war period and the post-war period are not only in the declining rate of fertility as a whole but also in the pattern of declining fertility. As it is shown in table 2, in pre-war period age-specific fertility declined at almost the same rate, but in post-war period the fertility of higher age group (30-49) declined at much higher rate than that of lower age group (15-29). This brings an important fact to light, that the future trend of birth rate depends mainly upon the fertility of younger age group. Already at present, about 75 per cent of births are by the young mothers aged 20-29.

4. The interprefectural difference in crude birth rates, measured by the coefficient of standard deviation, was 1.2 in 1920. In the post-war period the difference became much larger as compared to the pre-war period. The coefficient of standard deviation was 11.3 in 1950 and 13.1 in 1955. The difference diminished to 8.8 in 1960. This experience is quite typical of the process of differential fertility during the period of demographic transition as has been observed in the Western European countries. During the typical process, the regional differences in fertility widen in the early stages of demographic transition because birth control practices spread faster in the urban areas than in rural areas. As rural areas began to catch up with the urban areas in reducing their fertility rates, the regional differences in fertility rates began to diminish.

¹ R. Minami, *An analysis of interindustrial mobility of labour force* (Institute of Statistical Research, 1964).

² Bureau of Statistics, Office of the Prime Minister, *Population of Japan, 1960*, 67 (1963).

³ We do not have reliable vital statistics before 1920. But we can conclude as the result of estimation that the fertility trend remained on the same level 1870-1920. Y. Okasaki, *An Estimate of Population by Sex and Age, from 1870 to 1920*, Research Series No. 145 (1962).

5. As it is shown in table 3, the interprefectural difference of fertility is relatively small in three age groups, 20-24, 25-29, and 30-34, compared with other age groups. Putting together the three factors which I pointed out above, (a) that most of migrants are young, (b) that a considerable number of births is by young mothers and (c) that the interprefectural difference of fertility is small in the young female, we can establish a theoretical conclusion that the effect of internal migration on the trend of birth rate is rather small.

6. We can measure empirically the effect of internal migration on the level of birth rate by comparing the actual birth rate and the assumed birth rate which would be if there was no migration. For example the assumed birth rate is calculated by combining the prefecture-age specific birth rates in 1960 and the distribution of population over prefectures in 1955. The result which was obtained by this method for the period 1955-1960 is that the actual birth rate is lower than the assumed birth rate for almost all age groups in 1960, as it is shown in table 4. The total effect on the fertility, measured by the difference between the actual general fertility rate and the assumed general fertility rate in 1960, is that the actual rate is 62.51 per thousand and the assumed rate is 65.32 per thousand, therefore, the decline of birth rate due to migration is 2.81 per thousand (four per cent of the actual rate).

7. The interprefectural difference of mortality, measured by the coefficient of standard deviation of crude death rate, was 11.6 in 1960. Therefore the difference of mortality is larger than that of fertility. But most of migrants belong to the younger age group in which probability of death is rather small. Consequently we can conclude that the effect of migration on the death rate is not large.

8. The size of Japan's population will be determined exclusively by the levels of birth rate and death rate in the future as in the past, because the scale of international migration is negligible for Japan. The effects of internal migration on the birth rate level and death rate level won't be large in future, as it is clear from the above analysis. Therefore the future trend of Japan's population in size will be almost independent of the scale of internal migration.

9. In general it is the difference in rates of population increase of prefectures to change the population distribution. The rate of population increase can be divided into two elements, the rate of natural increase and the rate of social increase. Therefore we should observe the change of population distribution from the

difference of natural increase rate and the difference of social increase rate. The differences of rate of population increase, rate of natural increase and rate of social increase, measured by the coefficient of standard deviation for 1955-1960, are as follows:

The difference in rates of population increase	1.43
The difference in rates of natural increase	0.22
The difference in rates of social increase ..	10.38

These figures show that the change of population distribution is mainly due to social increase. Recently the change of population distribution has been great. During five years from 1955 to 1960 all prefectures had the positive natural increase but thirty-eight prefectures among all forty-six prefectures had negative social increase. On the contrary, in pre-war period there were few prefectures with negative population increase, although there were a number of prefectures with negative social increase.

10. There have been several excellent studies which attempted to clarify the socio-economic factors inducing internal migration in Japan. Among them Dr. Tachi's explanation was particularly clear and interesting. Dr. Tachi explained the motive of internal migration from the view-point of regional income disparity, and based on observations, he explained that there was a remarkably high correlation between the net migration rate and the income disparity.⁴ The per capita income in highly industrialized prefectures is about three times higher than that in rural prefectures. In addition there are many more job opportunities in industrialized areas than in rural areas. Therefore we conclude that the main factor which causes migration in Japan is the regional economic disparity. In spite of the large scale of migration, the regional economic disparity has not yet been reduced and the stream of interprefectural migration has become intensified.

11. As Dr. Tachi suggests, the concentration of population is an indispensable tendency, so long as there is a regional economic disparity. But over-concentration brings about several bad influences both on receiving areas and on sending areas. For example, it brings about the shortage of housing and transportation facilities in receiving areas and the shortage of productive manpower in sending areas. Against such a situation the national and local governments are pushing some regional development programmes which are considered effective in

⁴ M. Tachi, "Regional Income Disparity and International Migration in Japan," *Economic Development and Cultural Change* (1964).

mitigating the concentration of industries and population.

12. These governmental measures might be actually effective to change the distribution of population in future. But even governmental policies cannot transform entirely the pattern of population distribution which has developed during a long historical process. Therefore the future trend of concentration won't be different from the extension of the past trend.

13. The index of population concentration, measured by the coefficient of standard deviation of population densities, is shown in table 5. There we find two different tendencies for the pre-war period and for the post-war period. Fitting straight lines to these data by least squares method we can obtain two linear equations, as follows:

For the pre-war period:

$$y = 0.2549x + 2.2237 \quad r = +0.9957$$

For the post-war period:

$$y = 0.3764x + 1.9579 \quad r = +0.9980$$

On the equation for the post-war period we can calculate the future figures of concentration index. The result is: 3.84 in 1965, 4.22 in 1970, 4.59 in 1975, 4.97 in 1980, 5.35 in 1985, 5.72 in 1990, 6.10 in 1995 and 6.47 in 2000. If this projection is correct, the concentration of population in Japan would be almost double in forty years from now. It may be said in this connexion that the population density of all Japan was 253 per square kilometre in 1960, it will be 275 per square kilometre in 1970, 328 per square kilometre in 2000, according to the future population estimates.

Table 1. Age distribution of interprefectural migrants

Age group	Male	Female
TOTAL	100.0	100.0
1-14	11.0	14.0
15-19	26.7	26.2
20-24	22.8	22.7
25-29	15.5	15.0
30-39	12.9	11.3
40-49	6.0	4.4
50-59	3.2	2.9
60-69	1.3	2.0
70-79	0.4	1.1
80 and over	0.1	0.3

SOURCE: Bureau of Statistics, Office of the Prime Minister, *Population of Japan, 1960*, 542 (1963).

Table 2. The rates of decline of age-specific birth rates in pre-war period and post-war period

Age group	1925-1939 (per cent per annum)	1947-1961 (per cent per annum)
15-19	3.3	3.4
20-24	1.6	1.7
25-29	1.2	1.5
30-34	1.3	3.0
35-39	1.3	7.5
40-44	1.3	12.6
45-49	1.5	17.6

SOURCE: Documentation Section, Institute of Population Problems, Ministry of Health and Welfare, *Standardized vital rates for all Japan (1963)*.

Table 3. Interprefectural difference of fertility by age group, 1960

Age group	Coefficient of standard deviation
15-19	47.6
20-24	21.9
25-29	8.1
30-34	22.1
35-39	38.0
40-44	55.2
45-49	55.9

SOURCE: Division of Health and Welfare Statistics, Ministry of Health and Welfare, *Vital Statistics, 1960*.

Table 4. The effect of migration on levels of birth rates by age groups. (1955-1960)

<i>Age group</i>	<i>Actual birth rate (per thousand)</i>	<i>Assumed birth rate (per thousand)</i>	<i>Effect</i>
15-19	4.26	4.42	-0.16
20-24	106.63	109.01	-2.38
25-29	181.13	189.16	-1.03
30-34	79.74	79.87	-0.13
35-39	23.85	23.88	-0.03
40-44	5.18	5.16	-0.02
45-49	0.34	0.34	0.00

Table 5. The index of population concentration

<i>Pre-war years</i>		<i>Post-war years</i>	
<i>Year (x)</i>	<i>Index (y)</i>	<i>Year (x)</i>	<i>Index (y)</i>
1920	2.486	1947	2.373
1925	2.731	1950	2.659
1930	2.970	1955	3.066
1940	3.497	1960	3.474

The present and future demographic situation in China

ROLAND PRESSAT

[Translated from French]

I. STATISTICAL DATA ON THE CHINESE POPULATION

1. There has never been any systematic publication of the results of the 1953 Chinese census. What data are available have been laboriously reconstructed from scattered pieces of information, a process that tends to be somewhat arbitrary in character. Any revisions made in order to arrive at a picture of a population whose various structural features can be identified with what is generally known about populations characterized by a primitive demographic régime are, in our view, questionable. As the population of mainland China has never been reliably measured demographically, no reconstructed data on the Chinese population can be regarded as giving any better results than the primary data.

2. The statistics of population movement that have been published are of two kinds:

(a) Those intended to apply to the People's Republic of China as a whole and based on the general registration of vital statistics, which is in all probability far from complete (n : birth rate; m : death rate; per 1,000 population).

	"	"
1954	37	13
1955	35	12.4
1956	32	11.4
1957	34	11

(b) Those based on sample surveys or relating to certain of the main towns. One sample survey comprising twenty-nine towns and six districts in six different provinces disclosed a birth rate of 37 per 1,000 population and a death rate of 17 per 1,000. The results of a very large sampling taken about 1953 were similar. On the other hand, the general figures presented by Chen Ta show a birth rate of 41.6 per 1,000 and a death rate of 21.0 per 1,000 relating basically to the period 1952-1953. The figures for towns—which are of little interest in respect of the death rate principally

because of the particular characteristics of the age structure, the more advanced level of development of the population, etc.—generally show birth rates exceeding 40 per 1,000.

3. The birth and death statistics do not go beyond the year 1957. It has not, therefore, been possible to obtain the increasingly precise data on the actual demographic situation in China that would be expected from an established statistical organization. In addition, it has not been possible to measure the effects of the birth control campaign, which was particularly intense in 1957-1958, or the effect on mortality trends of the difficult years 1959-1961.

II. THE CHINESE POPULATION IN 1963

4. The Chinese population in 1963 will be estimated on the basis of retrospective projections.

5. The most precise information available on the fertility of a contemporary Chinese population is probably that represented by the data collected and analysed by Chi-hsien Tuan, which relate principally to the female generations of 1900-1937 in a rural region of Formosa. The fact that this information relates to a Chinese population is not a sufficient reason for regarding it as applicable to the population of mainland China as a whole between 1953 and 1963. Only the probability of the results obtained might justify such a transposition, at least on the operational level. Further details regarding these data will be given in section IV.

6. With regard to nuptiality, we shall use the age-specific rates for married females based on the 1935 census in Formosa. Mortality will be determined from the United Nations model life tables at the level 50 in 1953-1958 ($e_0 = 45$ years) and at the level 60 in 1958-1963 ($e_0 = 50$ years). The results thus obtained are as follows (P : population; n : birth rate; m : death rate):

30 June 1953	$P = 583$ million	$n = 43.0$ per 1,000; $m = 20.9$ per 1,000
30 June 1958	$P = 651$ million	$n = 39.7$ per 1,000; $m = 17.0$ per 1,000
30 June 1963	$P = 729$ million	

7. The population on 30 June 1958 is consistent with the various estimates compiled elsewhere. The two birth rate figures show an appreciable decline from the one period to the other even though fertility is assumed to be constant, and this might constitute a test of the "abnormal", but not necessarily aberrant, character of the initial age structure. They are, however, in general accord with the most plausible data derived from various sources. The same is true of the death rates and life expectancy figures. The presumed decline in mortality might seem surprising in the light of the serious economic difficulties during the second five-year period, but the downward trend in mortality seems to us to be based on changes in Chinese society profound enough to resist the shock of three severe years.

III. THE FUTURE DEMOGRAPHIC SITUATION IN CHINA

8. The very strong social organization which is now a feature of Chinese life greatly influences population trends. So far, the most marked effect has been on the trend in mortality, which has clearly been declining as fast as is compatible with the changing economic conditions. Economic growth itself, despite a number of set-backs, has probably been effected at a pace that would have been impossible without the change of régime; at least, there is no comparable example of a large, poor country experiencing such a veritable transformation of general living conditions.

9. The profound changes in Chinese society would seem at first glance to favour the propagation of voluntary birth control, particularly under the pressure of official encouragement. The policy in this matter has, however, been very changeable and contradictory. On the whole, and in the absence of any well-defined population policy, all the changes that have taken place in mainland China in the last fifteen years have shown themselves to be particularly favourable to population growth.

10. Barring any cataclysms, the decline in mortality will continue, for the margin of possible progress is still great. The following life expectancy progression has been adopted:

	<i>Years</i>
1963-1968	55
1968-1973	60.4
1973-1978	63.2

	<i>Years</i>
1978-1983	65.8
1983-1988	68.2
1988-1993	70.2
1993-1998	71.7

This is not so much a forecast as a fairly modest progression model, since it presumes, for example, that the present lag of twenty years behind the Japanese population will tend to increase (around 1990 it will be twenty-five years).

11. As always, the future trend of fertility is the great unknown factor. In the first place, much depends on the progress made in contraceptive techniques and on the likelihood that, with the possible spread of contraceptive pills in the near future, the traditional inertia characteristic of reproductive behaviour will be overcome. Theoretically, with the perfect contraceptive (perfect from the point of view of both use and effectiveness), anything is possible, and it is difficult to know what statistical models to use in order to project trends that seem at all likely. In particular, the historical models of decline in fertility (such as the European models) have very little relevance, since any transposition to the Chinese population would be quite gratuitous.

12. The choice of the assumptions used in our various projections was finally made in the light of the recommendations on marriage and fertility appearing in the Chinese Press. With the resumption of the birth control campaign in the spring of 1962, many newspapers began advocating standards in respect of marriage, number of children and the spacing of births that were more or less similar. We thought it would be of interest to indicate what the demographic consequences of complying with these standards would be.

IV. ASSUMPTIONS AND METHODS OF CALCULATION

13. Data on marriage and legitimate fertility in Formosa provided a basis (see section II) for making satisfactory population estimates for 1958 and 1963. It is this information or other data associated with it that will be used in calculating the projections, and possible modifications will be introduced subsequently, at the 1963 level or thereabouts, to take account of presumed changes in patterns of behaviour. The following are the actual indices used (disregarding the effect of mortality):

Table 1

<i>Age of a five-generation group</i>	<i>15-19 years</i>	<i>20-24 years</i>	<i>25-29 years</i>	<i>30-34 years</i>	<i>35-39 years</i>	<i>40-44 years</i>	<i>45-49 years</i>
First marriages	281	549	129	18	9	6	1
Annual births per 1,000 married women...	150	340	360	320	290	200	40

14. First marriages may subsequently end in divorce or, particularly in the population under study, in widowhood and may then be followed by remarriage. As, in the absence of the necessary basic information, it is not possible to come to any conclusions on the dissolution of marriages and remarriages without lengthy and somewhat unrealistic calculations, the number of legitimate births will be computed in relation to the total number of surviving ever-married women. In order, however, to take account of the over-estimation to which this procedure leads, and in the light of information obtained from calculations carried out concurrently by two methods, we have retained only 95 per cent of the number of births

determined in accordance with our simplified procedure.

15. The articles in the Chinese Press stress the advisability of late marriages for both men and women. Although the various recommendations are far from unanimous, the youngest age recommended for women is twenty-two; in some cases the recommended age is as high as twenty-eight. In assuming for our purposes that the average age at marriage will rise in the future, the nuptiality rate remaining unchanged, we shall suppose a progressive increase in the average age at marriage from 19.7 years to 24.3 years in the space of ten generations, as set out in the table below:

Table 2. Distribution of marriages according to generation group, date of marriage and age of group

<i>Generations</i>	<i>Marriages contracted from</i>	<i>Distribution of marriages according to age of group</i>							<i>Average age</i>	<i>Reference population</i>
		<i>15-19</i>	<i>20-24</i>	<i>25-29</i>	<i>30-34</i>	<i>35-39</i>	<i>40-44</i>	<i>45-49</i>		
1943-1948	1958-1963	281	549	129	18	9	6	1	19.7	Formosa, 1935
1948-1953	1963-1968	175	575	180	32	19	9	3	20.9	Interpolation
1953-1958	1968-1973	116	528	241	63	28	12	5	22.2	Israel, 1948
1958-1963	1973-1978	53	363	374	130	44	15	14	24.3	French generations, 1871-1875

16. While the nuptiality rate will remain constant in all the generations (993 women out of 1,000 will eventually marry), the fact that marriages will increasingly be delayed in relation to former practice will bring about a considerable decline in the current nuptiality rate. On the basis of 1,000 women in a fictitious cohort, the annual number of first marriages in each period will be as follows:

Table 3. Distribution of the annual number of first marriages (per 1,000 women)

<i>Period of marriage</i>	<i>First marriages</i>
1958-1963	993
1963-1968	887
1968-1973	854
1973-1978	795

<i>Period of marriage</i>	<i>First marriages</i>
1978-1983	705
1983-1988	879
1988-1993	958
1993-1998	979
1998-2003	984
2003-2008	993

The effect will, therefore, be spread over forty years, although it concerns only ten generations. During this transitional period, it will be as if 4.5 female generations contracted no marriages at all.

17. As regards fertility, two children, while not considered an absolute minimum, will constitute the proposed standard, three children being an exceptional figure never to be ex-

ceeded. We shall therefore take the systematic goal of two live-born children per married couple as being statistically equivalent to the most pronounced recommendations of the Chinese Press. The following table shows how, in our calculations, the transition will be effected from natural fertility (first line, 1918-

1923 generations) to fertility corresponding to a widespread limitation of family size to two children (last line, 1943-1948 generations). It should be noted that we have assumed that from 1973, i.e. in eight years' time, all married women will have a fertility equal to that of the 1943-1948 generations.

Table 4. Completed fertility of women who remain married, according to generation group and age at marriage

Generations	Age at marriage					
	Under 20 years	20 years	25 years	30 years	35 years	40 years
1918-1923	7.94	6.90	5.15	3.45	1.92	0.70
1923-1928	7.67	6.63	4.88	3.18	1.65	0.82
1928-1933	6.74	5.70	3.95	2.50	1.55	0.89
1933-1938	5.29	4.25	2.50	1.93	1.53	0.89
1938-1943	3.44	2.40	1.84	1.74	1.53	0.89
1943-1948	1.94	1.91	1.84	1.74	1.53	0.89

18. We give below the fertility of marriage cohorts (in terms of the average number of live-born children) corresponding to the different sets of assumptions considered.

Table 5. Average number of live-born children, according to the different assumptions

	Average number of children	
	Unchanged marriage patterns	Delayed marriages
Unchanged fertility (fertility of non-contracepting couples)	6.8	5.4
Declining fertility (limitation of family size to two children) ..	1.88	1.70

V. RESULTS

19. The future trend, if nuptiality and fertility remained unchanged, would be in the direction of a considerable increase in population. We see that as a result merely of a change in nuptiality (brought about by an increase in the average age at marriage) population growth slows down, although not to any marked extent in the first twenty years. In the long run, the birth rate becomes stabilized at 35 per 1,000 population, as against 41 per 1,000 when nuptiality remains unchanged, and the

annual rate of growth, on the assumption of very low mortality, is about 3 per cent as against 3.6 per cent. In the final analysis, the mere postponement of marriages, even to a considerably higher average age (almost five years), would not have any marked effect on population growth, particularly in the short term. Thus, the demographic variable which the leaders might at present most easily influence, by a combination of persuasion and legislative measures, is not apt, even within a wide range of variation, to affect the future demographic situation.

Table 6. Population forecasts for mainland China, in millions of inhabitants

		1963	1968	1973	1978	1983	1988	1993	1998
Unchanged fertility	{ Unchanged marriage patterns	729	824	944	1,098	1,295	1,539	1,837	2,197
	{ Delayed marriages	729	823	937	1,072	1,228	1,415	1,631	1,888
Declining fertility	{ Unchanged marriage patterns	729	798	845	885	937	988	1,025	1,053
	{ Delayed marriages	729	797	837	865	892	925	961	987

20. The models with rapidly declining fertility demonstrate the inertia imposed on population trends by the initial population structures. Although the birth rate is assumed to decline from the present 39 per 1,000 population (1964) to 18 per 1,000, or even 15 per 1,000, in ten years' time, the Chinese population is nevertheless certain to reach 1,000 million by the year 2000. This brings to mind the case of Japan, where, within ten years, the birth rate also dropped to 18 per 1,000, though the initial figure was lower (33 per 1,000 in 1949). Thus, according to our calculations, China is likely to undergo demographic transformations even more radical than those in Japan, and, as in the case of the latter country, it will be many decades after the beginning of the second phase of the demographic revolution before the population begins to level off. According to the latest Japanese projections, the population will not begin to decline until after the year 2005, i.e., fifty-five years after the beginning of the downward trend in the birth rate and at a time when the number of in-

habitants will have increased by 50 per cent: 121.7 million in 2005 against 81.3 million in 1949.

21. It is difficult to imagine more profound changes in Chinese fertility than those which we have just assumed. To go further, apart from the possession of the perfect contraceptive, one would have to suppose that the practice of limiting family size to one child will become widespread in China within the near future. This would clearly be going much further in the voluntary limitation of family size than the Chinese leaders are suggesting at the present time.

22. Although it seems to us that the two series of projections point to what the actual situation is very likely to be, it must be admitted that they cover a very wide range of possibilities. Undoubtedly, there will be a number of factors that will militate against a figure of the order of 2,000 million being reached by the year 2000, but it is evident that they can make themselves felt only as a result of fundamental changes in the demographic characteristics of the Chinese population. The figure of 2,000 million is strictly within the limits of the present potential.

23. In any event, the future demographic situation in China may depend initially on the determination, as yet not too clearly apparent, of their leaders on this question. In the long run, however, the means available to the Chinese for limiting fertility will be an important factor in determining future trends.

Table 7. Trend in birth rate with declining fertility (per 1,000 population)

	1963-1968	1968-1973	1973-1978	Situation around 2000
Unchanged marriage patterns..	31	21	18	13
Delayed marriages	31	20	15	13

Present and future patterns of population replacement

B. Y. SMULEVICH

[Translated from Russian]

1. In scientific demography, population replacement is considered to depend on a complex of interrelated long-term and short-term factors, which differ according to whether births are planned or unplanned. Population replacement depends on the material conditions of life, labour and leisure, on historically conditioned family relationships, on the economic role of the family, on the status of women, on the conditions for the rearing of children, on the cultural level, on psychological factors, on customs, traditions and religion, on medical science and the availability of medical care, on biological factors and geographical environment and on the age-sex structure of the population. In the final analysis, however, the main factors affecting population replacement are the manner in which material wealth is produced, the form of the State as determined by the social and economic structure of society and the policy of the State in population and health matters. Wars are disastrous for reproduction and health. They destroy people in the prime of life and damage the age-sex structure of the population. They impair the health of adults and children, disable millions and do vast and lasting physical and psychological harm. As a result of the high level of development of the means of destruction, war has become a threat to the very existence of a considerable portion of mankind, and preparation for war a heavy burden on the people.

2. There is a belief that Marxist population theory takes only the economic factor into account. In actual fact, Marxism does not break the "thread passing through the whole of organic nature right down to man" (Lenin) but holds that the laws governing the historical development of human society have a decisive effect on population replacement as well. When the higher (social) form of movement occurs, the lower (biological) form is retained within it even though the latter is at the same time subordinate to the former. This explains the historical nature of population laws. As regards the role of the economic factor, although Marx considered productive relations the basis of social development, he nevertheless said the fol-

lowing, as if warning against oversimplification and vulgar economism: "... the same economic basis—the same in its essential features—can, owing to the endless variety of empirical circumstances, natural conditions, racial relationships, exogenous historical influences and so on, display endless variations and gradations in the form it takes, and these can be understood only through analysis of these empirically given circumstances". All this is particularly important in relation to population replacement, which is very closely linked with such complex social phenomena as mode of life, family and indeed the entire spectrum of material and spiritual conditions. Just as changes in the social superstructure do not automatically follow upon changes in the basis, the superstructure having a relative degree of independence, so the interaction between population replacement and social and economic phenomena is all the more complex and these phenomena take longer to have effect. Of greatest importance to population replacement is the population law of the particular socio-economic structure in question. "By bringing about capital accumulation, the working population to an ever growing extent itself produces the means which make it a relatively surplus population. This is the population law characteristic of the capitalist mode of production" (K. Marx). This proposition of Marx's is not just a theory of unemployment; *it reveals the full depth and acuteness of the contradictions between the development of material productive forces and the living productive force that are characteristic of capitalism.* With the growth of labour productivity as a result of the use of machinery in production, and with the concentration and centralization of capital, more and more capital is transformed into means of production and less and less into manpower. This leads to a relative decline in the demand for labour (although not to an absolute decline, as A. Sauvy tries to make Marx say). Part of the working population becomes superfluous, not in relation to the available means of subsistence, but only in relation to the requirements of capital accumulation. Capital causes

the ruin of independent small producers (peasants, craftsmen, artisans). In underdeveloped countries this means the waste of human labour resources, which are condemned to idleness, want and inertia by the hundreds of millions. The main reason for all this is that the purpose of production under capitalism is profit, not satisfaction of the people's needs. The creation of relative overpopulation has a great influence on the situation not only of the unemployed and their families, but of all workers; it affects their economic, social and psychological condition and their reproduction patterns.

3. Socialist revolution lays the basis for new productive relationships. Manpower ceases to be a commodity, and the role and place of workers in social production changes. The subordination of social production to their interests has eliminated the contradiction, inherent in all class structures, between the role of the workers as the most important productive force in social production and their subordinate status as an exploited class. Socialism has abolished the antagonistic contradictions between the development of material productive forces and the living productive force, and a new population law, the socialist law, has come into being. The most important feature of the socialist population law is the principle of the full, planned and rational use of labour resources, which is directly linked with the planned training and use of skilled manpower and with a population policy deliberately formulated in the interests of the people. Although the transition to the planned management of the social aspects of life represents a new stage in human civilization, it should not be imagined that this process is swift and smooth and encounters no difficulties or contradictions. In the process of expanded socialist reproduction, the population law operates in close conjunction with other economic laws. Like the other economic laws of socialism, the population law does not take effect automatically or spontaneously, but in accordance with the requirements of the basic economic law and the law of proportional development in a constant struggle with difficulties and contradictions.

4. Many Western demographers and economists present socialist population policy in the wrong light. They believe that Marxist Communists are against planned parenthood and any kind of birth control. This is a misunderstanding. Lenin said: "Freedom of medical propaganda and protection of the elementary democratic rights of the citizen, whether male or female, is one thing. Neo-Malthusian social theory is another" (V. I.

Lenin, *Works* (Russian edition), vol. 23, p. 257). In other words, Marxists are against Malthusian theories, which seek to distract the attention of the oppressed classes and peoples from the real social and economic causes of their poverty. They are not, however, against planned parenthood; they are not against birth "control" of a kind which safeguards the health of women and mothers and helps to produce healthy and happy families. Socialist population policy is one aspect of a socio-economic policy designed to achieve the humanistic aims of all-round physical and spiritual development of the people and satisfaction of their growing needs, and in particular to enable women to combine happy motherhood with creative work. It is important to stress the unity of the political, economic, demographic, social and health aims which is characteristic of socialism. The population and health policy of socialist countries is designed to improve the health of the entire population and to reduce mortality. The birth rate differs, of course, from one socialist country to another, and in those where the socialist State is still of recent origin the birth rate is influenced by the social and economic conditions which existed before the socialist revolution. In some countries which have become socialist, population replacement is still affected by their long exploitation by the imperialist States. Marxists do not object to humane and hygienic measures to protect women from too frequent pregnancy and childbirth. At the same time they stress the limited nature of these measures and the falseness of regarding them as an alternative to radical social reform.

5. How do scientific demographers approach the task of studying current processes of population replacement? In the capitalist world we find two basic types of population replacement and two types of pathology (cause of death and morbidity patterns). In the developed countries, the birth and death rates and the rates of population growth are low (or medium), and there is a tendency towards depopulation during periods of crisis. Among the causes of death the degenerative diseases predominate. The most prevalent causes of illness are nervous and mental diseases.¹ In the United States, for example, nervous and mental diseases are the number one health problem.² In the developing countries, the birth and death rates and rates of population growth are characteristically

¹ It is to be noted that the increase in these diseases is not reflected in the death rate.

² *Journal of American Medical Association*, No. 4 (1954), pp. 327-431.

high. The main causes of death and sickness are infectious diseases. As such diseases become less prevalent, the death rate falls, and the rate of population growth rises. Many countries are at one stage or another between the second and the first type of population replacement.

6. What are the contributing factors in the first type of population replacement? With regard to the decline in mortality, they are: the progress of medicine; higher standards in general and particularly in the field of health and hygiene; the greater prosperity which certain groups of the population won through the class struggle; and the decline in the birth rate, particularly among the poor classes with their high infant mortality. In the case of the decline in the birth rate, they are: the process of urbanization due to industrialization; employment of women outside the home and the absence or insufficient number of institutions to care for their children; the rise in general standards; the decline in infant mortality; and the availability of contraceptives as a means of facilitating planned parenthood and family limitation. The practice of having only one or two children in the countries in question was due mainly to economic factors: among the bourgeoisie, reluctance to divide up the family estate; among the peasants, reluctance to divide up their plot of land once child labour had lost its importance; among the petty bourgeoisie, fear of ruin and proletarianization; among manual and non-manual workers, the gap between their needs and their means and fear of unemployment.

7. In the developing countries today, as in Europe in the nineteenth century, there are many factors conducive to a high birth rate: the low level of the family economy; the fact that the family as a productive unit uses child labour; early marriages; low standards, particularly as regards health and hygiene; illiteracy, tradition, religious advocacy of large families and high infant mortality. The application in the developing countries of the achievements of modern medicine leads to a decline in the death rate and a rise in the rate of population growth. Some scientists, taking the Malthusian view of the decisive influence of population growth on social development, see the rapid growth of population as the main reason for the poverty of these countries, and a reduction in the birth rate as the principal means of raising them to a higher level. Some of them even oppose reducing the death rate.

8. In actual fact, the reason for the poverty in these countries is their economic and cultural backwardness, which is the result of colonial exploitation. It is quite apparent that even

today the aid provided by the developed capitalist countries by no means always helps to strengthen the economies of the developing countries and that the profits taken out of those countries by the monopolies of the imperialist countries greatly exceed the amount invested. What is more, new investment consists increasingly of reinvested profits earned in the less developed countries, and the economic aid which they receive is often in fact military aid. As a result of the increased trend towards unbalanced exchange over the past two years, the total losses of primary producing countries from trade on the capitalist world market are several times greater than the total volume of economic aid from the Western countries. The aid which the developing countries receive from the socialist countries is of a different kind. It is in the form of the construction of industrial plants, assistance in the development of agriculture and the training of skilled workers.

9. The USSR, as far as it is able, provides the developing countries with non-repayable aid and grants them low-interest loans. All the USSR's assistance is designed to help these countries achieve economic independence, industrialization and better living standards. The Central Asian Republics provide a good example of the effectiveness of the policy followed by a socialist State towards under-developed peoples. From the very first years of its existence, the Soviet State took action under its economic and social development plans for more rapid development of the formerly backward national regions. As a result, the political inequality inherited from Tsarist times and the economic and cultural backwardness of the national minorities were eliminated, and these minorities are now equal members of the family of Soviet peoples. The great successes achieved in the economic and cultural development of the Uzbek, Kazakh, Kirgiz, Tadzhik and Turkmen Republics are common knowledge. Between 1913 and 1963, the population of these republics increased by 115 per cent, while the population of the USSR as a whole increased by 41 per cent, i.e., the rate of growth in these republics was 2.8 times higher than in the USSR generally. The proportion of urban population in these republics was less than 15 per cent in 1913, whereas it is now over 40 per cent. Under the Soviet régime, large-scale socialist industry and highly mechanized agriculture have been established in these republics. In every republic of Soviet Central Asia and in Kazakhstan, not only have the economic sectors basic to these regions been developed, but many other branches of the economy have been established and fostered.

Before the Socialist Revolution, the level of literacy in these republics was extremely low (at the end of the nineteenth century, the literacy rate in the Tadzhik SSR was only 2.3 per cent, in the Uzbek SSR 3.6 per cent, in the Turkmen SSR 7.8 per cent and in the Kazakh SSR 8.1 per cent), but universal literacy has now been achieved in them all. Great progress has been made in these republics in regard to higher and secondary specialized education. Whereas before the Revolution there were only four higher educational institutions in the eastern regions of the country, there are now over 200. Women now have equal rights with men in these republics and have become active participants in all aspects of economic, cultural and social life.

10. The experience of the Soviet Union shows that the problem of achieving a rate of economic development significantly higher than the rate of population growth can only be solved through planned industrialization coupled with agricultural development. Only through the harmonious planned development of industry and agriculture can over-population in rural areas and unemployment be eliminated and full employment be ensured. Industrialization and the urbanization that accompanies it lead to a rise in the cultural level of the people and set under-developed countries on the path of economic and cultural progress. Thus, the situation in the less developed countries can be effectively overcome only through economic and cultural development and through progressive social measures such as industrialization, the improvement and modernization of agriculture, improvement of living conditions, cultural development, granting of equal rights to women, elimination of incentive to child labour and improvement of general standards among the broad masses of the people particularly as regards health and hygiene. All this can best be achieved through the planned reorganization of life by the State on the basis of social ownership of the means of production and on the basis of an economic and social policy, and more particularly a population and health policy, designed to promote the interests of the workers. Most important of all is the need to eliminate overt and concealed forms of imperialist exploitation, the plunder of natural resources, excessive interest rates for loans, unbalanced exchange and the one-sided specialization in the production of primary commodities that has made the developing countries dependent on the monopolies of the imperialist Powers. The use for aid to the developing countries of even part of the

thousands of million dollars spent on the arms race would make an enormous difference.³

11. What are the demographic processes under socialism? In order to answer this question, the complexity of the factors affecting these processes must first be considered. It must be realized that such factors as the under-development of productive forces, family relationships, tradition, wars and their consequences and so on have long-term effects. It is thus understandable that conditions affecting population reproduction and health do not change as quickly as conditions affecting industrial production. That is why there are great differences in population replacement rates as between the socialist countries and even between different regions of those countries. Looking at the main features of population replacement in a socialist society such as that of the USSR, we find a rapid decline in general and infant mortality and an improvement in health.⁴ This situation is due to the improvement in living conditions (an economy designed not to enrich certain classes but to satisfy the needs of all workers) and to the existence of a State health system under which competent medical care is made available to the whole population free of charge. A further feature is that social differences in mortality disappear. The decline in the birth rate is due to: industrialization and urbanization and the concomitant migration; mass participation of women in industrial production and social affairs; the rapid growth of education and

³ In his book *World Without War*, John Bernal says that total military expenditure by all countries in the world over the period 1950-1958 amounted to \$720,000 million, or an average of \$90,000 million a year (of which the United States accounted for \$40,000 million a year).

⁴ A point which should be noted here is that, as a result of the progress of medicine, mortality due to certain diseases may decline even where social conditions are unfavourable. The Norwegian psychiatrist Astrup states that, because of this progress, somatic diseases do not give such a clear picture of the effect of social conditions on health as do mental diseases. Arguing against those scientists who maintain that a rise in nervous and mental diseases is an inevitable concomitant of modern civilization, he says that among the reasons for the growth of these diseases in capitalist countries are the cult of egoism, the social isolation of the individual, fear of unemployment, uncertainty about the future, nuclear war psychosis, and so on. Pointing out that nervous and mental diseases are not widespread in the USSR, Astrup says: "Under the socialist system of production, a change is effected not only in the economic basis but also in the whole structure of society and in the people themselves.... The principle of co-operation and mutual aid—replacing the principle of competition—certainty about one's own future and that of one's children and other similar factors are very important elements in mental health."

culture and its influence in encouraging planned parenthood; and changes in the age-sex structure of the population as a result of the war. In the USSR, however, a decline in the birth rate is counteracted by such other factors as: absence of unemployment and of uncertainty about one's own future and that of one's children; rapid growth in the number of child-care institutions; and improvement of the housing situation.

12. A characteristic feature of many population theories is to attribute absolute importance to merely one of the various factors (biological, psychological, economic) affecting the birth rate. The classic example is the biological theory of Malthus. Malthus, as we all know, put forward a non-historical law of population, according to which the population increases in geometrical progression whereas even under the most favourable conditions the means of subsistence can only increase in arithmetical progression. The social significance of the Malthusian "doctrine" lies in the fact that it diverts attention from social and economic conditions and class distinctions as the causes of poverty and unemployment and directs it towards demographic processes and questions of overpopulation. Malthus said that the poor, once acquainted with his theory, would be more resigned to their sad lot and would not rise up against the Government and the upper classes. This is the aim of Malthusianism to this very day. The unscientific nature of Malthus's basic propositions is shown by practical experience and has been demonstrated by many scientists (Marxist and non-Marxist). Nevertheless, even in the twentieth century, Malthusianism is used to justify imperialist aggression, the grievous consequences of colonial oppression, and so on. When there was a sharp fall in the birth rate after the First World War, Professor L. Hersch of the International Labour Office of the League of Nations put forward a theory, which he called Malthusianism in reverse, to the effect that unemployment and so on were attributable to the decline in the birth rate. Behind "classical Malthusianism" and "Malthusianism in reverse" lies a simplified model based on the arithmetical relationship between the number of people and the means of subsistence and divorced from the practical reality of social relations. This same Malthusian model is the principal basis for the "theory of optimum population", according to which the size of the population is the decisive factor affecting the standard of living and other social phenomena. This theory gives an appearance of resolving the difficulties supposed to be caused by either excessive or insufficient

population growth, and it depends on the elusive concept of "optimum population".⁵ The German economist and demographer Mombert rightly said that the optimum population was an abstract concept of a state of equilibrium which could not be achieved in practice. According to the optimum population theory, the main problem in the social sciences is not the laws governing the development of social structures or the contradictions inherent in such structures but the numerical relationship between actual and optimum population. Malthusianism is clearly reactionary. The optimum population theory was a more flexible, "humane" version of Malthusianism. G. Mackenroth, the West German demographer, called the optimum population theory a piece of philosophizing devoid of practical significance in which Malthus's theory loses its pessimistically poisonous fangs.

13. Arguing against Malthusianism in its various forms, Mackenroth rightly said that only a sociological population theory which took into account the multiplicity and interdependence of the social factors affecting population replacement could throw any scientific light on demographic processes. Having made this correct judgement, however, Mackenroth, like Sauvy and other non-Marxist sociologists, did not recognize that social phenomena are determined by the mode of production, by productive relations. In the opinion of these sociologists, social questions have nothing to do with class; they do not see the class contradictions of capitalism.⁶ According to them, unemployment and rural overpopulation are not socio-economic problems but problems of technology, organization and production. They consider that the antagonistic contradictions of capitalism can be eliminated, not through changes in productive relations, but through an improvement in the activities of the State, which they regard as an organization above class.⁷ To ignore the concept of socio-economic structures and the decisive role of productive relations for all

⁵ A. Sauvy, in his *Théorie générale de la population* (Paris, 1959), vol. II, p. 44 defines the optimum population as the one which most satisfactorily ensures the attainment of a certain aim, i.e., power, long life, health, culture, national income, family equilibrium, social harmony.

⁶ "The class hierarchy is gradually being replaced by a hierarchy of peoples", A. Sauvy, *Malthus et les deux Marx* (Paris, 1963), p. 140.

⁷ The West German hygienist Werner Kollath is closer to the truth in his book *Zivilisat. bedingte Krankheiten u. Todesursachen* (1958). In the chapter entitled "The State as the enemy of health", he cites data on the Federal Republic of Germany and the United States which show convincingly that the bourgeois State, acting in the interests of the capitalists, does great harm to the people's health.

social, and particularly demographic, phenomena makes it impossible to determine the laws governing these phenomena. Thus Mackenroth asks, "What made the European develop capitalism? He could have lived just as happily, and possibly more so, under pre-capitalist conditions." Mackenroth considered that the social sciences were incapable of explaining the laws of social development, the transition from feudalism to capitalism. Denying the objective laws of the development of society, he did not see that the replacement of one socio-economic structure by another (feudalism by capitalism, capitalism by socialism) was a process governed by laws. This scepticism also applies to demographic phenomena. He wrote: "We can prove the necessity of types of reproduction just as little as we can prove the necessity of social styles. . . . Why is capitalism, and possibly its type of reproduction, dying out again in Europe? Population theory cannot answer this question, and up to the present day no one has divined the nature of these relationships." In other words, Mackenroth, like Sauvy and many others, recognized himself to be incapable of determining the laws governing population replacement. Such is the fate of scientists who rely on an idealist philosophy and an electric theory of factors, for without a scientific sociological theory it is impossible to determine the patterns or the future trends of population replacement. This explains the prevalence of the "vicious circle" theory and the vagueness about future trends—some, viz., the Malthusians, are afraid of overpopulation, while others, the supporters of welfare theory, fear depopulation.

14. What is the outlook for future population growth? Under Communism, when people's needs are fully satisfied (in accordance with the principle "from each according to his ability, to each according to his needs"), the material and other obstacles to parenthood which reduce the birth rate will disappear. Does this mean unbridled multiplication and an ever rising or very high birth rate? In answer to this, we must say that human beings in a

communist society, both men and women, will be highly cultured persons deriving great satisfaction from their working and social activities and having an interest in the arts and science, and so on. Although children will be brought up mainly in children's institutions, it may be assumed that under conditions of very low infant mortality the desire for parenthood will be amply satisfied by an average number of children, i.e., neither will there be large families nor will it be the practice to have only one or two children. Will this not still mean, in the last analysis, overpopulation of the earth? The answer to this is "no", for even at the present stage of science, the earth could support many times its present population at a high standard of living if the productive relations of capitalism did not stand in the way.⁸ Communism presupposes a further and extremely high level of development of the forces of production. Engels's remark that people will quite consciously make their own history will also apply to population replacement. Planned parenthood will become universal under conditions of full harmony between the individual and society, and the reproductive behaviour of the family will correspond to the interests of society. Thus, Communist society will not be threatened either by overpopulation (as feared by the Malthusians) or by depopulation (as feared by the supporters of the welfare theory).

⁸ John Boyd Orr, a former Director-General of FAO, wrote that modern science knows how to answer Malthus. He said that food has never been produced to capacity because the aim of Western civilization has not been to produce the amount of food necessary to satisfy the needs of mankind but the amount that can be sold at a profit (J. Boyd Orr, *The White Man's Dilemma—Food and the Future*, 1953). Many scientists believe that the area under cultivation could be increased by two and a half to three times and that if scientific and technological knowledge was drawn upon in order to derive the same yield from this area as is obtained in Western Europe, it would be possible to produce sufficient food for over 30,000 million people. On the premise that the area under cultivation could be increased to a considerably greater extent than this, the possibilities for increasing the supply of foodstuffs for mankind are almost unlimited.

Internal migration and the future trend of population in India

N. V. SOVANI

1. The paper deals with the role of internal migration in determining the future trend of population in India and its rural-urban distribution. I will begin by discussing the possible ways in which internal migration can or will affect the factors underlying the future trend of population in India, and then discuss the trend of internal migration in the past and the future with special attention to rural-urban migration. This will involve consideration of the future trend of urbanization and of rural urban differentials in fertility and mortality. In the light of this I will then consider the future trend of population in India.

2. In what way does internal migration affect factors underlying population growth? Population growth in a country is the result of the balance of births and deaths and that of migration into and from abroad. Within a country the regional populations grow as a result of the balance of births and deaths and that of interregional migration. While the two factors (of vital and migration rates) are thus separated in analysis, is this also so in reality or are they interconnected? In so far as migration is selective with reference to sex, age, etc., there can be no doubt that it will and does affect the age and sex composition of the population which receives or loses migrants. It can be expected therefore to affect the composition of population in a direction more favourable or adverse to growth. Rural-urban migration, for instance, generally takes males in the reproductive ages from rural to urban areas, separates many of them from their wives if they are married, and in the return flow sends back the old migrants to the urban areas back to their rural home areas again in old age. This cannot but affect the natural rate of growth in towns as well as in the rural areas. The rural-to-rural migration usually results from colonization of new land or newly developed land and usually results in a fuller utilization of unused resources. It relieves pressure on the resources of the region from which outmigration takes place and thus (if we follow the crude Malthusian theory), makes room for further population growth there. There are many more ways besides these in which the

population growth factors are affected by internal migration.

3. Dr. Zachariah's important study of internal migration in India with the help of census data gives a fairly broad picture of the field during the last six decades. Table 1 summarizes the main features. The trend of net inter-state and inter-district redistribution was downward until 1921-1931 but accelerated in subsequent decades. During the same period the rural-urban redistribution trend was upwards until 1941-1951 but fell during 1951-1961. This downward trend reflects, according to Dr. Zachariah, decreases in both differential natural increase and net migration. A rough estimate of urban-rural migration during 1941-1951 is 8.2 million, compared to 5.2 million during the following decade. "It is surprising that in the same period when rural-urban migration has decreased by about 37 per cent, the inter-state migration seems to have increased."¹ A satisfactory explanation of these rather surprising developments cannot be had until the 1961 census data are fully available and analysed.

4. What kind of redistribution in respect of age and sex is brought about by internal migration in India? The available data in this respect are scanty but the examination of such as are available indicates, according to Dr. Zachariah, that "the contribution of females is almost as high as that of males and of children almost equal to that of adult workers. A redistribution of 100 persons results in a change of residence of only about 25 adult males (aged 15-55 years)." He adds, "As suggested by the age composition of net migration, return migration seems to be quite wide-spread in India. Workers moved out from their place of birth when they were young but a large proportion of them returned at older ages. ... The gaining

¹ K. C. Zachariah and J. P. Ambannavar, *Population Redistribution in India: Interstate and Rural-Urban*, paper read at the All India Seminar of Population, 12-14 March (1964), Institute of Economic Growth, Delhi; cf. also, K. C. Zachariah, *Internal Migration in India from the Historical Standpoint*, paper read at the 34th Session of International Statistical Institute, Ottawa, 1963.

areas on the whole tended to lose at older ages and losing areas to gain at these ages."²

5. Though the redistribution of the population through internal migration as a whole was not likely to change the age and sex composition of regions much, if we consider its two components, rural-rural and rural-urban, the over-all results would appear to conceal significant changes. In rural-urban migration, males predominate and urban populations are dominated by males in the adult age-group (15-45 years). The urban-rural return migration is dominated by old males above 45 years of age. In rural-rural migration the picture is not clearcut. In looking for effects of internal migration and the resulting redistribution of population on the future trend of population we shall have to concentrate attention on the rural-urban migration mainly.

6. The available data regarding rural-urban migration point up its extremely complicated nature. They also underline the difficulties of projecting the trends of urbanization in India from the trend of the previous decades. India's experience of slackening rate of urbanization during 1951-1961 is not unique. Ceylon and presumably China (mainland) have also reported similar developments, though in the latter case it is reported to have been deliberately brought about by planning. We are not quite sure as to what has been the position in other countries. Yet the data regarding India, China and Ceylon indicate that urbanization trends in them are not continuing along a path projected from earlier experience. In India's case it has been suggested that the rate of urbanization during 1941-1951 was abnormally high because of the large refugee movements across the borders of India and Pakistan and movements due to war. The slower rate of urban growth during 1951-1961 indicates perhaps that the older trend of slow growth is again asserting itself. In effect, the urbanization rate during 1941-1951 was abnormal. One does not know how far a similar kind of explanation can be suggested for the other two countries. But if we accept this as a possible hypothesis we may expect a slower rate of urbanization in India and other countries in the two or three decades to come.

7. Even with such a hypothesis we have to reckon with the fact that in the underdeveloped countries of Asia the very content of urbanization and the changes it brings about in population growth variables are completely out of pattern with those historically experienced in Europe and North America. The demographic

picture in urban populations is quite in contrast to that known for Europe and North America: (a) fertility is not lower in urban areas than in rural areas; (b) death rates are lower in urban areas than in rural areas; (c) the rate of natural growth of population is not necessarily lower than that in the rural areas. This is also true by and large in respect of India. In studying, therefore, the likely effects of urbanization on the future trend of population in India, I will try to concentrate on how it will affect fertility and mortality rates in rural and urban areas.

8. Fertility rates as between the urban and the rural areas are not very different in India. It does not however mean that there is no difference in the rural-urban fertility pattern. The total fertility performance of women of child-bearing ages is relatively smaller in urban than in rural areas. This mainly arises out of the higher age at marriage of women in urban as compared to rural areas.

9. The data regarding the urban and rural mean age at marriage is available only from the N.S.S. Report (No. 7) based on 4th Round data entitled "Couple fertility". The relevant information is contained in its table no. 19 reproduced here as table 2. The basic data were collected for extant couples and in the table adjustment allowing for differing probability of survival of couples married at different age groups have been carried out to get at the actual average ages at marriage. It is also found from these data when analysed by size of towns, that, both for the husband and the wife, the age at marriage increases with the size of the urban area.

10. The age at marriage affects age specific fertility rates, childlessness, family building, onset of sterility and spacing generally indicating that marriages contracted at higher ages bring about a less fertile union.³ A rising age at marriage reduces the intrinsic rate of population growth in a population by increasing the length of generation.⁴ One would therefore expect that urbanization will reduce total fertility somewhat because of the influence of the higher age at marriage generally prevalent in urban areas.

11. Potentially also another factor may accentuate this pattern. It is easily seen from the available data in respect of India that the spread of the methods of family planning is

³ S. P. Jain, *Indian Fertility—Our Knowledge and Gaps*, paper presented at the Population Seminar at Delhi (March 1964).

⁴ A. J. Coale and C. Y. Tye, "The significance of age patterns of fertility in high fertility populations", *Milbank Memorial Fund Quarterly* (1961).

² *Ibid.*

likely to be more rapid in the urban than in the rural areas. Facilities of family planning clinics, advice and materials are generally much more ample in urban than in rural areas as also are educational facilities. A combined effect of all this can be expected to be a lowering of fertility in urban areas through the spread of family planning much earlier than in rural ones.

12. What can be expected in regard to the trends of mortality? Today, urban mortality is generally lower than the rural mortality in India. Table 3 gives the death rates for rural and urban areas in three States in India and for India as a whole for the period 1951-1958. In Bombay and Punjab, the urban death rates are lower consistently than rural ones while in Madras it is the opposite. The all-India picture is one which hovers on the margin. Taking into account the limitations of vital registration, etc. the data indicate that urban death rates are generally ruling at lower levels than the rural ones.

13. The deleterious effects of urban overcrowding, bad housing, etc. still seems to be outweighed by the availability of greater medical facilities as well as the increased willingness and capability of urbanites to take advantage of them. The fall in urban mortality in recent years has been very materially due to the decline in the incidence of water-borne and infectious diseases. The fall in infant mortality

rates in urban areas also is an indication of the improving maternity services and other child medical care facilities. The present state of affairs, however, would appear to be of transition from the long-term point of view because if the living conditions in the urban centres do not improve radically within a reasonably short time, the prospect of the effects of increased medical facilities being overwhelmed by them may loom large and mortality may then tend to increase. It may continue to be at a lower level than the rural for some time but it will eventually be greater than the rural one. This, of course, assumes that rural mortality will not increase. But this would seem to be a reasonable assumption. We may generally expect that urban mortality will tend to increase in the future. If this happens and urbanization continues, the size of rural-urban migrations will have to increase.

14. A tendency towards a decline of fertility and an increase in mortality in urban areas spells a dampening of the over-all rate of growth of the total population. If an important sizable and growing (though slowly) component of the total population like urban population is going to be subjected to such dampening, the rate of growth of the total population is bound to be adversely affected. It must, however, be remembered that these are necessarily long-term expectations and as precarious as any such expectations can be.

Table 1. Volume and rate of net population redistribution between States, districts and rural and urban areas (1901-1961)

Decade	Inter-state		Inter-district		Rural-urban	
	Volume of re-distribution (millions)	Rate of redistribution ^a (per cent)	Volume of re-distribution (millions)	Rate of redistribution (per cent)	Volume of re-distribution (millions)	Rate of redistribution (per cent)
1901-1911	6.233	2.54	9.418	3.89	0.3 ^b	0.12 ^b
1911-1921	3.658	1.45	6.848	2.79	2.3 ^b	0.93 ^b
1921-1931	3.532	1.33	5.918	2.26	1.9 ^b	0.73 ^b
1931-1941	3.961	1.33	6.697	2.27	5.6 ^b	1.90 ^b
1941-1951	6.373	1.88	10.678	3.18	8.6 ^c	2.56 ^c
1951-1961	9.174	2.29	13.001	3.25	4.9 ^d	1.22 ^d

SOURCE: Zachariah and Ambannavar, op. cit.

^a Rates based on average population of the decade.

^b These are estimated on the basis of population of towns given in table A-IV of 1951 census and the method of computation is slightly different from those of 1941-1951 and 1951-1961.

^c Computation based on 2,697 towns for which both the 1941 and 1951 population totals were available.

^d Computation based on the 2,244 towns for which both 1951 and 1961 population totals were available.

Table 2. Adjusted average ages at marriage of the husband and the wife for different marriage cohort groups

Partner	Sector	Marriage period					
		Before 1910	1910-1919	1920-1929	1930-1939	1940-1945	1946-1951
Husband	Rural	19.4	20.4	19.8	20.5	20.3	20.2
Husband	Urban	21.6	22.0	22.0	22.0	22.5	23.0
Wife	Rural	12.9	13.5	13.6	14.1	14.6	14.6
Wife	Urban	14.0	14.5	14.7	14.7	15.6	16.4

Table 3. Death rate per thousand in rural and urban areas of some states in India during 1951-1958

	Madras		Punjab		Bombay		G. T. for India	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
1951	25.7	26.0	18.0	10.1	17.2	13.1	13.8	14.5
1952	25.0	24.8	18.6	10.8	17.6	15.1	16.0	14.9
1953	16.4	18.8	20.4	10.6	18.8	14.9	13.9	14.4
1954	12.8	15.5	15.2	8.7	16.2	12.7	12.6	12.2
1955	13.9	14.9	14.8	8.9	16.7	12.1	11.6	12.3
1956	10.8 ^a	13.4 ^a	16.9 ^a	9.3 ^a	13.0 ^a	10.4 ^a	9.8	9.0
1957	13.7 ^b	15.5 ^b	—	—	16.5 ^b	11.7 ^b	11.0	11.7
1958	12.6	14.4	15.4	9.2	17.3	12.4	11.4	11.5

SOURCE: *Health Statistics of India, 1951-1958* (Government of India, Ministry of Health, Directorate General of Health Services).

^a For the area before reorganization of states.

^b For the area after reorganization.

Future growth of population and changes in population composition: Tropical Africa

ETIENNE VAN DE WALLE

I. INTRODUCTION

1. For the purposes of this paper we shall consider the following regions and countries in Africa:

(a) *Western Africa*: Mauritania, Senegal, Gambia, Mali, Niger, Portuguese Guinea, Guinea, Sierra Leone, Liberia, Ivory Coast, Upper Volta, Ghana, Togo, Dahomey and Nigeria;

(b) *Middle Africa*: Chad, Cameroon, Central African Republic, Spanish Guinea, Gabon, the Congos and Angola;

(c) *Eastern Africa*: Kenya, Uganda, Tanganyika and Zanzibar, Rwanda, Burundi, Mozambique, Malawi, Zambia and Southern Rhodesia.

2. We consider only continental Africa and small islands off the coast. The Sudan and Spanish Sahara are traditionally classified with the Northern African countries. We excluded Ethiopia, Somalia and French Somaliland, since they are *terrae incognitae* on the demographic map. The exclusion of an unknown but large number of Ethiopians is particularly unfortunate.

3. Elsewhere in Tropical Africa, the population is known in general only within broad limits, and information on population movements and vital trends is hardly available at all. The first reliable inquiries on fertility and mortality are in most countries less than ten years old. Most of them have not yet been fully published, even less analysed. Birth and death registration has nowhere reached the operational stage.

4. Under these circumstances it may appear unreasonable to attempt a projection of the population of Tropical Africa, since even its present size is unknown and its present growth cannot be precisely ascertained. It is to that task nevertheless that the present paper is devoted. Its methodology, its limitations are determined by the nature of available data. It incorporates results of the analysis of African demographic data at Princeton University

which will be the subject of a forthcoming publication.

II. THE DATA

A. Population and growth estimates

5. The United Nations *Demographic Yearbook* publishes population estimates for countries in Tropical Africa based on national statistics. These are subject to important limitations, and the establishment of a base population for the purpose of projection involved a number of often arbitrary adjustments. Except for special cases, it is likely that most estimates tend to understate the population, and most of all administrative estimates based on tax counts. Demographic inquiries usually find significantly more people than had been reckoned by administrative counts in sample units: for instance, 6 per cent more in Guinea, 11 per cent more in Dahomey, 22 per cent in Upper Volta.¹ The results of demographic inquiries we have presumed not to be systematically deficient. We have corrected all administrative estimates by adding 10 per cent, and all full censuses, presumed more accurate, by adding five per cent. It must be considered that no census can be a hundred per cent complete under African conditions, and that even the 1950 United States census, for instance, has been estimated to have fallen short from the actual figure by three per cent.²

6. Estimates in the 1963 *Demographic Yearbook*, corrected in that way, have been brought back or forward to 1960 by using the following growth rates: 1.5 per cent in Western and Middle Africa, and 2.2 per cent in Eastern Africa. These growth rates are based on averages of estimated rates of natural increase

¹ *Etude démographique par sondage en Guinée 1954-55. Résultats définitifs*, 6 (Paris). République du Dahomey, *Donnée de base sur la situation démographique au Dahomey en 1961*, 8 (Paris, 1962). République de Haute-Volta, *La situation démographique en Haute-Volta*, 7 (Paris, 1962).

² A. J. Coale, "The population of the United States in 1950 classified by age, sex and color. A revision of census figures", *Journal of the American Statistical Association*, vol. L (1955), pp. 16-54.

in the late fifties or early sixties, and of intercensal growths in areas where censuses of approximately equal quality had been taken at successive dates. Available data suggest an acceleration of population increase through improving mortality mainly in Eastern and Middle Africa with Western Africa lagging. Since the fertility of Middle Africa is below that of the two other areas, its growth rate appears finally similar to that of Western Africa.

7. This set of standard adjustments cannot provide a realistic population figure for Nigeria, the giant which accounts for about half the population of Western Africa. The controversial 1963 census enumerated 56 million people, almost certainly an overestimate. Even if the 1953 census estimate of 31 million was the result of a 10 per cent undercount,³ and even if growth had reached the exceptionally high level of 2 per cent during the 'fifties, the estimate of 39 million for 1960 which we accept will be considerably under that implied in the new census.

8. Our final estimate of the populations defined above for 1960 is as follows:

	Million
Western Africa	75
Middle Africa	29
Eastern Africa	48
TOTAL	152

To this total various areas left out (i.e., Ethiopia, Somalia, Madagascar and various smaller areas) would perhaps add another 25 to 30 million.

B. Vital rates and age distribution

9. Only in about half the population which we attempt to project has there been some information collected on age distribution, fertility and mortality, and again less than half of that is detailed enough to permit complete analysis leading to the estimation of vital rates. Collected vital rates and age distributions are subject to such biases that they cannot be accepted at face value. Estimates of fertility and mortality used here are based on the analysis made at the Office of Population Research at Princeton. They are not representative of most areas in Tropical Africa, and constitute slender evidence of general tendencies. The attempted projection is largely a statistical exercise in which trends and hypotheses valid

for selected areas are extrapolated to entire regions.⁴ Migration is not taken into account.

10. Fertility was derived from the analysis of available inquiries by averaging various estimates of the birth rate. Combining birth rates with previous estimates of the rates of increase, a gross reproduction rate and an expectation of life at birth (e_0) for each of the three regions was derived by means of stable population models prepared at the Office of Population Research.⁵ The use of the stable models is based on two assumptions, which are presumed to be valid for most of Tropical Africa: that fertility had been stable in the recent past, and that the decline in mortality had been moderate enough not to affect the age distribution substantially. The association in the frame of the models of an index of fertility and of the growth rate permits us to infer an age distribution. Finally, the following estimates were accepted:

	Gross reproduction rate	Expectation of life at birth
Western Africa	3.1	32
Middle Africa	2.6	38.4
Eastern Africa	3.1	38.7

III. THE PROJECTIONS

11. We consider a range of alternative growths of the population of Tropical Africa until 1980. A Low, Medium and High variant is prepared for each region by assuming various courses of mortality decline. It is assumed that no significant decline of fertility will take place within fifteen years. The change in values that would bring about such a decline in Tropical Africa has not begun, and it has taken elsewhere a long time to be completed. On the contrary, in so far as low fertility in Middle Africa has a pathological origin, we have assumed for the High projection that fertility would increase linearly in that region to a gross reproduction rate of three in 1980.

12. Our projection covers the period from 1965 to 1980; a first task is to bring the population forward to 1965. For the High and Medium cases, it is assumed that mortality

⁴ For the countries or regions on which the estimates are based, see a forthcoming publication of the Office of Population Research on the Demography of Africa.

⁵ See A. J. Coale and P. Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, 1964). The North pattern of mortality has been accepted. The mean age of the maternity schedule was estimated at 27.7 years, as in the Guinea demographic inquiry. The shape (but not the level) of the Guinean fertility schedule by age has been accepted throughout the projections.

³ According to the 1952-1953 Census Superintendent: "There is no reason to suppose that half a million were left out...". Quoted by M. R. Prothero, "The population census of Northern Nigeria 1952: problems and results", *Population Studies*, vol. X, No. 2 (1956), p. 191.

decline has brought the $\dot{e}_0$ up to thirty-seven and forty-one years respectively in Western and Eastern Africa. In Middle Africa, however, any improvement must have been compensated by the failure of the Congo (Leopoldville) to maintain the stage of medical development reached in the 'fifties. We assume no progress in the region. In the Low projection, we suppose that some decline has taken place in Middle Africa and assume lower $\dot{e}_0$ in 1965 for Western and Eastern Africa: thirty-five, thirty-five and forty years respectively.

13. The Medium projection considers the implications of an increase in $\dot{e}_0$ of half a year per year of time after 1965. The Low projection accepts half that rate only. The High projection assumes that the potential mortality decline inherent in medical and technological progress will be largely realized in Tropical Africa, and that the $\dot{e}_0$ will reach sixty years in 1980 after a linear increase in the three regions. Between that rapid rate of progress—examples of which have been encountered elsewhere in recent years—and the relative stagnation of the Low projection, we tried to cover a range of alternatives of which the Medium case is perhaps the most plausible. We give the latter with some details in table 1. Table 2 gives total population figures according to the three sets of hypotheses.

14. The relevance of the projections for economic and social discussion or planning can only be briefly suggested here. Densities rise from fourteen, five and fourteen persons per square kilometre in 1965 for Western, Middle and Eastern Africa respectively, to eighteen, six and twenty persons in the Low, nineteen, six and twenty-one in the Medium, and twenty-one, seven and twenty-two persons in the High projection by 1980 in the same regions. Density figures are misleading because they provide no indication of the potential of the area on which populations are growing. However, since these figures are low on a scale of international comparison, it is likely that a reasonable rate of diffusion of technological progress will be able to accommodate increased numbers in most areas. High rates of increase on the other hand will create stresses in societies and their institutions. Rates of increase of the population would average respectively, according to the Low, Medium or High projection, 2, 2.3 or 2.8 per cent per year in Western, 1.4, 1.7 or 2.5

per cent in Middle, and 2.5, 2.7 or 3 per cent in Eastern Africa. A considerable expenditure in capital will thus be needed just to maintain per capita income at its present level.

15. Population composition in broad age classes is indicated for 1965 and 1980 in table 3. Let us from here on consider only the Medium variant in this discussion. The mortality decline increases the share of children and old people in the population. The dependency ratio (ratio of persons aged under fifteen and over sixty-five years, to adults between these ages) rises from 0.81, 0.74 and 0.87 in 1965, to 0.88, 0.79 and 0.93 for Western, Middle and Eastern Africa, in that order, in 1980. By then, the labour force (males aged between fifteen and sixty-five) will number 29.5, 11, and 39.4 million in these three regions. The possibility of large shifts away from agriculture is conditioned by these figures. The children of both sexes between ages five and fifteen (which provide most of the school children) will reach, always according to our Medium projection, 30.1 million in Western, 9.7 million in Middle, and 21.7 million in Eastern Africa. The performance of Africa's school system will be measured against this "educable" population.

IV. CONCLUSION

16. As other underdeveloped regions of the world, Tropical Africa will undergo rapid growth in the coming years. It is only at a later stage—after 1980—that any decline of fertility can be expected. An increase of mortality would be an unwelcome alternative to the growth. The pressure of expanding numbers will have to be borne. So much we can say with certainty.

17. Our attempt at forecasting more precisely the course of the increase was made hazardous by the uncertainty of demographic knowledge on Tropical Africa. It is a reflection on the unreliability of estimates of the present population and of its future development, that the projections prepared by the United Nations and presented at this Conference end up with quite different ranges of results.⁶

⁶ These projections were available to the writer in the following version: United Nations, *World Population Prospects, as Assessed in 1963* (United Nations publication, Sales No.: 66.XIII.2).

Table 1. Projection of regional populations by age, medium variant.
Tropical Africa, 1960 to 1980

<i>Ages</i>	<i>1960</i>	<i>1965</i>	<i>1970</i>	<i>1975</i>	<i>1980</i>
<i>Population (thousands)</i>					
<i>Western Africa</i>					
0-4	12,757	14,385	16,287	18,286	20,760
5-14	18,225	19,998	22,756	26,287	30,119
15-24	14,138	15,315	16,704	18,513	21,216
25-34	10,770	11,695	12,765	13,973	15,360
35-44	7,942	8,625	9,450	10,402	11,469
45-54	5,565	6,067	6,684	7,385	8,195
55-64	3,518	3,848	4,273	4,772	5,351
65 and over	2,085	2,342	2,697	3,122	3,628
TOTAL	75,000	82,276	91,616	102,740	116,098
<i>Middle Africa</i>					
0-4	4,495	4,845	5,288	5,826	6,466
5-14	6,777	7,306	7,915	8,691	9,680
15-24	5,380	5,799	6,253	6,769	7,380
25-34	4,196	4,524	4,889	5,295	5,750
35-44	3,190	3,439	3,711	4,027	4,393
45-54	2,329	2,510	2,716	2,947	3,218
55-64	1,560	1,682	1,813	1,976	2,173
65 and over	1,073	1,157	1,259	1,393	1,561
TOTAL	29,000	31,262	33,844	36,924	40,621
<i>Eastern Africa</i>					
0-4	8,602	9,799	11,280	13,094	15,084
5-14	12,346	13,884	15,907	18,516	21,725
15-24	9,139	10,219	11,566	13,082	14,978
25-34	6,653	7,450	8,373	9,432	10,752
35-44	4,728	5,285	5,949	6,726	7,628
45-54	3,230	3,620	4,075	4,612	5,250
55-64	2,016	2,267	2,565	2,923	3,343
65 and over	1,286	1,453	1,679	1,960	2,307
TOTAL	48,000	53,977	61,394	70,346	81,067

Table 2. Total population figures by region. Low, Medium and High projections.
Tropical Africa, 1960 to 1980.

	<i>1960</i>	<i>1965</i>	<i>1970</i>	<i>1975</i>	<i>1980</i>
<i>Population (thousands)</i>					
<i>Low projection</i>					
Western Africa	75,000	81,635	89,689	98,914	109,577
Middle Africa	29,000	30,992	33,058	35,501	38,305
Eastern Africa	48,000	53,825	60,634	68,589	77,911
<i>Medium projection</i>					
Western Africa	75,000	82,276	91,616	102,740	116,098
Middle Africa	29,000	31,262	33,844	36,924	40,621
Eastern Africa	48,000	53,977	61,394	70,346	81,067
<i>High projection</i>					
Western Africa	75,000	82,276	92,247	106,210	124,515
Middle Africa	29,000	31,262	34,372	39,076	45,354
Eastern Africa	48,000	53,977	61,655	71,797	84,874

Table 3. Age distribution in broad groups, by region, Low, Medium and High projections. Tropical Africa 1965 to 1980.

Ages	1965			1980		
	Western	Middle	Eastern	Western	Middle	Eastern
<i>Population (thousands)</i>						
<i>Low projection</i>						
0-14	33,954	11,974	23,580	46,925	14,858	34,741
15-64	44,380	17,881	28,801	59,397	22,051	41,017
65 and over	2,301	1,137	1,444	3,255	1,396	2,153
TOTAL	80,635	30,992	53,825	109,577	38,305	77,911
<i>Medium projection</i>						
0-14	34,384	12,151	23,683	50,879	16,147	36,809
15-64	45,549	17,954	29,841	61,591	22,913	41,951
65 and over	2,342	1,157	1,453	3,628	1,561	2,307
TOTAL	82,275	31,262	53,977	116,098	40,621	81,067
<i>High projection</i>						
0-14	34,384	12,151	23,683	56,377	19,656	39,339
15-64	45,549	17,954	28,841	63,920	23,862	42,965
65 and over	2,342	1,157	1,453	4,218	1,836	2,570
TOTAL	82,275	31,262	53,977	124,515	45,354	84,874

Projection of world population (distinguishing more developed and less developed areas at present)

ZDENĚK VÁVRA

1. The United Nations Population Division has been constantly engaged with the problems of future population growth in the world and its major regions. Some conclusions from the latest United Nations forecasts are discussed below.¹

I. WORLD POPULATION PROJECTIONS COMPARED WITH PAST POPULATION GROWTH

2. Table 1 shows estimates of world population growth during 1920-2000 of more developed as well as less developed areas.² According to the medium variant, world population of nearly 3,000 million in 1960 may increase to approximately 6,000 million by the year 2000. As other variants show, there is much uncertainty in the prospect so calculated. The population in 2000, according to the low variant, might be some 665 million less and according to the high variant 877 million more. On the other hand, if the recently observed fertility trends continue, the world population might be approximately 7,400 million by the end of the century.

3. Since the less developed segment of the world makes the largest contribution to the population of the world, its population trend increasingly determines the growth of the total world population. The medium variant suggests that in the less developed areas population would more than double, growing from 2,000 million in 1960 to more than 4,500 million by 2000; this increase might be 520 million less on the low variant, or 741 million more on the high. In the more developed world segment, the medium variant suggests an increase by 47 per cent, from somewhat less than 1,000 million to 1,400 million; here, the low variant

would amount to 145 million less, and the high variant to 136 million more.

4. The annual rates of increase indicate that the tempo of growth might diminish slightly. The rates of increase in the less developed areas, however, are estimated to be more than twice as high as those in the more developed areas. For the world as a whole, average annual growth in each decade during 1960-2000 is estimated in the range of 1.3 to 2.1 per cent, in the more developed segment as 0.7 to 1.2, and in the less developed as 1.6 to 2.6 per cent. If current fertility is maintained, increments would be even larger; 1.9 to 2.7 per cent for the world, 1.2 to 1.3 per cent for more developed, and 2.3 to 3.1 for less developed areas.

5. Comparison with past population growth shows that during the 1930's the two segments of world population began to differentiate themselves by their rates of population growth. In the more developed parts of the world, the average annual population growth rate fell to 0.8 per cent in 1930-1940 and to 0.4 per cent in 1940-1950. In the 1950's, there occurred a renewed acceleration, resulting in an annual growth of 1.3 per cent. In the world's less developed parts the average rate of growth shows a tendency to rise each decennium, from about 1 per cent in 1920-1930 to 2.1 in 1950-1960.

6. This divergence in population growth of the two principal world segments naturally affects also their relative size within the world total. In the past forty years the proportion of world population inhabiting the more developed segment diminished from 36 per cent to about 33 per cent. In the coming forty years, according to the assumptions made, this proportion may fall to 24 per cent, possibly even less.

II. CHANGES IN AGE STRUCTURE OF THE WORLD'S POPULATION

7. For a better understanding of future world population growth, and also to illustrate some of the consequent problems, in Fig. I are shown the contrasting features of age com-

¹ United Nations, *World Population Prospects, as Assessed in 1963* (United Nations publication, Sales No.: 66.XIII.2).

² For the purpose of this paper the following regions are included under more and less developed areas: (a) *more developed areas*—Japan, Europe, Soviet Union, Northern America, Temperate South America, Australia and New Zealand; (b) *less developed areas*—Africa, East Asia (excluding Japan), South Asia, Latin America (excluding Temperate South America), Melanesia, Polynesia and Micronesia.

Table 1

Year	World		More developed areas			Less developed areas		
	a	b	a	b	c	a	b	c
<i>Past population growth</i>								
1920	1,858	1.04	674	1.19	36.3	1,184	0.97	63.7
1930	2,061	1.02	759	0.79	36.8	1,302	1.12	63.2
1940	2,277	0.91	821	0.42	36.1	1,456	1.16	63.9
1950	2,493	1.84	858		34.4	1,635		65.6
1960	2,990		976	1.30	32.7	2,014	2.11	67.3
<i>Medium variant</i>								
		1.80		1.04			2.14	
1970	3,572	1.80	1,082	0.99	30.3	2,490	2.14	69.7
1980	4,271	1.76	1,195	0.98	28.0	3,076	2.01	72.0
1990	5,071	1.64	1,318	0.86	26.0	3,753	1.96	74.0
2000	5,965		1,438		24.1	4,527		75.9
<i>Low variant</i>								
		1.63		0.92			1.96	
1970	3,515	1.48	1,070	0.72	30.4	2,445	1.77	69.6
1980	4,068	1.37	1,150	0.71	28.3	2,918	1.61	71.7
1990	4,660	1.30	1,235	0.46	26.5	3,425	1.58	73.5
2000	5,300		1,293		24.4	4,007		75.6
<i>High variant</i>								
		2.15		1.22			2.58	
1970	3,702	2.13	1,102	1.24	29.8	2,600	2.49	70.2
1980	4,571	2.12	1,247	1.19	27.3	3,324	2.43	72.7
1990	5,636	1.96	1,403	1.15	24.9	4,233	2.21	75.1
2000	6,842		1,574		23.0	5,268		77.0
<i>Constant-fertility, no-migration variant</i>								
		1.94		1.20			2.29	
1970	3,624	2.06	1,100	1.22	30.4	2,524	2.49	69.6
1980	4,447	2.53	1,241	1.33	27.9	3,206	2.99	72.1
1990	5,706	2.65	1,402	1.20	24.6	4,304	3.09	75.4
2000	7,415		1,580		21.3	5,835		78.7

a: total population (million); b: annual increase for each decennial period (geometric mean); c: percentage of the world population.

Table 2

Indicators	World			More developed areas			Less developed areas		
	1960	1980	2000	1960	1980	2000	1960	1980	2000
<i>A. Indices of aging</i>									
Persons aged 65 and over:									
(a) Per 1000 total population	49	59	66	83	109	113	33	40	50
(b) Per 1000 persons aged 0-14	136	169	205	289	423	446	83	102	146
(c) Per 1000 persons aged 15-64	84	100	107	131	170	182	58	69	81
<i>B. Population in working age and dependency ratios</i>									
Persons aged 15-64 per									
1000 total population	588	590	615	630	637	630	568	572	610
Per 1000 persons aged 15-64 years:									
(a) Persons aged 0-14 and 65 and over	700	694	628	586	571	589	761	748	640
(b) Persons aged 0-14	616	594	521	455	401	407	703	679	559

position of population in the more and less developed areas.³ In the world's more developed segment the proportion of children and youth is comparatively small and that of aged persons comparatively large. By contrast, the age pyramids of the population of the less developed segment has a more regular form which, however, would be modified in the course of time; particularly there would occur a slow narrowing at the base, a widening in the middle portion, and relatively little change in the upper sections. The largest changes are in the groups of children and among the youngest groups of working age.

8. Some particular age groups by which a population can be characterized as young, aging, or aged are given in table 2 (section A). According to a criterion which has been used by the United Nations,⁴ already in 1960 the

³ In constructing the age composition of the world's population, some areas were left out of account, namely Hong Kong, Mongolia and Macao, Northern Korea and the Ryukyu Islands, Israel and Cyprus, Polynesia and Micronesia. The age composition calculated for Europe, Northern America, Australia and New Zealand does not include the effects of assumed migration.

⁴ United Nations, *The Aging of Populations and its Economic and Social Implications* (United Nations publication, Sales No.: 56. XIII.6), page 7.

world population can be considered as aging (approximately 5 per cent aged sixty-five years and over), and it will continue in this phase, so that by 2000 about 6.5 per cent of the world's population would be at ages sixty-five and over. In the more developed segment, the population was decidedly an "aged" one already in 1960 (more than 8 per cent at ages sixty-five and over), and yet the aging process will continue further, the proportion of persons of advanced age attaining about 11 per cent by 1980 and 11.3 per cent by 2000. This is in sharp contrast with the situation in the less developed segment where only a little more than 3.3 per cent of the population were aged sixty-five and over in 1960; here, the percentage rises slowly to approximately 5 by the century's end.

9. It is equally important to note the ratio between persons of advanced age and those of working age, and the ratio of elderly persons to the number of children (this being a highly sensitive index of aging). In both of these respects, the two segments of world population show probably continuing tendencies towards an increasing weight of older persons. The burden of old-age dependency is tending to rise, as is also the old-age portion within the overall dependency burden. This trend will proceed

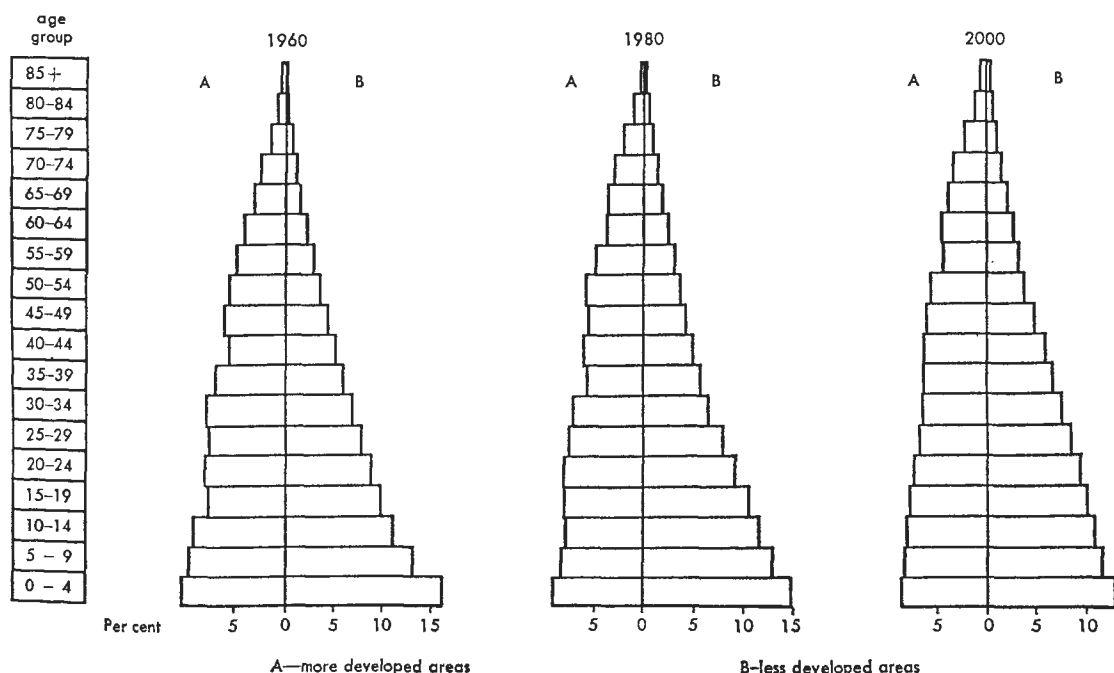


Figure I

Percentage of population in each age group, in the more developed and the less developed parts of the world

at a faster pace in the more developed than in the less developed world segment.

10. An important aspect, particularly for economic development, is the number and composition of that part of the population engaged in the productive processes. This part of the population will increase proportionately, mainly as a result of a decrease in the proportion of children. It will be noticeable chiefly in the less developed segment of the world, where the percentage of population aged fifteen to sixty-four years would be 57 both in 1960 and 1980, and attain 61 by 2000. In the more developed segment, a somewhat higher proportion, between 63 and 64 per cent, will be maintained.

11. It is likewise important to observe the prospective trends in the ratio between children and old persons, on the one hand, and the active population on the other (table 2, section B). With one minor exception (the more developed areas during 1980-2000) it can be foreseen that this ratio will decrease. From the component indicators which show separately the changes in child and old-age dependency ratios it can be seen that the latter tends to increase whereas the former tends to decrease. The decrease in the child-dependency ratio which results mainly from an assumed decline in fertility has the greater effect. In spite of this trend the less developed world segment by the year 2000 is expected to have still 559 children as against eighty-one older persons per 1,000 population, while in the more developed segment there would be 407 children as against 182 older persons.

III. DISCUSSION

12. From this very brief review of the salient features of the world population projection a number of important problems emerge. Although, from the standpoint of the long-range future, the "population explosion" and all that it involves stands out as the most spectacular feature, attention must not be diverted on that account from the numerous structural demographic problems, such as the aging of the population, changes in family size and modes of family living, all of which occur with varying intensity in parts of the world where development has become relatively advanced. These phenomena lose none of their importance because the share of presently more advanced regions in the world's population may decrease from nearly one third in 1960 to less than one quarter at the end of the century. Furthermore, the demographic conditions in the more developed parts of the world can serve as a model

eventually to be approximated by the total population of the world.

13. This long-range view, however, neglects the decisive factor of time. It is known that profound changes in population trends generally occur only in the course of several generations. This has been the case also in the changing population trends of the more developed parts of the world. It is therefore important to recognize that this viewpoint is insufficient in regarding the current and future problems arising out of the enormous population growth in the less developed areas. Essentially, a discontinuous jump has occurred as a result of the large decreases in general mortality in the less developed world regions since the Second World War. The problem has been stated in these terms which, in my view, are wrong: "Either the birth rate of the world must come down or the death rate must go up";⁵ more correctly, from the standpoint of human society, the problem is to be formulated in these terms: "There are no nations or cultures in the world prepared to accept an increase in mortality as a way of controlling population growth. In consequence, only the control of fertility remains as a way to check population increase."⁶

14. As in the case of mortality, a discontinuous drop in fertility would have to occur to restore the balance, but this is too improbable to constitute a reasonable expectation. The factors affecting fertility differ from those which affect mortality, and are not so easily changed. Mostly they act indirectly, through the medium of other correlated changes; hence they are not easily controlled. Some psychological factors jointly with other related circumstances in the areas of the rapid population growth often persist in impeding the voluntary spread of family planning. Yet it cannot be denied that the efficient planning of family size is the basis for solution of the population problem in conjunction with economic and social development. The past and present development of the more developed parts of the world demonstrates that future social progress makes this—family planning—a direct and indirect prerequisite.

15. An argument has been made that with further social progress, the assurance of sufficient food, the rise in levels of living, the elimination of illiteracy, and the growth of culture will of themselves cause the required decrease in fertility, but this is debatable. This might perhaps come about in a nearly stationary population, growing perhaps at a moderate rate,

⁵ National Academy of Science, *The Growth of World Population* (Washington, D.C., 1963), p. 9.

⁶ The American Assembly, *The Population Dilemma* (Columbia University, 1963), p. 5.

if that population were to grow temporarily at a slightly accelerated and yet not greatly excessive rate. However, on the assumption of such a tempo of growth as is indicated in the annual rates implied in the latest United Nations projection there are good grounds for apprehension that there exists a risk that social and economic progress, and especially the efforts to raise the levels of living in the less developed segments of the world, would tend to be swallowed up by population growth. Thus on the basis of certain assumptions, it has been suggested that population growth at an annual rate of one per cent requires an annual 4 per cent rate of growth in national income for the mere purpose of demographic investment, i.e., the investments necessary for maintenance of the existing level of living.⁷

16. This argument alone indicates, without going into further detail, that a one-sided formulation of the problem will not suffice; it would be disastrous to emphasize the need for artificial birth control while forgetting the imperative needs of accelerated economic development through a more efficient and rational use of human and natural resources which exist in the less developed areas; likewise, it is an oversimplification to suggest that with an acceleration of economic and social progress birth control has little significance; by such arguments, attention to fundamental social problems is misdirected. For purposes of solving present and future population problems, three facts should be held in view, namely:

⁷ B. C. Uralnis, "Demographic factors and planning of economic development," paper presented in United Nations Seminar on Planning Techniques for the Less Developed Countries of Asia, Africa and Latin America (Moscow, 1964). According to other opinions an increase of 2 to 5 per cent in national income is required to maintain the same living standard in a population growing by one per cent annually. See United Nations, *The Determinants and Consequences of Population Trends* (United Nations publication, Sales No.: 53.XIII.3), p. 278.

(a) The general problem of the interrelations between population trends and economic and social development, which exists at all times;

(b) The change in salient features of that general problem which has occurred as a result of social and scientific progress, requiring the necessity of a new approach to problem-solving;

(c) In the past, when the rate of growth of productive forces and levels of social aspirations were essentially lower than today, there did exist a problem of very rapid population growth in the regions now considered as developed. Today there are two aspects of the world population problem: the "explosion", and the "aging" of those populations which grow moderately.

In the long run, the present areas of the enormous population growth might undergo demographic change assimilating them to the more developed parts of the world. In other words, one has to consider the rapid growth of population in the less developed regions jointly with the long-run tendencies of demographic, economic and social trends.

17. In my view, the hope for a successful solution of future social and demographic problems depends on whether population growth will be regarded in isolation, or as a problem which is fully intertwined with the other leading features of social and economic evolution. This includes the corollary view that, within social and economic development, a large role will be played by a positive demographic policy which may differ in its content. For example a different view will be applied in the less developed and more developed areas. Birth control plays a major role in the formulation of population policy. Under the various practical circumstances, this means that the provisions made for wide-spread use of birth control should become part of social and economic planning, thereby avoiding some of the sharpest disproportions and dislocations between population, economic and social changes.

The future population of Mexico: total, urban and rural

RAÚL BENÍTEZ ZENTENO and GUSTAVO CABRERA ACEVEDO

[Translated from Spanish]

I. THE PAST RECORD

1. During the last thirty years the annual rate of growth of the Mexican population has risen rapidly from 1.73 in the period 1930-1940 to 3.08 in 1950-1960. This last figure is one of the highest recorded in history.

2. This trend is a result of the persistently high birth rate, approximately 45 births per thousand, and of the sharp decline in mortality, from 26.6 deaths per thousand in 1930 to 11.5 in 1960.

3. As a consequence of these trends, the age structure of the population has become even more youthful than it was in 1930. The popu-

lation of 0 to 14 years represented 39.21 per cent of the total population in 1930; in 1960 the percentage rose to 44.25. In its turn, the ratio of the economically inactive to active population rose from 730 per thousand in 1930 to 923 in 1960.

4. International migration has not been an important factor in population growth, nor has it significantly influenced the age structure. The difference between emigrants and immigrants in the period 1950-1960 represented only 0.2 per cent of the total population in 1960.

5. The indicators considered, estimated for the period 1930 to 1960, are presented in summary form in tables 1 and 2.

Table 1. Various demographic indicators of the Mexican Republic, 1930-1960

Year	Population (thousands)	Rate of growth	Death rate	Birth rate	Rate of natural increase	Life expectancy at birth
1930	16,553	1.73	26.6	43.8	17.2	33.26
1940	19,653	2.75	23.2	44.3	21.1	38.40
1950	25,791	3.08	16.2	45.5	29.3	49.71
1960	34,923		11.5	46.0	34.5	58.96

Table 2. Age structure (percentage of enumerated population) — Mexican Republic

Year	Total	0-14 years	15-64 years	65 and over	Unknown
1930	100.00	39.21	57.82	2.95	0.02
1940	100.00	41.19	55.80	2.98	0.03
1950	100.00	41.70	54.76	3.36	0.18
1960	100.00	44.25	52.01	3.42	0.32

II. PROJECTION

6. The projection of the total population was based on the sex and age structure of the population enumerated in 1960, corrected (a) for under-enumeration of the 0-4 age group, which gave an increase of 1,014,800 inhabitants of both sexes, and (b) for redistribution of the population to compensate for inaccurate age reports from five years of age upwards, which gave an increase of 102,000 persons. The two

corrections represented a 2.9 per cent increase over to the enumerated population. The projection was computed by the well-known "component" method.

7. The future trend of mortality was inferred from the relationship between the annual increase in life expectancy at birth for fifty-five countries in an inter-censal period no longer than ten years and the level of life expectancy at the end of that period. It was

assumed that life expectancy at birth would increase from 57.63 and 60.29 for men and women respectively in 1960, to 67.05 and 69.38 for the period 1975-1980. The model tables prepared by the United Nations were used for projecting survival probabilities by sex and age groups (${}_5P_x$)². It was assumed that the survival probabilities observed for Mexico in 1960 would in future follow the trends established in these tables.

8. Owing to the difficulties of forecasting future fertility rates, three assumptions were worked out on the basis of the gross reproduction rate in 1960, it being assumed that the same declines in the specific fertility rates would be proportional to magnitude of the rate in each age group. The three assumptions were the following:

Assumption I. The fertility level will remain constant (R_{1960} 3.16);

Assumption II. Constant fertility from 1960 to 1970; declining 5 per cent from 1970 to 1975; declining 10 per cent from 1975 to 1980;

² United Nations, *Methods for Population Projections by Sex and Age* (United Nations publication, Sales No. 56.XIII.3).

Assumption III. Constant fertility until 1965; declining 5 per cent from 1965 to 1970; 10 per cent from 1970 to 1975; and 15 per cent from 1975 to 1980.

The gross reproduction rates in 1960 and 1980, according to the three assumptions, are presented in table 3.

Table 3. Gross reproduction rates according to the three projection assumptions

Assumption	Year	
	1960	1980
I	3.16	3.16
II	3.16	2.70
III	3.16	2.30

9. The projections of the urban and rural populations, from 1960 to 1980, were computed in two stages: (a) estimation of the totals of the urban and rural populations for each of the projection moments, and (b) subdivision of the totals by sex and age groups.

10. The average annual rates of growth for each inter-censal period from 1930 to 1960 appear in table 4.

Table 4. Average annual rates of growth (percentages), 1930-1960

Period	Total population	Urban population	Rural population
1930-1940	1.73	2.22	1.49
1940-1950	2.73	4.77	1.50
1950-1960	3.08	4.89	1.51

It was considered that the future growth of the rural population would be: (I) equal to that observed from 1950 to 1960 (1.51 per cent per year, similar to the growth from 1930 to 1960), and (II) greater than that observed from 1950 to 1960: 2 per cent per year. The rates of

growth of the urban population corresponding to each of these rates of growth of the rural population, in the case of the second assumption for the projection of total population, are given in table 5.

Table 5. Average annual rates of growth assumed for the urban and rural population in the period 1960 to 1980 (percentages)

Period	Total population ^a	^b Urban population ^c		Rural population	
1960-1970	3.56	5.26 ^b	4.90 ^c	1.51	2.00
1970-1980	3.48	4.65 ^b	4.46 ^c	1.51	2.00

^a According to assumption II for the projection of the total population.

^b With a growth rate of 1.51 for the rural population.

^c With a growth rate of 2.00 for the rural population.

The proportions of the rural population in relation to the total population derived from the censuses taken since 1900, and

those which follow from the two assumptions for the growth of rural population, are given in table 6.

Table 6. Proportion of the rural population in relation to the total population^a (percentages)*Observed*

1900	71.0
1910	70.7
1921	68.8
1930	66.5
1940	64.9
1950	57.4
1960	49.3

<i>Projected</i>	<i>With</i> <i>r = 1.51%</i>	<i>With</i> <i>r = 2%</i>
1970	40.4	42.4
1980	33.3	36.7

^a Rural population: people living in communities of less than 2,500 inhabitants.

11. The subdivision by sex and age groups of the estimated urban and rural populations was based on the assumption that the ratios of the sex and age-group structures of the urban and rural populations to that of the total population would remain constant and

equal to those observed in 1960 at the particular moments of the projection. The 1960 population census was the first to show the sex and age distribution of the urban and rural populations.

III. RESULTS

12. The results of the projections are presented in tables 8-11. The results of projection I show that the population is tending to be even younger, and that the dependency ratio (defined as the relationship between the total number of persons under 15 and over 64 and the number in the 15-64 age group) will increase from 958 per 1,000 in 1960 to 1,010 in 1980. In projection II, the dependency ratio remains almost stable, rising to 965 per 1,000 in 1980. Projection III covers a population frankly entering a stage of "demographic transition" in which the decline in fertility entails a decrease in the dependency ratio from 958 per 1,000 in 1960 to 892 in 1980.

13. The demographic indicators implicit in the three projections appear in table 7.

Table 7. Estimation of demographic indicators according to the three assumptions (per thousand)

Demographic indicators	Period			
	1960-65	1965-70	1970-75	1975-80
<i>Projection I</i>				
Fertility rate	44.4	43.8	43.5	43.4
Mortality rate	9.9	8.4	7.4	6.8
Rate of increase	34.5	35.4	36.1	36.6
<i>Projection II</i>				
Fertility rate	44.4	43.8	42.4	39.8
Mortality rate	9.9	8.4	7.4	6.5
Rate of increase	34.5	35.4	35.0	33.3
<i>Projection III</i>				
Fertility rate	44.4	42.7	39.7	35.9
Mortality rate	9.9	8.4	7.3	6.5
Rate of increase	34.5	34.3	32.4	29.4

Table 8. Projected population of the Mexican Republic (In thousands)

Projection	1960	1965	1970	1975	1980
<i>Projection I</i>					
Total	36,003.0	42,808.6	51,086.2	61,211.5	73,579.5
Men	17,967.9	21,432.9	25,649.7	30,814.4	37,189.3
Women	18,035.1	21,375.7	25,436.5	30,397.1	36,390.2
<i>Projection II</i>					
Total	36,003.0	42,808.6	51,086.2	60,891.7	71,940.5
Men	17,967.9	21,432.9	25,649.7	30,650.4	36,296.6
Women	18,035.1	21,375.7	25,436.5	30,241.3	35,643.9
<i>Projection III</i>					
Total	36,003.0	42,808.6	50,826.1	59,786.6	69,268.8
Men	17,967.9	21,432.9	25,516.6	30,084.4	34,926.0
Women	18,035.1	21,375.7	25,309.5	29,702.2	34,342.8

Table 9. Percentage distribution of the projected population by sex and broad age-groups, in 1960 and 1980

Sex and age groups	1960	1980			
		Projection I	Projection II	Projection III	
<i>Men</i>					
Less than 15	46.62	47.75	46.47	44.36	
15-64	50.08	49.14	50.36	52.34	
15-34	30.30	32.17	32.97	34.27	
35-64	19.38	16.97	17.39	18.07	
65 and over	3.30	3.11	3.17	3.30	
TOTAL	100.00	100.00	100.00	100.00	
<i>Women</i>					
Less than 15	44.39	46.08	44.97	42.87	
15-64	52.06	50.38	51.43	53.38	
15-34	31.78	31.70	32.35	33.59	
35-64	20.28	18.68	19.08	19.79	
65 and over	3.55	3.54	3.60	3.75	
TOTAL	100.00	100.00	100.00	100.00	

Table 10. Projected urban and rural population based on the projection of total population under assumption II (in thousands)

Year	Urban population			Rural population		
	Total	Men	Women	Total	Men	Women
<i>With a growth rate of 1.51 per 1,00 for the rural population</i>						
1960	18,253.5	8,880.3	9,373.2	17,749.5	9,087.6	8,661.9
1965	23,675.9	11,596.7	12,079.2	19,132.7	9,836.2	9,296.5
1970	30,464.7	15,011.4	15,453.3	20,621.5	10,638.3	9,983.2
1975	38,665.6	19,148.0	19,517.6	22,226.1	11,502.4	10,723.7
1980	47,985.0	23,853.3	24,131.7	23,995.5	12,443.3	11,552.2
<i>With a growth rate of 2 per 1,00 for the rural population</i>						
1960	18,253.5	8,880.3	9,373.2	17,749.5	9,087.6	8,661.9
1965	23,211.8	11,354.3	11,857.5	19,596.8	10,078.6	9,518.2
1970	29,449.8	14,676.8	14,973.0	21,636.4	11,172.9	10,463.5
1975	37,003.4	18,263.1	18,780.3	23,888.3	12,387.3	11,501.0
1980	45,565.9	22,575.9	22,990.0	26,374.6	13,720.7	12,653.9

Table 11. Percentage distribution of the projected urban and rural population, by sex and broad age-groups, 1960 and 1980

Sex and age groups	1960		1980 ^a		1980 ^b	
	Urban	Rural	Urban	Rural	Urban	Rural
Men						
Less than 15	46.05	47.16	46.26	46.85	45.88	47.02
15-64	50.72	49.47	50.61	49.85	51.00	49.71
15-34	30.94	30.46	33.19	32.53	33.27	32.68
35-64	19.78	19.01	17.42	17.32	17.73	17.03
65 and over	3.23	3.37	3.13	3.30	3.12	3.27
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00
Women						
Less than 15	42.44	46.52	44.09	46.79	46.05	47.02
15-64	53.64	50.31	52.20	49.84	53.00	49.77
15-34	32.42	31.08	33.08	30.87	33.02	31.66
35-64	21.22	19.23	19.12	18.97	18.98	18.11
65 and over	3.92	3.17	3.71	3.37	3.95	3.21
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

^a With a growth rate of 1.51 per cent for the rural population.^b With a growth rate of 2 per cent for the rural population.

Fertility tends to decline under assumption I despite the fact that the gross reproduction rates and specific rates of fertility remain constant; under assumption II fertility begins to show a significant decline, and under assumption III it declines sharply. According to assumptions II and III, the mortality rate will decline gradually to 6.5 per 1,000 in 1980, a rate calculated by applying the survival ratios for a life expectancy at birth of 68.9 years for men and women, in a population with a "young" age structure.

IV. CONCLUSIONS

14. Life expectancy at birth will continue to increase until 1980, but more slowly than in past decades. A slight decline in fertility is expected after 1970. This consideration is based on the fertility difference between urban and rural areas, where the average live births in 1960, according to the population census, were 2.39 and 2.93 respectively. It is

estimated that by 1970 the urban population will represent 60 per cent, and by 1980, 67 per cent.

15. It is expected that the rate of growth of the Mexican population will reach its maximum in the decade 1960-1970 (3.56 per year), and it will begin to decline from 1970 to 1980. The age structure of the population, even with an appreciable decline in fertility, will not undergo important changes before 1980. Changes in the age structure may occur in the following twenty years.

16. Although no substantial changes are expected in the age structure, the rate of population growth, one of the highest in the world, means that enormous efforts must be made to provide employment, schools, housing, social services, etc. In Mexico, the demographic factor constitutes, by the very magnitude of its growth, an element of major importance in programmes of economic and social development.

SUMMARIES OF PAPERS

Population forecasts: practical problems of making such forecasts in developing countries

ROBERT BLANC

[*Translated from French*]

The developing countries are in great need of accurate population forecasts; however, the state of statistical documentation in these countries is generally such as to make forecasts of this type an extremely hazardous undertaking.

It is therefore advisable to employ methods which take account of the probable margin of error in the available data and to formulate hypotheses concerning future trends which are as reasonable as possible, i.e., which are likely to diverge as little as possible from reality.

In particular, an effort must be made to eliminate, in so far as possible, all temporary peculiarities in a demographic situation and possible anomalies resulting from faulty observation, retaining only essential and lasting characteristics—those which will markedly affect trends in the country concerned over a relatively long period of time.

It may be useful to make forecasts of trends for a group of countries having certain conditions in common, in the hope that their future development will bring about a gradual lessening of their initial peculiarities.

This is the method which has been applied to fifteen French-speaking African and Malagasy countries; the details and results of this approach are described in the paper.

Estimated trends of fertility, mortality and natural increase in the North Mindanao Region of the Philippine Islands, 1960-1970

FRANCIS C. MADIGAN

The North Mindanao Region absorbed surplus population between 1939 and 1960, growing at 3.1 per cent annually, while the national population grew at only 2.5 per cent. Taeuber's analysis of 1939 census data, combined with Madigan's analysis in this paper of 1960 and

additional 1939 census data, supports the judgement that regional fertility is not below national levels, which many demographers estimate (in terms of a crude birth rate) at approximately 50 births per 1,000. Further support comes from Madigan's estimate of 47.7 births per 1,000 for Misamis Oriental Province from 1959 sample data.

Crude birth rates for each regional province are estimated from child-women ratios and percentages of children less than 15 years of age. The crude regional birth rate is estimated at 48.8 births per 1,000, with some indications of lower fertility in the predominantly Muslim province of Lanao del Sur than in the four predominantly Christian provinces of the Region, supporting Taeuber's hypothesis. No indications of declining fertility are evident.

Age-specific fertility data for the Region are available only from the 1959 survey cited. These data indicate very high fertility until age 35, probably reflect age patterns of fertility in all four "Christian" provinces, and may also closely approximate patterns in Bukidnon and the two Lanao provinces.

Current regional crude death rates are estimated to be less favorable than national averages and are placed at 20 to 23 deaths per 1,000. Little probability of significant decline from this level is foreseen between 1965 and 1970. Thus, the rate of natural increase conservatively estimated for this quinquennium ranges from 2.6 to 2.9 per cent a year, which, if maintained, would mean a doubling of the 1960 population between 1984 and 1987.

Alternative population projections and first-level school enrolments

JERRY MINER

General objectives. This paper illustrates the implications of alternative rates of population growth on the rate of expansion of first-level educational enrolments. Given alternative estimates of the rate of growth of the school-age population and relevant specifications regarding proposed expansion of enrolments, it is possible to calculate the different rates of increase of enrolments that follow from the different estimates of population growth. Alternatively, if it

is believed that structural and economic factors limit annual rates of expansion of first-level enrolments, a useful approach is to show the enrolment ratios which follow from different rates of population growth and the assumption of several potential rates of expansion of the first-level educational system.

The problem of expansion of first-level enrolment ratios in developing countries. In virtually all developing countries current ratios of first-level enrolments to relevant school-age population and the duration of school programs are substantially below the goals in national educational plans and the recommendations of educational planning missions and regional conferences on education. As a consequence, in most developing countries desired goals can be accomplished within the next ten or fifteen years only by an expansion of first-level education greatly in excess of the rate of growth of the relevant population. The crucial question, especially for countries with high rates of population growth, is whether these ambitious goals imply a rate of expansion which cannot be attained without crippling effects on other levels of education and on other sectors essential to economic and social development.

Method. Two ways of depicting the effects on enrolments of alternative rates of population growth are used: one shows the growth in enrolments required for a given target (here, 100 per cent enrolment ratios by 1980 or 1981) by each alternative population projection; the other shows the enrolment ratios that follow from the assumption of various annual rates of growth of the educational system (here, 1, 3, or 6 per cent) and the alternative population projections. The countries selected for illustrative analysis were: Pakistan, Indonesia, Guatemala, and Peru. The alternative projections of the Population Division of the United Nations Bureau of Social Affairs were used.

Conclusions. The analyses of the four countries indicate that the annual rates of increase required to achieve the assumed targets were roughly 2.5 per cent greater for the higher population projections than for the lower projections, and about one per cent greater than for the conservative or medium projections. The enrolment ratios implied by the three alternative rates of potential enrolment increase constitute a second way of showing the effects of the different population assumptions. For example, in Indonesia a three per cent annual increase in enrolments will serve to achieve a 100 per cent ratio in 1980 if the assumptions underlying the rapidly declining fertility projection are fulfilled, but the enrolment ratio will

reach only 67 per cent in 1980 if the low mortality projection prevails.

The limited illustrative country analyses of this paper indicate some apparently unrealistic goals in educational planning. Pakistan, with a record of a 4.0 per cent annual rate of expansion of first-level enrolments from 1950-1959, proposes a programme which, under the low mortality assumption, implies an annual rate of growth in enrolments in excess of 11 per cent.

It is hoped that this paper has presented one useful and practical approach to the consideration of population growth in the establishment of practical limits to educational expansion.

Recent developments and prospects of migration in Europe

ATTILIO OBLATH

Recent development is characterized by a change in the migration movement from permanent flow from Europe to overseas countries to temporary flows within Europe and to Europe from other continents. More attention has recently been given to the social aspects of migration in addition to its economic aspects. A further role of international migration has been to provide vocational training facilities to non-European migrants with a view to assisting the developing countries.

As for future developments, it would appear from available demographic, economic and political information that the demand for foreign manpower would persist while the supply of European manpower would decrease; most of the European migration countries have already or will soon put into force specific development plans, with the aim, *inter alia*, of absorbing by industry a great proportion of their surplus agricultural population. The intra-European migration flows and those towards Latin America would, thus, decrease while the necessity of bringing more non-European migrant workers to Europe would become greater. From the repatriation of professionally and socially experienced workers, the developing countries would receive further benefits for their economic development and social progress. This would, also, lead to a better equilibrium between the advantages that emigration and immigration countries receive from international migration, as well as a better understanding of their respective needs and a closer bilateral co-operation. However, special measures should be taken to facilitate the adaptation

of non-European migrants to the new environment.

Future consequences of the differences in population growth in Europe, Asia—particularly China—and North Africa

RODERICH VON UNGERN-STERNBERG

Statistics show that the natural growth of the population in Europe (including the Soviet Union) amounts to barely 1 per cent, whereas in Asia and Africa the average annual increase is 2.6 per cent. That is a considerable difference, which means that Europe is bordered on the east and south by countries having an annual population growth three times greater than its own. Central and South America aside, natural fertility is especially high in the People's Republic of China. In addition, agglomerations in many parts of China show a high population density. Judging by experience to date, the probability that the birth rate in the East and in Africa, and again particularly in China, will be reduced in the foreseeable future to any substantial extent, demographically speaking, by the use of contraceptives is certainly very slight. That would necessitate a quite revolutionary change in the mentality of Chinese, Moslem and Hindu families in Asia and Africa. Such an adaptation of very broad sectors of the population to the European spirit of rationalism and ambition for social progress (*arrivisme*) could at best come about over a very long time, in a period of one or two generations. At present, ruling circles in China are undecided about promoting the use of contraceptives. Moreover, they claim that China could feed 600 million more people. Even if the Government decided to encourage the use of contraceptives, it remains doubtful whether the masses of the people would act upon its recommendations in sufficient numbers to bring about any demographically significant reduction in births. Thus, the people of China will continue

to suffer heavy population pressure and, in times of poor harvests, shortage of food.

History demonstrates that such conditions can easily degenerate, causing an explosive exodus towards countries offering attractions to space-starved and hungry people. Such a movement may take place over a long period and may develop peacefully if access to suitable countries is open to them. But it can also degenerate into a military migration.

As matters now stand, the danger that sooner or later there will be an explosive population movement from China towards the west is clearly not to be disregarded.

Demographical comparative and flow diagrammes

KURT WITTHAUER

The paper explains in detail the usefulness of the "demographic comparative and flow diagrammes" in making comprehensive surveys of the dynamics of population change. These diagrammes indicate the regions or dates of comparison at the intersection of the co-ordinates of birth rates and death rates, simultaneously stressing the curves of identical natural increase. The diagrammes also stress the more important phases in the movement of population in case of a temporal comparison or emphasize the present demographic location expressed and differentiated geographically.

Sweden and Brazil are used to illustrate known long-term demographic developments. The former represents the substantially settled population cycle, while the latter stands for those countries which have high birth and death rates, and whose natural rate of increase can be expected to maintain its upward trend in the near future. These "general demographical flow diagrammes" can help in the simultaneous comparison of existing demographic situations and make developments over various time-periods easier to comprehend.

Meeting A.1

FERTILITY

PAPERS

The use of statistical guides and measures of effectiveness in determining government policy for influencing fertility—Pakistan

ENVER ADIL

I. INTRODUCTION

1. The economic development of Pakistan is rapid but partially prejudiced by increase of population. In realization of the necessity of controlling population growth, Pakistan is one of the few countries of the world which has a national family planning programme at government level.

2. In order to establish goals, choose methods and evaluate results, various guides and indices are needed for a family planning programme. In this paper a variety of these are listed. Most of them are tried and widely used methods that need no elaboration. However, the paper focuses on several techniques which are perhaps not as familiar and are being used or will be used in Pakistan. Data derived by these techniques or formulas prepared for them are used as illustrations.

II. DEMOGRAPHIC AND ECONOMIC CONDITIONS AND FAMILY PLANNING PROGRAMMES IN PAKISTAN

3. With a high fertility and declining mortality, the growth rate of Pakistan is almost 3 per cent per year which will double the present population of 110 million in the next twenty-five years.

4. In this predominantly Muslim country, religion as such does not bar family limitation. The main reasons for high fertility seem to be social traditions concerning the status of women, early and universal marriage with early motherhood (average age at marriage of females is fifteen and one half years and 99 per cent of women marry before the end of the reproductive period), illiteracy (84 per cent of the population is illiterate), dependence on agriculture (87 per cent of the population live in the

rural areas and 76 per cent earn their livelihood from agriculture), low standard of living (average per capita annual income less than \$70), and to a certain extent fatalistic attitudes. The practice of family limitation is almost entirely absent. There is little knowledge about birth control methods and the masses cannot afford to buy any but the most inexpensive types of contraceptives. Other factors include the desire for large families, lack of spacing between the earlier children, remarriage of widows and the extended form of family organization.

5. Taking into consideration the socio-economic conditions of the country, the Government of Pakistan mentioned the need and importance of family planning in the First Five-Year Plan for the period 1955-1960. An actual Family Planning Programme was started during the Second Plan period 1960-1965, when Rs. 30.5 million were allocated. The objective of the programme was to reduce the growth rate by limiting births through change in social attitudes and by scientifically based methods for control of conception.

6. During the Second Plan period, actual implementation of the programme was very limited in scope and did not achieve the desired goals. An allocation of Rs. 300 million has been made for the Third Five-Year Plan period. The goal is to reduce the birth rate by 20 per cent and to lower the growth rate to 2.5 per cent per annum by 1970. Out of 10 million contraceptive adopters, 3 million would receive intra-uterine contraceptive devices (IUD) and most of the remainder would be expected to use conventional contraceptives. To achieve the desired objectives, emphasis will be placed on an educational programme and

on making contraceptives widely available through clinics and through other governmental and private agencies.

7. Among the guides and indices listed below, those discussed in detail are marked with an asterisk.

(a) Guides and steps in the design of the National Family Planning Programme:

- (i) Estimation of population growth rate—population projections;
- (ii) Estimation of economic development and impact of population growth;
- (iii) Establishment of national population growth goals;
- (iv) Estimation of amount of reduction in birth rate needed to achieve the goal;
- (v) Identification of factors to be faced:
 - (a) Population distribution: geographic, urban/rural;
 - (b) Socio-cultural factors: political, social and community organization patterns;
 - (c) Literacy levels;
 - (d) Attitudes towards family planning;
 - (e) Official, public, male and female.
- (vi) Assessment of resources:
 - (a) Resources: personnel and facilities;
 - (b) Professional: doctors, para-medical personnel, non-professional, hospitals, clinics;
 - (c) Communication and transportation.
- (vii) Estimation of potential programme development:
 - (a) Potential effectiveness of different methods of contraception, if practised consistently (e.g., IUD data*);
 - (b) Probability of acceptance and consistent practice;
 - (c) Feasibility of dissemination and service.
- (viii) Decision on:
 - (a) Types of contraception;
 - (b) Methods of dissemination;
 - (c) Over-all goal for adoption of contraceptive practice and goals for each contraceptive method.

(b) Indices for evaluation of family planning programme and for modification of it:

- (i) Service data—to assess fulfilment of

service objectives and to correct deficiencies;

- (ii) Attitude studies—to assess change in acceptability of family planning;
- (iii) Family planning practice studies—to assess adoption of family planning practice (including types of contraceptive);
- (iv) Quantities of contraceptive supplies distributed;
- * (v) Studies on failure rates of different contraceptive methods among individuals who adopt them (including IUD);
- (vi) Community studies on effects of family planning programmes on births and pregnancies:
 - (a) Spot surveys on total birth rate;
 - * (b) "Target births";
 - * (c) Birth intervals (and pregnancy intervals);
 - * (d) Pregnancy prevalence.

III. SELECTED RESEARCH STUDIES FOR IMPROVING THE FAMILY PLANNING PROGRAMME IN PAKISTAN

8. Efficacy and applicability are the aspects that are being evaluated by planned studies. These studies aim to help the family planning administrators to make necessary changes in the programme without dissipating limited resources and hopefully without losing a good deal of time.

9. In a study, conventional contraceptives were advocated in those villages where government programmes of modernization of way of life, improvement of agricultural practices, better home sanitation, women's education, etc., were already under way. The study showed that desire for limiting family size is commonly present. But the people lack the necessary knowledge and often live far from existing sources of contraceptive supplies. Most of the female adopters are in high orders of parity, middle aged, and with average married life span of fourteen years.

10. To introduce the IUD in the national programme, two studies are being made. In the first study, twelve clinics in different parts of the country have admitted 1,757 women to test the advantages and disadvantages, efficacy and safety of the IUD. The demographic data shows that women are interested in the device in proportion to the size of the family already acquired. Their objective usually seems to be to maintain their present family size rather

than to space pregnancies. This shows that a strong educational campaign is needed to bring women to seek the IUD for the spacing of children in the early reproductive period.

11. The most common reason for discontinuation of the device is bleeding. Though the bleeding is usually of minor degree, often merely spotting, and not greatly prolonged, the women show great concern. In a population with high illiteracy, such a concern could result in failure of the programme. For this reason another more extended study is being done on needs for training and supervision and on other problems that may arise when the programme is broadened among less selected groups of people and under varying conditions of control and medical management. During the early period results have been encouraging.

The present plan includes para-medical personnel who will work under the supervision of qualified and trained doctors.

12. As for preference for the IUD from among various choices of contraceptive methods offered, one study population was given an opportunity to change from the IUD to oral contraceptive pills and another group to do the reverse. Approximately 50 per cent of both shifted. This demonstrated merely that the women are not completely satisfied with any method that is as yet available to them and that a good many will experiment with almost any new method offered.

13. The following illustration, based on Pakistani data, shows the use of study findings in estimating the potential role of IUD in a mass family planning programme:

(a)	<i>Per cent retained from first year of insertion</i>	<i>Cumulative number in use per 100 insertions done annually</i>		
(i)	At end of 1st year...	75	Experienced	75
(ii)	At end of 2nd year...	50		125
(iii)	At end of 3rd year...	35		160
(iv)	At end of 4th year...	25	Estimated Projection	185
(v)	At end of 5th year...	10		195
(vi)	At end of 6th year...	0		195

Pakistan data:

- (b) Data needed:
- (i) Average interval between births among the women prior to their coming to the IUD clinic 3 years
 - (ii) Pregnancy rate that actually occurred among IUD wearers in project 1.5/100 woman years of IUD use
 - (iii) Per cent of women who discontinued IUD use 22
 - (iv) Average IUD retention span before discontinuation 4.8 months
- (c) Calculations per 100 IUD insertions:
- (i) Expected number of births without IUD programme (at rate of 33/100 woman-years of use) 33.0
 - (ii) Estimated number of births with IUD programme (at rate of 1.5/100 woman-years of use):

(a) Pregnancies among IUD wearers:

(i) 78% retained IUD full year
 $0.78 \times 1.5 \dots$

1.17

(ii) 22% discontinued IUD after average retention span of 4.8 months: $0.22 \times 4.8/12 \times 1.5 \dots$		0.13	
(b) Pregnancies after discontinuation (assuming usual rate of 33/100 woman-years): $0.22 \times 7.2/12 \times 33 \dots$		4.36	
		<u>5.66</u>	<u>-5.66</u>
(iii) Number of births prevented per 100 IUD insertions...			<u>27.34</u>

14. In Pakistan with approximately 5 million babies born per year, a five-year effort at 20 per cent reduction by means of IUD alone would require 1.85 million insertions per year. (In the fifth year, there would be 1.85 million $\times 1.95$ or 3,600,000 IUD wearers.)

15. The criterion of birth rate for measuring the effect of family planning promotion is not readily available in Pakistan due to incompleteness of vital statistics. Obviously, even if there is a downward trend in general birth rate over a five- to ten-year period, it is hard to prove that the drop is the result of the family planning programme rather than a rise in the standard of living or other socio-cultural changes. For the same reason, regular vital registration data cannot be used for comparison between communities with and without local family planning programmes.

16. The Central Statistical Office has for several years conducted a population growth estimation project in which data were collected regularly from selected sample areas. For geographic and administrative reasons it has not been possible to superimpose a controlled experimental family planning programme upon this project. The converse has been attempted in at least one community of 12,000 population (Lulliani), but the proportionate cost and effort to establish and maintain full vital statistics are very large.

17. Consequently, several "short cut" methods have been selected and will be utilized periodically in evaluation of the new family planning scheme of the Third Five-Year Plan period (1965-1970). Several of the indices to be used are here listed.

18. No attempt will be made to maintain a population cohort or to make "before and after" comparisons. Instead, in areas covered by the family planning programme, different reasonably representative areas will be used and

comparisons will be made by place and over a span of time. At the outset, several indices from crude to finer are to be used, with the objective of comparing them with each other so that the simplest and most economically derived that furnish the desired information will be retained. All the indices will attempt to measure achievement of the goal of preventing high parity (here defined as over four) and short interval (here defined as under three years) births. In all probability, age of parents will be ignored, although at first, attempt will be made to assess the advantages, if any, of using age-specific groups. It is expected that parity alone will give almost as much information.

19. Surveys will be done by a sampling of residential structures located by area maps. In each structure, only the following questions need be asked:

(a) Names of all married women thirteen to fifty years of age (excluding widows);

And for each:

(b) Any baby born alive during the defined survey period (six-month span) (one-year span);

(c) Date of birth;

(d) Parity:

(i) Date of last live birth before start of the defined survey period;

(ii) If none, duration of consummated marriage.

20. Indices in decreasing order of crudeness:

(a) Birth—household ratio:

(i) Total number of live births during survey period per 100 houses sampled;

(b) "Fertility" rates:

(i) Total number of live births during survey period per 100 married women (thirteen-fifty) in the sample;

- (c) "Target birth" ratios:
 - (i) Number of target births (parity over four) during survey period per 100 married women (thirteen-fifty) in the sample;
 - (ii) Number of target births (parity over six) during survey period per 100 married women (thirteen-fifty) in the sample;
- (d) Specific target birth rate (high order parity):
 - (i) Number of target births (parity over four) during survey period per 100 women in the sample with previous parity of four or more;
 - (ii) Number of target births (parity over six) during survey period per 100 women in the sample with previous parity of six or more;
- (e) General birth-interval ratio:
 - (i) All births during survey period per 100 women-years of "last exposure";
 - (ii) "Last exposure period" defined as interval between:
 - (a) Last live birth before survey period, or time of marriage consummation if no live birth before survey period; and
 - (b) Time of live birth during survey period, or end of survey period if no live birth during survey period.
- (f) Target birth-interval ratio:
 - (i) Number of target births (birth-interval under three years) during survey period per 100 women-years of last exposure period;
 - (ii) Number of target births (birth-interval under two years) during survey period per 100 women-years of last exposure period;
- (g) "Short exposure" birth ratio (among women with length of last exposure period between nine months and three years):
 - (i) Births during survey period (to these women) per 100 women-years of last exposure period (of these women).

This ratio attempts to measure the rate of occurrence of short-interval births that occur despite the presence of a family planning programme. It includes in both numerator and denominator only those women whose total span of most recent exposure to pregnancy occurred within the time when the family planning programme was in effect. It attempts to exclude factors related to birth-free intervals that existed prior to the start of the family planning programme and focuses on the objective of birth spacing rather than limitation of parity.

21. *Pregnancy interval.* This method attempts to obtain data on a cohort of women for comparison of pregnancy interval before and after access to the family planning programme. The cohort is obtained by a single retrospective interview that covers pregnancies back to the *last complete inter-pregnancy interval* prior to the date established as the beginning of the expected family planning programme effect. Methods of calculation and expected difficulties in recall, especially for interrupted pregnancies and foetal deaths, are under study and will be reported in another paper at a later date.

22. *Pregnancy prevalence.* A study is under way by use of the slide agglutination pregnancy test to estimate pregnancy prevalence. Sample surveys of households are made and varying types of indices are used, similar to the procedures in the "Target Birth" studies described above.

IV. CONCLUSION

23. The ultimate test of effectiveness of a family planning programme is prevention of pregnancies. Methods must be found for inexpensive, prompt assessment of such programmes rather than waiting for decennial censuses or other late information. Not enough is known as yet about how best to launch and conduct family planning programmes to permit continued investment of funds and resources without purposefully and in advance creating the opportunity and continuously seeking for its prompt critical appraisal.

Relation between foetal-infant mortality and fertility

JEAN BOURGEOIS-PICHAT

[Translated from French]

1. The fertility of human populations is measured in terms of live births. Such births are of course dependent on the behaviour of couples. This behaviour does in fact regulate conceptions, but in studying fertility we must take account of a factor arising during pregnancy, namely foetal-infant mortality.

2. Official statistics are concerned with late foetal deaths: those occurring after six months of gestation. This late foetal mortality is in fact only the end of a process which begins with birth. There are few observations on what happens during the first six months of pregnancy. Graph no. I gives one of the rare tables of foetal mortality, perhaps the only one available. It was established recently by F. E. French and J. M. Bierman,¹ who used data collected in a continuous observation study carried out from 1953 to 1956 on the island of Kauai (Hawaii). The table covers approximately 3,000 pregnancies. Graph no. I gives the probability of foetal death calculated by four-week cycles from the first month of pregnancy. The probability starts at a high level, then decreases rapidly and stabilizes at around the sixth month. The curve ends in a plateau. Late foetal mortality statistics provide us with information concerning this plateau level.

3. What is called the late foetal death rate (or also the stillbirth rate) generally is computed as the ratio of late foetal deaths to live births. Graph no. I shows that the rate thus computed is roughly equal to four times the probability of foetal death at the plateau of the curve. In other words, if we divide the late foetal death rates published in official statistics by four, we obtain the probability of death at the plateau of the curve. Table 1 gives the changes in the probability thus computed for three recent periods in countries in which late foetal deaths may be considered to be relatively well declared.

4. The probability of foetal death obtained

from the French and Bierman table is given in the last line of table 1. It is situated in the region of low mortality rates. The countries are listed in decreasing order of mortality for the period 1945-1949. The order of the list is, moreover, roughly constant throughout the period, and over a ten-year period we can see an overall decrease in foetal mortality.

5. However, all this provides us only with information concerning the plateau of the curve. What can we deduce about foetal mortality before the end of the sixth month of gestation? It seems unlikely that we can extrapolate backwards the differences in mortality observed after six months of gestation. The case of Trinidad and Tobago in 1945-1949 may be taken as an example. After six months of gestation, mortality is 3.7 times higher than in the French and Bierman table. If we assume that this coefficient can be applied before the end of the sixth month of gestation, we find that 68 per cent of conceptions end in foetal death, which seems an inordinately high proportion.

6. It seems more logical to assume that foetal mortality at the beginning of pregnancy is not influenced to any great extent by environment. It would therefore be a kind of biological mortality and the French and Bierman table would be valid in all cases. Then, as pregnancy continues, the environment exercises more and more influence and the gradual decrease of mortality halts at a plateau which is highest when the conditions are least favourable. In graph no. I a curve has been drawn to show this and a plateau is indicated at 20 per 1,000. The curves corresponding to the countries in table 1 would then lie between the two curves in the graph. According to the lower curve (French and Bierman), 23.8 per cent of conceptions end in foetal death while with the upper curve 34.8 per cent do so. We shall take 30 per cent as being the average situation. The method is admittedly very arbitrary. Other observations which unfortunately do not exist are required for a better understanding of the problem.

¹ F. E. French and J. M. Bierman, "Probabilities of foetal mortality", *Public Health Reports*, 77 (1962), pp. 835-884. This mortality table was included in *Population*, No. 3 (1964), pp. 579-583.

7. Let us see in what way the foetal mortality factor may be introduced in moving from conceptions to live births. Let us take the case of a population in which fertility is not "controlled" and let us consider fecund couples. We can add a time interval to each conception which is the sum of the following three periods:

The duration of pregnancy;

The period of temporary sterility following each birth;

The period required for conception after the temporary sterility has ceased.

8. The period required for conception is the same in the case of both live births and foetal deaths. The period of temporary sterility and the duration of pregnancy are shorter where foetal death occurs than where there is a live birth. If we take 100 conceptions, thirty of which end in foetal death (the average figure mentioned above), and if d_f is the interval associated with a foetal death and d_v is the interval associated with a live birth, d_f is smaller than d_v . The quantity $30d_f + 70d_v$ represents the time required for seventy live births to occur and therefore: $i_v = \frac{30d_f + 70d_v}{70}$

equals the average interval between live births.

Finally we find that: $i_v = \frac{30}{70}d_f + d_v$. In a

group of fecund couples, with the same reproductive capacity, the reciprocal $\frac{1}{i_v}$ is the fertility

rate.² If there were no foetal deaths the average interval between live births would equal d_f and the fertility rate would be $\frac{1}{d_v}$. If we compare

$\frac{1}{d_v}$ and $\frac{1}{i_v}$ we can see the effect of foetal deaths on fertility. It will be seen that in determining i_v the ratio k of foetal deaths to live births must be considered (in the example chosen it is equal to $\frac{30}{70}$). This ratio k is similar in nature

to the stillbirth rate, but instead of relating to the period after the sixth month of gestation it relates to the entire period of pregnancy.

9. We shall now try to apply this in numerical terms. In all these calculations it is convenient to use as time unit the menstrual cycle which for practical purposes may be regarded as equal to four weeks. This was the unit used above when considering foetal mortality.

(a) Computing the time required for conception once temporary sterility has ceased

² If i_v is expressed in cycles we obtain the fertility rate by cycle.

may be reduced to a conventional problem of probability. A very good summary of the various methods and results can be found in an article³ by G. Potter, Jr. The time required for conception depends on the frequency of sexual intercourse. This decreases with the age of the woman and the time required for conception increases as she grows older. The length of pregnancy does not vary greatly for a live birth and can be taken as equal to ten cycles. There is less information about foetal deaths. For the upper curve of graph no. I the average period is 3.8 cycles, and for the lower curve it is 2.7 cycles. A period of 3 cycles will be taken as the average situation.

(b) The period of temporary sterility varies a great deal from population to population. Among populations where fertility is not "controlled" the period is generally quite long. We will take the figure given by Mrs. Dandekar⁴ for a live birth: 14 cycles. There is no information about foetal deaths and so we will take 1 cycle as an arbitrary figure.

(c) With these assumptions we obtain 1_f and 1_v by adding 4 cycles and 24 cycles respectively to the time required for conception. Since the time required for conception increases with the age of the woman 1_f and 1_v will also increase.

10. We now have to establish the ratio k . We said that we would take 0.30 for conceptions as a whole, but that ratio varies with the age of the woman. We have already said that it was similar in nature to the stillbirth ratio and we know that that ratio varies with the age of the woman.⁵ Table 2 which is represented by curve I of graph no. II shows the variation of the stillbirth ratio with age for women in France for the period 1960-1963. Similar variations are found in the other countries. However, this gives us information concerning only one part of the ratio k : that corresponding to the plateau of the curves in graph no. I, i.e., the period after six months of gestation. What happens before the end of the sixth month?

11. The French and Bierman table gives no indication of the variations of k with the age of the woman. There is, however, another

³ Robert G. Potter, Jr., "Length of the fertile period", *The Milbank Memorial Fund Quarterly*, vol. XXXIX, No. 1 (1961), pp. 132-162. See also: J. Bourgeois-Pichat, "Les facteurs de la fécondité non dirigée", *Population*, No. 3 (1965).

⁴ K. Dandekar, *Demographic survey of six rural communities* (Gokhale Institute of Politics and Economics), table 6-3, p. 62.

⁵ Léon Tabah and Jean Sutter, "Influence respective de l'âge maternel et du rang de naissance sur la mortalité. La notion de létalité", *Population*, No. 1 (January-March 1948), pp. 64-92.

table of foetal and infant mortality which was prepared by Sam Shapiro, Ellen W. Jones and Paul M. Densen, D.Sc. These authors used observations collected for 6,844 pregnancies during 1958 and 1959 in the New York area (USA). It was not possible to compute with these observations probabilities of death as precise as those of French and Bierman, particularly for short periods of gestation. On the other hand, they do give some indication of the variation of k with the woman's age. These variations are represented by curve II in graph no. II. The curves are very similar, but the ordinates of curve II are nearly ten times greater than the ordinates of curve I. It can probably be assumed that the ratio k varies with the age of the woman in the same way as the stillbirth ratio. According to the observations of Shapiro *et al.*, 14.2 per cent of conceptions end in foetal death. We said above that the average situation was 30 per cent. The k ratios corresponding to this average situation can be obtained by multiplying the Shapiro *et al.* ratios by $\frac{30}{14.2}$. This is curve III of graph no. II which has been extrapolated beyond the age of forty.

12. We can now calculate the fertility rates of fertile couples, with and without foetal deaths. This is the subject of table 3. If we compare the last two columns in table 3 we see the effect of foetal deaths on fertility under the conditions which we have established. In order to move from the fertility of fertile women to the fertility of women as a whole, we must take into account the increase of infecundity in women with age and the way in which marriages take place. We can summarize the effects of these two factors by computing "the expectation of fecund married life of a woman aged fifteen". If we multiply this expect-

tation of life by the average rates in the last two lines of table 3, we obtain an estimate of the average number of live births per couple; if we divide this average number of births by 2.05 we obtain the average number of female offspring, which gives us ultimately the gross reproduction rate.⁶ The expectation of fecund married life at age fifteen varies from country to country. If fertility is not controlled we can assume that a fifteen-year expectation is a fair average situation. Using that value we obtain the following gross reproduction rates: 3.17 with foetal death and 3.60 without foetal death. It will be recalled that our assumptions related to foetal deaths representing 30 per cent of conceptions. If such foetal deaths did not occur, there would be an increase of only 13.6 per cent in gross reproduction rates.

13. We have considered the case where fertility is not controlled. The reasoning would be the same for peoples practising birth control. The only factor which would be modified would be the expectation of fecund married life at age fifteen. Elimination of foetal deaths would result in a 13.6 per cent increase in the fertility of women as a whole.

14. In our assumptions, we have always taken quite a long period of temporary sterility: fourteen menstrual cycles. With a shorter period, the effect of elimination of foetal deaths would be greater. With, for example, a period of temporary sterility of one cycle, the elimination of foetal deaths would increase the fertility of women as a whole by 18.1 per cent.

15. In conclusion, we should like to emphasize that the values given to the parameters in our calculations have often had to be chosen arbitrarily. Further research appears essential.

⁶ This is all based on the assumption that there are no illegitimate births.

Table 1. Estimate of the probability of foetal death by four-week periods after six months of gestation, in countries with relatively good statistics from 1945 to 1949 (probability per 1,000)

Country	1945-1949	1950-1954	1955-1959
Mauritius	18.7	15.7	17.5
Japan	13.6	9.4	8.3
Trinidad and Tobago	12.1	10.1	8.3
British Guiana	11.5	9.4	8.3
Antigua	10.7	8.4	6.3
St. Kitts-Nevis and Anguilla	9.9	9.2	7.7
British Honduras	8.6	8.1	5.9
Guatemala	7.9	7.7	7.7
St. Vincent	7.8	8.6	6.2
Scotland	7.8	6.9	6.0
Mozambique (civilized population) ..	6.8	7.3	6.7
Barbados	6.7	6.4	4.8
Algeria (European population)	6.5	6.8	6.8
England and Wales	6.4	5.8	5.6
Hungary	6.2	4.6	3.8
Federal Republic of Germany	5.6	5.4	4.5
France	5.4	4.7	4.3
Austria	5.3	5.0	4.2
New Zealand	5.1	4.7	4.0
Norway	4.9	3.9	3.7
Netherlands	4.8	4.6	4.2
Denmark	4.6	4.7	4.1
Switzerland	4.1	4.0	3.4
Czechoslovakia	4.1	3.8	2.8
Bulgaria	2.7	3.2	3.1
Foetal mortality table of French and Bierman (graph no. I)			3.3

SOURCES: United Nations, *Demographic Yearbook 1961* (United Nations publication, Sales No.: 62.XIII.1).

Table 2. Stillbirth ratio by age of mother in France, 1960-1963

	Age of mother											
	15	16	17	18	19	20	20-24	25-29	30-34	35-39	40-44	45-49
Stillbirth ratio (per 1,000)	32.9	27.9	20.9	19.7	17.8	—	16.4	17.2	22.4	32.0	47.4	79.3

Table 3. Calculation of fertility rates of fecund women with and without foetal deaths assuming uncontrolled fertility

	Age groups (years)						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Frequency of sexual intercourse for cycle ^a ...	9.84	8.00	6.96	6.16	5.36	4.56	3.76
Period required for conception, in cycles ^b	1.61	1.90	2.10	2.33	2.56	3.03	3.51
Period 1 _r : period required for conception + 4 cycles	5.61	5.90	6.10	6.33	6.56	7.03	7.51
Ratio k	0.3570	0.2579	0.3228	0.4948	0.6724	0.8727	1.0000
$k \times 1_r$	2.00	1.52	1.97	3.13	4.41	6.14	7.51
Period 1 _s : period required for conception + 24 cycles	25.61	25.90	26.10	26.33	26.56	27.03	27.51
Interval between live-births $\frac{1}{k}$ (sum of lines 5 and 6)	27.61	27.42	28.07	29.46	30.97	33.17	35.02
<i>Annual fertility rates: ^c</i>							
Reciprocal of line 7 multiplied by 13 ^d	0.4708	0.4740	0.4631	0.4413	0.4197	0.3919	0.3712
Reciprocal of line 6 multiplied by 13 ^e	0.5076	0.5018	0.4980	0.4937	0.4894	0.4809	0.4725

^a The decrease with age is identical to that given in the second Kinsey report for a sample of 6,925 American married women.

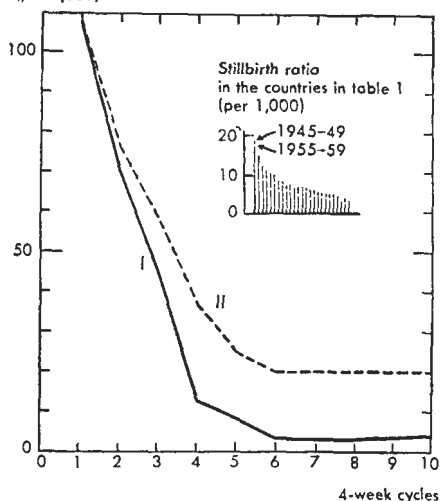
^b Computed according to Potter.

^c Thirteen menstrual cycles per year are assumed.

^d Average rate 0.4331.

^e Average rate 0.4920.

Probability of foetal death by 4-week cycles (per 1,000)

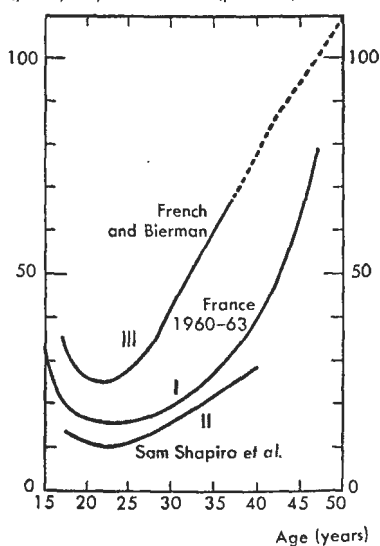


Graph No. I

Foetal mortality tables

Stillbirth ratio Curve I (per 1,000)

Coefficient k Curves II and III (per 100)



Graph No. II

Variations in foetal mortality by age of the woman

The influence of socio-economic factors on natality (as exemplified in the Armenian Soviet Socialist Republic)

L. M. DAVTYAN

[Translated from Russian]

1. In the course of the historical evolution of human society, natality has been transformed from a predominantly biological into a socio-biological phenomenon. The conditions affecting the level of natality have also been transformed; the decisive role in determining levels of natality is now played by socio-economic factors.

2. Investigation of the influence of socio-economic factors on the level of natality is one of the urgent tasks of demographic statistics, and one of great theoretical and practical importance.

3. The purpose of this report is to demonstrate the influence of the most important socio-economic factors on the level of natality (in its dynamic and statistical aspects) by the example of Soviet Armenia, one of the national republics of the USSR.

4. Before the Revolution, Armenia was an economically backward border region of Tsarist Russia. Its economy was dominated by agriculture, which accounted for more than 80 per cent of gross output as a whole. Only 10 per cent of the population lived in towns. More than 90 per cent of the population between nine and forty-nine years of age were illiterate, and not more than 3.5 per cent of the total population had received any education. There was not a single institution of higher education. There were only 0.7 doctors of all types, including dentists, and only 2.1 hospital beds, for every 10,000 population.

5. In 1913 the population of Armenia within its present boundaries was 1 million.

6. The characteristic features of the population replacement process were a high level of natality and as high a level of general and, particularly, infant mortality, low expectation of life and a rapid rate of generation reproduction.

7. The birth rate in 1913 was 46.3 per 1,000 (the gross reproduction rate for the period 1910-1914 was 3.3¹).

8. The causes of this high level of natality

were the excessively low age at marriage of women and the infrequency of contraceptive practices. It need only be observed that over the period 1900-1914 the average age at marriage was 17.1, 14.4 per cent of all women marrying before their fifteenth birthday.¹

9. Since medical treatment facilities were almost totally lacking, epidemics (malaria, typhus, etc.) swept the country unchecked, claiming large numbers of victims. The crude death rate in 1913 was 23.9 per 1,000 population. Infant mortality was high. Only 62.9 per cent of children born in the period 1910-1914 survived to the age of five.²

10. The crude rate of natural increase was high (22.4 per 1,000 in 1913). That, however, did not reflect a satisfactory level of public health, since the high crude rate of natural increase was the product not only of high natality but also of high mortality.

11. By the end of 1920, on the eve of the establishment of Soviet power in Armenia, the First World War, the total dislocation of economic life, hunger and mass epidemics had reduced the population of Armenia to 780,000.

12. In the era of Soviet power, Armenia has been transformed: it is now a republic endowed with a highly advanced industry and mechanized socialist agriculture and enjoying 100 per cent literacy. By 1963 the gross output of industry—the leading sector of the economy—had been increased as compared with 1913 by a factor of 89; and the output of agriculture had been increased almost threefold.

¹ Data for 1900-1914 and 1910-1914 from R. I. Siffman: *Infant natality and mortality in Transcaucasian villages* (manuscript), M., 1951. These data were obtained through a demographic sample survey carried out by the anamnestic method in 1947 in rural areas of Transcaucasia with a view to the retrospective investigation of infant natality and mortality. As 90 per cent of the population of Armenia lived in rural areas before the Revolution, the demographic data for the rural population obtained from this survey are here taken as applicable to the population of Armenia as a whole.

² *Ibid.*

13. Since 1920 the population of the Armenian Republic has risen by almost 200 per cent, standing at 2,069,000 on 1 January 1964. The rapid development of industry has brought great changes in the distribution of the population: at the beginning of 1964 one half (50.1 per cent) of the total population lived in twenty-three cities of the Armenian SSR.

14. Armenia has undergone a veritable cultural revolution. The 1959 census figures showed that 28 per 1,000 population had received higher education and 289 secondary education (including incomplete secondary education). In the academic year 1963-1964, 29,000 students were receiving education in Armenia's eleven higher educational establishments.

15. An extensive system of hospitals, polyclinics, special preventive clinics and other institutions of preventive and curative medicine and anti-epidemic establishments, supplied with modern equipment, exists to protect the health of the working people. In 1963 the Armenian SSR had 25.4 doctors of all types, including dentists, and 76.9 hospital beds, per 1,000 population.

16. In 1930 unemployment was eradicated once and for all in the USSR, including the Armenian SSR—the practical reflection of the operation of the socialist law of population, whose objective prerequisite is the full employment of all able-bodied members of society. In all spheres of the economic, cultural and scientific life of the Armenian Republic, women are actively at work side by side with men. In 1959, according to the census figures for that year, 31 per cent of all engineering and technical staff in the Armenian SSR, 60 per cent of all doctors and 55 per cent of all scientific workers, teachers and educators were women.

17. The basis for any growth of incomes, whether of society as a whole or of individual families, is the full and rational use of labour resources in conjunction with constantly rising labour productivity. In 1963 real incomes of factory workers in the Armenian SSR were 5.9 times greater, and of peasants 7 times greater, than in 1913. In the last six years alone (1958-1963) one out of every three families in the republic has received a new well-appointed apartment or has been able to improve its housing conditions in old buildings.

18. A fundamentally new type of population replacement has come into being, the basic feature of which is a sharp reduction in mortality with a comparatively high level of natality.

19. In 1961-1962 the fertility rate in the Armenian SSR was 152.7 per 1,000 women in age group 15-49, while the gross reproduction rate was 2.1. Natality per 1,000 population was 1.3 times smaller in 1961-1962 than before the Revolution. The principal causes of the marked decline in natality which has taken place are the drop in the proportion of married women of child-bearing age and the decline in the fertility rate of married women. The decline in the proportion of married women of reproductive age has been due both to an appreciable rise in the average age at marriage (in recent years the median age of women at marriage has been about twenty-three), and to an increase in the proportion of unmarried women in older age groups (the result of the Great Patriotic War).

20. The rise in standards of living and the marked improvements which have taken place in medical services, hygienic conditions, etc., have had a decisive influence on mortality. In 1962 the crude death rate in the Armenian SSR was 3.6 times lower than before the Revolution. Particularly great advances have been made in preventing the loss of child life. By 1962 mortality had been reduced as compared with 1910-1914 by a factor of nearly 4 among children in the first year of life, 5 among one-year-old children, almost 20 among two-year-old children and 30 among three-year-old children. The average expectation of life for children born in 1961-1962 was seventy-one years.

21. The decline in natality which has taken place against a background of rising well-being would appear to justify the conclusion that the level of natality varies inversely with the level of well-being. Such a deduction, however, would be incomplete.

22. When we study the indicators of natality and mortality, it becomes clear that what has been taking place is a profound social process. Analysis of the data for the Armenian SSR shows that the decline in the natality level has been accompanied—and in a sense determined also—by a still more rapid decline in mortality, and that as a result the rate of population replacement has not only not slowed down but substantially accelerated in comparison with the pre-revolutionary period. Thus, the rate of natural increase has risen from 22.4 per 1,000 in 1913 to an average of 30 per 1,000 over the last ten years.

23. It follows that the trend described has been due not to any negative influence of rising levels of well-being and culture on natality, but to the transition from an unfavourable

avourable to a rational type of population replacement. This will become clear if we consider the "coefficient of rationality of replacement"³. In pre-revolutionary Russia (1913), this stood at 0.32, while over the period 1961-1963 it stood at 0.69.

24. Let us now consider the statistical relationship between socio-economic factors and natality.

25. In destroying private property in the means of production and doing away with the antagonism between classes, socialism does not thereby entirely eliminate inequalities in the distribution and consumption of the means of existence. In socialist society, differences of standards of living as between working people remain, since material goods are distributed according to the quantity and quality of labour expended. The special surveys carried out in 1934 and 1964 by the Central Statistical Board of the USSR show that differences in natality also remain. A high natality level is found among sections of the population having lower levels of per capita income.

26. A special survey of women in the city of Erevan carried out in 1963 by the Institute of Economics of the Academy of Sciences of the Armenian SSR showed the same relationship between fertility and income: as income rose, fertility declined. If, however, a more

³ This indicator is calculated by dividing the difference between the birth and death rates by their sum. The point of the coefficient of rationality of replacement (which is applicable only in conditions of expanded reproduction) is that it shows the magnitude of the natural increase within the process of circulation of the population. The smaller the specific effect of mortality on the general circulation of the population, the more closely this indicator approaches unity and, consequently, the more rational is the process of population replacement.

precise indicator of material well-being is applied, income being calculated on the basis not of the number of family members (excluding newborns) but on the basis of a national consumer unit (using the sex- and age-specific consumption norms constructed by the Institute of Dietetics of the Academy of Medical Sciences of the USSR and the Labour Research Institute), the regularity of the correlation noted between fertility and income disappears.

27. There is another important consideration which we must bear in mind if our picture of the relationship between fertility and income is not to be defective. We refer to the fact that in both this and other surveys carried out in the USSR, per capita income as an indicator of material well-being has been calculated as the sum of incomes in cash and kind received by the family (wages, pensions, allowances, supplies from personal plots of land, etc.). But under socialism, of course, the real incomes of working people are made up to an increasing extent of health, educational and other services provided free of charge by the State.

28. This component of income, which is not directly reflected in family budgets used in the studies of this subject, deserves particular attention because it is distributed not on the basis of the quantity and quality of work expended but of the number of members of each family. Thus the more members, and particularly children, a family has, the larger its income from this source. This may be seen from the following figures, compiled on the basis of a special survey of the family incomes and consumption of factory and professional and office workers carried out in Leninakan in 1963 by the Institute of Economics of the Academy of Sciences of the Armenian SSR.

Number of family members	Combined income	Income by types	
		Income directly reflected in family budgets (tangible income)	Benefits and free services from public consumption funds (intangible income) (percentages)
4	100	85	15
5	100	84	16
6	100	83	17
7	100	79	21

29. If we were to take into account services distributed according to numbers of family members, which make up a substantial part of the real income of working people, we might find the inverse correlation between fertility and income reduced or even cancelled.

30. In point of fact, the relationship between fertility and income does not exist in "pure form"; it operates in conjunction with many other factors whose specific effects are often very difficult to define. Let us consider, by way of example, the inter-relationship between

employment, income and female fertility.

31. According to data provided by the survey of women in the city of Erevan referred to above, the mean fertility rate of employed women was 36.6 per cent lower than the fertility rate of women not employed outside the home. This reflects an inverse correlation between employment and fertility. Where adequate children's care institutions, domestic facilities and services, etc., are lacking, women find some difficulty in combining outside employment with the care of children. Thus, a study of the use of leisure time by working women in the city of Erevan carried out by the Institute of Economics of the Academy of Sciences of the Armenian SSR has shown that a woman with one child spends on the average about twice as much time looking after household as a childless woman. The greater the number of children, the greater this difference becomes.

32. The same survey shows that among employed women there is no clearly defined relationship between fertility and income. That is a very significant fact: it means that the inverse correlation fails to operate with regard to more than half of the women of reproductive age in the Armenian Republic.

33. Let us sum up our analysis of the relations we have noted between income, employ-

ment and fertility. The inverse correlation between income and fertility which is characteristic of women as a whole is the combined effect of the inverse correlation between income and fertility which operates among non-employed women, on the one hand, and the level of employment and fertility of employed women, on the other.

34. As its productive forces develop, the Socialist State allocates increasing funds for the improvement of cultural levels. In individual families, one of the conditions for improving the standard of living is to raise the working skills of the family members. It follows that both in society as a whole and in the family, its primary cell, there is a direct correlation between income and cultural levels.

35. What then is the relationship between cultural levels and fertility?

36. A sample processing of census returns from the 1959 census (14,000 families in the Armenian SSR) showed the following relationship between the level of education of mothers and the average number of children.⁴

⁴ E. Chomaryan and L. Davtyan, *The Family in Soviet Armenia Today* (Publishing House of the Academy of Sciences of the Armenian Socialist Soviet Republic, Erevan, 1962), p. 59 (in Armenian).

<i>Figures per 100 families, each of one married couple and children</i>			
<i>Level of education of mother</i>	<i>Number of family members</i>	<i>Including children</i>	
		<i>(Absolute figures)</i>	<i>(Percentage of total number of family members)</i>
Higher, incomplete higher, secondary specialized	430	188	43.7
Secondary general, incomplete secondary, 7-year	466	229	49.1
Primary	470	246	52.3

37. These figures show that rising educational levels are accompanied by a decline in the average number of children.

38. A similar result was obtained in a survey carried out in the city of Erevan. This showed that the legitimate fertility rate of women with secondary and 7-year education was 127.4 per 1,000, or 13.9 per cent higher than the fertility rate of women with higher and secondary specialized education.

39. Thus, the data for the Armenian SSR confirm the existence of an inverse correlation between the fertility and the cultural level of women. However, the importance of this correlation is sometimes exaggerated: some au-

thors represent it as the major influence on fertility levels. In our view this is a fallacious theory. As has been pointed out above, cultural levels, while they do have an important influence on female fertility, are a secondary and derivative influence, depending on the level of development of productive forces and on the structure of society.

40. But it would be equally erroneous to regard the influence of cultural levels on fertility simply as an intermediate link between income and fertility. In this connexion, let us consider the effect of another factor—age at marriage—which is to a considerable extent determined by age on termination of studies. A

course of higher education takes five years, and a course of secondary specialized education not less than three years, after completion of secondary studies. Other things being equal, that delays a woman's marriage and thus automatically reduces natality. Moreover, women at a high educational level try to retain as much leisure time as possible for the satisfaction of their spiritual needs, and therefore tend more frequently to reduce the number of their children. In addition, highly educated women reflect more clearly the effects of the fact that in the present fundamentally new conditions of population replacement a woman may give birth to fewer children yet retain as many as survived in the not too distant past despite a comparatively high level of natality.

41. Thus, cultural levels, which are directly proportionate to income and inversely proportionate to fertility, have their own specific influence on the formation of an inverse correlation between fertility and standards of living.

42. We have also investigated the relationship between housing conditions and fertility.

43. Among the urban population of the Armenian SSR there is an inverse correlation between housing conditions and fertility. The fertility rate of women living in separate apartments is 35 per cent lower than that of women living in shared apartments.

44. Housing is an integral part of the national patrimony, and the law provides that it is to be divided free of charge according to the number of family members. Thus, the system of housing allocation objectively precludes any possibility of an inverse correlation between housing space and fertility.

45. What, then, explains the existence of such an inverse correlation?

46. The reason is that housing conditions change relatively slowly, whereas family sizes are subject to more dynamic changes. Natality, mortality, marriage—these are events of constant occurrence in family life; and since, through the operation of a variety of socio-economic factors, these demographic events do not occur with uniform intensity, the correspondences between family size and housing conditions is soon negated. The paradoxical situation arises that bad housing conditions appear to result in high natality. In point of fact, however, natality (together with other demographic events) is in a certain sense a primary influence on changes in housing con-

ditions, and is one of the causes leading to the differentiation of families according to housing conditions.

47. That, however, does not mean that housing conditions—one of the major components of the standard of living—have no influence at all on natality.

48. It stands to reason that families living in comparatively poor housing conditions have more substantial grounds for reducing the number of births. If, nevertheless, families living in bad housing conditions display a high level of natality, there must probably be other factors operating more strongly among them.

49. Generally speaking, however, the inter-relationship between housing conditions and natality levels has so far not been investigated very thoroughly, and should be studied more deeply and comprehensively in the future.

50. Erevan, the capital of the Armenian Republic, which was formerly a small provincial city of 30,000 inhabitants, is now one of the largest industrial and cultural centres of the Soviet Union, with more than 600,000 residents. One of the factors in this rapid population growth has undoubtedly been mechanical increase at the expense of other population aggregates (especially in rural areas).

51. The programme of our sample survey also included a study of the effect of migration on natality levels. According to the data assembled in the course of this study, the legitimate fertility rate of women aged twenty-five to thirty-nine moving to Erevan was 44.5 per cent higher during their first five years of residence than the fertility rate of permanent residents. In their second five years in the city, the fertility rate of new women residents begins to decline sharply, reaching a level almost identical with that of native residents of Erevan towards the end of the period.

52. We must observe in conclusion that our study should be regarded solely as a tentative investigation of the effects of certain socio-economic factors on the fertility rate of women.

53. The relationship between natality and socio-economic conditions needs further thorough and comprehensive study, designed not only to identify the factors affecting natality in all its varied forms, but also to determine the degree of influence of each individual factor.

Doctrines and attitudes of major religions in regard to fertility

RICHARD M. FAGLEY

1. The awesome character of procreation and the mystery of a childless marriage are understandably related to the religious sense of mankind. While the question of fertility among the major faiths is less of a preoccupation than in many primitive religions, it remains an important concern. A brief paper on so broad a subject can hope to offer only the most summary kind of introductory overview. The varying concepts of man which offer perspectives for understanding doctrines concerning fertility, as well as most references to the historical development of such doctrines, must perforce be omitted. Also consideration has had to be limited to four of the faiths with large numbers of adherents.

2. Even in a treatment so compressed, it is deemed necessary to refer to attitudes as well as to doctrines. The thesis here is that for a full picture, social analysis must reckon with the beliefs and the practices of the living community as well as the tenets advanced on the basis of sacred writings and traditions.¹ It is often assumed that differences between the two mean a dilution of faith and the supervention of non-religious influences. Any such assumption should be tested, for in the application of religious principles to changing social conditions it is quite normal to find a certain interaction, a kind of dialogue, between the community of believers and the religious heritage expounded by the teaching authorities.² Such a dialogue can be a sign of religious vitality rather than mean a loss of religious interest.

3. No man can escape the perspective of his own convictions. He can but try to be just to

other faiths, and the paper requested is presented in that spirit.

DOCTRINES ON FERTILITY

4. The diverse traditions of Hinduism are both world-renouncing and family- and caste-affirming. The early sages upheld the ideal of the *muni* or wandering friar, who has "risen above the desire for sons, for wealth and for domination". In the classic pattern, the first two of the four stages of life are devoted to withdrawal and renunciation, and some have adopted the ascetic life in early manhood. The traditional opposition to the remarriage of widows, and the subordination of marital intercourse to various ritual requirements for abstinence, have also had some limiting influence on fertility.³

5. Hindu teachings on the whole, however, have had a strong pro-natalist orientation. In the second stage of life, that of householder, the begetting of a son is regarded as a prime religious duty, not only to continue the family line and serve the *dharma* or caste law, but also as a means to salvation for the father and his ancestors. A son is called *putra*, signifying that his mission is to deliver his forebears from a hell called *puth*.⁴ According to Manu, "a man conquers the world by the birth of a son; he enjoys eternity by that of a grandson, and the great-grandfathers enjoy eternal happiness by the birth of a grandson's son".⁵

6. This traditional stress on the procreation and survival of at least one scion has understandably made for high fertility, in the face of high mortality. Thus the *sutras* related to marriage ceremonies stress the begetting of

¹ In Islam, for example, the *Ijma* or Moslem consensus is recognized as helping to interpret the Qur'an and *Sunna* or tradition.

² The respective roles of the two factors may, of course, vary considerably; in the present Protestant consensus on responsible parenthood, the regulation of fertility within the community developed for a full half century before official church statements began to elaborate the present position. R. M. Fagley, "A Protestant view of population control", *Law and contemporary problems*, vol. XIV, No. 3 (Durham, North Carolina, USA, 1961), p. 472f.

³ C. Chandrasekaran, "Cultural patterns in relation to family planning in India", *Proceedings of the Third International Conference on Planned Parenthood* (Bombay, 1952); the author points out that ritual abstinence related to menstruation tends to have the opposite effect, a point also noted in regard to the Judaic regulation in *Leviticus* 15:19.

⁴ P. Thomas, *Hindu religion, customs and manners* (Bombay, 1947), p. 87.

⁵ P. N. Prabhu, *Hindu social organization* (Bombay, 1958), p. 242. Again, according to Manu, "A son of Brahman, if he performs virtuous acts, redeems from sin his ten ancestors".

offspring: "Let us acquire many sons who may reach old age".⁶ The custom of early marriage and the high incidence of marriage no doubt received support from this procreational concern. And the consequences, when large families ensued, were eased by the support given by the joint family and caste solidarity.⁷

7. In Buddhist teaching, procreation and family life are matters of secondary interest, since the focus of concern is to "break the bonds of worldly passions" in the pursuit of spiritual emancipation and serenity. This is symbolized by Gautama's own turning away from family ties in his pilgrimage for *nirvana* (enlightenment). The involvements of marriage were seen as impediments to the spiritual life: "To the Buddha, it was not marrying and multiplying that marked the higher man, but rather self-control and celibacy."⁸ The celibate priesthood reflects the ascetic element in Buddhism.

8. At the same time, the Buddhist Way stresses the Middle Path, avoiding extremes of "sensuality on the one hand and unprofitable asceticism on the other".⁹ Both of the major traditions, the Mahayana, which spread in East Asia and the Theravada, which spread in South Asia, provide a real if subordinate status for the married man, and the former holds Buddhahood to be available to him while involved in family life.¹⁰ The Theravada branch holds that he must become a "homeless brother" to achieve Enlightenment; but in the meantime he should learn to live with wife and child in harmony, train and provide for his children, and follow the rules of detachment as far as possible. Injunctions to marry and generate found in other major religions are lacking in Buddhism, and pro-natalist influences in Buddhist cultures appear to stem mainly from folk mores.¹¹

⁶ Louis Renou, ed., *Hinduism* (New York, 1962). According to a law of manu, "women were created to bring children into the world and men to perpetuate the species".

⁷ K. W. Kapp, *Hindu culture, economic development and economic planning in India* (Bombay, 1963), p. 56.

⁸ P. Thomas, *Indian women through the ages* (London, 1964), p. 81, "And what, bhikkhus, is right doing? Abstaining from taking life, from taking what is not given, from carnal indulgence. This is what is called right doing." T. W. Rhys Davids and C. A. F., trans., *Dialogues of the Buddha* (London, 1951), p. 343.

⁹ F. H. Smith, *The Buddhist Way of Life* (London, 1951), p. 36.

¹⁰ A. B. Keith, *Buddhist Philosophy in India and Ceylon* (Oxford, 1923), p. 296f.

¹¹ "The moral patterns which predominate among the masses of the people in Buddhist areas are more

9. In Christian teaching, the chief source of authority, the New Testament, has little to say directly about procreation. It dignifies marriage as a divinely ordained "one flesh" union, but the main focus is on the spiritual transformation of life rather than on its natural continuation.¹² The fathers of the early church took a somewhat ambivalent attitude. They increasingly stressed celibacy in relation to religious vocation. But, in the face of Gnostic heresies which condemned procreation as the imprisonment of souls in evil bodies, they cited the "increase and multiply" verses of Genesis to affirm the essential goodness of procreation and as justification for marriage.¹³ In general, the non-procreational use of sex was condemned.¹⁴

10. The attitudes towards marriage and procreation found in the patristic writings have had a profound influence on the Eastern Orthodox ethos, which attaches great weight to the Sacred Tradition. Mutual sanctification is held to be the primary purpose of marriage, in at least one of its dimensions, in accord with the passage in Ephesians which forms a central element in the Orthodox wedding service. Other statements speak of procreation as the primary end of marriage on its sexual side and condemn the non-procreative use of sex.¹⁵ In regard to ensuing difficulties, emphasis is placed on trust in the beneficent providence of God. It should be added, however, that Eastern Orthodoxy, in carrying forward the patristic traditions, does not apply them in a legalistic manner. Thus the principles found in pronouncements by the higher clergy who come from the monastic orders, may find quite flexible application at the parish level.¹⁶

to be identified with the indigenous pre-Buddhist cultures and general custom morality of the specific area than with a system of ethics and morals which are peculiarly Buddhist", Philip Ashby, cited in R. M. Fagley, *The population explosion and Christian responsibility* (New York, 1960), p. 101.

¹² Mark 10:6-9, Ephesians 5:21-33; in regard to family ties, however, the claims of the Kingdom of God come first: "He who loves son or daughter more than me is not worthy of me", Matthew 10:37.

¹³ Genesis 1:28, 9:1, 7, etc.; these injunctions did much to shape the pro-natalist ethos of historic Judaism, the religious duty later being defined as the procreation of at least two children; on contemporary Judaism, see R. M. Fagley, op. cit., p. 120ff.

¹⁴ Summary, *ibid.*, p. 144ff.

¹⁵ Athenagoras Koddinakakis, *Parents and priests as servants of redemption* (New York, 1958), p. 55f; 1 Timothy 2:15 is cited (p. 57) to support the idea of salvation through childbearing.

¹⁶ E.g., the then Bishop of Elaiia wrote, in regard to cases where childbearing would endanger the life of the mother: "the Orthodox confessor is not expected to advise his people to disregard the scientific opinion", *ibid.*, p. 58; also Fagley, op. cit., p. 160ff.

11. Roman Catholic teaching, which praises celibacy in relation to religious vocation, holds procreation to be not a general duty but rather an obligation for those who choose the married state. The ground of this procreational duty, as Pope Pius XI indicated in his encyclical *Casti Connubii*, is the "increase and multiply" injunction in Genesis.¹⁷ Over the centuries, however, a broader understanding of the ends of marriage has developed. The Code of Canon Law of 1917 (Canon 1013, No. 1) stated: "The primary end of marriage is the procreation and education of children; its secondary end is mutual aid and the allaying of concupiscence". To these subordinate purposes, the 1930 encyclical added "the cultivating of mutual love". Furthermore, Pope Pius XII in 1951, after referring to the procreative duty of married couples, stated that "serious reasons, such as those found in the medical, eugenic, economic and social 'indications' can exempt for a long time, perhaps even for the whole duration of the marriage, from this positive duty".¹⁸

12. On the basis of such clarifications, the idea of a prudent regulation of fertility within a concept of responsible parenthood makes its way. This does not mean a fundamental change in the generally pro-natalist position, but rather a spelling out of considerations which couples need to weigh in making conscientious decisions, such as the welfare of the offspring and of the family, and the requirements of society. More extreme tendencies of the past, such as praise of the large family and of "generous" parents found in certain marriage manuals, are increasingly offset by moderate trends. The further clarification of the position is one of the issues in the present *aggiornamento* of the Roman Church.¹⁹

13. In one sense the Protestant ethos has been more pro-natalist than that of the other branches of Christianity, in that marriage has been viewed as a religious vocation, indeed preferable to celibacy except for those particularly qualified. Furthermore, while Luther regarded procreation more as a blessing than a command, and Calvin thought the need for companionship the highest Biblical insight on the man-woman relationship, "procreation

remained for them, as for Augustine and Aquinas, the only really positive purpose of sex".²⁰ Only during the past century, first the community and during the past generation the official church bodies have developed a concept of responsible parenthood which sanctions a regulation and limitation of fertility for the sake of the quality of family life. Since 1930, when the Lambeth Conference gave a cautious sanction of the idea of family limitation, the Protestant consensus on behalf of responsible procreation has grown rapidly both in geographical width and theological depth.²¹

14. The current consensus of Protestant leaders regards marital companionship and procreation as separable values which can help the couple to fulfil their covenant and serve the "one flesh" union. The nature of this union elevates the question of parenthood above the determinism of lesser species into the realm of freedom and ethical decision. Couples, to whom the power of procreation has been given, have an obligation, in accordance with the concrete circumstances of the marriage, to seek another child or to defer or prevent a further conception. This decision requires that various considerations be weighed: the prospects for health of a future child, the right of children to love and nurture in the full sense, the health of the mother-wife, the claims of the couple's vocation, and, some would add, the claims of the social situation of which the family is a part. These are elements in the current Protestant understanding of responsible parenthood.²²

15. The strong pro-natalist orientation of Islam stems less from direct injunctions to procreate than from the support of conditions which make for high fertility.²³ Children are viewed as among the richest blessings granted by Allah, but the Qur'an also states that good deeds are better than wealth and children: surrender and obedience are the primary values.²⁴ Important among the pro-fertility factors is the prevalence of marriage; celibacy is contrary to the ethos of Islam. The medi-

²⁰ G. William Cole, *Sex in Christianity and Psychoanalysis* (New York, 1955), p. 131.

²¹ Fagley: op. cit., p. 189ff.

²² In addition to various denominational statements, two ecumenical reports may be cited: the Mansfield Conference Report, "Responsible Parenthood and Population Problem," *the Ecumenical Review*, vol. XII, No. 1 (Geneva, 1959); and the Consultation of the East Asia Christian Conference, *The Asian Churches and Responsible Parenthood* (Bangkok, 1964).

²³ There are references such as "marry and generate" and "marry a woman... who is richly fruitful", but such references are much less common than in the Torah, for example.

²⁴ On the first, cf. Sura XVI, 72; and on the second point XVIII, 47; LVIII, 17; LXIV, 15; the

¹⁷ On Christian marriage, paragraph 8, Paulist Press (New York, 1941); Latin text in *Acta Apostolicae Sedis*, 22 (1930), pp. 539-592.

¹⁸ Address to Italian Catholic Union of Midwives (October, 1951); *A.A.S.*, 43 (1951), p. 832.

¹⁹ For background on the Catholic position, L. J. Suenens, "Amour et maîtrise de soi" (Bruges, 1960); Stanislas de Lestapis, *La limitation des naissances* (Paris, 1959); E. C. Messenger, *Two in One Flesh* (Westminster, Md., USA, 1948), 3 vols.

aveal theologian, Al-Ghazzali, reminded his readers that the Prophet had said three times that a "man who abstains from marriage because he is terrified of a family cannot belong to us".²⁵ The marriage permissions given the man in Sura IV, 3, the importance of marriage and motherhood for the status of a woman, and the sanction for the early remarriage of a widowed or divorced woman, all contribute to the prevalence of the married state. Another factor is the positive value attached to sexual intercourse within the bond of marriage, a value reflected in Moslem concepts of Paradise.²⁶

16. A principal pro-natalist factor in Islam stems from a strong belief in the active providence of Allah. It is Allah who creates sexuality and determines procreation or barrenness. "He multiplieth you in the earth."²⁷ A tradition quotes the Prophet as saying, "whichever soul is destined to come to this world shall come". This concept of predestination gives a strong sense of *kismet*, fate, to the ethos of Islam, which undoubtedly does much to sustain high fertility patterns. Since it includes trust in the beneficent character of divine providence,²⁸ any question of restricting the number of offspring tends to appear as lacking in piety.

DOCTRINES ON THE REGULATION OF FERTILITY

17. In regard to the regulation of fertility, neither Hinduism nor Buddhism has explicit teachings bearing on family planning in the contemporary sense. The doctrine of *ahimsa*, non-injury, has long been cited in opposition to infanticide and abortion, and has had a certain influence on popular opposition to any conscious attempt at limitation other than through restraint. Misunderstanding of the physiology of conception has no doubt been a factor.²⁹ Another influence hostile to the regulation of fertility has been the popular fear

of upsetting the cycle of *karma*, the law of cause and effect, of sowing and reaping, in human existence. It can be argued that fatalistic beliefs, such as those associated with *karma* and *kismet*, "may be more important than formal prescriptions about contraception".³⁰

18. On the other hand, there is enough flexibility in the Eastern faiths for modern reformers to put forward the case for scientific methods of family planning. Indeed, the *kama* literature associated with Hinduism indicates that efforts to prevent conception have had a long history in Eastern cultures.³¹ In current expositions, major emphasis is placed on right motives. As Dr. Sarvepalli Radhakrishnan stated in 1952, in regard to methods of family planning: "If the purpose is not wrong, there is no ethical or spiritual harm done, and it is the purpose which determines the use or abuse of these modern inventions."³²

19. While Moslem opinion has been divided over the morality of efforts to regulate fertility, the weight of Islamic scholarship supports the licitness of temporary measures to prevent conception.³³ The Qur'an did not forbid *'azl* or *coitus interruptus*, and one *hadith* or tradition quotes Muhammad as saying that "if it were harmful, it would have been harmful for Persia and Rome as well". The classic theologian, Al-Ghazzali, stated that *'azl* was justified to protect one's property, to preserve the wife's health and beauty, and to allay anxieties over numerous children.³⁴ On the basis of the traditions and of various Islamic principles, such as the avoidance of hardship, the need for balance and equity, the claims of necessity, the modern *fatwas* or legal opinions on the subject provide a sanction for contraception. Typical is the summary 1937 statement by the Mufti of Egypt: "It is permissible for either husband or wife, by mutual consent, to take

(foot-note 24, continued from previous page)

Sunna or traditions include advice against having too many children, and the view that an excess constitutes a curse—the inheritance regulations (IV, 11-12) may be a factor here.

²⁵ Quoted in *Islamic Opinion on Contraception* (Comilla, Pakistan, 1961).

²⁶ Brief restrictions apply in regard to menstruation and fasting (II, 187, 222); II, 223.

²⁷ Sura LXVIII, 24; cf. XLII, 49-50; this is a major theme in the Qur'an.

²⁸ "We provide you and your children with food", VI, 152; XVII, 31.

²⁹ "In Hinduism... the need for taking full advantage of the fertility of women was once a sacred duty, and the husband who failed to co-habit with his wife during her fertile period was considered guilty of embryo-murder", P. Thomas: op. cit., p. 373; Bryce Ryan, "Hinayana Buddhism and family planning in

Ceylon," *The Interrelations of Demographic, Economic and Social Problems in Selected Underdeveloped Areas* (New York, Millbank Memorial Fund, 1954), p. 93.

³⁰ Ronald Freedman, "The sociology of human fertility", *Current Sociology*, vol. X/XI (Oxford, 1961-2), p. 51.

³¹ Norman E. Hines, *Medical History of Contraception* (Baltimore, 1936), p. 105ff.

³² The Third International Conference on Planned Parenthood in Bombay (1952).

³³ Abortion, particularly after the "quickening" of the embryo, is strongly condemned on the basis of Sura XVII, 33: "Do not slay your children out of fear of poverty"; and permanent sterilization has been condemned, e.g., by the Fatwa Committee of El Azhar University in Cairo.

³⁴ Akter Hameed Khan, *Islamic Opinions on Contraception* (Dacca, East Pakistan, 1963).

any measures to prevent semen entering the uterus, in order to prevent conception."³⁵

20. In Eastern Orthodox Christianity, statements by the higher clergy have interpreted the patristic traditions as justifying marital abstinence, when it is necessary to prevent conception, but not periodic continence or other contraceptive methods.³⁶ This is not an official position, however, since none of the early ecumenical councils pronounced on the subject. Moreover, the Orthodox tradition places primary responsibility on husband and wife for making conscientious decisions in this area. Consequently, the position is more flexible than would appear from published statements. As the then Bishop of Elaia said, in regard to situations where avoidance of another pregnancy was imperative, a confessor would be bound to tell the spouses "to follow their doctor's advice or abstain from sex experiences".³⁷

21. In Roman Catholic teaching, Pope Pius XII made it clear, as noted above, that valid reasons can justify a regulation of fertility. In regard to means, Pope Pius XI summarized in *Casti Connubii* the governing principle in the following terms: "Any use whatsoever of matrimony exercised in such a way that the act is deliberately frustrated in its natural power to generate life is an offense against the law of God and of nature..."³⁸ Thus, it is held that any conjugal act involving a physical or chemical barrier to the union of sperm and ovum, or not carried out in its "proper manner", is vitiated in its integrity, or essential "nature", and hence is gravely sinful. The same stricture is not applied to periodic continence, which is held to be licit *qua* method, since it permits the act to be carried out in the "proper manner".³⁹ Indeed, Pope Pius XII said: "One

may even hope... that science will succeed in providing this licit method with a sufficiently secure basis..."⁴⁰

22. The traditional condemnation of abortion was extended by Pius XII in these words: "Every attempt on the part of the married couple during the conjugal act, or during the development of its natural consequences, to deprive it of its inherent power and to hinder the procreation of a new life is immoral."⁴¹ Sterilization, unless necessary for the good of the whole body, is condemned on the basis of the ban on mutilation. In regard to the anovulant drugs, Pius XII stated in September, 1958 that a direct and therefore illicit sterilization is provoked when medicines are used "to prevent conception by preventing ovulation". Certain aspects of the position, however, are under review. In addition to the consideration being given by the Second Vatican Council, Pope Paul VI announced in June, 1964 that a commission was examining the newer scientific developments.⁴²

23. The contemporary Protestant consensus on responsible parenthood holds the marital act to be the servant of the "one flesh" union and that husband and wife are free to use the gifts of science to serve the needs of that union, whether to facilitate conception or to defer and limit it. In regard to the means of family planning, the Mansfield Report of an ecumenical study group rather typically found no inherent moral distinction between contraception, periodic continence, and anovulant drugs if free from injurious side effects.⁴³ The principles stressed in various statements are that the methods be mutually acceptable to husband and wife, injurious to neither spouse nor to new life, and sufficiently effective to meet the needs of the couple. The possible lack of effective alternatives in some of the developing countries has tended to qualify in recent years the generally cautionary approach to sterilization. Abortion is strongly condemned as a method of family planning.⁴⁴

³⁵ English translation in *Human Fertility*, vol. X, No. 2 (June 1945); comparable *fatwas* were issued by the Fatwa Committee of El Azhar University in 1953, by the Directorate of Religious Affairs in Turkey in 1961, and by the Grand Mufti of Jordan in 1964.

³⁶ Some references appear to link contraception with ancient condemnations of abortion and infanticide.

³⁷ Kokkidakis: op. cit., p. 53.

³⁸ Para. 56—Latin text in *Acta Apostolicae Sedis*, 22 (1930), p. 559; the 1917 Code of Canon Law similarly refers to "acts which are of themselves suitable for generation of children", Canon 1081, No. 2.

³⁹ Sanctioned first by the Sacred Penitentiary in 1853, the "licit method" was reinforced by *Casti Connubii*; cf. articles by Cardinal Suenens and Dr. John Marshall, Arthur McCormack, ed., *Christian Responsibility and World Poverty* (Westminster, Md., USA, 1963), pp. 31-59.

⁴⁰ Address to the "Family Front" (Nov. 1951); S. de Lestapis: op. cit., p. 149; there appears to be a growing receptivity to drugs and procedures to make the rhythm method more reliable.

⁴¹ Address to midwives (Oct. 1951), R. M. Fagley: op. cit., p. 187.

⁴² Certain Catholics have urged a broader review: Thomas D. Roberts, et al., *Contraception and Holiness* (New York, 1964).

⁴³ R. M. Fagley: op. cit., p. 225ff.

⁴⁴ For background on the Protestant position, cf., *inter alia*, M. A. C. Warren, et al., *The Family and Contemporary Society* (London, 1958); Helmut Thielicke, *The ethics of sex* (New York, 1964).

ATTITUDES TOWARDS FERTILITY AND ITS CONTROL

24. As noted above, an understanding of the attitudes and practices of the community of believers is necessary for a full picture of the position of a given faith in relation to fertility. While religious factors are an increasing subject of inquiry,⁴⁵ the data remain far from adequate, particularly in regard to the larger international communities of major religions. Even the inquiries in national societies, predominantly conducted in Western countries, tend to raise more questions than they answer. To establish a correlation between religious affiliation and differences in fertility, or desired size of family, is a first step but only a beginning. More sophisticated instruments and analysis are required to distinguish the influence of religious teachings and beliefs from that of closely associated non-theological factors. There is the further question as to whether differences between teachings, beliefs, and practices represent a diminution of faith or reflect conscientious convictions which are factors of religious adaptation and renewal.

25. The complexity of the problem grows on analysis. The bits and pieces of information permit only a few of the simplest generalizations, such as the fact that the more pro-natalist religious traditions and interpretations are found in the societies and sectors of society with the least economic and social development, while religious positions and attitudes more favourable to family planning and limitation are found in more developed societies and sectors. The complexity begins with the intertwining of religious beliefs and ethnic mores and folkways, which help to give color to the total religious mosaic but which need to be distinguished. For example, the contrast between the pattern of delayed marriage and non-marriage in Ireland and the consensual unions found in some Latin American countries, despite elements of a common religious heritage, suggests the importance of separating out the ethnic mores.⁴⁶ Again, the Princeton Study, which stressed the importance of religion as a social factor of differential fertility in its survey of white couples in U.S. cities, noted the wide fertility differences among the various nationality backgrounds within the Roman Catholic community.⁴⁷ An analysis of such ethnic dif-

ferences is necessary to determine the full significance of differences between the religious communities.

26. Furthermore, there is the question of the effect of relations between religious communities, and the historical development of such relations, in a pluralistic society. The influence of competition and conflict, particularly on the community which feels itself to be disadvantaged, needs to be explored. Van Heek, in his study of the persistent relatively high fertility of Dutch Roman Catholics, exceeded only by the more conservative of the Reformed communities, advanced the thesis of a "front mentality" as a pro-natalist factor, in a country closely divided religiously and with a history of conflict.⁴⁸ It is the kind of concept which needs to be examined in other situations. Is there a factor of "front mentality", for example, in the difference between Moslem and Christian birth rates in the urban areas of Lebanon, described by Yaukey?⁴⁹ While religious and ethnic influences undoubtedly make for high fertility in Moslem communities, have communal conflicts of the past two decades tended to sustain the difference between Moslem and Hindu birth rates in India and Pakistan?⁵⁰ If the thesis is valid, one might possibly find, in view of communal tensions in recent years, some difference between Tamil and Sinhalese fertility in Ceylon, if a survey updating that of Irene Taeuber were undertaken.⁵¹

27. Finally, time is an important condition for ascertaining the religious influence on fertility, for it is clear that religious attitudes and practices are in transition in many parts of the world. In the more developed countries of Europe and Northern America, it seems clear that religious differences in regard to fertility are narrowing, as concern for a smaller and better educated family continues to spread. There is a rough but significant indication in the decline of crude birth rates in predomi-

⁴⁸ English summary in *Population Studies*, vol. X, No. 2 (November 1956), pp. 125-138.

⁴⁹ David Yaukey, *Fertility Differences in a Modernizing Country* (Princeton, 1961); the author attributes the lower fertility of the Christian groups mainly to their closer contacts with the West, rather than to differences in religious teaching, which are not locally "particularly permissive of fertility control", pp. 81-82.

⁵⁰ On the differences, cf. K. Davis, *The Population of India and Pakistan* (Princeton, 1951); United Nations, *The Mysore population study* (United Nations publication, Sales No.: 61.XIII.3).

⁵¹ I. B. Taeuber, "Ceylon as a demographic laboratory", *Population Index*, vol. XV, No. 4 (October 1949); no significant differences were found among the Buddhist Sinhalese, Hindu Tamils, and Mohammedan Moors in respect to birth rates.

⁴⁵ R. Freedman: op. cit., p. 104f.

⁴⁶ Frank Lorimer, et al., *Culture and Human Fertility* (Paris, 1954), p. 192ff.

⁴⁷ C. F. Westoff, et al., *Family Growth in Metropolitan America* (Princeton, 1961); a broader inquiry would have involved additional ethnic and cultural factors.

nantly Catholic Southern Europe from 31.2 in 1920-1924 to 20.5 in 1960-1962, as compared with a decline from 21.9 to 17.6 in predominantly Protestant Northern Europe.⁵² Similarly, there is evidence of a significant decline of birth rates in Eastern Orthodox populations, which were judged to be higher, for the interwar years in Europe, than the Roman Catholic.⁵³ Today, the officially recorded crude birth rate for Greece is below the weighted average for Southern Europe, and figures for Eastern European countries show a similar trend. Thus, in general, the Christian communities of the more developed world are moving closer together in regard to fertility attitudes and practices.

28. It may be noted further that at the other end of the spectrum, in areas of under-development, particularly the least developed sectors, religious differences in respect to fertility may be slight. Busia, for example, found in the then Gold Coast no significant difference between Christian and Moslem illiterates, in regard to the average number of children.⁵⁴ Rizk in the U.A.R. and Yaukey in Lebanon found fertility differences between

non-city Moslems and non-city Christians to be insignificant.⁵⁵ Societies, whether with Moslem, Hindu, Buddhist or Christian religious predominance, may be found with estimated crude birth rates in the 45 to 50 range—e.g., Pakistan, Nepal, Thailand, and the Philippines. The thesis suggested by all this is that religious differentials in fertility show up most in societies in the broad middle ground of economic and social transition from a less developed to a more developed state.

29. In regard to high-fertility areas, such as rural communities of several Asian countries, there are accumulating signs of an interest in a regulation of fertility beyond what the practice of such communities would suggest. The University of Kerala, for example, in a study of attitudes towards family planning, found that, over against one fifth of the sample who were unfavourable on religious grounds, roughly two thirds of each of the major religious groups—Hindu, Moslem, Roman Catholic, and Other Christian (predominantly Orthodox in background)—were favourable.⁵⁶ Signs such as this suggest that changes in religious attitudes in the developing countries will take place at a much more rapid rate than has been the case in Western cultures.

⁵² United Nations, weighted averages in *World population prospects, as assessed in 1963* (United Nations publication, Sales No.: 66.XIII.2); surveys and census figures in West Germany give a more precise indication of the narrowing differences in Protestant and Catholic fertility in industrialized societies.

⁵³ Dudley Kirk, *Europe's Population in the Inter-war Years* (Geneva, 1946).

⁵⁴ K. A. Busia in Lorimer: op. cit., p. 346.

⁵⁵ Yaukey: op. cit., p. 31.

⁵⁶ University of Kerala, *Report of Preliminary Survey, Family Planning Communication Research Programme* (Trivandrum, 1963); the figures for the Action and Control Units are here taken together.

Twentieth century levels and trends of fertility in developing countries

HALVOR GILLE

I. INTRODUCTION

1. In this paper the term "developing countries" is used to include countries in Africa, Asia and Latin America, leaving out of consideration a few countries in Europe which might normally be included under this term. While some statistical information exists in most of the developing countries indicating the current level of fertility—often not very accurately, but with some reasonable approximation—it is far more difficult to obtain data on the trends in fertility. Only for few of these countries is it possible to describe the trend during the first half of the twentieth century.

II. TRENDS IN FERTILITY

2. Table 1 presents census data from a recent United Nations Survey.¹ This data is supplemented by the author with the most recent information on the birth rates in eighteen developing countries for which reliable vital statistics are available over several decades of this century. Although the countries selected are not necessarily representative of all the developing countries, the pattern indicated for these areas with a total population around one third of that for all countries will no doubt indicate the general pattern.

3. The striking feature is the fairly stable level in the birth rate since the beginning of the century in most areas. Among the exceptions to this pattern is Argentina, among others, where the decline in the birth rate began even before the turn of the century and has proceeded slowly, but fairly steadily, until the birth rate is now on a level similar to that in a number of developed countries in North America and Europe. In Chile, the decline in the birth rate began later, and although it has continued since the First World War, it is still well above 30 per thousand or close to that of some other developing countries. Japan is a well-known case of a country which has experienced a rapid decline in the birth rate in the period after the Second World War,

reaching a level as low as that in most of the highly developed countries. Only China (Taiwan), Puerto Rico and Singapore seem to have embarked upon a definite declining trend in the last five to ten years, with a drop in the birth rate of 20 per cent or more. In the other countries, including most of those for which a long series of relatively good data is not available and not included in the table, the available evidence does not seem to indicate any pronounced downward or upward trend; a slightly downward trend is noted in recent years in some small areas like Cyprus and Mauritius and a slightly upward trend in Jamaica.

4. The birth rate is, of course, a rather crude measurement of fertility, making no allowance for changes in the age structure which in some countries, even if the level of fertility has remained stable, have changed considerably particularly due to emigration or immigration. Only for a small number of countries with relatively good statistics is information available on gross reproduction rates for several decades back. This information on age-specific fertility seems generally to confirm the stable long-term trend in fertility indicated by the crude birth rate in most developing areas. The recent declines in the birth rate noted above in a few countries are confirmed by the trend in the gross reproduction rate. This is the case not only in the relatively developed Japan and Chile, but also in China (Taiwan), Singapore, Cyprus and Mauritius where the gross reproduction rate has declined around 10-20 per cent in recent years.

5. Data from two or more censuses on the number of children born to women at the end of their childbearing period would give an indication of the long-term trend in fertility, but such information is available as yet only in a few countries from recent censuses. In Mexico the women aged 45-49 are reported to have had an average of 4.9 children (equivalent to an age-sex adjusted birth rate around 38) which was exactly the same number of child-births stated in the 1950 census. The 1950 and 1960 censuses in Bermuda indicated the same stability.

¹ United Nations, *Population Bulletin*, No. 7 (United Nations publication, Sales No.: 64.XIII.2).

Table 1. Trends in the birth rate in areas with relatively good data

	Africa			Latin America							Asia								
	Mauri- tius	South Africa (coloured)	U.A.R.	Argen- tina	Chile	Costa Rica	Jamaica	Mexico	Puerto Rico	Trini- dad & Tobago	Ceylon	China (Tai- wan)	Cyprus	Feder- ation of Malaya	India	Japan	Philip- pines	Singa- pore	Thai- land
1900-1904	37	—	—	—	—	—	39	—	41	36	39	—	38 ^a	—	48 ^a	32	—	—	—
1905-1909	36	—	—	37	—	44	38	—		35	37	—	—	—		—	32	—	—
1910-1914	38	—	47 ^a	34	46	48	39	—	40	33	38	42	37 ^a	—	49 ^a	34	—	—	—
1915-1919	36	—	47 ^a	—	43	45	35	—		32	37	40	—	—		—	33	—	—
1920-1924	37	—	47 ^a	32	42	43	38	—	39	33	39	42	33 ^a	—	46 ^a	35	—	—	—
1925-1929	38	—	47 ^a	30	42	47	36	—		32	41	44	27	—		—	34	—	—
1930-1934	37	—	47 ^a	27	41	46	34	45	41	30	38	46	30	—	45 ^a	32	52 ^b	—	—
1935-1939	34	46	47	24	37	45	32	44	39	32	36	45	32	41		29	—	46	46 ^b
1940-1944	34	44	44	24	36	45	32	44	40	36	37	42	29	40	40 ^a	30	53 ^b	45 ^b	—
1945-1949	42	46	47	25	36	45	32	44	41	39	38	40	31	41		30	51 ^b	46 ^b	47 ^b
1950-1954	46	47	47	25	34	49	35	45	37	38	39	46	28	44	42 ^a	24	50	46	46
1955-1959	42	46	43	23	36	50	39	46	34	38	37	43	26	44	41 ^a	18	—	43	—
1960	40	48	45	22	35	50	43	46	32	40	37	40	25	41	—	17	—	39	—
1961	40	46	46	22	34	49	41	46	31	38	36	38	26	42	—	17	—	37	—
1962	39	48	43	22	34	44	41	46	31	37	36	37	25	40	—	17	—	35	—
1963	40	46	44	22	34	50	40	45	31	35	34	36	25	39	—	17	—	34	—
1964	38	—	—	22	—	—	40	—	30	—	—	35	24	—	—	18	—	32	—

SOURCES: United Nations, "Conditions and trends of fertility in the world", *Population Bulletin*, No. 7 (United Nations publication, Sales No.: 64.XIII.2); United Nations, *Demographic Yearbook 1963* (United Nations publication, Sales No.: 64.XIII.1); United Nations, *Population and Vital statistics report* (quarterly) (New York, 1 October 1964).

^a Estimate derived from census data (generally by "reverse-survival" method).

^b Data relate only to a part of the five-year period concerned.

Table 2. Levels of the birth rate and the total population in the major regions of Africa, Latin America and Asia

	Births, per 1,000 population					
	Under 35	35-39	40-44	45-49	50-54	55 and over
	(Population in millions)					
North Africa	—	—	35	23	13	—
West Africa	—	1	5	10	10	72
South and East Africa	3	1	22	30	15	4
AFRICA	3	2	62	63	38	76
Central America	10	2	10	52	1	—
South America	24	8	101	21	—	—
LATIN AMERICA	34	10	111	73	1	—
South West Asia	8	2	30	31	—	—
South Central Asia	—	11	449	125	—	—
South East Asia	—	2	78	46	138	—
East Asia	98	660	—	28	—	—
ASIA (excl. USSR)	106	675	557	230	138	—

SOURCES: See table 1.

III. CURRENT LEVELS OF FERTILITY

6. The dichotomy between the highly developed countries and the developing countries is more pronounced and clear-cut if measured by level of fertility than by any other demographic, economic or social indicators, as shown in the above-mentioned United Nations report. While the highly developed countries have a gross reproduction rate generally between 1 and 2 (with the average around 1.4), the developing countries have, with few exceptions, a gross reproduction rate between 2 and 3.5, most of them around 3. (Among the exceptions are Japan and Cyprus.) Similarly, the birth rate of around 25 to 30 per 1,000 is the clear-cut border line between the two categories of countries. About two thirds of the developing areas have a birth rate around 40-50 per 1,000.

7. Although the present level of fertility is generally high in the developing countries, wide differences prevail within this group. Table 2 shows the birth rates prevailing in the major regions of Africa, Latin America and Asia and the population in these areas. On the whole, the major part of the population of Africa has higher birth rates than those found in the other two continents. In areas inhabited by nearly one half of the total population of Africa, the birth rate is estimated to be around 50 and over. Very high birth rates are found particularly in West Africa, in some areas as high as

around 60, and gross reproduction rates around 3.5. A high level of fertility seems also to be prevailing in the Sudan, Kenya and Northern Rhodesia with estimated birth rates 50-54 and gross reproduction rates over 3. Examples of areas with a birth rate below 40 are not many, the white population of South Africa being the most important one.

8. In Latin America there are no areas with exceedingly high fertility; the birth rate is almost everywhere below 50. The level of fertility is highest in Central America where areas with more than two thirds of the population of the whole region have birth rates in the 45-49 range and gross reproduction rates around 3. However, in two of the Caribbean islands, Puerto Rico and Cuba, the birth rate is below 35 and the gross reproduction rate a little over 2. In South America, birth rates are within the 40-44 range in areas with about two thirds of the region's total population. However, several of the smaller countries, such as Ecuador, Peru and Venezuela, have a slightly higher level of fertility while the fairly industrialized and urbanized countries in the temperate zone have low fertility—Argentina and Uruguay around 22 and Chile around 34.

9. The picture for the region of Asia as a whole is dominated by the question about the level of fertility in China (mainland). According to official annual estimates, the birth

rate in the 1950's was 32-38 and the United Nations has estimated it to be around 38.² In the second largest country, India, the birth rate is estimated at 41 and the gross reproduction rate at 2.7.³ In most of the other countries in Asia, except Israel and Japan, the level of fertility is somewhat higher. Several areas in the south eastern part, including Cambodia, the Philippines and Thailand, have birth rates around 50 and gross reproduction rates 3.2-3.5. In Pakistan, Republic of Korea, Iran and Iraq, the level of fertility is almost as high.

IV. THE WIDENING GAP BETWEEN FERTILITY AND MORTALITY

10. At the same time as the level of fertility has in most, although not all, parts of the developing world remained high and fairly stable throughout the twentieth century up to

² United Nations, *World Population Prospects, as assessed in 1963* (United Nations publication, Sales No.: 66.XIII.2).

³ Government of India, Office of Registrar-General, *All India Population Projections* (New Delhi, 1964).

now, large decreases in mortality have taken place in all these areas, with the result that the rates of natural increase have shown dramatic increases.

11. At the beginning of the century, the rate of natural increase in most areas of the three continents was very small. In India, for example, it was around 0.5 per cent annually. Generally speaking, the rate of increase was below 1 per cent with the exception of a few Latin American countries where it was a little higher. Since the Second World War sharp increases have taken place in natural increase almost everywhere. At present, the annual increase in Africa and South and East Asia is 2.3 per cent and in Latin America 2.9 per cent. In several areas the rate of increase is 3.5 per cent or more. In view of the potentialities for further decreases in mortality and the absence of any indication that a decline in fertility is generally under way the rate of population growth in the developing countries will continue to increase for some time to come and will reach new unprecedented high levels.

Demographic effects of abortion legislation in some European socialist countries

ANDRÁS KLINGER

1. In all countries, the induced interruption of pregnancy plays an important role in birth control. The respective provisions of law, however, differ considerably from country to country, and their execution especially reveals great divergencies. Due to this, in the countries where legally induced abortions are forbidden, the frequency of their occurrence and thus the role they play in birth control, as well as their impact on the number of births, can be determined only by means of very uncertain estimates.

2. It is easier to state the demographic effects of induced abortions in such countries where they are legalized, i.e., in which induced abortions may be carried out—under certain conditions—by the doctors or the health authorities. In some countries, however, although induced abortions are authorized and the data relating to them are known, a direct connection between the number of abortions and the number of births cannot be established in every case. For abortions—even if they are carried out legally—are not the causes, but only the means of birth control.

3. All this is mentioned in advance only to point to the complexity of the task of determining directly the demographic impact of the legality of abortions in the socialist countries. We must confine ourselves rather to the summarizing of the respective facts, and all we can set as our aim is to establish some major connexions.

4. On the basis of more deliberate population-political considerations, from 1955 on measures were taken by the European socialist countries—with the exception of Albania and the German Democratic Republic—in order to legalize abortions (in December 1955 by the Soviet Union; in April 1956 by Poland and Bulgaria; in June 1956 by Hungary and in February 1960 by Yugoslavia; the date of the measures taken by Romania is unknown). Each of these measures started from the fact that it is the right of the woman (mother) to determine the size of the family, and that it is the woman who is entitled to interrupt an undesired pregnancy by means of induced abor-

tion. Besides, the basic goal of the measures taken was also the protection of the health of the women, since in the preceding years a great number of women had undergone illegal abortion, which had often jeopardized not only the health, but in many cases also the life of the woman. On the basis of the new legal measures, abortions may be carried out, in general, only in hospitals and health institutions after a medical examination determining the state of health of the woman. The decreasing number of deaths due to abortions clearly shows the impact of legalized abortions on the health of the females. In countries where abortions have been legalized, the number of deaths due to abortions has decreased considerably, in spite of the significant increase in the number of registered abortions. Thus, mortality due to abortions has decreased considerably, and only one or two females a year die in each of these countries as a result of legally performed abortions.

5. Besides permitting abortions on medical grounds, some countries also recognize the legality of abortions arising from various personal and social circumstances. In Czechoslovakia, such causes as the advanced age of the female, disrupted family life, economic insecurity, "single" marital status, provide legitimate reasons for abortion. In other countries, the legal basis for abortion is defined in general terms only. Thus, Hungary permits abortion to take place because of the "personal and family circumstances" of the woman. Similarly, Poland considers "difficult social status" as grounds for abortion, whereas in Yugoslavia, "difficult personal, family, or financial circumstances" of the woman can be a basis for legal abortion. Other provisions of law make abortion legally permissible if the woman requests it. Most of these cases are studied by competent medical and social committees, who consider carefully the various requests for legitimate abortions. The effects of these legal provisions on the annual number of abortions cannot be measured accurately, since some countries, like the Soviet Union and Romania, do not publish relevant data on abortions. For other countries, there is no basis for comparison, as there is no

reliable information on the situation that existed before abortions were legalized. Various estimates put the number of abortions in the early 1950's at approximately 100,000-300,000 in Czechoslovakia, 100,000 in Hungary, and 250,000-300,000 in Poland. Since the legalization of abortions, the necessity for illicit abortions has ceased to exist, although an insignificant number of unlawful abortions still take place. In Czechoslovakia, illegal abortions amount to no more than 3,000-5,000 a year, while the number for Hungary is approximately 5,000-6,000 a year.

6. The effects of legalized abortions in Bulgaria, Czechoslovakia, Hungary, Poland and Yugoslavia are shown in table 1. It should be noted that the number of registered abortions in each of these countries increased considerably in the year in which the abortion laws came into force. In all of the above countries, this increase was sustained to varying degrees. Both Bulgaria and Yugoslavia had consistent increases. The increases in Czechoslovakia and Hungary lasted till 1961, in Poland until 1960. The number of abortions in Hungary has fluctuated. There was a decline in 1962, but an increase in both 1963 and 1964. Abortions relative to the number of women of child bearing age (15-49), as well as relative to the number of live births, reached their highest level in Hungary in 1963, when there were 70 induced abortions out of a total of 84 abortions per 1,000 females in the reproductive age group (15-49). The next highest rate prevailed in Bulgaria. In Czechoslovakia, Yugoslavia and Poland, the rates were considerably lower. With respect to the number of abortions per 100 live births, a similar rank ordering of these countries is obtained (table 2).

7. It is also significant that in countries where data are available, the 25-29 age group has the greatest frequency of induced abortions. For the years 1962 and 1963, 133 induced abortions per 1,000 women were performed in Hungary, whereas in Czechoslovakia the comparable figure for 1962 was only 49. Age groups 20-24 in Hungary and 30-34 in Czechoslovakia were next in order.

8. The influence of the number of children on the level of induced legal abortions can be studied similarly for Czechoslovakia and Hungary. In both countries, the greater number of women undergoing abortion had two or more children: 86 per cent in Czechoslovakia (1962), and 56 per cent in Hungary (1963). Of all the women having abortions in Hungary, slightly less than 15 per cent were childless. Sixty per cent of these childless women were single. Women with two children were predominantly

the largest group (95 abortions per 1,000 women of reproductive age) having abortions. Eighty-five out of 1,000 women of reproductive age having abortions had three or more children, while the proportion of women with one child was 80 per 1,000. Women with no children undergoing abortions amounted to only 23 per 1,000.

9. In Bulgaria in 1962, 4.4 per cent of all women had an abortion before their first confinement. This group contained 23 per cent of all the abortions taking place. Six and nine tenths per cent had their first abortion after their first confinement, while 7.5 per cent had their first abortion after their second delivery.

10. A study of the impact of abortions on fertility would require a more detailed and thorough effort, but it can be stated that for the European socialist countries where abortion has been legalized, both the live birth rates and fertility rates show a tendency to decrease. Even in those countries where fertility was low before abortion was legalized, i.e., Bulgaria, Czechoslovakia and Hungary, the number of births began to decrease at a faster rate. On the other hand, in countries with higher fertility (Soviet Union, Poland, Yugoslavia) the decline in fertility started later, and with the exception of Poland, the rate of decline was slightly lower (see table 3). Countries with higher abortion rates have lower birth rates, whereas decreasing abortion rates have been accompanied by increasing birth rates, as in Czechoslovakia. Whether this reveals a certain relationship cannot be confirmed.

11. To sum up, it can be stated that in spite of identical legal provisions regarding induced abortions, the role of abortion as an instrument of birth control has varied from country to country. This may suggest that abortion is not the basis, but only a measure of birth control, and that within the context of the socio-economic structure, it is the cultural outlook of women which determines their plans for family size. Induced and legalized abortion is only one of the measures to fulfil these changing plans.

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Table 1. Total and induced (legalized) abortions, 1954-1963
(In thousands)

Country	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
<i>Total registered abortions</i>										
Bulgaria	18.6	19.1	40.0	46.2	55.5	63.8	74.1	88.7	97.8	103.8
Czechoslovakia	33.4	35.1	34.1	37.5	89.1	105.5	114.6	120.3	115.9	99.9
Hungary	58.3	78.5	123.6	168.8	183.0	187.7	196.0	203.7	197.6	207.9
Poland	—	101.6	104.3	121.8	126.4	161.5	223.8	216.6	210.7	—
Yugoslavia	—	—	—	—	—	111.8	133.3	164.5	200.0	—
<i>Induced (legalized) abortions</i>										
Bulgaria	1.1	—	—	30.9	37.5	45.6	54.8	68.8	76.7	83.3
Czechoslovakia	2.8	2.1	3.1	7.3	61.4	79.1	88.3	94.3	89.8	70.5
Hungary	16.3	35.4	82.5	123.3	145.6	152.4	162.6	170.0	163.7	173.8
Poland	—	1.4	18.9	36.4	44.2	79.0	150.4	143.8	140.4	—
Yugoslavia	—	—	—	—	—	54.5	76.7	104.7	—	—

Table 2. Induced (legalized) abortions per 1,000 15-49-year-old females
and per 100 livebirths, 1954-1963

Year	<i>Induced abortions per 1000: 15-49 year old females</i>					<i>Induced abortions per 100 livebirths</i>				
	Bulga- ria	Czecho- slova- kia	Hun- gary	Poland	Yugo- slavia	Bulga- ria	Czecho- slova- kia	Hun- gary	Poland	Yugo- slavia
1954	1	1	6	—	—	1	1	7	—	—
1955	—	1	14	0	—	—	1	17	0	—
1956	—	1	33	3	—	—	1	43	2	—
1957	16	2	49	5	—	22	3	74	5	—
1958	19	19	58	6	—	27	26	92	6	—
1959	23	25	61	11	11	33	36	101	11	13
1960	27	28	65	21	16	39	41	111	23	18
1961	34	29	69	20	22	50	43	121	23	25
1962	38	28	66	20	—	57	41	126	23	—
1963	41	22	70	—	—	63	30	131	—	—

Table 3. Livebirth rates (per 1,000 population) in the European
socialist countries, 1954-1963

Country	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Albania	40.8	44.5	41.9	39.1	41.8	41.9	43.3	41.2	—	—
Bulgaria	20.2	20.1	19.5	18.4	17.9	17.6	17.8	17.4	16.7	16.4
Czechoslovakia	20.6	20.3	19.8	18.9	17.4	16.0	15.9	15.8	15.7	16.9
German Dem. Rep.	16.6	16.7	16.2	15.9	15.6	16.9	17.0	17.0	17.4	17.6
Hungary	23.0	21.4	19.5	17.0	16.0	15.2	14.7	14.0	12.9	13.1
Poland	29.1	29.1	28.0	27.6	26.3	24.7	22.6	20.9	19.6	19.0
Romania	24.8	25.6	24.2	22.9	21.6	20.2	19.1	17.5	16.2	15.7
USSR	26.6	25.7	25.2	25.4	25.3	25.0	24.9	23.8	22.4	21.2
Yugoslavia	28.5	26.8	25.9	23.7	24.0	23.3	23.5	22.7	21.9	21.4

The economics of family formation under different conditions

FRANK LORIMER

1. This study is limited to changes in family economics associated with economic transition and related demographic trends. The major variables to be considered here are: (a) level and pattern of fertility, (b) level of mortality, (c) consumption needs by sex and age, (d) production potentials by sex and age, (e) relation of the nuclear family to other social structures, (f) productive resources. Interactions among the first four factors can be examined on hypothetical models. We shall construct models to simulate the following conditions: (I) traditional agriculture, high fertility, high mortality; (II) same except moderate mortality; (III) early industrialization, high fertility, moderate mortality; (IV) same, except moderate fertility. The hypotheses are stated in paragraphs 2-5.

2. *Fertility.* High fertility (F_t): 7.0; moderate: 4.0; ages at marriage in models I-III: brides 18.0; grooms 21.0; first birth 1.0-1.9 years later. In model IV these ages are postponed 5 years. It is initially assumed that children leave the parental family at marriage. Use of 2.5 years inter-birth intervals (for which there is the widest empirical support) would bring the seventh birth at wife's age 34 years. This is below the mean age of last births in most societies with high fertility; births are spread by variations in the onset of sterility and prolongation of late inter-birth intervals.¹ As a compromise we use the series: 2, 3, 3, 3, 3, 4 years.

3. *Mortality.* Model life tables: female expectations of life at birth: 30 years, 50 years. We use the "West" set in the Princeton series.² The results here are not significantly different than would have been obtained on the United Nations series.

4. *Consumption units.* Somewhat surprisingly, the relative needs of adults and children at different ages seem to be fairly similar in India and in the United States.³ In low-income countries requirements are largely controlled by food needs. At higher standards of living the relative expenditures for children and adults on other items tend to be roughly parallel to relative expenditures for food.⁴ It is necessary in our scheme to use a graduated scale by single years of age, analogous to that in a United Nations study.⁵ Such a scale is necessarily inaccurate in detail, but this limitation does not strongly affect the comparative results with which we are concerned. The average need of an adult male is taken as a unit, and that of an adult female as 0.8. Values for children (both sexes) are as follows: Under two years 0.3, rising by equal amounts to 0.4 at five years, and thereafter by larger equal amounts to the adult level at 15 years of age. This scale is conservative, as compared with some in current use; it may underestimate the needs of children as compared with adults.

5. *Production units.* Though it is deemed permissible for our purpose to use the same relative consumption values under different economic conditions, this is not so with respect to production. In an *agrarian society* men, women, and children are productive, though the man assumes the major role. There is little precise information on labor inputs by members of the family. (In West Germany all farm wives not otherwise employed are reported as unpaid family workers; only 1.4 per cent of all

³ N. V. Sovani, *Social Survey of Kolhapur City* (Gokhale Institute of Economics and Politics, 1952), p. 148, chap. III, "Family living and social life"; S. Brahme, "Cost of Children in a family," *Artha Vijnana*, vol. IV, No. 2 (1962); "Estimating equivalent incomes or budget costs by family type" (typed abstract), *Monthly Labor Review*, vol. LXXXIII (Washington, D.C., 1960), pp. 1197-1200. Reviews results of five investigations.

⁴ F. Lorimer and H. Roback, "Economics of family relative to the number of children," *Milbank Memorial Fund Quarterly*, vol. XVIII (1940), pp. 114-136.

⁵ United Nations, *The aging of populations and its economic and social implications* (United Nations publication, Sales No.: 56.XIII.6), p. 46.

¹ L. Henry, "Some data on natural fertility," *Eugenics Quarterly*, vol. VIII (1961), pp. 81-91. Survey findings in India support the use of three years as the mean inter-birth interval; A. Collver, "The family cycle in India and the United States," *American Sociological Review*, vol. XXVIII (1963), pp. 86-96.

² A. J. Coale and P. Demeny, *Regional model life tables and stable populations* (Princeton University Press, 1965).

women in the U. A. R. and less than 0.5 per cent in some Latin American countries are so reported.) We are forced to proceed on broad hypotheses. (We are not concerned with absolute values, but only with variations by stages of family life and differences in patterns under different conditions.)

(a) The productivity of families dependent on subsistence farming, in the past when mortality was high, must generally have been adequate for population maintenance. We select a set of relative productivity values that satisfies this requirement as follows: males aged 15 years and over, 1.6 adult-male-consumption units; adult females, 0.8 unit (equal to the requirement for consumption); children (undifferentiated by sex prior to 15 years): 0.15 at 8 years, rising by equal amounts to the mean adult level (both sexes) 1.2 units at 15 years. Half of the children reaching 18 years (the males) remain at home during the next 3 years, as in previous models.

(b) Some information is available on worker rates and earnings by sex and age in industrial localities during the early stages of economic transition. According to a survey of households (7,263 earners) in Poona 15.3 per cent of the earners were women and 0.5 per cent were children under 15 years.⁶ At ages 15-19, 35 per cent of the males and 7 per cent of the females were gainfully occupied. The average earning of all women workers was Rs. 280, as compared with Rs. 845 for men.⁷ The mean ratio of female workers to women aged 15-64 in the metropolitan population of seven highly developed countries around 1950 was 39 per cent (including 3 per cent in domestic employment); the corresponding ratio in eight less developed countries was 28 per cent (including 11 per cent in domestic service).⁸ The average worker-participation rates for males aged 10-14 years in the urban populations of selected countries are as follows: 8 Asian countries 12.1 per cent; 8 Latin American countries 11.4 per cent; 10 highly industrialized countries 3.3 per cent.⁹ Proportions of females employed at these ages are generally lower.

(c) Removal of production from the home, preference for adult males and oversupply of

workers reduce employment opportunities for women and children during early industrialization in most countries today—though the trend in early modern Europe and Japan may have been different. For the urban sectors of low-income countries (model III) we assume the following values: adult males 1.8, females 0.6 (giving the same couple productivity as in agriculture); children aged 12 years 0.12, plus equal units at each later age to the mean adult level (1.2 units) at 15 years. This scale is also conservative in the sense that it may minimize agricultural-industrial differences.

6. The results of the experiment are shown in figure I. The moderate inflation of the production-consumption curve for a family of high fertility and high mortality in a traditional agrarian society suggests that under these conditions the economic stress (during the years after several children are present and before any have achieved significant productivity) is not very intense. On our hypothesis, the ratio of production to consumer needs during these (11) deficit years averages 94 per cent, and never falls below 85 per cent in any year. Moreover the expected surplus of production over consumption in the preceding period (after marriage of the parents) plus that in the later period (before the last child is married) exceeds the cumulative force of deficits during the lean years. The family can meet this period of stress by the receipt from others of goods and services similar to those that they can give at other times, or by extra effort and austerity. A large family in this situation is not, strictly speaking, an economic asset while the children are in the family. But children provide "insurance" against the hazards of old age, the premature death of a parent and other risks at a "cost" which the family can well afford.

7. This conclusion is subject to the condition that successive additions to the family's labour force are not subject to severe diminution of production due to limitation of resources. Where such limitation is severe it intensifies the stress in agrarian families during their formation and may prevent the transmission of adequate resources by inheritance from one generation to the next—thus creating pressures that are recognized in varying degrees in different cultures.

8. Decline in mortality from high to moderate levels intensifies stress in family formation. With female expectation at birth at 30 years there are 7.5 years of child life per birth at ages under 12, when productivity balances consumption, and 2.7 years from 13 through 17 years. With expectation at 50 years these values become 9.9 and 3.9. The propor-

⁶ N. V. Sovani, D. P. Apte and R. G. Pendse, *Poona: A re-survey* (Gokhale Institute of Politics and Economics, 1956), pp. 272-3.

⁷ S. Brahme, "Earnings in different occupations in relation to age and sex," *Artha Vijnana*, vol. I (Gokhale Institute of Politics and Economics, 1959) pp. 282-297. Data from sale survey.

⁸ A. Collver and E. Langlois, "The female labor force in metropolitan areas," *Economic Development and Cultural Change*, vol. X (1962), pp. 367-385.

⁹ Unpublished study by Edith Adams.

tion who survive from birth to maturity rises from about one half to about three fourths. The effect of these changes is, on our hypothesis, to raise the cumulative deficit during the period of economic stress from 2.2 units to 4.8 units. This is only partially offset by changes in production-consumption relations at other ages while children are in the home. "Insurance" against the risks of old age and illness is increased unnecessarily at greater "cost". If there already is a shortage of resources the increase in size of family has serious consequences. Reduction in mortality has a salutary effect on family by prolonging the joint life of couples and reducing the frequency of premature orphanage.¹⁰ Associated improvement in health also increases production.

9. Early industrialization increases economic strains in family formation—due to the removal of production from the home, decreased opportunity for juvenile production and increased needs for formal schooling. The period of deficiency in production relative to consumption is extended on our hypotheses to 23 years, with an average production-consumption ratio of only 80 per cent. The cumulative deficit is raised from 5 units (model II) to 19 units (model III). The net difference between expected total production and total consumption needs while children are in the home is changed from a positive value (12.5 units) to a negative value (—11 units). Families in urban centers during industrialization may, in general, meet their increased burdens by an increase in wages over incomes in the agricultural sector. However, families with many children are subjected to deprivation in comparison with smaller families in the same situation.

10. The intensified strains in family economy caused by declines in mortality and, more severely, by transition towards industrialization may lead to one or all of several possible adaptations. The first response in traditional Asian societies tends to be greater chronic dependence on kinship obligations (previously most important as insurance against special crises and the hazards of illness and old age)—either through the perpetuation of joint families or emphasis on the reciprocal giving of goods and services. The average size of households in India (both number of adults and number of children) in-

creased between 1951 and 1961 in all states.¹¹ During this interval the relative frequency of joint families remained fairly constant. A typical pattern (as shown by a married male leadership rate similar to the median in Indian states) is represented in a survey of 13,030 rural families in Maharashtra. Excluding households in which there was no married couple (about one fifth), the households were distributed as follows: with one couple 71.7 per cent, two couples 21.0 per cent, three couples 5.8 per cent, four or more 2.5 per cent. Thus nearly one half (48 per cent) of all couples were living in joint families. Among 1,653 households in four localities near Los Baños (seat of a College of Agriculture, about 65 kilometres from Manila) 22 per cent included relatives other than husband, wife, and their children.¹² Other studies by the senior author show an almost universal pattern of mutual assistance among related families, including unpaid services, gifts, loans, etc.

11. An analogous approach to the economic needs of families is public provision of health, education and other services to children, aged persons and others in special need and/or family subventions. Family allowance schemes are in force in many technically advanced countries. They are not equally applicable to the situation in low-income countries because of the magnitude of the need and the paucity of government resources.

12. Finally, the economic strains of family formation can be relieved by reduction in size of family through restraints on marriage and/or the limitation of fertility within marriage. The efficacy of this approach is indicated in model IV (versus model III). The assumed 5-year shift of ages at marriage does not affect production-consumption relations but changes their location in the family cycle. Delayed marriage, as well as reduction in size of family, enhances the economic position of families, either by retaining income-producing sons and daughters for a longer time in the parental family, or by enabling young persons to accumulate savings and up-grade their capacities. Nevertheless, there is a period of acute stress in the family of moderate size before the oldest child attains significant productive capacity; at its peak the deficit in production relative to consumption

¹⁰ R. J. Myers, "Statistical measures in the marital life cycles of men and women", *International Population Conference, Vienna, 1959* (Vienna, IUSSP, 1959). Its precise measurement is complicated by lower rates of death for married persons than for widowed or single persons. A. Collver, op. cit., presents an ingenious attempt to overcome this complication, but his combination of information from sources subject to different errors involves other difficulties.

¹¹ Kumudini Dandekar and P. B. Unde, *Interstate and intrastate differentials in household formation rates* (manuscript). Maharashtra data from a report by V. M. Dandekar and V. P. Pethe are cited.

¹² G. Tagumpay-Castillo and J. F. Pua, "Research notes on the contemporary Filipino family. Findings in a Tagalog area" (mimeograph) (College of Agriculture, University of the Philippines, 1963).

equals that in the larger family. However, the smaller cumulative deficit during the shortened period of stress (10.6 units in model IV versus 19 units in model III) in conjunction with greater surplus at other times gives a positive balance, rather than a deficit, for the whole

time that children are in the home. This has been the dominant approach to the problems of family formation during economic transitions in Europe and in Japan. It has contributed at the national level to increased savings, investment, and productivity.

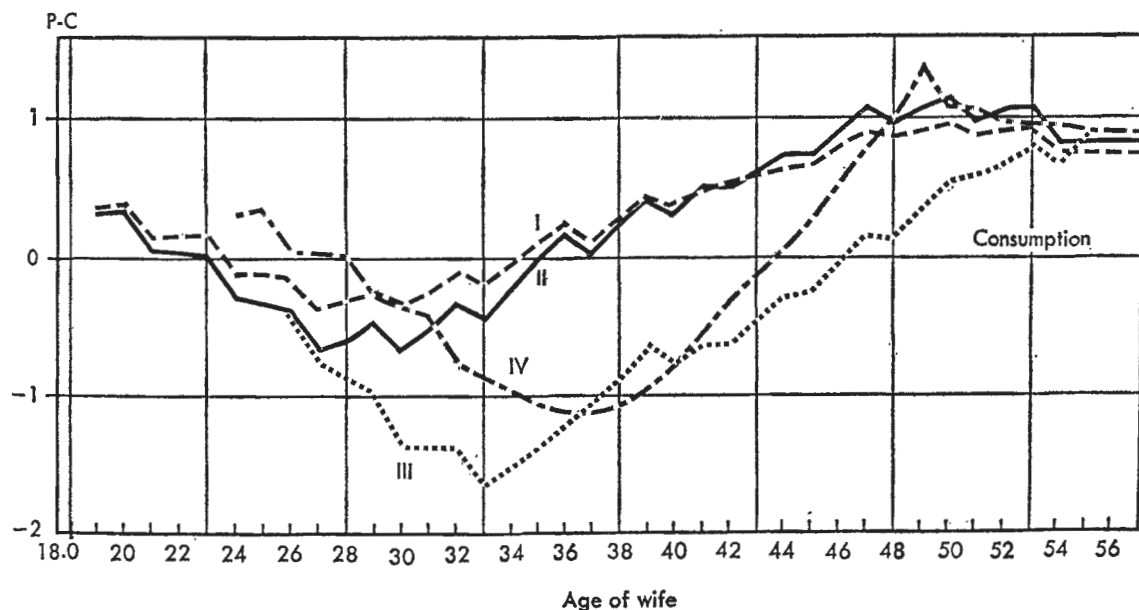


Figure 1. Hypothetical production-consumption relations

HYPOTHESES		SUMMARY			
	Type	Period (years)	Total C (units)	P-C (units)	P/C
I. Agrarian; $F_t 7.0$; $e_o^F 30$	I.....	6	12.60	1.80	1.14
		11	33.80	-2.16	0.94
		23	73.83	14.70	1.20
		40	120.23	14.34	1.12
II. Agrarian; $F_t 7.0$; $e_o^F 50$	II.....	6	13.01	1.39	1.11
		11	38.62	-4.79	0.88
		23	87.22	15.92	1.18
		40	138.85	12.52	1.09
III. Industrial; $F_t 7.0$; $e_o^F 50$	III.....	6	13.01	1.39	1.11
		23	93.80	-19.08	0.80
		11	32.04	6.62	1.21
		40	138.85	-11.07	.92
IV. Industrial; $F_t 4.0$; $e_o^F 50$	IV.....	6	13.01	1.39	1.11
		15	53.78	-10.59	0.80
		14	48.21	11.76	1.24
		35	115.00	2.56	1.02

Production (P) and consumption (C) both in adult male consumption requirement units (see text).

Policy measures and social changes for fertility decline in Japan

MINORU MURAMATSU

1. The possibility of whether the rapid decline in fertility could be effected by various public policy measures aimed at influencing fertility in a country has been explored with unusually great attention in these years, particularly in the developing countries, with a view to curbing down the accelerated rate of population growth and thereby improving the level of living among the masses. Past experiences of decline in the birth rate in the more advanced countries of the West are under careful observation in the hope of obtaining some useful information to formulate policy measures so designed in a most efficient way. The experiences of the West, however, usually point to the fact that the process involved was rather a gradual one and that it occurred primarily as an expression of people's desire for small family size, very often in defiance of unfavourable circumstances of Governments' opposition or indifference. Also, the apparent differences between the West and East in regard to their socio-economic conditions and cultural backgrounds frequently make it doubtful if the comparison between the two worlds could be really valid.

2. In this connexion, the postwar decline in fertility in Japan is viewed with particular interest for the reasons that it took place in an Asian country and that the rapidity and the magnitude of the decline were unprecedented, as is evidenced by the phenomenon that Japan's birth rate was reduced to one of the lowest levels in the world today within a decade or so.

3. To those who are interested in the careful observations on the postwar decline in fertility in Japan, it would appear reasonable to state that there are at least two significant points to note: first, the precipitous fall in fertility in Japan after the war was, in fact, not a phenomenon emerging abruptly with the end of the war but rather a continuation of the steady trend of declining birth rate that had been existing since around 1920, although the trend line was considerably disturbed by social confusions due to the war (table 1). In other words, the downward trend in fertility actually began around 1920 with the initiation of

modernization and industrialization process and, after passing through irregularities during the war years, it again became operative and acted as the fundamental driving force in the fertility performance among the people. Second, in creating the basic motivation towards small family pattern even before the war and particularly in promoting it after the war, changes in social, economic, cultural and psychological factors along with the general modernization and urbanization of the country played by far the most important role. Thus, it would seem that the past experiences in the Japanese fertility are, in final analysis, much closer to those of many Western countries with regard to the basic contributing factors, except that the time required for the decline was considerably shortened in the case of Japan. But, in any event, it will be worthwhile to describe in some detail the course of events that happened in Japan in relation to its changes in fertility.

4. Soon after the war, around 1946 and 1947, grave concern about the country's overpopulation was voiced by many social leaders. Public forums were held frequently on this theme and the radio and other mass communication media actively participated. Confronted with extreme difficulties in their daily life, the Japanese people as a whole reacted strongly in favour of birth limitation. Remarks made by Japanese and foreign population experts advocating birth control as a quick remedy were reported with great sensation. Then in 1948, the Eugenic Protection Law was submitted by a group of Diet members and was passed after some debate by the Diet. A most outstanding significance of the Law was, among other things, a greatly liberalized attitude towards induced abortion. The essential consideration in the establishment of this Law was, according to the statement of a medical person who was actually responsible for it, not to utilize induced abortion for population control, but rather to bring to the surface, to a large extent, induced abortions clandestinely performed, so as to minimize possible harmful effects associated with the operation. Admittedly, underlying the whole process there was a serious concern about population and a recog-

nition of the need for fertility limitation, but the Law itself was formulated not primarily as a population policy; it was primarily to meet the demand of the people and to open safer channels of legalized induced abortion from the health standpoint. In any event, the influence which this legal action exerted on the subsequent course of events has been really enormous as it permitted a considerably wide use of one of the most definite measures of birth limitation.

5. During the period from 1949 to 1954, several official committees specially charged with the study of population problems were formed at the national level. All of these committees indicated the seriousness of the problems and emphatically advised the central government to take positive measures for the promotion of conception control. As a matter of fact, one such committee, the Minister of Welfare's Advisory Council on Population Problems went to the extreme when they included in their resolution a statement: "In relation to wage payments as well as the taxation system, measures should be taken to avoid provisions which may be interpreted as encouraging large families." Thus, the resolutions submitted by these informed leaders are illustrative of the extent to which population problems were regarded as vital to the future of the country.

6. Being in a position to receive these resolutions, however, the central government, and the Ministry of Health and Welfare in particular, almost never adopted any official population control policy explicitly labeled as such. Apparently higher officials in the Government personally were likewise seriously concerned about the population problems, but they did not try to enforce any public policy measures clearly designed to reduce the birth rate for the purpose of population control. That birth control was too negative a policy for a Government to take was perhaps one consideration which led them to take such an attitude, but more significantly, it may be safe to say that the general public in Japan were already so well prepared to do something about family limitation themselves that the Government did not find it particularly necessary to initiate some intentional efforts.

7. In the meantime, as years passed by since the introduction of the Eugenic Protection Law in 1948, the numbers of induced abortions reported to the health authorities rose very sharply. Alarmed with the too rapid increase in induced abortions, the Government considered it advisable to enact some official programs and try to replace induced abortion with the practice of contraception. Thus, in October,

1951, the Japanese Cabinet agreed to state: "The number of abortions is increasing.... Occasional damage to the mother's health, however, makes the dissemination of the knowledge of contraception desirable to eliminate the bad influence of abortions on the mother's health.... It is therefore necessary to disseminate contraceptive information to decrease these undesirable effects." Subsequently, on the basis of this Cabinet agreement, in June, 1952, the Ministry of Health and Welfare issued an official instruction to all prefectures urging them to make efforts to promote conception control throughout the country. And, in the formulation of concrete programmes along this line, results obtained by the so-called pilot projects of family planning conducted by the Institute of Public Health and other organizations were taken into consideration. The main emphasis in these programmes was laid on the general educational approach of family planning, its techniques as well as the principle, and the provisions of supplying contraceptives with government subsidies were confined only to the social groups with low incomes.

8. The programmes for the promotion of conception control to replace induced abortion which were sponsored by the Government and operated through the public health network, however, could not accomplish much at least for the first few years. Induced abortions still continued the upward trend, and a number of improvements were required so as to maximize their results, such as the extensive use of midwives in the teaching of contraceptive techniques. Then, in 1955, the reported number of induced abortions reached a peak of 1.17 million, and since that year, the trend has been reversed to show a gradual decrease (table 2). Though the recent figure of 955,000 abortions for 1963 indicated a still fairly high incidence, it is likely that more of the young couples will successfully plan their families through contraception in the future as compared with the past tendency of older couples resorting to induced abortion as an ultimate check on the number of children they desired.

9. In reviewing all the events described above which had much to do with the determination of the postwar trend in fertility in Japan, it is obvious that the concern about Japan's over-population and the recognition of the need to do something about it which developed among the people themselves were a strong, influential factor involved. Underlying the whole process there existed this general climate of opinion, and on this basis, there developed these various programmes. But, more fundamentally, a most important observation

here is that these programmes were adopted not to create the basic motivation towards fertility regulation but rather they were formulated to meet the people's strong desire for small families and to provide certain practical means to accomplish such desire. To state differently, in postwar Japan, the Government in general was not in a position to tell the people what to do but rather to follow the people, and to help them accomplish their desire.

10. A big question then is what factors were most conducive to the creation of such a high motivation towards family planning among the Japanese. The question is, all in all, a very complex one. But, in answering this, one may possibly count such factors as: a high degree of literacy, universal education system, great interest of parents to give even better education to their children, effect of prolonged years of compulsory education after the war, enormous influence of newspapers and magazines and other reading materials, impact of the new Constitution which prescribed, among other things, equal inheritance by all children, rising status of women, disappearance of urban-rural differential characteristics, traditional "realistic" way of thinking of the Japanese, historical heritage of population limitation practice existing already a century ago and keen interest in learning from abroad.¹

11. In summary, it is to be noted that in the postwar decline in fertility in Japan, numerous social factors such as enumerated above were powerful enough to further promote the small-family motivation long existing among the

people since even before the war. When these factors were coupled with extreme economic difficulties in the daily life, the Japanese people immediately started to take action for family limitation after the war. The motivation did not remain merely as a stated wish, but went into some actual behaviour. The establishment of the Eugenic Protection Law and the government programmes of teaching in family planning techniques provided free access to some actual methods to fulfil their desire and thus speeded up the whole movement. One may possibly learn from these observations that in the field of voluntary fertility regulation, the basic motivation is important on one hand, but at the same time to make available certain practical means of known effectiveness is no less significant, on the other hand, especially when the decline in fertility must be brought about within a short period of time. It is very difficult to evaluate correctly and objectively the role played by the Government and its public measures in bringing down Japan's birth rate in the past fifteen or twenty years, but if one dare to make some speculations, one would probably conclude that the real merit of the Government's efforts in this connection lies in that they rendered a great help in diffusing the knowledge and practice of family planning all over the country rapidly and extensively, since the official sanction and endorsement of family planning by the Government meant a great deal to the general public. With this help, the length of time required for the observed decline in fertility apparently was reduced considerably. But, at the same time, one may be equally justified in speculating that the present low level of fertility in Japan would have been reached anyway sooner or later even if there had been no such government-sponsored efforts at all.

¹ See, for example, Minoru Noda, "Contraception in Japan: Problems of motivation and communication", *Research in Family Planning* (Princeton, New Jersey, Princeton University Press, 1962).

Table 1. Annual fertility, 1920-1955, Japan

Year	Births to Japanese in Japan per 1,000 Population	Female births per 1,000 women aged 15-49	Gross reproduction rate
1920	36.1	77.6	2.7
1921	35.0	75.6	2.6
1922	34.1	74.0	2.5
1923	34.1	75.7	2.6
1924	33.7	73.2	2.5
1925	34.8	75.7	2.6
1926	34.7	74.6	2.6
1927	33.5	72.8	2.5
1928	34.2	74.2	2.6
1929	32.8	71.3	2.4

Table 1. Annual fertility, 1920-1955, Japan (*continued*)

Year	Births to Japanese in Japan per 1,000 Population	Female births per 1,000 women aged 15-49	Gross reproduction rate
1930	32.4	70.2	2.4
1931	32.2	70.3	2.4
1932	32.9	71.9	2.4
1933	31.5	69.0	2.3
1934	30.0	66.1	2.2
1935	31.7	69.3	2.3
1936	30.0	65.4	2.2
1937	30.8	66.7	2.2
1938	27.1	57.7	1.9
1939	26.6	56.2	1.9
1940	29.4	61.4	2.1
1941	31.1	65.2	2.2
1942	30.2	62.9	2.2
1943	30.2	62.7	2.2
1944	—	—	—
1945	—	—	—
1946	—	—	—
1947	34.3	64.9	2.2
1948	33.5	63.6	2.1
1949	33.0	63.3	2.1
1950	28.1	53.6	1.8
1951	25.3	48.3	1.6
1952	23.4	44.4	1.5
1953	21.5	40.6	1.3
1954	20.0	37.5	1.2
1955	19.3	36.4	1.2

SOURCE: Irene B. Taeuber, *The Population of Japan* (Princeton, New Jersey, Princeton University Press, 1958), p. 232.

Table 2. Number of induced abortions reported to the health authorities, 1949-1963, Japan

Year	Number (in thousands)
1949	246
1950	489
1951	638
1952	806
1953	1,068
1954	1,143
1955	1,170
1956	1,159
1957	1,122
1958	1,128
1959	1,099
1960	1,063
1961	1,035
1962	985
1963	955

SOURCE: Ministry of Health and Welfare, Japan, *Reports of Statistics concerning Eugenic Protection*.

Possible effects of public policy measures on fertility in India

B. L. RAINA

I. INTRODUCTION

1. The problems of feeding its teeming millions and raising the standard of living of the general population made it incumbent on the Government of India to embark upon a definite population policy. It has been clearly realized that the economic gains of planning all these years are swamped by the increasing numbers, and hence a consistent and effective policy of slowing down population growth is an absolute necessity for improving economic conditions in the country. Of the three factors which determine population growth, it is clearly insane, in these days of rapid advancements in the fields of public health, medicine and international co-operation, to bank upon mortality to check increase in population. Everything that is relevant in this connection points to a continuing decline in the death rate, with the consequential effect of aiding population growth. To think of relief through international migration is not practical. Hence, for checking population rise, the only factor that seems amenable to control is fertility. In realization of the situation, the Government of India has embarked upon an expanding national programme of encouraging voluntary family planning among the people.

2. *The approach.* At the level of national policy, the current Five-Year Plan clearly identifies family planning to be "at the very centre of planned development". During the first three Five-Year Plans, the budget allocations for family planning increased successively from approximately Rs.1.45 million in the First Plan and Rs.21.56 million in the Second Plan to 270 million rupees during the present plan. In the fourth Five-Year Plan, due to begin next year, the tentative provision is approximately Rs.950 million. The immediate aim is to reduce the birth rate to 25 per 1,000 as soon as possible. The means advocated to achieve this goal are as follows:

(a) Popularizing adoption of family limitation methods like:

- (i) Voluntary sterilization;
- (ii) Intra-uterine contraceptive devices;

(iii) Mechanical and chemical contraceptives;

(iv) Coitus-interruptus, abstinence, rhythm, etc., which require no devices;

(v) New discoveries which are found effective and acceptable in India for general use, like oral contraceptives, etc.;

(b) Stimulating social changes which affect fertility, such as raising the age of marriage for women, improving the women's status, education and employment opportunities, old-age security, compulsory education of children and eliminating child labour;

(c) Accelerating economic changes like increase in per capita income in real terms, industrialization, etc. The net effects are showing up. Some of the States of India are arriving virtually at the stage of a widespread change; others have not yet come to that point. It is known that fertility rates in the upper economic classes are falling, and that this trend is spreading gradually to the lower economic groups. Birth rates in some urban areas are now distinctly lower than those in the surrounding rural areas. There are indications that in districts where a programme has been in progress for five to seven years, declining trends in birth rate are emerging. Other, less direct indicators, such as the consumption rate of contraceptives and popular response to the programme, also show the increasing impact of the drive.

3. *The tasks.* While there seems to be no doubt that immediately emphasis has to be placed on extending rapidly the intra-uterine contraceptive device, sterilization and contraceptive distribution services, social policies and legislation must be pursued for sustained long-term effects. The Central Family Planning Board set up under the Fourth Plan Evaluation Committee a study group, which in 1963 considered possible social policies and legislation to support the programme. It seems that purposeful action in this area is still hindered by lack of sufficient basic knowledge about the effects of social policies on fertility that have been noticed so far, and those which may be expected in the future. Doubts are often raised

about possible repercussions and some people are not sure of getting reasonably quick results. Some objective data could throw light on the point and indicate whether or not such doubts are indeed justified in a particular case. They will provide a sounder basis for discussion and decisions. For the purpose of the present paper, public policies and their possible effects on fertility are discussed below under three main heads—family planning programme, economic policies and social policies.

II. THE FAMILY PLANNING PROGRAMME

4. A firm government decision to develop family planning action programmes is itself an important policy decision, which influences the psychology relating to fertility throughout the country. Traditionally, children are regarded as gifts from God and uncontrolled procreation is looked upon as one of the laws of normal life. The massive drive for family planning makes even the uninitiated pause to think whether these dogmas are so sacrosanct. Such doubts, however casual, pave the way for the ultimate acceptance of the idea of reducing the number of births. This is irrespective of the method that appeals to the individual. The family planning movement in India is linked with the activities for promoting the health, economic stability and general well-being of the family, and hence is styled as a "Family Welfare Planning Programme". It incorporates provisions to help childless couples to attain parenthood, where medically possible, and to give guidance on problems arising from marriage and family relationships. The family planning movement in India aims at the promotion of happiness of married couples, the well-being and proper development of their children, and creation of a sense of family oneness, while permitting self-expression to each individual member, with the objective of enriching daily living. These underlying ideals of the family planning movement have appealed to a large number of people and have led to popular acceptance of the idea of family planning.

III. ECONOMIC POLICIES

5. *Economic prosperity.* Such policies may bring about changes, which may be conducive to a rise in fertility. Prosperity resulting from better food supply, due to higher agricultural production, development of transport system, application of public health and medical research, and improved civil administration help to reduce mortality and improve the nutritional status of the people at large. This would mean that physiological and disease barriers that kept the expression of fuller fertility in check will

be weakened. Premature disruption of married life by the death of a partner will be reduced, and there will be a higher proportion of fecund married couples. These movements will lead to a higher fertility. But the change from an agrarian to a more economically developed society may unleash a complex of forces, the impact of which is not easy to trace in Indian fertility conditions.

6. *Industrialization.* In Western countries, industrialization was the main force which led to the voluntary large-scale adoption of contraception for restricting family size. It may have been partly due to environmental factors in the industrialized areas, such as overcrowding, lack of proper housing and other civic amenities. These factors are present in the industrialized areas in India, but it is not certain how far they are operating towards a reduction in fertility. There is no precise idea about the fertility differential between industrial and non-industrial populations in India. It is certain, however, that the major factor which encouraged family limitation in the industrialized areas in the West was the "emancipation of women" and the appreciation of the fact that having a large family conflicts with the acquisition and enjoyment of goods and materials, which are associated with the better ways of life. It may be that such realization is dawning on the Indian industrial population. Much depends on the availability of cheap consumer goods within easy reach and buying capacity. A conscious effort in this direction is bound to result in the acceptance of contraception.

7. *Compulsory education.* Then again, desire for a higher standard of life means better food, clothing and shelter for each member of the family. As the standard goes up and up, the individual becomes more and more conscious of the economic burden involved in adding an extra child to his family. In agrarian societies, it is held that if there is a mouth to feed, there are also two hands to work. In the Indian agricultural communities, the child shares the available resources of the family in regard to food, clothing and shelter, which are generally at near-subsistence level or quite often even below it. If this static complacency is disturbed by an appreciation of basic needs for civilized existence and a desire to attain a higher living standard, the case for fertility control becomes strong. Measures to remove children from the labour market and to give them education will greatly strengthen this process. In India legislation banning child labour exists in organized industrial sectors. Possibilities of extending this legislation to other sectors and ensuring effective implementation should be explored. Along

with this should go concerted efforts to provide educational facilities for all children, and to introduce compulsory school education. So far, this aspect could not be pursued vigorously, but obviously there is need to do so because of the many other developmental needs.

8. *Employment of women.* Quite a substantial proportion of women in India are working, but they are employed mostly in agriculture and other home industries. This does not seriously interfere with their child-rearing. Employment of women in other fields is limited. A systematic policy of increasing the number of jobs open to women in the organized industrial and commercial sectors, and of introducing positive incentives to employ women in these jobs will be extremely useful. This would provide an alternative way of life for women, with economic advantages and improved status to be gained for the family by employment outside the home. This economic advantage would tend, at least, to encourage delay in marrying and adoption of deliberate measures for avoiding frequent pregnancies, which conflict directly with employment obligations. In most of the organized sectors, maternity leave and certain allowances are granted, but they are not looked upon with favour by some observers.

9. *Tax.* Tax structure is based on the economic policies of the Government. As it is, in India a certain tax relief is granted to married persons with children. Recently, direct provision has been made favouring family planning in the recent Finance Bill of 1965. The elements of discrimination against unmarried women and bachelors have been eliminated. There is a tax exemption for a married individual with two dependent children of up to an income level of Rs.4,300 per year. It also provides that any bonafide expenditure incurred by a company for the purpose of promoting family planning amongst their employees will be allowed as a deduction in computing the company's taxable income. In case this expenditure is of a capital nature, such as is incurred for constructing a building to be used as a family planning clinic for the use of the employees or for purchasing equipment for such a clinic, there will be allowed deduction over a period of five years, in equal amounts, commencing from the year in which the expenditure was incurred. Expenditure for promoting family planning which is not of a capital nature will be allowed as a deduction in full, in the computation of the income of the company for the year in which such expenditure was incurred.

10. *Land reform legislation.* In India it is based on economic and social objectives, but it

has an indirect impact on fertility. The legislation tends to encourage individual ownership and to break up land into smaller holdings. To the extent that these tendencies keep people in agricultural pursuits, the process of decline in fertility may be checked. However, such tendencies may attract the more enterprising section of the population to other industries and organized activities, due to the inability of the small holdings to support the family. Such movement, along with concern about division of land, may promote a desire for smaller families. It is known that in the State of Punjab, there appears to be a tendency to discourage the marriage of younger sons of landlords in order to avoid division of holdings.

IV. SOCIAL POLICIES

11. *Marriage age.* In India, women marry quite early. It has been earnestly suggested that government policies should be directed towards raising the age at marriage, and that such policies should be supported by the necessary legislation. Such policies may be conceived of as measures of social reform, and are desirable from the various angles of national welfare. The Sarda Act of 1930, which prohibited marriage of girls below the age of fourteen years and of boys below eighteen years, though loosely enforced, has been instrumental in creating a climate for a higher marriage age for boys and girls. The average marriage age for females in India was thirteen around the first decade of the century, but is now about sixteen. The effect of this rise on fertility is not quite obvious, since the age still continues to fall in the range of what has been called "adolescent sterility". The move to raise it still higher will have a definite effect on fertility, but its direction and magnitude require detailed examination. There is no doubt, however, that postponement of marriage will delay the onset of childbearing and hence reduce the actual reproductive period, if it be assumed that the age when the woman ceases reproduction will not be raised correspondingly. But it is not known whether the age-specific fertility rates will remain unchanged, will rise or decline. Some studies show that the bride, being more mature, conceives her first child quite early and builds up her family comparatively more rapidly. However, one thing seems to be fairly clear: either as a result of mature thinking or education or employment, the girl is more likely to adopt family planning quite early in married life. This may act as a powerful force for reducing fertility.

12. *Marriage reform.* In India previously, widow remarriage was not favoured among

some groups. This custom is breaking down, and, to some extent, adds to the average child-bearing period, leading to higher fertility. The effect depends on the magnitude of increase in widow remarriage and the age at which they remarry.

13. *Education of girls.* At present, although rapid strides have been taken in spreading education throughout the country, women's education lags behind. The 1961 census indicated that female literacy in the various States ranged from 11 to 47 per cent. It should be noted that the proportion of girls of school age, who are in school, has risen markedly in some areas. It is of great interest to study the effect on the fertility of a given population when this band of more educated girls gets married and begins to bear children. It is interesting to observe that the National Sample Survey has shown that the number of children born per woman is 2.5 if she has passed the intermediate academic examination, above 4.2 if she has matriculated, 4.5 if she has passed middle-school and over 6 if she is illiterate.

14. *Social security.* Sons have traditionally been looked upon as the best social security for the aging parents. In view of the prevalent high infant and child mortality, a large family was accepted as a desirable norm, so that at least some will be alive to give the parents protection against old age. This norm remains unchanged, though sharp declines in infant mortality have now taken place. Even now, sons are expected to look after the parents in old age, or in situations when they are not able to earn their living. However, this joint family approach is showing signs of cracking, and the Government is increasingly adopting policies to provide protection against calamities of illness, unemployment, death and old age. There is a gradual shift from family and community measures of protection to State provision of welfare and security services. Welfare services and insurance against illness and unemployment are slowly progressing. The cost of extending adequate social security to the population at large is enormous, but developments in this direction are likely to weaken the desire for a large family. As the institutions for providing social security develop, the norm of a smaller family may increasingly be accepted by the people.

15. *Modification of abortion law.* Some enthusiasts advocate "legalization of abortion" on a mass scale as an important family planning instrument. Others equally vehemently maintain that for many practical and ethical reasons, it should not be permitted on a mass scale. At

the present time, the legal position regarding abortion is that it is permitted for "medical" reasons. Because of the lack of clear definition of the last term, doctors are hesitant to take responsibility for performing abortion, even if humanitarian considerations overwhelmingly justify it. For example, take an extreme case, where a minor, unmarried or insane girl is criminally raped and becomes pregnant. The law is not sufficiently explicit as to whether abortion is permitted in such a case, if it is established that, in the absence of abortion, serious psychological damage will be done to the girl. Modern medicine sees a person as a psychosomatic entity, and recognizes that psychological injury can cripple or even kill an individual. Similarly consider the case of a woman who has five children and has been faithfully using contraceptive methods. She conceives again, due to contraceptive failure, and desires abortion. It is doubtful whether any doctor will legally perform the abortion in such a case. Keeping in view the fact that the public policy is in line with the people's feelings and expectations, the Government of India has appointed a committee to examine the problems.

16. *Small family norm.* In schools, much could still be done to help "legitimize" and encourage the general concept that having a small family is proper, normal and advantageous. In the course of reading lessons, for example, stories could be included about happy small families. Also, as a part of citizenship education and social studies, some general thinking could be done about the problems encountered by very large families. Also, the national implications of excess population can be made clear to children.

V. CONCLUSION

17. Discussion of social legislation for influencing fertility sometimes gets bogged down under the weight of the criticism that one or the other type of social policy change will not "do the whole job," and that if the policy is at all effective, it will take time. It is indeed rare when only one factor can be so effective as to lead to a deep social change. There is no single magical step that will, by itself, solve the whole problem. It is known that change in fertility is a complex process. It is necessary to take whatever steps are possible for creating a general social and psychological atmosphere which will at least remove barriers and people's inhibitions about adopting small family size. A large number of steps have to be taken to create a really favourable environment. When such a social environment has been created, the services of the family planning action pro-

gramme will be accepted and utilized more effectively. The results will be enduring if the problem of moderating fertility is dealt with in a broad perspective, with a multifactoral approach. The process of establishing a small

family norm can be speeded up if the general rationality and objectivity of the approach to childbearing is increased, and the powerful forces of extensive education, social policy and social legislation are fully harnessed.

Fertility in developed countries during the twentieth century

N. B. RYDER

I. SCOPE OF THE PAPER

1. Any essay so entitled is presumptuous, since more data on the subject of fertility exist today, than at any other time. Accordingly this appraisal is limited to the technical explanations of major movements and variations in the level of fertility. Moreover, since no other variable provides a sharp definition of development, "developed" countries are defined as those which currently have a gross reproduction rate of less than 2.0 per woman, or an annual crude birth rate below 30 per 1,000 persons. Some "developed" countries are excluded from coverage either because they are statistically insignificant or because of inadequate time series of trustworthy data.

II. THE TRANSITION SEQUENCE

2. During the course of their development, all countries have moved from higher to lower fertility. The principal determinant of comparative levels and sequences is the time period when each nation passed into the low fertility category. Approximate times for some of the countries are as follows:

1830's....	France
1840's....	Ireland
1880's....	Switzerland, Belgium
1890's....	Sweden, Denmark, England and Wales, Scotland, Australia, New Zealand
1900's....	Netherlands, Norway, Germany, United States
1910's....	Canada, Finland, Austria, Hun- gary, Czechoslovakia
1920's....	Italy, Spain, Portugal
1930's....	Poland, Bulgaria, Romania
1940's....	Soviet Union
1950's....	Japan, Yugoslavia

This timetable conceals the levels from which fertility declined. For some countries, like Sweden and Japan, the higher birth rate was only a little above 30. For others, like Germany and Soviet Union, it was well above 40. The duration of the decline is likewise hidden. It took a long time in the United States, but a short time in Ireland.

III. THE CRUDE BIRTH RATE SINCE 1900

3. This measure is little used in analysis because its movements depend on the age structure, and because it is highly variable in the short run. But it is the most available index, its movements shape the age structure, it is the principal growth determinant in developed countries, and its variability is a characteristic common to all period-specific measures. Figure I shows the approximate movement of fertility since 1900 for the nations of paragraph 2, in the form of a median crude birth rate.¹ There is considerable, but diminishing, decline, interrupted somewhat by the First World War and especially by the Great Depression and the Second World War. The series confounds individual sequences and the succession of transitions, and conceals differential involvement in war and depression.

4. The array of rates shows considerable convergence combined with change in the composition of the extremes. Bulgaria and Romania have been replaced at the top by New Zealand and Canada; Ireland and France have been replaced at the bottom by Sweden and Hungary. The negative correlation between fertility and development is weaker now than it was in 1900. Since 1945 there has been gradual decline from the postwar peak to a low plateau. The principal departures from this pattern have been stability at a moderately high level in Portugal, Ireland and Spain, and much more rapid decline in Eastern Europe and Japan, commonly after a delayed and moderate post-war peak.

¹ The principal source of all data used in this paper is: United Nations, *Recent Trends in Fertility in Industrialized Countries* (United Nations publication, Sales No.: 57.XIII.2). For earlier years and other countries, the writer used: R. R. Kuczynski, *The Measurement of Population Growth* (New York, Oxford University Press, 1936). For later years reference was made to various issues of *The United Nations Demographic Yearbook* and to *Population Index*. Data for Hungary were taken from: J. S. Siegel, *The Population of Hungary* (Washington, United States Government Printing Office, 1958). Data for the Soviet Union were taken from: United Nations, *World Population Prospects, As Assessed in 1963* (United Nations publication, Sales No. 66.XIII.2). Where sources disagreed, the later figure was taken.

IV. REINTERPRETATION PROMPTED BY THE GROSS REPRODUCTION RATE

5. The gross reproduction rate is the sum over all ages of the birth rates obtained by dividing female births to women in each age by the person-years of their exposure. It is superior to the crude birth rate because it avoids the arithmetical influence of the age-sex distribution, it is a component of the stable population model, and it is descriptive of the family life cycle rather than total population change. Recent change is emphasized here because the long-run movements differ little from those of figure I, because earlier variations are discussed elsewhere,² and because there is differential availability of the rates in space and time.

6. Table 1 displays the array of gross reproduction rates for 1961, and for comparison, the crude birth rates.³ Current differences in the latter clearly understate the variance of international fertility, as shown, for example, in the comparison of gross reproduction rates for the overseas English-speaking countries and for the countries of Eastern Europe. Although the median crude birth rate fell by one eighth between 1951 and 1962, the median gross reproduction rate remained stable. In every country except Japan, the gross reproduction rate rose more or declined less than the crude birth rate during the 1950's.

7. The main source of divergence between these indices is the age structure. Except for the shocks of migration and war, its movements are broadly patterned by fertility change. When the birth rate declines, the proportion in the childbearing age rises, and when it rises, that proportion declines. As the small cohorts of the Depression years move through the reproductive ages, the time series of their proportions will repeat the trough in the birth rate a generation earlier.

V. THE CHANGING AGE DISTRIBUTION OF CHILDBEARING

8. The gross reproduction rate, because it is constructed from period-specific data, may be an unreliable indicator of the fertility of its constituent cohorts. This is the case whenever the age pattern of childbearing is transformed

from cohort to cohort in the short run or in the long run. If the cohorts producing a period's fertility are tending towards younger childbearing, then the earlier (older) cohorts and the later (younger) cohorts also will have higher proportions of their fertility. In consequence, their summation for that period will show upward distortion. This distortion is approximately revealed by a simple calculation. Define the mean age of period fertility by

$$A = \frac{\sum x f(x)}{\sum f(x)}, \text{ where } f(x) \text{ is the fertility rate}$$

for age x . Then the ratio of (the gross reproduction rate for the cohort at age A in the period) to (the gross reproduction rate for the period) is approximately $(1 + a)$, where a is the annual absolute change in the mean age of period fertility.⁴ Thus the factor $(1 + a)$ suggests the extent to which it is misleading to use the period gross reproduction rate for comparisons of cohort fertility.

9. Table 2 gives current mean ages of fertility, and average annual changes during the preceding decade.⁵ There is very little differentiation in this mean from country to country. It is determined by the age pattern of childbearing and by the level of completed fertility (since higher orders of birth take more time). Both factors are relevant in table 2: some countries with low fertility have high mean ages of fertility, and vice versa. In every country except West Germany, the mean age of fertility has recently declined. (The exception is explained by the erosion of sex imbalance as a consequence of war mortality.) This decline, following the argument of paragraph 8, implies that current period of reproduction rates overstate cohort fertility levels. Their different amounts of decline indicate that the disparity between fertility in Western Europe and that in the overseas English-speaking countries is understated.

VI. NUPTIALITY AND MARITAL FERTILITY

10. Since most countries have shown stable fertility during the past decade, it follows that childbearing is being redistributed towards the younger ages. One source of this is a declining age at marriage. Table 3 illustrates the change for a few countries. The procedure for obtaining these measures is based on age-specific propor-

² The United Nations publication, *Recent Trends in Fertility in Industrialized Countries*, cited in footnote 1, is highly recommended for authoritative treatment of detailed differences and changes in these and more highly specific measures.

³ The rates for Spain apply to 1960; the rates for the Soviet Union apply to 1960-1961; the rates for Romania are the average of 1960 and 1962.

⁴ N. B. Ryder, "The Process of Demographic Translation", *Demography*, No. 1 (1964), pp. 74-82.

⁵ The change for Austria is the average for the preceding seven years; the change for Hungary is the average for the preceding thirteen years; in all other cases, the change is the average for the preceding ten years.

tions single in successive censuses.⁶ Table 3 shows a pronounced and persistent decline in marriage age. These and other data indicate a convergence towards early and extensive marriage in all developed countries, despite other cultural differences. Where birth registrations provide information about marital duration, it is possible to analyse duration-specific fertility for marriage cohorts, and thus focus more sharply on the distinction between the timing of marriage and the timing of marital fertility. Thus Biraben and his colleagues have used a measure akin to the period gross reproduction rate, but based on duration-specific birth rates.⁷ They observed a tendency for marital fertility to rise somewhat in Western Europe during the 1950's, with the qualification that this may be partly attributable to a modified time pattern of family formation (producing the distortion characteristic of all period measures). Exception must be taken to one conclusion of these writers. They estimated that marital fertility in the United States is approximately the same as in Western Europe, whereas, to the present writer, it would seem to be some fifty per cent higher.⁸ Their suggestion that the large differences in general fertility are to be explained by higher American marriage levels is belied by the small differences in proportions ever-married.

VII. CONCLUDING COMMENTARY

11. All developed countries have embarked sooner or later on a course of fertility reduction in the higher parities and ages, coincident with the pace of socio-economic development, but responding more and more promptly with time. Fertility declined to the region of replacement during the Depression in the then-developed countries. There has been subsequent con-

vergence: countries with the lowest fertility in the 1930's have shown moderate increases; countries with the highest fertility have shown large decreases. Coincident with the movement towards small families has been an increase in marriage and a decrease in marital infertility. Both the large family and the infertile life have been rejected.

12. The rise of fertility in many countries in the past thirty years seems more easily explained in terms of how low fertility was during the Depression than how high it is now. No country has persisted at sub-replacement in normal times. It is remarkable that so close a correspondence now exists between the demographic requirements of each developed society, and the net outcome of individual reproductive decisions, despite the disparity in perspective and the lag of consequences beyond their determinants. Perhaps the future will see long swings above and below equilibrium as the results of decisions about family formation are transmitted through time into the markets for jobs and for homes.⁹

13. The outstanding difference in fertility among developed nations is that of the overseas English-speaking countries relative to the rest. It would be unwise to ascribe their proli-ficity to higher living levels, because persistent differences within Europe refute such a relationship. Thus fertility is higher and later in Spain, Portugal and Ireland, apparently through the influence of religion and slower socio-economic development. The nations with the lowest fertility (Bulgaria, Romania, Hungary and Japan) have all shown rapid recent decline, which may, following paragraph 12, induce a tendency to increase. There remain differences in the modes (and efficacy) of fertility regulation—giving some nations more unwanted births than others—and in the extent to which governmental action makes it possible for most citizens to participate in producing the next generation without severe economic penalties, as well as a residue of variability in the norms governing decisions about family formation. Nevertheless, the most striking fact about fertility in the developed nations today is that differences are dwarfed by similarities. Within narrow limits, the character of socio-economic development seems to have prescribed a single modern fertility pattern.

⁶ N. B. Ryder, "Measures of recent nuptiality in the Western World", International Union for the Scientific Study of Population, *International Population Conference, New York, 1961* (London, 1963), vol. II, pp. 293-301. Similar observations are reported by other analysts, for example, Roland Pressat, "Tendances récentes de la fécondité en Europe occidentale", International Union for the Scientific Study of Population, *International Population Conference, New York, 1961* (London, 1963), vol. I, pp. 117-127.

⁷ J. N. Biraben, "Evolution récente de la fécondité des mariages dans les pays occidentaux", *Population*, No. 1 (1961), pp. 49-70; J. N. Biraben, Y. Péron and A. Nizard, "La situation démographique de l'Europe occidentale", *Population*, No. 3 (1964), pp. 439-484.

⁸ The principal misunderstanding is that the combination of parity progression ratios (*probabilités d'agrandissement*) for parities one, two, three, etc. ($a_1, a_2, a_3, 111$), into the sum $a_1 + a_1a_2 + a_1a_2a_3 + \dots$, gives the ratio of second and higher order births to first births, and this is less by one than the number of births per mother.

⁹ H. Gille, "An international survey of recent fertility," *Demographic and Economic Change in Developed Countries* (Princeton, New Jersey, Princeton University Press, 1960), pp. 17-35; R. Freedman, "Comment", *Demographic and Economic Change in Developed Countries* (Princeton, New Jersey, Princeton University Press, 1960), pp. 72-76.

Table 1. Gross reproduction rates and crude birth rates, 1961³

	GRR	CBR
New Zealand	2.03	27.1
Canada	1.87	26.0
United States	1.79	23.3
Australia	1.72	22.8
Netherlands	1.56	21.3
Portugal	1.53	24.5
Scotland	1.42	19.5
Norway	1.39	17.3
Spain	1.38	21.5
Soviet Union	1.37	24.9
France	1.37	18.2
Austria	1.36	18.6
Poland	1.36	20.9
Yugoslavia	1.36	22.7
England and Wales	1.35	17.6
Finland	1.32	18.4
Belgium	1.29	17.3
Denmark	1.23	16.6
West Germany	1.23	18.3
Switzerland	1.21	18.1
Italy	1.18	18.6
Czechoslovakia	1.16	15.8
Bulgaria	1.10	17.4
Roumania	1.07	17.6
Sweden	1.07	13.9
Japan	0.95	16.9
Hungary	0.94	14.0

Table 2. Current mean age of fertility and change per annum during 1950's⁵

	Year	MAF	Change
Spain	1960	29.99	— .075
Portugal	1960	29.58	— .077
Netherlands	1962	29.52	— .122
Italy	1961	29.16	— .085
Switzerland	1961	28.60	— .083
West Germany	1961	28.22	+ .034
Finland	1962	28.20	— .109
France	1962	28.09	— .050
Belgium	1960	28.05	— .073
Norway	1961	27.96	— .145
Canada	1962	27.84	— .031
Japan	1961	27.84	— .174
Scotland	1962	27.71	— .091
Austria	1958	27.71	— .047
Australia	1962	27.54	— .042
Yugoslavia	1961	27.54	— .153
Sweden	1961	27.46	— .067
New Zealand	1962	27.43	— .086
Poland	1961	27.42	— .141
England and Wales	1962	27.40	— .071
Denmark	1961	26.96	— .071
United States	1962	26.45	— .018
Hungary	1962	25.73	— .134
Bulgaria	1962	25.17	— .117

Table 3. Female mean age at first marriage

	1930's	1940's	1950's
United States	22.6	21.6	21.1
New Zealand	24.9	22.4	22.3
Canada	24.2	23.3	22.4
Denmark	24.4	23.5	22.7
Sweden	25.9	24.3	23.8
Finland	26.4	24.7	23.6
West Germany	—	24.9	23.7
Portugal	26.0	25.1	24.5

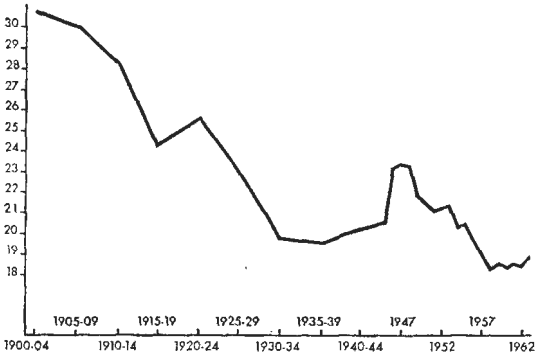


Figure I

Median crude birth rate (per 1,000 per annum),
twenty-seven developed countries, 1900-1963

Birth control measures and their influence on population replacement

E. A. SADVOKASOVA

[Translated from Russian]

1. The birth-rate (the number of live births per year per 1,000 population) depends on a large number of factors, one of which is the age and sex structure of the population.

2. As a result of the Second World War, the proportion of men in the population of the Soviet Union dropped to 45 per cent in 1959 as compared with 48 per cent in 1926. The excess of females over males was to be found, according to the 1959 census figures, mainly in age groups over 32 years; in all age groups under 32 years males outnumbered females. In the future, as the war years, which brought heavy and irreplaceable losses of males in particular, recede further and further into the past, the proportion of males to females will constantly improve. By 1963 men made up 45.5 per cent of the total population of the Soviet Union, and outnumbered women in all age groups under 36 years.

3. Because of the imbalance in the sex structure of the Soviet population caused by the Second World War, the proportion of married men in male age groups over 30 years has been appreciably higher than the proportion of married women in similar female age groups. In other words, while in a given male age group the proportion of married men has stood at the highest possible level, the corresponding female age group has included a large number of unmarried women with very little likelihood of marrying. Thus, the proportion of married men among males of 16 years and over was the same in the Soviet Union in 1960 as in the United States, whereas the proportion of married women among females in the same age group was 14 per cent lower. Naturally, that situation has inevitably tended to reduce the birth-rate in the Soviet Union.

4. The low birth-rate in the Soviet Union during the Second World War had by 1961-1963 resulted in a decline in the proportion of women of childbearing age (15-49) in the total female population, and the natural consequence of this has been a decline in the crude birth-rate in the Soviet Union in the last few years. A further significant factor in this connexion

is the age of men and women at marriage, since fertility varies very widely among the different age groups.

5. A vital influence on the birth-rate is exercised by standards of living. The most important of the factors involved are the development of the economy, the growth of incomes, the cultural level of the people and, especially, the extent of women's participation in social production. It is these factors which explain, for the most part, the differences in birth-rates between economically advanced and backward countries, between urban and rural populations, between manual and intellectual workers and between women participating or not participating in social production.

6. Another factor operating to reduce the birth-rate has been the appreciable reduction of infant mortality (mortality of children in the first year of life), since when a child dies the mother will try to replace her loss by having another child.

7. Natality, like female fertility (the number of live births per 1,000 women of 15 to 49 years of age), is only one element, though the most important, in "potential" fertility as a whole. Interruptions of pregnancy (early foetal mortality, or abortion, and late foetal mortality, or miscarriage) and the prevention of conception are additional elements. Taken in conjunction, and excluding the insignificant proportion of spontaneous abortions and miscarriages, these in fact represent the end result of a conscious effort on the part of parents to regulate the size of their families by limiting natality ("birth control").

8. If we add female and male sterilization to abortion and contraception, we shall have exhausted all the methods by which the birth-rate can be reduced.

9. State demographic policy varies from country to country, and is determined by economic and political conditions—themselves the product of historical evolution—at the given point of time. The extreme differences in regard to birth-control policy which we have been able to observe in our time may be illustrated by

the examples of recent practice in France and Japan.

10. France has for a number of years been taking vigorous State action to encourage a rise in natality (family allowances on childbirth, maternity homes) and has prohibited abortion and contraceptive devices. Thanks to these measures, and perhaps also to other causes, the birth-rate in France is now higher than before the war (1939—14.8 per 1,000; 1962—17.7 per 1,000; 1963—18.2 per 1,000).

11. In Japan a variety of birth-control measures have been legalized in recent years (there is widespread resort to artificial abortion and contraceptive methods, even including the sterilization of the parents after the birth of a given number of children). The Japanese birth-rate has declined by more than 40 per cent as compared with 1940; in 1963 the birth-rate was 17.3 per 1,000 as against 29.4 per 1,000 in 1940.

12. However, it would be wrong to believe that the birth-rate in Japan has fallen solely as a result of the above-mentioned measures to reduce it artificially. On the contrary, these measures have been merely the accompaniment of such basic factors as the growth of the urban population caused by the development of industry, the rise in the cultural level of the Japanese people, the influx of women into social production and the expansion of women's participation in the national cultural life. The age at marriage of Japanese girls has risen substantially, as it did earlier in European countries. Available data show that the proportion of married women among females under twenty years of age has declined from 18 per cent in 1920 to 1.8 per cent in 1955.

13. Occasionally, opinions on birth control may differ among social and political groups in the same country. In France, for example, efforts have been going on in Parliament for some years to put through a law authorizing abortion and contraception.

14. In the developing countries of Africa, Asia and Latin America, where the birth-rate is extremely high (about 40 or more per 1,000 population in some countries) and the population is growing fast despite severe shortages of material goods, the present-day Malthusians are recommending as a universal panacea the use of artificial methods to reduce natality. In other words, they are trying to make "birth control" the cornerstone of State policy in the developing countries. But any attempt to attribute the economic difficulties of the developing countries, their unemployment and the poverty of their working masses to biological

factors (a high birth-rate) is scientifically unjustified.

15. The experience of more than a half a century both in the economically advanced capitalist countries of Western Europe and America and in the socialist countries of Eastern Europe, including the USSR, has demonstrated beyond all doubt that vigorous economic development, the establishment of new urban settlements and the rapid growth of existing cities—with a resultant growth of the urban population—rising cultural levels among both the urban and the rural population and a constantly increasing influx of women into social production are followed by conscious efforts on the part of parents themselves to regulate the size of their families, in other words result in a decline of the birth-rate. The process of declining birth-rates began in the Western European countries and the United States at the end of the 19th and the beginning of the 20th centuries, and in the Eastern European and Asian countries in the middle of the 20th century.

16. One of the most important causes of the decline in the birth-rate in the economically advanced countries has been the change in the social status of women reflected in the entry of women into productive labour. This factor was noted as early as the last century by two students as different in their philosophical and political outlook as the well-known English political economist John Stuart Mill (1806-1873) and his contemporary, the not less well-known Russian writer and critic, N. G. Chernyshevsky (1828-1889).

17. In economically backward pre-revolutionary Russia, which had one of the highest birth-rates in the world, 83.4 per cent of women aged nine to forty-nine were illiterate (1897 census data). Eighty per cent of all gainfully employed women were domestic servants or farm hands, 13 per cent worked in industry or on auxiliary construction jobs, while only 4 per cent worked in education and public health (only one out of ten doctors was a woman).

18. In the period of little more than half a century which has passed since that time, the position of women in the Soviet Union has undergone a radical transformation. The Constitution of the Soviet Union has given Soviet women equal rights with men in all fields of life (economic affairs, government administration, cultural and political and social life). The census figures for 1959 show that on that date there were 47.6 million women at work in social production, a figure accounting for

48 per cent of the total employed population. The proportion of women in the labour force employed in industry, construction, transport and communications was 39 per cent; in trade, mass catering, procurement, supplies and marketing, 61 per cent; and in education, science and public health, as much as 71 per cent. In 1959, women accounted for 39 per cent of the total number of engineers and technicians (including agronomists and zoo-technicians), or 32 per cent of the total number of engineers alone. On 1 December 1961, women accounted for 59 per cent of all specialists with higher and secondary specialized education employed in the national economy, 70 per cent of all teachers and school principals and 74 per cent of all doctors.

19. In 1961, more than 37 per cent of the total force of scientific workers were women; about 31,000 women scientific workers held the degrees of doctor or candidate of science—a figure representing more than 27 per cent of the total number of persons holding academic degrees. Nearly 800 women are academicians, full members and corresponding members of the various branch academies, or professors; about 13,000 women hold the academic rank of university lecturer or senior scientific officer.

20. The economic development of the Soviet Union advanced rapidly, at a rate many times greater than that of population growth; between 1913 and 1963 the population of the Soviet Union (within its present boundaries) rose by 42 per cent, while industrial output increased during the same period by a factor of fifty-two. The Soviet Union has now become a country of virtually total literacy. At the beginning of 1964, 32 per cent of the population had received higher and secondary education. Of the working population, 50 per cent (44 per cent of all manual workers, 26 per cent of all collective farm workers and 92 per cent of all specialists and professional and office workers) had received higher and secondary education. The total number of intellectual workers in the Soviet Union was a little more than 2.5 million in 1926, 20.5 million in 1959 and 24.1 million by the beginning of 1964.

21. National income in 1963 was more than twenty-seven times greater than in 1913, or more than nineteen times greater on a per capita basis.

22. In 1963, 86 per cent of the total economically active population (excluding members of the armed forces) were at work in the national economy of the Soviet Union. By way of comparison, it may be pointed out that in the United States only 71 per cent of the total

economically active population are employed in the national economy. In the Soviet Union there has been no unemployment either in urban or rural areas for about thirty-five years.

23. The vigorous economic development of the Soviet Union has brought with it a constant and rapid rise of the urban population. In 1913 and 1926, the urban population accounted for only 18 per cent of the total population; by 1939 this figure had risen to 32 per cent, and the figures for 1959 and 1963 were 48 per cent and 52 per cent respectively.

24. As a result of these various social and economic changes, the birth-rate in the Soviet Union has declined by more than half over the last half century:

<i>Year</i>	<i>Number of births per 1,000 population</i>
1913 (within the boundaries of the Soviet Union before 17 September 1939)	47.0
1913 (within the present boundaries of the Soviet Union)	45.5
1927	44.8
1937	38.7
1940	31.2
1950	26.7
1960	24.9
1963	21.2

25. In 1959-1961 the proportion of mothers bearing a first, second or third child was higher than in 1950 and the proportion of mothers bearing a sixth or later child smaller.

26. In the economically advanced socialist countries of Eastern Europe, the proportion of women in the total labour force employed in the national economy exceeds 40 per cent, approaching the Soviet Union figure in some cases. The figure for the German Democratic Republic, for example, is 46 per cent (1963), and for Czechoslovakia 44 per cent. In the German Democratic Republic, at the same time, the birth-rate has risen somewhat over the last few years (1958—15.6 per 1,000; 1960—17.0 per 1,000; 1963—17.6 per 1,000).

27. In the United States, the United Kingdom, the Federal Republic of Germany, Denmark and some other economically advanced capitalist countries, the proportion of women in the total labour force is considerably lower than in the Soviet Union (under 33.3 per cent), and in Japan, France and Norway it is smaller still. At the same time, the birth-rate in all these countries, except for the United States, was appreciably lower in 1961 than in the Soviet Union (United Kingdom—17.9 per 1,000; Federal Republic of Germany—18.3 per 1,000; Denmark—16.6 per 1,000; Norway—17.3 per

1,000). Clearly the substantial unemployment existing in the capitalist countries and the consequent lack of a sense of security among the workers inevitably—together with other causes—tend to reduce the birth-rate.

28. Side by side with a constant decline in the birth-rate, the USSR is experiencing a substantial decline in the mortality rate. In 1913, Tsarist Russia had the highest mortality rate of any European State; in recent years the mortality rate in the Soviet Union has been lower (1959-1963—7.3 per thousand) than in any European State. As a consequence the decline in the natural increase of the population over the last fifty years has been insignificant (1913—16.4 per 1,000; 1963—14.0 per 1,000). Thanks to the sharp drop in infant mortality which has taken place over the same period (1913—269 per 1,000 births; 1963—30.9) the average expectation of life in the Soviet Union has more than doubled over this period (1896-1897—32; 1960-1961—70).

29. Special fertility studies have shown that there is an inverse correlation between the employment of women in social production and the level of natality. The fertility of non-working women in all age groups of workers and professional or office workers is higher than among working women.

30. In the Soviet Union, data throwing light on this point were assembled for the first time by Academician S. G. Strumilin on the basis of a sample survey carried out in 1934 (covering the period 1929-1933). They show that the fertility rate (number of live births per 1,000 women of ages 16-45) of employed women was 87.7 per 1,000 and of non-working women 169.1 per 1,000, or almost double (93 per cent higher). Special fertility studies carried out in the Soviet Union in recent years have confirmed the conclusions arrived at by Strumilin thirty years ago.

31. Studies of other countries published in recent years also show that work in social production reduces female fertility. In Hungary (1959) fertility was 86 per cent higher among dependent women in urban areas than among employed women. In Czechoslovakia (Central Statistical Board, 1961) employed women in all age groups have a smaller average number of children than housewives. Special studies show that women confronted with the dilemma of going into employment or having large families choose the first alternative and accordingly take steps to limit their confinements.

32. The Soviet Union possesses a comprehensive and well co-ordinated system of State protection for working women, and large num-

bers of preventive, curative and educational maternal and child welfare institutions (women's and children's clinics, maternity homes, creches and kindergartens) which care for mothers and children before, during and after confinement. In 1963 about 10 million children in the Soviet Union were attending kindergartens, creches and children's playgrounds. In addition, State allowances are granted in the Soviet Union to pregnant women, mothers of large families and single mothers. In 1963 more than 6 million mothers of large families and single mothers were receiving State benefits.

33. Despite this, female fertility in the Soviet Union is at present lower than before the war, the decline being greater among urban than rural women. The proportion of women married and the nuptiality rate is higher among women in rural areas than among urban residents, but on the other hand rural women marry at an earlier age. Thus, a sample study made in 1960 in connexion with a comprehensive investigation of the birth-rate showed that in age group 17-19 the proportion of women married was three times as high among collective farm workers than among urban women (18 per cent as compared with 6 per cent). A similar divergency was observed in age group 20-24, but was not so sharp: the proportion of women married was 53 per cent among collective farm workers, 35 per cent among factory workers and 24 per cent among office and professional workers.

34. A breakdown of birth-rates in 1958-1959 by various social groups of women shows that in collective farm families female fertility in age group 15-49 was 18 per cent higher than in the families of factory, office and professional workers. Among working women (factory, office and professional workers) living in rural areas, fertility was 29 per cent higher than among urban women.

35. No State action has ever hitherto been taken in the Soviet Union to reduce the birth-rate artificially, and no such action is being taken at present. In the Soviet Union, the use of contraceptives and the artificial termination of pregnancy (abortion) are authorized by law. Women enjoy the right to decide questions of motherhood for themselves. A special study of the problem of abortion carried out in the Soviet Union has shown that with the further growth of the national economy, the rise of cultural levels and the provision of pre-school children's institutions in adequate numbers, the women of the Soviet Union will resort far less frequently to the artificial termination of pregnancy (abortion). As a result, the birth-rate in the USSR may rise somewhat in the future.

36. In many countries, abortion is at present a widely used birth-control measure. Many studies carried out on the problem both in the Soviet Union and abroad have shown that the artificial termination of pregnancy, even when carried out in proper medical conditions, is not without effect on women's health and may be followed by various immediate or later adverse effects, up to and including secondary sterility. The reason for this is that pregnancy is not a function of the female reproductive organs alone, so that any sudden violent termination of pregnancy upsets the natural harmony of the maternal organism as a whole. Abortion is particularly harmful to the health of a primipara; but later abortions are undesirable also, particularly when carried out at short intervals (less than six months). Illegal abortions, which are usually carried out in unsuitable conditions, not infrequently result in serious complications and sometimes even death.

37. Because of these facts, the problem of abortion has been a subject of constant interest to medical circles and public health authorities in many countries. In the last decade, special conferences on abortion have been held in New York (1955) on the initiative of the Planned Parenthood Federation of America, and in Rostock (German Democratic Republic 1960) on the initiative of the Medical Society of Hygiene and the Ministry of Public Health of the German Democratic Republic. These con-

ferences were attended by participants from many countries—not only doctors but also specialists in other related branches of science and practice. While there were many dissenters, most of the participants were convinced that the artificial termination of pregnancy should give way as a method of family planning to the more civilized method of contraception, which has no ill-effects on women's health.

38. In the Soviet Union, the problem of artificial termination of pregnancy is discussed at many regional and republic meetings, conferences and symposia of obstetricians and gynecologists. They are all agreed that abortion has harmful effects on women's health and should therefore be replaced by contraceptive methods.

39. Unfortunately, no fully acceptable and adequately tested contraceptive device has yet been found to meet all the necessary requirements: safety as regards the health of men, women and their offspring, accessibility, the absence of untoward effects on the physiology of sexual intercourse, and, of course, adequate effectiveness. In any event, the discovery of such a contraceptive device would not in itself be enough. To ensure its use, especially in the developing countries, a continued rise in the general cultural level of the population would be needed, and that can be achieved through economic and social development.

SUMMARIES OF PAPERS

Study of women's fertility considering number of the previously born children

L. E. DARSKY-TOLCHINSKY

The main shortcoming of the existing methods of measuring fertility lies in the impossibility of constructing an orderly system of indices for a hypothetical generation, similar to a life table. Such a system provides opportunities of analysis but it can be constructed only where an event whose frequency or probability is measured by the basic ratio can occur only once in a lifetime. Besides, fertility of an age is determined largely by the number of living children, and consequently it depends on the past fertility of the women, thus complicating the analysis.

These difficulties can be overcome if one takes as the base of measuring fertility function $f_x^{(x+1)}$, that is, a probability to give birth to $(n+1)$ th child for a woman in the age interval of $(x; x+1)$ after having "n" children by the "x" age. "N"th child can be born only once in a lifetime and only by those x-years-old women who have by this age given birth to $(n-1)$ children. The function $f_x^{(x+1)}$ enables us to follow the life of the hypothetical generation, where the initial population of childless women W_{15}^0 will move gradually as they become older into the population of women who have had one child. $W_{x+1}^1 = W_x^0 (1 - f_x^0)$ and $N_x^1 = W_x^0 \cdot f_x^0$ where N_x^1 represents a number of women who have given birth to their first child at "x" age. The number of women who had their first child by the "x" age will be $Q_x^1 = \sum_{15}^{x-1} N_x^1$, while the number of women who have a chance to have the second child at this age is $W_x^1 = Q_x^1 - Q_x^0$; the number of those who had their second child at the age "x" is $N_x^2 = W_x^1 \cdot f_x^1$ and so forth.

The construction of such a fertility table is possible on the data of census and current registration. The calculations for Yugoslavia for the year of 1953 are given as an example. As a result we get a fertility table which shows the distribution of the women of a hypothetical generation according to the age and number of children born, while the children are distributed according to the age of mothers and to the parity. The proposed method enables us to

take into account mortality and get the indices of reproduction; it can be included in the model of stable population and can be combined with the marriage table.

Economic development and fertility

DAVID M. HEER

Two schools of theorists have been concerned with the effect of economic development on fertility. One school has contended that economic development has an inhibiting effect on fertility. The demographic transition which has occurred among the now developed countries confirms their viewpoint. Another school of thought, including in its members Thomas Malthus, has believed that economic development promoted fertility. Much empirical evidence may also be brought to bear to support this viewpoint.

The present paper attempts to reconcile these viewpoints. We hypothesize that the direct effect of economic development is to increase fertility. However, various factors which usually accompany the process of economic development serve to reduce fertility. These include an increase in the flow of communications concerning birth control and a reduction in infant and childhood mortality. Making use of data for 43 nations pertaining to the decade of the 1950's, we confirm that fertility is directly associated with per-capita net national product when controls for per-capita newspaper circulation and for infant mortality are instituted. On the other hand, controlling for net national product per capita and infant mortality, per-capita newspaper circulation is inversely related to fertility, and, with controls for per-capita net national product and newspaper circulation, fertility is directly associated with infant mortality.

Furthermore, the results presented have several important policy implications. First, they show the folly of attempting to rely on uncontrolled economic development to reduce fertility. The implication would be to include large expenditures on education so that flow of communications shall increase in the process of social development. Secondly, our findings indicate that programmes to reduce fertility have their greatest effect where they are in fact

most needed. Given, two nations with equal communication flow and equal child mortality levels, the poorer of the two nations is most likely to reduce its fertility. Thirdly, the results indicate the continued importance of public health programmes, which, by reducing infant and childhood mortality, motivate parents to have fewer children.

The influence of disproportions in the sexes on the married state of population and natality in the Ukrainian Soviet Socialist Republic

V. P. PISKUNOV

This paper discusses the influence of disproportions in the sexes on the married state of population and natality in the Ukrainian SSR. To determine the extent to which the natural ratios of men to women are violated under the influence of non-demographic factors the actual correlation of men to women is compared with the ideal. The ideal ratio is deduced by comparing the numbers of living males and females in a stationary population (L_x), adjusted to the ratio of boys to girls among the live births. An analysis shows that by 1958-1959 the ratio of men to women had improved compared with the previous periods and is now favourable for the marrying of women in all reproductive ages. This improvement is the direct result of a decrease in infant mortality. It is then concluded that if the ratio of men to women in reproductive ages evolved only under the influence of modern demographic factors, i.e., the ratio of boys to girls among the live births and the differences in the death rate of men and women, all women in the fifteen to forty-nine years age group would now have the (objective) opportunity to find a spouse. Moreover, unlike the situation that existed thirty or forty years ago the discontinuance of marriage owing to the death of the husband is more likely than owing to the death of the wife. The report also cites data showing that the ratio of men to women and the share of unmarried women are closely connected. The values of correlation coefficients between them derived from data on twenty-five regions of the Ukrainian SSR demonstrate that in the older reproductive ages (forty to forty-nine) the connexion between the ratio of men to women and the share of unmarried women is almost functional. By extrapolating the above ratios the author makes an attempt to determine the relative number of married women in the future population of the republic and suggests that projections of the future number of births should be calculated

with allowance for changes in the married state of the female population. In conclusion the author points out that if the tendency to decrease the number of children in a family does not manifest itself with greater force, the total annual number of future births, calculated with allowance for the normalization of the ratio of men to women and the change of the married state of female population, will be two or three per cent greater in the sixties and four to five per cent greater in the seventies than in calculations that do not take into account the changes in the married state of population.

On one method of interpolation and on new parameter of birth intensity

EMANOUIL SIMEONOFF

In this paper, problems of theoretical technical calculation of frequency changes of a random variable ξ , caused by a given continuous parameter τ are demonstrated by the interpolation of birth rates of the population of Bulgaria.

Let us suppose that the function of the birth frequency $\phi = \phi(\tau, v, \nu)$ depends on τ and the two parameters v and ν . This continuous function has derivatives with respect to τ in the age interval (a, b) , at which women give birth to children. The function of the birth frequency has to satisfy the following relationship:

$$\sum_j x_{\tau_{ij}} \phi_i(\tau_{ij} + \theta_j \Delta' \tau, v, \nu) \Delta' \tau = T_{\tau_i}$$

This relationship connects the function ϕ and obtained data by observation. A definition of the velocity $v(\tau, v, \nu)$ of the development of the birth rate with respect to τ is as follows:

$$v(\tau, v, \nu) = \frac{d\phi(\tau, v, \nu)}{d\tau} = \phi'(\tau, v, \nu)$$

Then the expression $T = \frac{1}{2} \int_a^b [\phi'(\tau, v, \nu)]^2 d\tau$ gives the "kinetic energy" of the process of development of birth rate. The method is based on the idea that T has to be minimum, i.e., $\delta T = 0$ is equivalent to $\delta T / \delta v = 0$ and $\delta T / \delta \nu = 0$. Now the value of parameter T as being characteristic of the birth intensity of population can be expressed as follows:

$$\bar{T} = \sum_{ij} \phi_i(\tau_{ij} + \theta_j \Delta' \tau, v, \nu) [\Delta \phi_i(\tau_{ij})]^2 \Delta' \tau$$

A study of the birth rates and the value of $\bar{T}$ for the three observed years, 1946, 1952 and 1957 shows that birth intensity has been decreasing through the years.

Age-specific fertility rates in Poland

EGON VIELROSE

The paper deals with the level and changes of age-specific fertility rates in 1950-1960. The rates show a declining trend of fertility in general, and a tendency to shorten the child-bearing period, together with a relative rise of fertility in the youngest age group.

By making comparisons with the maximum

fertility rates ever observed, we draw conclusions as to the extent of family planning in different age groups. Family planning proves to be more effective in older age groups. In the youngest, it is virtually non-existent.

There is also a marked fertility rate equalizing tendency among urban and rural areas in different districts of the country, which if allowed to persist in the future will eventually produce definite urban-rural patterns all over the country.

Meeting B.1

FACTORS AND PATTERNS OF FERTILITY IN AREAS WHERE FERTILITY IS RELATIVELY HIGH

PAPERS

Evaluation of progress in fertility control in Singapore

CHING SAN CHUNG, M.D.

I. POPULATION

1. The population of Singapore is expanding rapidly. The average increase in the intercensal years 1947-1957 was 4.3 per cent. Of this, 3.6 per cent was due to natural increase and 0.7 per cent to immigration. Many reasons have been suggested to explain this dramatic increase. Perhaps the most important one is the spectacular post-war decline in the death-rate, from 13.3 in 1947 to 5.9 in 1963. The birth-rate during the same period was consistently

around 45 per thousand until 1956, when it began to decline progressively to 34 in 1963 (figure 1). The other factor that may be of importance is the sex ratio of the population—the number of males per 100 females. For four decades, 1871-1901, the sex ratio stood at around 300. During the next two decades, 1911-1931, it was around 200. From 1947 up to the present, the sex ratio gradually slipped down to a comparatively equal level. In 1962 the estimated sex ratio was 109.

Table 1. Population of Singapore by sex and sex ratio at census years and estimate at mid-year 1962

Year		Males	Females	Total	Sex Ratio ^a
1871	census	74,348	22,763	99,111	327
1881	census	104,064	33,691	137,755	309
1891	census	138,462	43,150	181,612	321
1901	census	169,993	57,599	227,592	295
1911	census	215,489	87,832	303,321	245
1921	census	280,918	137,440	418,358	204
1931	census	352,167	205,578	557,745	171
1947	census	514,963	423,181	938,144	122
1957	census	762,760	683,169	1,445,929	112
1962	estimated	903,300	829,500	1,732,800	109

^a Number of males per 100 females.

2. It may be noted from the table that the highest gain in the female population occurred between 1921 and 1947—from 137,440 to 423,181—an increase of 300 per cent. This increase was mainly due to unrestricted entry of female immigrants. The increase in the male population during the same period was less than 200 per cent; consequently the sex ratio levelled off during this period from 204 to 122.

The post-war increase of about 260,000 in the female population between 1947 and 1957 will be reaching the reproductive age in this and the next decade, and planners of social and public services will have to take this into account.

II. AGE DISTRIBUTION

3. Figure 2 shows age pyramids for the total population in the census years 1931, 1947,

and 1957. These indicate the youth of the current population of Singapore and the balance of the numbers of both sexes at all age groups in 1957 as compared with 1947 and 1931. The 1957 population age pyramid shows that 42.8 per cent of the total population is under 15 years of age and only 4 to 5 per cent in the age groups of 60 years and over. Singapore will thus be faced, for a long time to come, with problems associated with dependency,

education, health, employment, and housing in a young population.

III. FERTILITY RATES

4. The census authorities have estimated population projections for quinquennial periods from 1962 up to 1982 according to various degrees of fertility. The following table shows these Singapore Population Projections for 1962-1982:

Table 2. Singapore population projections 1962-1982 (in thousands)

<i>Year</i>	<i>Existing fertility^a</i>	<i>Moderate fertility decline^b</i>	<i>Rapid fertility decline^c</i>
1962	1,713.7	1,713.7	1,713.7
1967	2,017.2	2,008.2	1,999.3
1972	2,383.5	2,342.4	2,301.3
1977	2,840.5	2,733.4	2,626.5
1982	3,406.7	3,186.5	2,966.4

^a Fertility as in 1957, with no mortality decline.

^b Fertility constant until 1962, declining continuously thereafter by amount equal to 1 per cent of pre-1962 rate; mortality rate unchanged.

^c Fertility constant until 1962, declining continuously thereafter by annual amount equal to 2 per cent of the pre-1962 rate; mortality rate unchanged.

With the spread of family planning knowledge and the rise in living standards, it is expected that there would be some decline in fertility. On the basis of the two alternative assumptions, moderate or rapid fertility decline, the total population in 1982 will be 3.2 or 3.0 million, respectively. Population growth will not be significantly affected unless the fertility decline becomes still more rapid than the projected rate of 2 per cent of the pre-1962 rate after 1962, with unchanged mortality rate.

5. The ethnic distribution of the population

of Singapore in 1962 showed that the Chinese formed the largest ethnic group, comprising 75 per cent of the total population, the Malaysians 14 per cent, and the Indians and Pakistanis 8 per cent. As can be seen from table 3 (You, 1962), since 1957 the gross reproduction rate for the total population and among the Chinese has progressively declined. This decline, however, is not so pronounced among the Indians and Pakistanis, while among the Malaysians the gross reproduction rates have been progressively increasing.

Table 3. Gross reproduction rates in Singapore, 1957-1961

<i>Year</i>	<i>Chinese</i>	<i>Malaysians</i>	<i>Indians, Pakistanis</i>	<i>Total</i>
1957	3.17	3.03	3.58	3.14
1958	3.09	3.21	3.65	3.10
1959	2.97	3.30	3.56	3.01
1960	2.85	3.27	3.52	2.90
1961	2.64	3.29	3.24	2.73

6. Many reasons have been put forward to account for the decrease in gross reproduction rates during the past few years among the Chinese and the total population and the lack of decline among the Malaysians. It is not within the scope of this paper to assess these

reasons, but it may be worth-while to review the work of the Singapore Family Planning Association during this period and to suggest some link in this decline of gross reproduction rates.

IV. SINGAPORE FAMILY PLANNING ASSOCIATION

7. The Singapore Family Planning Association was established in 1949 as a voluntary organization by a group of well-meaning workers. Since its inception when work began in a private physician's own clinic located in a densely populated section of the city, the Association has expanded its activities to 31 clinics in both urban and rural areas, housed

mostly in Government maternity and child welfare clinics.

V. ATTENDANCE

8. Table 4 shows the yearly attendance at all these clinics, 1952-1963. From 600 patients in 1949, it has increased to 8,429 new patients in 1963, and from a total of 3,841 clinic visits in the year 1952 to 60,194 in 1963—a fifteen-fold increase, amounting to an average of 5,000 per month.

Table 4. Annual clinic attendance, 1952-1963, Singapore Family Planning Association

<i>Year</i>	<i>New patients</i>	<i>Revisits</i>	<i>Total</i>
1952	1,787	2,054	3,841
1953	2,302	3,246	5,548
1954	2,966	6,257	9,223
1955	2,850	7,222	10,072
1956	3,772	10,621	14,393
1957	3,820	14,623	18,443
1958	5,280	22,242	27,522
1959	5,938	28,507	34,445
1960	7,472	30,285	37,757
1961	8,070	35,654	43,724
1962	7,189	41,727	48,916
1963	8,429	51,765	60,194

9. The average age at marriage of Singapore women in 1960 was 23, but in 1962 it was 22, indicating a trend to marriage at a younger age. The average age of patients on admission to the Family Planning Association clinics is estimated at 27, which indicates that most of them are within the reproductive age bracket 15 to 44 years of age. The population projection (table 5) made by the Department of Statistics for 1962 was based on the 1957 census and the assumption that the population was increasing at the 1957 rate; if we extend this projection, the maximum number of women in the reproductive age bracket in 1963 would be 325,000.

Then, if we assume that all of the 64,226 patients admitted to the Family Planning Association clinics since 1949 (table 6) were still within the reproductive age bracket in 1963,

the claim may be made that as many as 20 per cent of the possibly fertile women of Singapore attended the clinics where birth-control methods were prescribed.

Table 5. Singapore female population (all races), projection for 1962

<i>Age group</i>	<i>Number (in thousands)</i>
15-19	64.9
20-24	65.5
25-29	58.0
30-34	52.0
35-39	39.1
40-44	35.2
TOTAL	314.7

Table 6. 1963 attendance at Singapore F.P.A. clinics
by year of registration (1949-1963)

<i>New patients registered</i>		
<i>Year</i>	<i>Number</i>	<i>Number attending</i>
1949	600	1
1950	1,871	41
1951	1,880	88
1952	1,787	138
1953	2,302	190
1954	2,966	306
1955	2,850	412
1956	3,772	654
1957	3,820	752
1958	5,280	1,215
1959	5,938	1,612
1960	7,472	2,270
1961	8,070	3,264
1962	7,189	4,063
1963	8,429	8,429
TOTAL	64,226	23,435

Or supposing the reproductive years were to be limited to the 20-39 age bracket, the percentage of fertile women helped by the Family Planning Association would be 36 per cent of a maximum of 230,000. In other words, we may say that 20-36 per cent of the total possible fertile female population of Singapore attended the Family Planning Association clinics through 1963.

10. We may also consider the actual number of patients admitted to Family Planning Association clinics each year from 1949 through 1963. Table 6 shows that while 8,429 new patients were admitted in 1963, so many of the patients admitted in previous years returned in 1963 that the total number of patients seen was 23,435, which is 7 per cent of the estimated fertile female population in the 15-44 age

bracket. Or if the reproductive age bracket is limited to ages 20-39, the percentage would be 10 per cent. In other words, 7-10 per cent of the estimated fertile female population is currently attending the Family Planning Association clinics, indeed a feat for a voluntary health organization. These figures do not include individuals who have been informed indirectly by the Family Planning Association through its health education programme and who obtain contraceptive supplies from other sources.

VI. RELIGIOUS AND ETHNIC DISTRIBUTION

11. All the important ethnic groups are represented among the F.P.A. patients; table 7 shows new admissions in 1961, 1962, and 1963 by ethnic group.

Table 7. Ethnic distribution of new patients, 1961-1963,
Singapore Family Planning Association

	1961	1962	1963
Chinese	6,467 (80.1%)	5,807 (80.8%)	6,503 (77.1%)
Malaysians	746 (9.2%)	551 (7.7%)	887 (10.5%)
Indians and Pakistanis .	457 (5.7%)	326 (4.5%)	376 (4.5%)
Others	400 (5.0%)	505 (7.0%)	663 (7.9%)
TOTAL	8,070 (100.0%)	7,189 (100.0%)	8,429 (100.0%)

It is of particular interest to observe the increase in attendance by members of the Malay community, who hitherto have rather shunned our clinics. At each of the Association's clinics located within easy access of a Malay residen-

tial area there has been a noticeable and encouraging increase in the number of mothers availing themselves of the services. As mentioned previously, the gross reproduction rate of this ethnic group maintained a higher level

than those of other ethnic groups; and it is hoped that with better education and publicity specifically oriented to this group the gross reproduction rate for the entire population will decline further.

12. It is also interesting to note that religious affiliation does not appear to affect attendance at the family planning clinics in Singapore. Buddhists, Hindus, Muslims are all represented. In a study made in one of the clinics, it is interesting to note that the number of Catholic patients is around 5 per cent of the total patients admitted in 1962.

VII. COSTS AND FINANCES

13. Total expenditures for 1963 amounted to Malaysia dollars 132,000 (U.S. \$44,000) out of this total, M \$107,000 (U.S. \$35,000) was spent on personal emoluments. The bulk of income in 1963 came from a Government grant amounting to M \$100,000 (U.S. \$33,000). Approximately one third of all patients were assisted by the Association to the extent of free service and reduced charges for supplies, while 11 per cent were given both supplies and service free. The average cost to the F.P.A. per patient visit is thus about M \$2.20 (U.S. 70¢), and the average amount spent for each new patient is M \$6 (U.S. \$2). Clinic fees charged to patients able to pay are on a sliding scale, the maximum being less than cost M \$5 (U.S. \$1.60) per year, exclusive of supplies. Con-

sidering that the Government finds it necessary to spend as much as approximately M \$30 (U.S. \$10) annually per inhabitant on medical and health care—exclusive of the amount granted to the F.P.A.—it is plain that the Government grant to the Singapore F.P.A. is a good investment in preventive care.

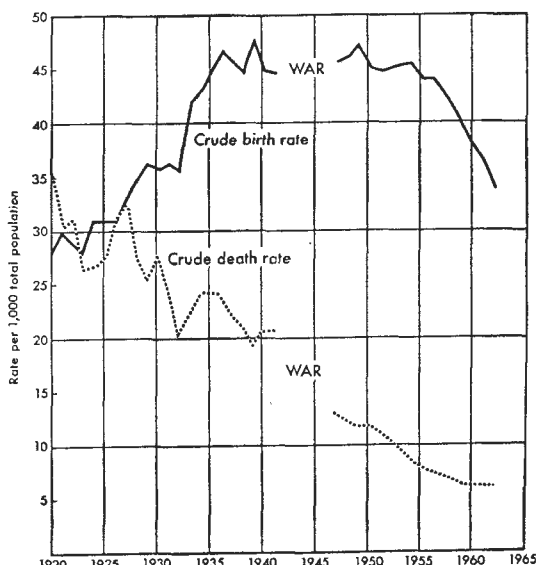


Figure 1

Trend of crude birth and death rates in Singapore: 1920 onwards

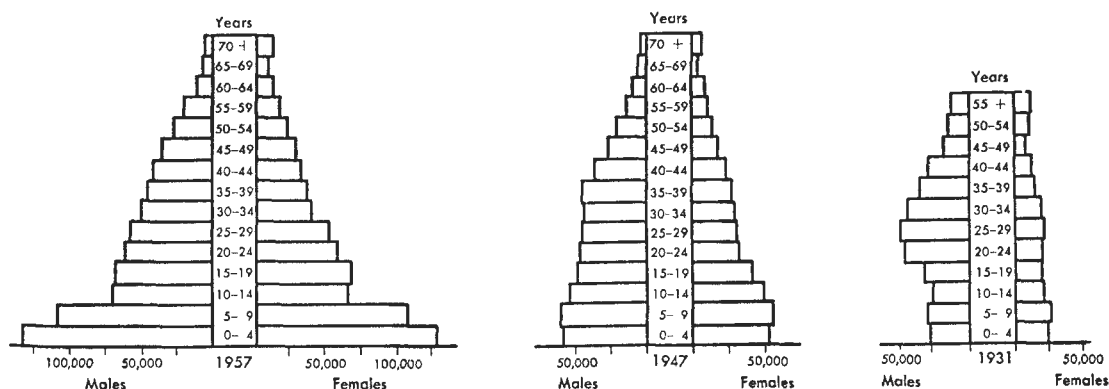


Figure 2

Age pyramids (Singapore): total population: 1931, 1947 and 1957

The effect of current social and economic changes in the developing countries on differential fertility

MERCEDES B. CONCEPCIÓN

1. A great many of the countries in Asia, Africa, and Latin America have development plans of some kind. These plans generally recognize the importance of both social and economic factors in the developmental process. However, the pressure of population on resources and the high rate of population growth caused by mortality declines have tended to offset improvements in the levels of living. Reductions in the rate of population growth are unlikely unless substantial changes in the social and economic structure have been attained. Such changes can be effected gradually when one group within the society responds and is the first to shift to a modern demographic pattern. By transmission, the pattern is spread to other groups within the country thus changing the context within which the responses are altered to further modify demographic trends.

2. If this be so, the question arises as to the effect of current social and economic changes on the fertility of groups within developing nations. Have such concomitant factors of economic and social development as urbanization, improvements in health, education, and economic status actually modified levels of fertility within the country? If so, to what extent have they been modified? This paper will examine data on differential fertility from selected countries in an attempt to provide the answers to these questions. The techniques of measurement applied to differential fertility studies vary from one country to the next. In analysing the evidence the nature of the techniques should be kept in mind.

3. Freedman and his associates,¹ in studying fertility trends in Taiwan, have remarked on the high levels of literacy, education, urbanization, non-agricultural employment, use of mass media and communication via the mails attained in the country by 1961. In this setting, marked rural-urban differences in crude birth-

rate, general fertility rate and total fertility rate were found although earlier findings by Barclay showed only slight differences between town and country fertility for the pre-war period.² Present fertility is lower in those areas where development is most advanced and the excess of fertility rates in the countryside as compared with the cities is particularly striking in the age groups between 30 and 44.

4. Available studies of Philippine fertility demonstrate that the better educated city resident high on the socio-economic scale produces less children on the average than the lesser educated villager of low status.³ Even with age and education controlled, the rural-urban differences persisted leading to the suspicion that such differentials probably existed during the past fifty years. Possible explanatory factors for the significantly lower fertility of city women include age at marriage, length of city residence, migration by age, and the incidence of crippling diseases.

5. According to Davis,⁴ an inverse relationship between city size and fertility level was apparent in the child-woman ratios calculated from the 1931 census of India. Using the same measure, he reported that the differences between city and country were small and had remained about the same over the period 1891-1941. Further analysis of Indian fertility was undertaken by Robinson, employing the same basic measurement of fertility. Two major conclusions were reached: "first, the large rural-urban fertility ratio differentials disclosed by earlier investigations have been diminishing over the last several decades; and second, only modest rural-urban fertility ratio differentials exist using the most recent age distributions, particularly in terms of the marital fertility

² G. W. Barclay, *Colonial development and population in Taiwan* (Princeton, Princeton University Press, 1954), pp. 77-81.

³ M. B. Concepción, *Fertility differences among married women in the Philippines* (unpublished Ph. D. dissertation, University of Chicago, 1963).

⁴ K. Davis, *The population of India and Pakistan* (Princeton, Princeton University Press, 1951), pp. 70-73.

¹ R. Freedman, J. Y. Peng, Y. Takeshita and T. H. Sun, "Fertility trends in Taiwan: tradition and change," *Population Studies*, vol. XVI, No. 3 (March, 1963), pp. 219, 225.

ratio".⁵ Robinson points to the striking relationships between infant mortality and fertility ratios as a possible cause of the change in Indian rural-urban fertility ratios. Another reason cited is that "heavy inflows of migrants in recent years have changed the basic character of the Indian cities, destroying some tendencies which may have existed towards fertility lower than that of rural areas, thus reinforcing the movement towards convergence of rural-urban ratios".⁶

6. The Indian National Sample Survey reported the results of a question on fertility asked during the second and fourth rounds of the survey in 1951 and 1952.⁷ The number of children born to couples of various durations of marriage up to 22 years showed slight differentials according to rural-urban classifications. For marriage durations exceeding 22 years, the difference was insignificant indicating that the tendency of urban fertility to exceed rural fertility occurred only within the last 20 years or so. Using the child-woman ratio as the measure of fertility, city fertility was seen to be lower than that of the three rural zones included in the Mysore study.⁸ However, using number of children ever born and living as the measures of fertility showed no important differences. Most of the evidence available from other studies of differential fertility in India show that urban fertility is no higher than rural fertility. It seems clear that the awaited fertility declines were yet to be seen in Indian cities in 1951. More recent data may reveal the effect of changes occurring in the social and economic structure in bringing about significant rural-urban differences.

7. In Pakistan, the fertility of cities is below that of the country and reproductive performance varies inversely with city size. A sample survey of Karachi metropolis in 1959 showed that service occupations had higher fertility than other occupational groups. Hashmi explained this difference as due to the fact that wives of personnel in this occupation are probably healthier and have access to better prenatal and maternity care.⁹ It thus seems that

improvements in health conditions are positively associated with the level of fertility.

8. Total fertility by place of residence was recorded for older and younger generation Lebanese women studied by Yaukey. He found the pattern of differences between town and city to be almost identical for the two generations and was led to suspect that "whatever rural-urban fertility differences exist are of rather long duration, probably antedating recent industrialization".¹⁰ Patterns of fertility differences associated with rural-urban residence and socio-economic status were different for Christians and Moslems. Apparently, "religious identification has qualified how rapidly any residential socio-economic type has been making the transition from high fertility to low fertility".¹¹

9. Egyptian data support Lebanese findings. Large rural-urban differences were found by Rizk¹² to have existed amongst Christians while Moslems were seemingly unaffected by urban influences. A later study of Egyptian fertility patterns revealed the following facts as reported by Rizk: "In urban areas there was a pronounced decline in fertility rate among wives of university educated husbands, a definite but lesser decline among wives of secondary educated husbands, and no difference in fertility between wives of the primary or elementary educated and illiterate husbands. . . . In the rural sample where education is limited to primary and elementary schooling, there was no difference in fertility rate among wives, whether classified by education, occupation or religion."¹³ Two causes, birth control and mean age at marriage, may have contributed to the differences in fertility in the urban area. Birth control was scarcely practised in the rural area. "It is apparent from the study," Rizk states, "that family limitation in Egypt has been fairly well established among the top educational class in the urban areas and has spread slightly among the secondary educated class but has been almost unknown or ineffective among the illiterate and lower educational groups".¹⁴

10. A 1956-1957 demographic inquiry in the Congo yielded a most interesting finding—

⁵ W. C. Robinson, "Urban-rural differences in Indian fertility". *Population Studies*, vol. XIV, No. 3 (January, 1961), p. 221.

⁶ *Ibid.*, p. 233.

⁷ A. Das Gupta, R. K. Som, M. Majumdar and S. N. Mitra, "Couple fertility," *National Sample Survey Report No. 7* (India, Department of Economic Affairs, Ministry of Finance, 1955).

⁸ United Nations, *The Mysore Population Study* (United Nations publication, Sales No.: 61.XIII.3), table 8.8, p. 83.

⁹ S. S. Hashmi, *The people of Karachi: Demographic characteristics* (Pakistan, Institute for the Development of Economics, 1964).

¹⁰ D. Yaukey, *Fertility differences in a modernizing country* (Princeton, Princeton University Press, 1961), p. 30.

¹¹ *Ibid.*, p. 79.

¹² H. Rizk, *Fertility patterns in selected areas in Egypt* (unpublished Ph.D. dissertation, Princeton University, 1959).

¹³ H. Rizk, "Population growth and its effect on economic and social goals in the United Arab Republic," in S. Mudd, et al., ed., *The population crisis and the use of world resources* (The Hague, Dr. W. Junk-publishers, 1964), pp. 171-172.

¹⁴ *Ibid.*

the urban population showed higher fertility than the rural population. Romaniuk called attention to the high proportion of young women in monogamous marriages and to the diminishing rate of childlessness among the same group of women in the urban centers.¹⁵ In addition, the urban dwellers are composed mainly of persons with rural backgrounds who preserve their traditional pro-natalist outlook. Favourable social and economic conditions in the city merely intensify this outlook resulting in an increased number of live births.

11. The fertility of the rural population in Puerto Rico has been considered higher than that of the urban population. The 1950 census data showed sharp and pronounced differences by education as well as by residence with the average completed family size ranging from 7 among rural women of no education to 1.7 among urban women with one or more years of college.¹⁶ Moreover, it was found that in most age groups about three fourths of the difference was accounted for by the transition from 4 to 7 years of school to 12 years of completed schooling. Furthermore, Jaffe found that residential differences disappeared after a decade of schooling.¹⁷ Better educated women of village origin resident in the city tended to adopt and conform to urban ways of life.

12. The effect of various factors on present fertility trends in Latin America has been examined in an effort to plot the probable future course of the birth-rate. With data from the 1950 censuses of several Latin American countries it has been possible to postulate the existence of urban-rural differentials in fertility with an urban child-woman ratio significantly lower than that of the rural area. The average number of children ever born to women in the different age groups found in Cuba, Brazil, Panama and Mexico classified by rural and urban residence showed the same pattern.¹⁸ Although the magnitude of the differential varies from one country to another there is no question that rural fertility is greater than that of the urban sector.

13. Mexican rural-urban fertility differentials were re-examined by Robinson, using data from the decennial censuses taken in 1930, 1940

and 1950. The measures of fertility used included both the fertility and marital fertility ratios. Although differences between rural and urban Mexico existed during the period 1930-1950, a narrowing of the differentials seems to have occurred since about 1930. Robinson questions the notion that rural-urban differences in Mexico are attributable to the effects of industrialization inasmuch as urban fertility "appears to have been higher in 1950 than in 1930".¹⁹ He states further that "it is by no means clear that the likely effect of further urbanization or industrialization on Mexican fertility will be a reduced birth rate".²⁰

14. The 1940 census data for Peru revealed that urban-rural differentials were substantial when measured by the number of children ever born to mothers. However, this difference could be accounted for almost entirely in terms of the number of women in Lima who become mothers. Stycos,²¹ reporting on a sample survey of currently mated women in Lima-Callao and a rural coastal village in Peru, disclosed existing differential fertility by class and residence. There was evidence of an inverse relation between social class and fertility but the differences in the two uppermost classes were small. The women were also questioned on their awareness of differences in the fertility performance of rich and poor, urban and rural residents. Results showed that more births were being attributed to poor and rural women than to rich and urban women. The data tended to indicate that at least three of the four urban social classes are curtailing fertility in some measure.

15. Differentials by social class also seem to have been established at least for other cities in Latin America. The Guanabara Demographic Pilot Survey in Rio de Janeiro obtained crude birth-rates for lower class which were over 60 per cent higher than those of the upper class.²² Notable differences in cumulative fertility ratios of women classified by residential zone were obtained from an analysis of the 1936 census of the city of Buenos Aires. Recchini attributed such differences to the predominant class in the zone, i.e., upper class zones reported smaller numbers of children

¹⁵ A. Romaniuk, "Fécondité et stérilité des femmes congolaises," *Proceedings of the International Population Conference, New York, 1961* (London, John Wright and Sons Ltd., 1963), pp. 112-113.

¹⁶ U.S. Bureau of the Census, *Census of population: 1950*, series PC-14, No. 21 (Washington, U.S. Government Printing Office), p. 28.

¹⁷ A. J. Jaffe, *People, jobs and economic development* (Glencoe Free Press, 1951), p. 181.

¹⁸ C. Miró, "The population of Latin America," *Demography*, vol. I, No. 1 (1964), pp. 36-38.

¹⁹ W. Robinson, "Rural-urban fertility differentials in Mexico," *American Sociological Review*, vol. XXV, No. 1 (February, 1960), p. 81.

²⁰ *Ibid.*

²¹ J. M. Stycos, "Social classes and differential fertility in Peru," *Proceedings of the International Population Conference, New York, 1961* (London, John Wright and Sons Ltd., 1963), pp. 124-125.

²² United Nations, *Guanabara Demographic Pilot Survey*, a joint study with the Government of Brazil (United Nations publication, Sales No.: 64.XIII.3), p. 40.

than laboring class zones.²³ While limited to cities, the data may be taken as an indication that class differentials in fertility are a reality in the urban population of Latin America.

16. Preliminary results of a survey carried out in 1959 by CELADE in Santiago, Chile, reported by Tabah and Samuel, showed that "many of the classical phenomena of differential fertility observed in advanced countries are also to be seen in Santiago, i.e., more voluntary childlessness in the well-to-do and educated strata of the population than among the poor and uneducated. The ultimate fertility of married women declines at least 50 per cent between the two extremes of the educational or economic scale".²⁴ There are indications that

differential fertility may be attributable in part to late age at marriage among the educated and the well-to-do and to the spread of birth control among women nearing the end of the reproductive period.

17. Studies of fertility differentials among sub-groups within countries undergoing modernization are scarce and limited. Rural-urban differences have been observed but to a large extent have been explained by the lower marriage and infant mortality rates prevailing in the cities. Educational differentials have been pronounced as well as differences associated with religion and social class. The survey of differential fertility suggests that, in the short run at least, increasing modernization may bring about increased fertility of certain sub-groups in the population. In addition, there are indications that major improvements in education do not necessarily bring about reductions in fertility.

²³ Z. I. Recchini, *La fecundidad en la Ciudad de Buenos Aires desde fines del siglo pasado hasta 1936* (E/EN. CELADE/C.4, Santiago, Chile, 1963), p. 12.

²⁴ L. Tabah and R. Samuel, "Preliminary findings of a survey on fertility and attitudes toward family formation in Santiago, Chile," in *Research in family planning*, C. V. Kiser, ed. (Princeton, Princeton University Press, 1962), p. 301.

A note on the effect of postponement of marriage on fertility

NITAI CHANDRA DAS

1. Recently the death rate has been declining in the countries of high mortality. Consequently in those countries the growth rate is steadily increasing, the birth rate remaining at a constant level. In Ireland, where fertility is largely uncontrolled¹ and the age at marriage is very high, the birth rate is much lower than that in Asian and Latin American countries. It is thus believed widely that the postponement of marriage in Asian and Latin American countries will reduce the birth rate in those countries.

2. In India, much difficulty is being experienced to raise the standard of living through economic planning owing to the steady birth rate and declining death rate. Consequently, social and institutional changes which postpone the occurrence of births become important.

3. In India, women are married at an early age. Indian women, therefore, start their reproductive life early. The average age at marriage for the wife for the different marriage cohorts and the distribution of the marriages by wife's age-group at marriage for Hindu couples married 1930 and after are shown in table 1 and table 2 respectively. Table 1 shows that the average age at marriage for the wives during 1930-1951 increased slowly.

4. Table 3 gives the distribution of births by mothers' age at reported birth. It may be seen that nearly 50 per cent of the births occur to the mothers aged below 25 years.

5. This paper attempts to throw some light on the effect of postponement of marriage on fertility of Indian women rather than making no attempt to measure the same. India is a country where there is no system of recording demographic information excepting the system of registration of births and deaths which is also known to be very defective. Therefore, the data available through the survey based on probability sampling are used in this paper.

6. The female populations of three states of India, viz. Madras, Kerala and Mysore, are

almost identical in age composition but differ in age-marital-status composition. The age distribution is shown in table 4. The age-specific fertility pattern of the three states taking into consideration age-marital-status composition will enable us to draw plausible inferences.

7. Table 5 shows the proportion of never-married females in broad age-groups for Madras, Kerala and Mysore. It may be seen that very few females in these states remain unmarried at the end of reproductive life and very few females are married at an age below 15. In Mysore, the females in age-group 15-24 are mostly married. In the same age-group, nearly 43 per cent of the females in Kerala are unmarried. In Madras, the proportion of never-married females in age-group 15-24 is 26 per cent.

8. Table 6 gives the age-specific general fertility rate and marital fertility rate for Madras, Kerala and Mysore. It may be seen that in Kerala fertility rate is at a low level in age-group 15-24 and attains a very high level in age-group 20-24 and rises further in age-group 25-29 and declines steadily thereafter. In Madras, however, fertility rate is at a fairly high level in age-group 15-24 and attains highest level in age-group 20-24 and declines progressively thereafter. In Mysore, fertility rate in age-group 15-24 is at a much higher level than the other two states and attains highest level in age-group 20-24 and declines thereafter. As compared to Madras and Mysore the age-span of reproductivity in Kerala has merely shifted to higher age-group. The fertility rate in age-group 35-39 in Kerala is also higher than that in Madras. The proportion of widows in age-group 25-44 in Madras, Kerala and Mysore was 14, 7 and 15 per cent respectively. If we assume that the widows in age-group 25-44 became widows before attaining 35 years and relate the births that occurred to women in age-group 35-39 to women excepting widows the fertility rate in age-group 35-39 in Madras comes out to be 93. The over-all marital fertility rate in Madras is also slightly lower than that in Kerala. The over-all general fertility rate in Kerala and Mysore is, however,

¹ United Nations, *Recent Trends in Fertility in Industrialized Countries* (United Nations publication, Sales No.: 57.XIII.2.).

almost of the same order of magnitude, whereas in Madras, the general fertility rate is of slightly lower order than the other two states.

9. The estimated birth rates in Madras, Kerala and Mysore are shown in table 7. The birth rates as estimated by Census Actuary and from NSS data in Kerala and Mysore are almost of the same order of magnitude. The same in Madras is of lower order of magnitude than that in the other two states. The sex-ratios in different age-groups in the three states are also more or less identical.

10. The above analysis shows that the fertility and birth rate was not reduced by the postponement of marriage. The hypothesis that the postponement of marriage leads to the reduction in fertility appears not to be so simple or straightforward, at least, for a limited rise in age at marriage. It may be that there exists a critical line below which the postponement of marriage does not affect the fertility rate. The experience of other developing countries will confirm whether the Indian experience can be ascribed to the peculiar socio-economic condition as prevailing in India.

Table 1. Average age at marriage for the wife for different marriage cohort groups: National Sample Survey, second and fourth rounds, rural, 1951-1952

<i>Before 1910</i> (1)	<i>1910-1919</i> (2)	<i>1920-1929</i> (3)	<i>1930-1939</i> (4)	<i>1940-1945</i> (5)	<i>1946-1951</i> (6)
12.3	13.3	13.6	14.2	14.4	14.6

SOURCE: Ajit Das Gupta, *et al.*, "Couple Fertility," *National Sample Survey No. 7* (Government of India, New Delhi, 1955).

Table 2. Number of marriages in specified wife's age-group at marriage per 100 marriages: National Sample Survey, second and fourth rounds, rural, 1951-1952

<i>Wife's age-group at marriage</i>						
<i>0-5</i> (1)	<i>6-11</i> (2)	<i>12-14</i> (3)	<i>15-16</i> (4)	<i>17-21</i> (5)	<i>22 and above</i> (6)	<i>All ages</i> (7)
4.26	25.96	29.52	19.06	15.53	5.67	100

SOURCE: Ajit Das Gupta, *et al.*, "Couple Fertility," *National Sample Survey No. 7* (1955).

Table 3. Percentage distribution of births by age of mother: National Sample Survey, seventh round, rural, 1953-1954

<i>Age of mother</i>						
<i>Below 20</i> (1)	<i>20-24</i> (2)	<i>25-29</i> (3)	<i>30-34</i> (4)	<i>35-39</i> (5)	<i>40 and above</i> (6)	<i>All ages</i> (7)
18.1	30.7	22.0	15.0	8.5	5.7	100

SOURCE: Vital rates, *National Sample Survey No. 54* (Government of India, New Delhi, 1962).

Table 4. Percentage distribution of females in age-groups and sex from two interpenetrating samples: National Sample Survey, fourteenth round, rural, 1958-1959

State (1)	Sample (2)	Age-group								45 and above (11)
		0-9 (3)	10-14 (4)	15-19 (5)	20-24 (6)	25-29 (7)	30-34 (8)	35-39 (9)	40-44 (10)	
Madras	1	25.34	10.27	9.02	8.70	8.93	7.43	5.89	5.64	18.78
	2	25.95	9.70	8.48	8.45	9.99	7.41	6.27	4.67	19.08
	Combined	25.61	10.03	8.79	8.60	9.37	7.42	6.05	5.23	18.90
Kerala	1	28.57	12.58	9.60	8.27	7.11	6.44	5.67	4.76	17.00
	2	28.32	13.98	8.96	9.56	7.93	6.43	5.09	4.08	15.65
	Combined	28.44	13.28	9.28	8.92	7.52	6.43	5.38	4.42	16.33
Mysore	1	31.63	12.03	6.97	8.33	8.50	6.12	5.83	4.60	15.99
	2	29.36	10.03	10.29	9.19	8.01	6.29	5.85	5.08	15.90
	Combined	30.45	11.01	8.67	8.77	8.25	6.21	5.84	4.85	15.95

SOURCE: "Fertility and Mortality Rates in India", *National Sample Survey, No. 76* (Government of India, New Delhi, 1963).

Table 5. Proportion of never-married females by age-group from two interpenetrating samples: National Sample Survey, fourteenth round, rural, 1958-1959

Age group (1)	Madras			Kerala			Mysore		
	Sample 1 (2)	Sample 2 (3)	Com- bined (4)	Sample 1 (5)	Sample 2 (6)	Com- bined (7)	Sample 1 (8)	Sample 2 (9)	Com- bined (10)
0-14	98.83	98.86	98.84	99.09	99.73	99.41	93.91	94.16	94.03
15-24	28.60	23.16	26.37	44.64	41.08	42.83	8.52	6.77	7.52
25-44	0.74	1.08	0.88	4.13	4.30	4.22	0.96	1.85	1.45
45 and above.....	0.18	0.25	0.21	1.41	0.68	1.06	1.05	1.01	1.03

SOURCE: "Fertility and Mortality Rates in India," *National Sample Survey No. 76* (Government of India, New Delhi, 1963).

Table 6. Annual age-specific general fertility rate, and annual marital fertility rate per 1,000 females from two interpenetrating samples: National Survey, fourteenth round, rural, 1958-1959

State (1)	Sample (2)	General fertility rate ^a							Marital ferti- lity rate (10)
		15-19 (3)	20-24 (4)	25-29 (5)	30-34 (6)	35-39 (7)	40-44 (8)	45-44 (9)	
Madras	1	108	236	199	128	99	22	150	183
	2	196	260	220	121	57	19	154	209
	Combined	144	246	208	128	80	21	152	194
Kerala	1	88	221	276	214	169	35	185	237
	2	78	231	280	177	137	55	160	248
	Combined	83	227	278	195	154	45	172	242
Mysore	1	210	259	266	178	105	36	185	245
	2	201	287	248	144	114	28	196	223
	Combined	205	274	257	160	109	32	190	233

SOURCE: "Fertility and Mortality Rates in India," *National Sample Survey No. 76* (Government of India, New Delhi, 1963).

^a The sample size for the age-specific rates was 872 villages and that for over-all rate was 2616 villages.

Table 7. Estimated birth rate in Madras, Kerala and Mysore

State (1)	Census ^a 1941-1951 (2)	National Sample Survey ^b (July 1958-July 1959)		
		Sample 1 (3)	Sample 2 (4)	Combined (5)
Madras	34.7	34.9	34.2	34.6
Kerala	39.8	45.3	34.8	39.6
Mysore	38.7	39.9	40.8	40.4

^a "Preliminary estimates of birth and death rates and of the rate of growth of population", *National Sample Survey, No. 48* (Government of India, New Delhi, 1961).
^b *Census of India, Paper No. 6 of 1954* (Government of India, New Delhi, 1954).

Parental control, delayed marriage, and population policy *

JUDITH DAVIS-BLAKE

1. In our search for anti-natalist means suited to developing countries today, we cannot afford to forget Malthus' suggestion of "moral restraint," or delayed marriage. Shorn of his tiresome morality, Malthus' emphasis on marital delay was too well placed from a demographic point of view not to be included today as a vital part of population policy.¹ Not only did delayed marriage figure as a principal means of demographic control in the history of presently developed countries, but the nature of its relationship to demographic processes gives it certain universal and timeless advantages. If contraception is not widely and expertly practised, marital postponement may contribute substantially to lowering birth rates. It may also lead to smaller completed families because exposure to pregnancy may take place during years of declining fecundity. Even if contraception is practised with such facility that few births occur in excess of those desired, delayed marriage will (other things equal) lengthen the period between generations and hence put an independent brake on long-range population growth. Finally, a later age at marriage allows a longer period for youthful education and (in the case of women) for work outside the home. These activities not only influence family-size desires and contraceptive efficiency, but are obviously of importance for economic development as well.

I. MARRIAGE AS A DECISION PROCESS

2. Unlike reproduction in some societies and most deaths in all societies, marriage is a form

of demographic behaviour representing a definite, more or less planned decision.² It is, furthermore, a particular kind of decision—one that involves an agreement between two or more persons. It follows that age at marriage may be delayed either by a desire to enter matrimony late, or by an inability to find and/or convince the right partner. A society may thus influence the age at marriage by conditions affecting the desirability or undesirability of matrimony in general, or by conditions affecting the ease or difficulty of finding mates in particular.

3. In the present paper we shall single out the problem of influences on the desirability of marriage (and marriage age) realizing, of course, that this ideal will not be the only determinant of actual age at marriage.³ Moreover, since analysis of variability in the attractiveness or unattractiveness of marriages raises the crucial issue of who controls the decision that a couple will marry, we shall address ourselves to the following question: Is it true that the social structure of the parentally arranged or controlled marriage (so characteristic of developing countries) is geared to a more youthful marital ideal than the free choice situation? Or, are there important elements of the parentally arranged marriage that could, under appropriate conditions, lead parents to desire late marriages for their children? If so, what are they, and how could social and economic policy be geared to affect them in an anti-natalist direction?

II. PARENTAL GAINS FROM CHILDREN'S MARRIAGES

4. Clearly, the interests of parents in their children's marriages are inherently different from those of the parties themselves. Since the

* This paper is part of a longer work on the determinants of age at marriage, with Kingsley Davis as co-author. We wish to acknowledge the assistance of a grant from the Equitable Life Assurance Company to International Population and Urban Research, Institute of International Studies, University of California, Berkeley.

¹ The importance for fertility reduction of delayed marriage (assuming little illegitimacy) is well known to demographers. See, Ansley J. Coale and C. Y. Tye, "The significance of age-patterns of fertility in high fertility populations," *Milbank Memorial Fund Quarterly*, vol. XXXIX (October, 1961), pp. 631-646; J. William Leasure, "Malthus, marriage, and multiplication," *Milbank Memorial Fund Quarterly*, part I, vol. XLI, pp. 419-435.

² For detailed discussion of motivational aspects of demographic behaviour, see, Judith Blake and Kingsley Davis, "Population and public opinion—the need for basic research," *American Behavioural Scientist*, vol. 6 (May, 1963), pp. 24-29.

³ Demographers will recognize that this analysis parallels the familiar one for family size, where family size ideals or desires are found to be significantly related to actual family size, although not completely determinant of it.

couple carry a lifetime responsibility for the marriage (regardless of who initially arranged the union), we would expect that, in contrast to the advantages accruing to all other interested parties, they will get the greatest and most continuous gains. Indeed, for the parties to a marriage, there seems to be a universal congruence between individual satisfaction and important aspects of marriage as a social institution. The bride and groom are accorded whatever prestige goes with "being married"; they normally get legitimate children; they receive the right of sexual access; and they have the benefits of services deriving from the sexual division of labor.

5. For parents, on the other hand, the transition represented by their children's marriages is not from the socially engendered limitations of being single to the satisfactions of marriage, but rather from the complete institutional support of their parenthood to a significant redefinition of their positions. No matter how parents' feelings, egos, and desires for authority, affection, and companionship may be buffered by filial deference, service, and attention, the marriage of children is in many ways the beginning of the end for parents as parents. It symbolizes the cyclical aspect of family life by recognizing society's claim on the children as new parents and responsible adults.

6. What then prevents parents, when they control mating, from indulging themselves by personally consuming the economic and social good that their children represent for them, rather than allowing the offspring to marry and devote their principal energies to a new generation? This question must be answered because some societies where nuptials are parentally arranged exhibit a pattern of very early marriage.

7. Clearly such societies do not rely primarily on the enlightened community orientation of parents for the determination of marriages. Instead they create some identity or complementarity of couple and parent interest in marriage, and some sanctions over parents as a final resort. Typically, religion will play its usual role of reconciling the irreconcilable and, thereby, make parents want to do what they have to do. Marrying off children may be a religious duty and its accomplishment will be viewed, therefore, as an independent source of honor and prestige; having grandchildren may be necessary for rituals associated with salvation; maintaining premarital chastity may be a religious obligation resting heavily on the parents if they control the arrangement of children's marriage. Finally, the complete submissiveness of youth to parents in the name

of filial piety may make the older generation view the addition of a daughter-in-law as an economic advantage since her services replace those of daughters who leave in marriage. Thus the things that attract the young to marriage—prestige, children, legitimate sexual access, and sexual division of labor—become important objectives for the parents as well.

8. Once such a moral system is in operation, it carries its own sanctions. To some extent the parents will internalize the norms and themselves strongly desire to comply. Short of this, they will usually be sensitive to an anticipation of community opinion. If their motives are completely deviant, their behaviour will nonetheless be under great community pressure, because the interests of other parents lie in having them enter the marriage market and expand the available choices.

9. We are thus led to recognize that the customs pressing elders to make early marriages for their children are in part control mechanisms inhibiting their latent desires for delay—desires based on the socially supported expectation of rewards for parenthood. These customs bear the burden of effecting a transition that would typically not be made without such pressure, since parents must relinquish a share of a lifetime investment and they must do so at a time when they themselves are entering a period of declining vigour. When parentally arranged marriages are viewed in this way, we can begin to understand why parental control may actually lead to very late marriage. Where the community does not check parental interests (or even implicitly encourages them), then control by the elders can be a powerful influence leading to late marriage.

10. Why then do we so often think of parental arrangement as being primarily associated with very early marriage? There would seem to be two principal reasons: One is selectivity of observation and analysis, and the other is a concentration on the conditions for marriage rather than on the interests of the decision-makers. With regard to selectivity, descriptions of societies where marriages are, or were, customarily arranged by parents emphasize the norms leading elders to take this step as soon as possible. Structurally generated sources of strain are presented as resting primarily on the young, whose personal inclinations and freedom are drastically curtailed. But once we realize that the parent-youth conflict with respect to marriage in these societies has a latent as well as an obvious aspect, we are able to take notice of evidence concerning parents' latent desires to delay their children's marriage or stop it altogether.

11. In the cases of both India and traditional China parents have exhibited marked patterns of ambivalence towards early marriage. It is well known that in India they often try to keep their daughters at home long after return marriage (*gauna*) by means of prolonged visits. Mayer, in his book on Central India, describes the ruses parents use to prevent the daughter from having to return to her husband's household.⁴ Aileen Ross shows that among urban Hindus the customary early marriage is becoming undesirable to elders in terms of their traditional expectations of parental rewards. The elders strongly desire to educate sons so that they may compete in an uncertain job market and in turn help the parents later in life. Early marriage interferes with such education and, in particular, the ceremonial demands of weddings are backbreakingly expensive and use up funds that could be devoted to education. Increasing education for both sexes places a significant educational gap between the older and younger generation and makes many mothers hesitate to have to cope with a knowledgeable daughter-in-law in the same household. Finally, a decline in joint family living accentuates the traditional dependency of the Indian mother on her son for affection and support. She is, therefore, apparently less willing than ever to share him with another woman.⁵

12. In traditional China, similar strains at the parental level have been described by Levy, Lang, and Yang.⁶ Female infanticide and the sale of daughters into prostitution have, moreover, apparently been radical adjustments that parents felt forced to make because of the potential demands on them if they reared many daughters for marriage. Hence, although in both India and traditional China arranged marriages were youthful, parents have frequently deviated from the obligation to marry their offspring and have given other evidence of ambivalence toward such marriages even when they outwardly complied.

13. Turning to countries where relatively late marriage has been for long a social characteristic—the countries of Western Europe and

Japan—we see that they achieved this result in association with parental control over wedlock. Whereas it was once believed that in late medieval and post-medieval Europe marriage came very early by modern standards, scarce but increasing information is beginning to suggest that matrimony came surprisingly late. Russell gives data on proportions “unmarried” which, if representative, would place the median nuptial age for women in England at about 20 under Edward I and Edward II (1272-1307 and 1307-1327 respectively), and about 15 under Henry VII (1485-1509).⁷ Peller also refers to “a little information from an English village at the end of the 16th century” which shows “an average marriage age of 27.6 for men and 24.5 for women.”⁸ British ducal families of the seventeenth and eighteenth centuries are found by Hollingsworth to have had mean matrimonial ages of 28.6 for men and 22.2 for women.⁹ Families in Geneva during approximately the same period showed a mean age at marriage of 32.3 for males and 25.0 for females.¹⁰ Among dukes and peers in France during the period 1650-1699, males married at a mean age of 25.5 and females at 20.0.¹¹ Gautier and Henry find the median age for first marriage in a Normandy village during the period 1674-1742 to be 26.3 for males and 24.1 for females.¹² The earliest data given by Hajnal in his historical series are those for Sweden in 1750. From the proportions single it seems that the median age at wedlock for females was approximately 24.4 and for males something like 24.6 years. Half a century later, in 1800, the two figures were approximately 25.1 and 25.5.¹³ Ohlin shows the mean age at first marriage for women to have been almost 26.0 during 1751-1800, “one year lower than in the late nineteenth cen-

⁷ Josiah C. Russell, *British Medieval Population* (Albuquerque, University of New Mexico Press, 1948), pp. 157-158; same author, *Late Ancient and Medieval Population* (Philadelphia, American Philosophical Society, Transactions, June 1958), new series, vol. 48, part 3, p. 19.

⁸ S. Peller, “Studies in mortality since the Renaissance,” *Bulletin of the History of Medicine*, vol. 13, p. 428.

⁹ T. H. Hollingsworth, “A demographic study of the British ducal families,” *Population Studies*, vol. 11 (July, 1957), p. 14.

¹⁰ L. Henry, “Anciennes familles genevoises. Etude démographique XVI-XX siècles,” *Travaux et documents de l'I.N.E.D.*, cahier no. 26 (1956), p. 234.

¹¹ C. Levy and L. Henry, “Ducs et pairs sous l'Ancien Régime. Caractéristiques démographiques d'une caste,” *Population*, no. 5 (Oct.-Dec., 1960), p. 813.

¹² E. Gautier and L. Henry, “La population de Crulai, paroisse normande,” *Travaux et documents de l'I.N.E.D.*, cahier no. 33, (1958), pp. 83-84.

¹³ J. Hajnal, “The marriage boom,” *Population Index*, vol. 19 (April, 1953), p. 84.

⁴ Adrian C. Mayer, *Caste and Kinship in Central India* (Berkeley and Los Angeles, University of California Press, 1960), pp. 226-227.

⁵ Aileen D. Ross, *The Hindu Family in Its Urban Setting* (Toronto, University of Toronto Press, 1961), *passim*.

⁶ Marion J. Levy, *The Family Revolution in Modern China* (Cambridge, Harvard University Press, 1949); Olga Lang, *Chinese Family and Society* (New Haven, Yale University Press, 1946); C. K. Yang, *The Chinese Family in the Communist Revolution* (Cambridge, Technology Press, 1959).

tury."¹⁴ Finally, although Connell states that "in the decades centering on 1800 the Irish married while unusually young," his statistical evidence for the period 1830-1840 indicates a median marrying age for females of about 21.2 years.¹⁵

14. The Japanese during the industrializing period (while parents still controlled marriage) underwent an extremely rapid rise in age at marriage. Among girls aged 15-19 the proportion ever married fell from almost 18 per cent in 1920 to less than 2 per cent in 1955, and for girls aged 20-24 from almost 77 per cent in 1920 to about 34 per cent in 1955. The change for men was also dramatic.¹⁶ It is worth noting, moreover, that the age at marriage in Japan prior to industrialization does not seem to have been extremely young. Taeuber says, "The very early marriage . . . were not prevalent in Japan even in the late nineteenth century, when the *koseki* records first became relatively complete and accurate. In 1910 the average age at recorded first marriage was 23 for women and 27 for men . . . the average ages at the time of recorded marriages for the various prefectures over the years from the 1890's to the present would not be regarded as low in other agrarian societies of the East."¹⁷

15. It would appear, therefore, that in Western Europe and Japan, culturally distinctive institutional arrangements had similar functions for parental control and desire to delay children's marriages. In Europe, the structural independence of the nuclear, or frequently stem, family from a ramified kinship system was bolstered by a nonfamilistic religion—Roman Catholicism. Supernatural belief, ultimate loyalty, and religious ritual were not centered on the clan as a group or descent as a principle. Progeny were not defined as necessary for salvation. The head of the household was not a priest, nor were the departed ancestors the objects of worship. Instead, Northwest Europe had a religion the priesthood of which was organized and controlled apart from the family. This religion revered celibacy above marriage, itself set the conditions for wedlock, and was in part competitive with kinship groups for loyalty, personnel, and property. Thus, in Europe parents were not required, as in Hin-

duism, to get the children married. Consequently, when marriage was postponed, or foregone altogether, there was no imposed penalty deriving from the normative order, either for the prospective brides and grooms or for their parents. Whether marriage came early or late for the individual couples therefore depended on parental definition of social, economic, and demographic circumstances—not on moral considerations.

16. In pre-industrial Japan, despite the importance of the immediate family in Japanese life, there were apparently few intensely pronatalist, kinship-oriented pressures on Japanese parents. The religion, although emphasizing filial piety, limited religious obligations to a few close relatives. Japanese social life was for centuries very complex, with the family and kinship playing a subordinate role to the feudal system and the state. Moreover, the Japanese had a long history of infanticide apparently geared to keeping families small. One thus gets a picture of a fairly instrumental and flexible view of family life by parents in traditional Japan. As a result, when a period of great economic expansion began, they were able to combine marital delay with orderly eventual marriage. The delay enabled them to capitalize on unfolding economic and educational opportunity for themselves and their children—they could temporarily substitute capital formation for family formation. The eventual marriages that they arranged prevented widespread disaffection and disorganization among the young during a period of great social transition, and, as a consequence, bolstered parental control and the role of the family as an agency promoting orderly social change.¹⁸

17. We must thus admit that available empirical evidence does not support the notion that parental control has been primarily associated with very early wedlock in man's history. Indeed, such control seems suited to either extreme of marriage age—very early or very late. Which course parents actually take will depend on the degree to which their desires for delay are suppressed or encouraged by the existing social organization. Apparently, therefore, in associating arranged matches with early ones, we have been more impressed by *a priori* reasoning in terms of the *conditions* of match-

¹⁴ P. G. Ohlin, *The Positive and the Preventive Check: A Study of the Rate of Growth of Pre-Industrial Population* (Harvard University: unpublished Ph.D. dissertation, 1955), pp. 99-100.

¹⁵ K. H. Connell, *The Population of Ireland, 1750-1845* (Oxford, Clarendon Press, 1950), p. 51.

¹⁶ Irene Taeuber, *The Population of Japan* (Princeton: Princeton University Press, 1958), p. 211.

¹⁷ Irene Taeuber, *The Population of Japan* (Princeton, Princeton University Press, 1958), p. 227.

¹⁸ For discussion of pre-war Japanese social organization, see, Marion J. Levy, Jr., "Contrasting factors in the modernization of China and Japan," in *Economic Growth: Brazil, India, Japan*, Simon Kuznets, Wilbert E. Moore, and Joseph J. Spengler, ed. (Durham, Duke University Press, 1955), pp. 496-536; Ruth Benedict, *The Chrysanthemum and the Sword* (New York: Houghton, Mifflin, 1946), pp. 48 ff.; and Irene B. Taeuber, *op cit.*, *passim*.

making than by either the weight of the historical and cross-cultural evidence, or by analysis of parental interests in the matter. The free choice situation seems to require later marriage than the arranged match because the parties must be old enough to make their own decisions, to have acquired courtship skills, to set up a household (typically), and to be financially independent. The arranged match, on the other hand, can occur at birth, entails no period of courtship or search for a mate while the individual is already marriageable, often implies residence with parents, and may require no financial independence. Thus, from a conditional point of view, the arranged match seems ideally suited to early family formation. But by the same token, it is also ideally suited to a long delay and a high proportion permanently unmarried, since, in making the decision to delay, the parents are not motivated by the personal attractions of marriage (as are the potential parties to the match) and can therefore take an unemotional view of the matter. Thus, we frequently find that in the free-choice situation an opening up of resources will press down the age at marriage because many conditional elements which have been inhibiting marriage can be overcome and new and higher standards of living are not yet crystallized.¹⁹

¹⁹ William Petersen believes that in Holland the growth of urban job opportunities, coupled with emerging free choice in marriage, may well have

But, equally, social changes that release parents from intense moral obligation to marry off their children will allow the older generation to use its control to prevent early marriage despite favourable conditions encouraging it.

18. Our discussion suggests that parental control over when marriage is to occur could be a powerful instrument for matrimonial delay if parents were encouraged to take a more instrumental, and less moral, view of their children's nuptials. We have argued that the older generation has powerful motives for such an instrumental view. Thus, the basic motivational background for an overthrow of customary procedures regarding age at marriage exists already in many developing nations. More extended sociological analysis of the role of family structure in family formation might therefore point the way to making marital postponement an object of effective population policy.

lowered the age at marriage early in the Industrial Revolution. See his article, "The demographic transition in the Netherlands," *American Sociological Review*, vol. 25 (June 1960), pp. 334-347. Petersen's view is not incompatible with the idea that as the industrializing process progressed, new and higher standards of living and consumption emerged and these led individuals in the free-choice situation to postpone marriage even without parental control. See, for example, J. A. Banks, *Prosperity and Parenthood* (London, Routledge and Kegan Paul, 1954).

Regional fertility differences among socio-economic groups in the United Arab Republic

M. A. EL-BADRY and HANNA RIZK

1. In most of the developing countries, tremendous efforts are now being expended to achieve economic development and higher standards of living. However the gains that have already been achieved in many of these countries or that will be achieved in the future, are seriously challenged by the recently increasing rates of growth of their populations, which in turn have been caused by the declining mortality rates. The attention of all those concerned with progress in these countries is, therefore, focused on fertility rates as a means of controlling population growth, and keep it within the limits that will enable the current development efforts to bring about significant and continuous increases in the standard of living.

2. There are many countries whose birth rates have not declined. The question, therefore, arises whether factors connected with the current social and economic development measures (e.g., urbanization, economic and educational improvements, etc.) might have caused differentials in the fertility levels within these countries? And, if so, to what extent? The present study attempts to examine this question for the United Arab Republic.

3. The study is based on data collected in a sample survey in 1957¹ which was supplemented by the 1960 census data on the total number of child births. There are limitations to this data since birth registrations are not quite adequate to study fertility differences among different socio-economic groups; even urban-rural differences cannot be safely derived from such data due to variations in the degree of under-reporting.

4. The number of children born to currently married women during their current marriage, was tabulated in the 1960 census by mother's educational status and by father's occupation, for each marriage-duration group in each governorate. Fertility differences between different

groups are studied here by comparing standardized parities of currently married women in each group. The standardization in any governorate or any combination of governorates is carried out with respect to the distribution by marriage duration of all married women in that governorate or group of governorates. The standardization was not carried out whenever the number of women in any duration group was less than about 30. This is why several adjacent governorates were grouped together; and the standardized average parity was calculated for women with university degrees only in Cairo and in groups of governorates including Cairo.

I. REGIONAL FERTILITY DIFFERENCES BY EDUCATIONAL STATUS

5. The standardized averages for each educational group within each governorate or group of adjacent governorates are given in table 3. The table starts from the south of the country; Aswan is the southern-most governorate and Giza, which is immediately south of Cairo, is the northern-most governorate in Upper Egypt. In Lower Egypt, Behera lies west of the Delta; Menoufia, Gharbia and Kafr-El-Sheikh are between the two branches of the Nile; Kalyubia, Sharkia and Dakahlia are in the east of the Delta; and Damietta is situated around the northern part of the eastern branch of the Nile.

6. The general picture of fertility differences in the non-urban governorates, as shown by the table is as follows:

(a) The fertility level of illiterate women lies usually below that of women who just read and write;

(b) Fertility of women with secondary school certificate is lower than that of women who just read and write and, with a few exceptions, it is also lower than that of the illiterates;

(c) There is generally little difference between women with little education, i.e., those holding an elementary school certificate, and those who just read and write.

¹ This survey was initiated by the Permanent Council for Public Services and its data were analysed by H. Rizk in his Ph.D. dissertation, *Fertility Patterns in Selected Areas in Egypt* (Princeton, 1959).

7. The fertility trend by educational status of the woman in the non-urban governorates is thus unimodal, with the peak either among those who just read and write or among the holders of elementary certificates. This picture is true for all governorates except two, namely Giza and Damietta which follow the urban pattern. Giza, it will be noticed, is neighbouring Cairo and its capital city is in many respects considered as part of Cairo; Damietta is a newly formed governorate around the city of Damietta which stood in the past on its own as an urban governorate.

8. In all urban governorates and in Giza and Damietta, the fertility level decreases monotonically as the educational status rises, with the standardized average parity of university degree holders only a little above one half of that illiterate women. Thus if we consider parities of equal groups of women, for every 100 children ever born to illiterates there will be 87 to women who just read and write, 82 to elementary certificate holders, 63 to those with secondary school certificates and 53 to university graduates.

9. It is thus perhaps well-established that with the exception of rural illiterates, fertility decreases with education. The observed decrease among rural illiterates, if it is not entirely due to deficient reporting of children ever born,² may well be due to worse health and environmental conditions which raise the incidence of miscarriage.

10. From the last four rows in table 3, we see that in the case of non-urban governorates there is little difference between Upper and Lower Egypt in the fertility levels of their corresponding educational groups. Urban governorates, on the other hand, have significantly lower averages than those of non-urban governorates, in all educational groups except the illiterates whose average is considerably higher in urban governorates.

11. Data on regional fertility differences by educational status of the husband are also given by the above mentioned sample survey. The survey, incidentally, covered samples taken in Cairo, Alexandria, a semi-urban industrial town and three villages, one in Lower Egypt and two

in Upper Egypt. The survey covered women who were either currently married or had lived with their husbands till at least age 45. The sample consisted of 2,334 urban, 676 semi-urban, and 3,057 rural women.

12. The pattern of fertility difference by husband's educational status obtained from the survey is shown in table 1. The data show the increase in rural fertility from the illiterate husbands to those with little education.

13. This result is similar to that obtained from the 1960 census parity data concerning illiterate wives and those with elementary education. The completed family size of rural women—including children to any previous marriage—was equal to 8 children. In urban areas the survey results show a definite fertility decrease with the rise in educational level from the elementary level upwards. The completed fertility thus decreased from 7.1 children among elementary-certificate husbands to 5.9 among those holding secondary certificates to 3.9 among university graduates; the standardized average parity among women aged 15-44 (standardized with respect to marriage duration) in these three groups were 4.7, 4.0, and 2.8, respectively. The decrease in non-rural fertility from illiterates to those with elementary education appeared only among semi-urban women.

II. REGIONAL FERTILITY DIFFERENCES BY OCCUPATION

14. In the 1960 tabulations on parity by father's occupation, the international standard one digit classification was used. Owing to smallness of numbers in some governorates, further grouping was made here and the standardized parity averages were calculated for the following groups: 0 + 1: professional and technical + administrative workers, 2: clerical workers, 3: sales workers, 4: farmers, 5-8: miners + transport workers + craftsmen + production process workers and 9: service workers.

15. These standardized averages are given in table 4. The table shows that the professional and administrative group 0 + 1 distinguishes itself as the class with lowest fertility only in urban governorates and, again, in Giza and Damietta where there is a considerable degree of urban influence. In these urban governorates the clerical group 2 has the second lowest fertility.

16. Throughout non-urban governorates except Giza and Damietta, on the other hand, the picture is reversed and we find that groups 0 + 1 and 2, which have virtually the same

² All that can be said with respect to omission of deaths is that in both 1947 and 1960 a question on children ever born who were still alive was asked along with the question on all children ever born. The numbers still alive were tabulated in 1947 and the published tables show sizable differences from those ever born; see: *Department of Statistics, 1947 Census of Egypt*, vol. II, tables 20, a, b, c and d (1953). But, of course, this does not prove absence of deficiency, particularly in the light of the increase in parity averages observed in 1960.

average parities, have universally the highest fertility levels. These results are obviously due to the big difference in the technical level between members of the 0 + 1 in urban and non-urban areas. In the latter they will include larger proportions of small shop owners, owners of small workshops, and semi-professionals whose fertility level turned out to be the same as that of those who were clearly distinguished as clerks.

17. The two groups of industrial workers and salesmen have virtually the same averages in urban and non-urban governorates. They have the highest fertility level in urban governorates, with the standardized average parity for the industrial group 5-8 equal to 4.5 children per woman, as compared to 3.6 for the professional group 0 + 1. In non-urban governorates, the two groups of industrial workers and salesmen also have a high fertility level which is surpassed only by that of the professional and clerical groups.

18. It is perhaps surprising that farmers have the lowest fertility level in non-urban governorates and their standardized average parity is as low as 4.0 children per woman while that of the clerical group is 4.7. Even in the rural suburbs of the urban cities, we find that it is only the groups 0 + 1 and 2 which have lower fertility levels than farmers. If this lower fertility level among farmers is not entirely due to deficient reporting, it is perhaps wholly or partly due to the effect of worse health and environmental conditions, as mentioned earlier.

19. The survey also showed the existence of fertility differences among occupational groups. When the rural data are classified by husband's occupation it is found that, while completed fertilities show no specific trends, standardized incomplete fertility shows that farmers have a somewhat lower fertility than other labourers; these averages were 404 among farmers, 418 among unskilled labourers, and 447 among skilled labourers. This ranking was true in each of the three villages.³ The same trend, the reader will notice, was shown above by the 1960 data.

20. Urban fertility was also studied by social class in the light of the survey data. Three classes were distinguished by means of the husband's occupation and education, the condition of the household, and the total income. The inverse relationship between class and fertility level was shown by the figures on

³ H. Rizk, "Social and psychological factors affecting fertility in U.A.R." *Marriage and Family Living Journal*, vol. XXV, no. 1 (February 1963).

completed fertility which were 528 for class I (the highest), 683 for class II and 705 for class III.

III. THE EFFECT OF AGE AT MARRIAGE

21. Differences in age at marriage as a possible factor affecting the observed fertility differences were also studied by means of the survey data. The following results were obtained.⁴

(a) Very little difference in wife's mean age at marriage was observed between illiterate husbands in the rural, semi-urban, and urban areas of the sample. This mean was 16-17 years among those married in 1938-47, and 18-19 years among those married in 1948-57. The same observation and the same levels held among wives whose husbands had elementary education.

(b) Over these three decades, the mean age at marriage of wives of illiterate husbands and those with elementary education increased by one year in rural areas and by two years in semi-urban areas.

(c) In the case of urban wives whose husbands finished at least secondary education, the mean age at marriage rose from 18 years in 1928-37 to 21 years in 1948-57. It has been one to two years higher than elsewhere and has scored an increase of three years over the three decades.

(d) The mean age at marriage thus seems to be rising, but the observed differences between its values in the three areas and among the three educational groups are perhaps too small to account for observed fertility differences.

IV. REGIONAL FERTILITY DIFFERENCES IN BIRTH CONTROL, BY EDUCATIONAL LEVEL

22. In the same survey, family limitation practice was measured by the percentage of those who stated that they made an effort to prevent pregnancy. The percentages of such controllers in each of the three localities and each education level is shown in table 2.

23. The percentages demonstrate that:

(a) Admitted family limitation practice in rural areas is nil;

(b) The frequency of attempted birth control increases as the educational level increases both in urban and semi-urban areas;

(c) In each educational group the proportion of controllers is larger in urban than in

⁴ *Ibid.*

semi-urban areas, with the proportion of women who have ever practiced family limitation equal to about one third among women with completed fertility and about one half among those still in the reproductive ages.

Table 1

Husband's education	Urban		Semi-urban	Rural	
	Completed fertility	Standardized average per 100 women 15-44	Standardized average per 100 women 15-44	Completed fertility	Standardized average per 100 women 15-44
Illiterate	703	445	490	755	431
Elementary	708	471	474	797	454
Secondary	589	395	—	—	—
University	394	278	—	—	—

SOURCE: H. Rizk, unpublished data.

Table 2

Educational level	Urban		Semi-urban		Rural	
	Women 15-44	Women 45 and over	Women 15-44	Women 45 and over	15-44	Women 45 and over
Illiterate	10.7	8.9	10.3	0.0	0.8	1.0
Elementary	23.0	18.7	17.5	17.0	3.0	3.0
Secondary and university	51.0	33.8	—	—	—	—
All women	24.0	17.4	—	15.0	1.0	—

SOURCE: H. Rizk, "Social and psychological factors affecting fertility in the U.A.R.", *Journal of Marriage and Family Living* (February 1963).

Table 3. Standardized^a average—parity (per 100 married women) by educational status of the woman and governorate, United Arab Republic, 1960

Governorate	Women's educational status ^b					
	0	1-2	3	4-5	6	
Upper Egypt:						
Aswan and Kena	370	448	457	382	—	
Asyut and Sohag	446	502	499	415	—	
Menya, Beni Suef and Fayoum	395	485	460	412	—	
Giza	425	414	385	333	—	
Lower Egypt:						
Behera	394	465	—	—	—	
Manoufia, Gharbia and Kafr-el-Sheikh	417	476	452	371	—	
Kalyubia and Sharkia	405	476	471	—	—	
Dakahlia	440	472	438	379	—	
Damietta	448	440	371	—	—	
Urban governorates:						
Cairo	445	402	366	289	241	
Alexandria	468	368	359	273	—	
Port-Said, Ismailia and Suez	445	420	394	314	—	
SUMMARY:						
Upper Egypt	411	462	439	371	—	
Lower Egypt	415	472	446	382	—	
Non-urban governorates	413	468	442	376	—	
Urban governorates	451	394	368	286	239	

^a The standardization in any row is with respect to the distribution by marriage duration of all married women belonging to that row.

^b The educational status code is as follows: 0: illiterate; 1: read only; 2: read and write; 3: elementary certificate holders; 4: secondary certificate holders; 5: holders of a diploma below a university degree; 6: holders of university degrees.

Table 4. Standardized ^a—average parity (per 100 married women) by husband's occupational group and governorate, U.A.R., 1960

Governorate	Husband's occupational group ^b					
	0 + 1	2	3	4	5-8	9
<i>Upper Egypt:</i>						
Aswan and Kena	449	442	382	365	398	367
Asyut and Sohag	503	505	476	432	470	476
Menya, Beni Suef and Fayoum	471	472	437	378	428	419
Giza	388	453	443	397	447	433
<i>Lower Egypt:</i>						
Behera	458	463	447	378	440	419
Menoufia	522	496	464	413	446	447
Gharbia and Kafr El Sheikh	456	465	452	400	445	434
Kalyubia and Sharkia	475	473	450	387	442	428
Dakahlia	468	466	462	430	449	448
Damietta	409	450	454	443	440	442
<i>Urban governorates:</i>						
Cairo	360	405	436	404	441	416
Alexandria	355	381	449	438	462	450
Port Said, Ismailia and Suez	394	427	458	414	446	450
SUMMARY:						
Upper Egypt	452	473	448	394	440	428
Lower Egypt	471	470	455	401	445	434
Non-urban governorates	463	471	452	398	443	431
Urban governorates	362	404	442	416	448	427

^a The standardization in any row is with respect to the distribution by marriage duration of all married women belonging to that row.

^b The occupational code is as follows: 0 + 1: professional and technical and administrative workers; 2: clerical workers; 3: sales workers; 4: farmers; 5-8 miners and transport workers and craftsmen and production process workers; and 9: services workers.

Evaluation of progress in fertility control in the United Arab Republic

HASAN M. HUSEIN

1. Deep scientific concern over the high rate of population growth in Egypt dates as far back as the early nineteen thirties. Specialists in humanities and economics have observed that in the two previous decades the population has grown steadily at the annual rate of 1.3 per cent. This means that the population would double in about half a century, thus endangering the economic progress of the country. At that time, the economy of Egypt was almost completely agrarian and while the population was increasing at this high rate, the cultivated area was hardly increasing at all. It is true that the crop area, which has more significance, was increasing through the use of better agricultural and irrigation techniques, yet the rate of increase was far below that of population growth.

2. Scientific studies in this field went on since then as individual efforts. At the same time some sincere but detached attempts were made by a few public service groups, like women's associations for child welfare or for family improvement, to raise the general awareness of the population problem so that people might start facing it with progressive and fruitful action. The governments at that time were very passive and there was a strong religious and even social resistance to the extent that made these efforts bear very little fruit. A fairly strong medical movement went on at the same time. Gynæcologists particularly felt that too many conceptions without sufficient care had a harmful effect on the health of the mother as well as the child.

3. With the coming into power of the Revolutionary Government in 1952, a more rational attitude towards public affairs began to prevail. The establishment of the Permanent Council for the Development of National Production and the Permanent Council for Public Services was an indication of such an attitude. These two organizations were made responsible for conducting extensive studies in their respective fields and advising on the most efficient manner of carrying out the various development schemes.

4. The Permanent Council for Public Services formed the National Committee for Population Problems in 1953. This was the first official recognition that there might exist a population problem in Egypt which had to be studied. The membership of this Committee consisted of the Ministers of Social Affairs (Chairman), Agriculture, Education, Health and the Deputy Minister of Finance. Also included in the Committee were the leading gynæcologists, economists, demographers, sociologists and statisticians. According to its terms of reference, the Committee was to institute research programmes in demographic aspects of development and advise in the formulation of a certain population policy if necessary. The two permanent councils merged early in 1957 into the new National Planning Commission. At the same time, the National Committee for Population Problems became the Egyptian Association for Population Studies. It is now a non-governmental organization with the same members, including the Chairman, even though it was still being financed through an annual governmental subsidy. In 1962, the President announced the Charter of the Republic. The Charter included references to the scientific work being carried out by competent organizations in the field of population growth. It also suggested that every citizen should plan his family. The Charter was interpreted to give additional support to the Association and its activities.

5. The National Committee for Population Problems established Family Planning Centres in November, 1955. Eight of these centres were situated in Alexandria and Cairo, the two biggest cities in Egypt. The policy was to open the clinics in conjunction with various public service organizations like the Red Crescent Association, the Mabarra Hospitals Association, the Moassat Association and the Women's Associations for Health Improvement, Child Welfare, and Moslem communities. These organizations supplied accommodations for the clinics, while the Egyptian Association for Population Studies provided equipment and personnel.

6. In the next year, 1956, four more clinics were opened in four different towns. This meant that clinics in the first two years were confined to urban areas although two of them were located in industrialized areas full of newly urbanized families migrating from rural areas. In 1957, six new clinics were opened in rural areas attached to combined Rural Centres in villages in Lower Egypt near Cairo. Six more of the same type were opened in 1958 in villages in Upper Egypt near Cairo. In the next four years, one more clinic was opened annually in an urban area or a rural area alternately, until in 1962 there were fourteen clinics in each type of area. Towards the end of 1963, six more clinics were opened in capitals of six governorates drawing on a population mainly of a semi-urban nature. Early in 1964, four more clinics were established in capitals of other governorates of similar type. Table 1 shows the historical development of the number of clinics functioning each year since 1955.

7. These clinics were not meant to give service but to afford the means for scientific experimentation and supply of data in the fields of birth control and sterility treatment. The idea was to assure the people that both birth control and sterility treatment are two aspects of family planning. About one third of the new patients visiting the clinics asked for sterility treatment. Those who apply for birth control get it only if they have sufficient medical grounds or the approval of their husbands and at least three children alive. Data in table 2 show that there has been a steady and reasonable demand for birth control measures. Two observations, however, should be made in this respect. First, the drop in the number of requests, in spite of the number of clinics in the years 1958 through 1961, is due to the difficulties of importing contraceptives. These difficulties have since then been overcome and local manufacturing of contraceptives has begun to take place. Secondly, a large increase in the number of requests took place in the first nine months of 1964, which could largely be due to the formal recognition, in the Charter of the Republic, of the wisdom of using contraceptives.

8. The policy of these clinics, ever since their beginning, was to give free treatment to all, but to sell the contraceptives at cost price to those who can afford it, at half-price to those who cannot pay the full price, and to give it free to those in great need either economically, socially or from the health point of view. This meant an indirect government subsidy to those deciding to practise birth control.

9. The figures in table 2 do not represent all those practising birth control, since there are other individual efforts by a few lady social leaders spreading the awareness and supplying limited service through their social work activities in Women's Welfare Associations. One of these ladies has been making successful efforts with certain communities in Alexandria, while recently another one started dealing with rural communities around Cairo. In both cases, enthusiastic assistance is secured from highly qualified and experienced gynaecologists to ensure the correct scientific application of the various methods. Side by side with this, numerous physicians all over the country are giving advice and treatment in birth control to those of their patients who ask for it or need it for genuine reasons. There is a fairly sizable amount of contraceptive devices and drugs of the types approved by the authorities available on sale in pharmacies.

10. One of the main tasks of these clinics was to assess the suitability, acceptability and success of the various contraceptive devices in the different communities in the United Arab Republic. The results obtained for each method are given below:

(a) Vaginal diaphragm and jelly (V.D. and J.): out of an initial total sample of 474 women in two Cairo clinics, only 398 women continued to use it for a period of 3206 menstrual cycles resulting in 43 conceptions. This implies a very low failure rate of 16 women per 100 years. This method is still the most widely used in the clinics, and has met with a great deal of success and the least number of complaints. It is mostly used by more enlightened women, whereas others prefer foaming tablets, due to the simplicity of their use;

(b) Vaginal foaming tablets (V.F.T.): this method is generally favoured by illiterate women in rural areas due to the simplicity of its use. This method has a high demand in spite of the fact that its rate of success is lower than that of the vaginal diaphragm and jelly;

(c) Preceptive jelly and Delfin Cream with applicators (P.J. and D.C.): the use of this method by the clinics was started in 1962, and received a strong acceptance due to the simplicity of its usage. A follow-up study of 398 women in two Cairo clinics using this method for 2824 menstrual cycles resulted in 60 conceptions. This amounts to a failure rate of 25.5 women per 100 years. This method is therefore less successful than the previous two;

(d) Oral contraceptive pills (O.C.P.): the use of these pills started recently in one clinic

only on an experimental basis under the supervision of a group of professors of gynaecology from Cairo University and the Egyptian Association for Population Studies. No final results specially in reference to the side results, have been arrived at yet. So far, this method has wide acceptability and a high degree of success;

(e) Intra uterine contraceptive device (I.U.C.D.): these were introduced for the first time in four clinics in the beginning of August, 1964. Two hundred cases have been treated in the first three months with encouraging results. Table 3 shows a comparison of the results of

the different methods.

11. It is well realized that the use of these methods and others, however efficient, cannot give decisive results without a wide belief in, and acceptance of birth control policy. For this reason, mass communication media are being utilized to spread the idea and increase the awareness of people about the immense economic and social disadvantages to the country of allowing the population to increase at such a high rate as the one prevailing now. It is believed that the rescue will come through education and a perceptible rise in the standard of living of the people.

Table 1. Number of family planning clinics functioning in urban and rural areas since 1955

Year	Number of clinics		
	Urban	Rural	Total
1955	8	—	8
1956	12	—	12
1957	12	6	18
1958	12	12	24
1959	13	12	25
1960	13	13	26
1961	14	13	27
1962	14	14	28
1963	20	14	34
1964	24	14	38

Table 2. Number of new cases treated annually in the urban clinics for birth control since 1955

Year	Number of cases
1956	4,811
1957	5,929
1958	4,150
1959	3,421
1960	3,704
1961	3,506
1962	4,997
1963	4,880
1964 (Jan.-Sept.)	8,946

Table 3. Results of experience in the association's clinics

Method used	Usage (per cent)	Acceptability (per cent)	Success (per cent)
V.D. and J.	20	90	90
V.F.T.	30	90	85
P.J. or D.C.	15	85	80
O.C.P.	20	80	98
I.U.C.D.	15	95	98
	100		

Age at marriage and the trend of fertility in Korea

YUN KIM

1. More than 99 per cent of Korean women who survived to the age group 30-34 years in the census have married at least once up to 1960. However, the age pattern of marriage has changed considerably in recent years, particularly after World War II and the Korean War, 1950-1953. According to the census of 1935, about 65 per cent of males and 96 per cent of females were already married before they reached the age group 20-24 years, whereas only 21 per cent of males and about 73 per cent of females were married at the time of the 1960 census. The mean age at marriage calculated from the registered marriages, which was fairly stable at about 22.9 years for males and 19.8 years for females before 1945, increased to 28.7 and 24.0 years by 1960. The mean age at marriage calculated from the census data (singulate mean age at marriage)¹ which was 20.8 and 16.5 years for males and females before 1945, also increased to 25.1 and 21.3 years in 1960. (See table 1.)

2. The major factor contributing to the change in the singulate mean age at marriage was undoubtedly the surplus of females at the ages at which it was customary for them to marry, as compared with the number of single males of marriageable ages who were available for marriage in the post-war period. There were only 62 single males aged 20-34 years per 100 single females aged 15-29 years in 1955 compared with 102 single males per 100 single females in the respective age groups in 1935. A large proportion of females undergoing higher education and the higher proportion of females in the labor force as a result of rapid social changes and industrial development following the division of North and South Korea could also have affected the postponement of marriage. In the 1955 census, the proportion of females who had completed or were continuing higher education (high school and above) was 4.9 per cent for the age group 20-24 years while it was only 1.4 per cent for the cohort 10 years older. About 67 per cent of females aged 14-49 years were in the working force.

¹ J. Hajnal, "Age at marriage and proportions marrying", *Population Studies*, vol. VII, No. 2 (1953), pp. 111-136.

3. The larger change in the mean age at marriage, when all marriages are considered, probably indicated greater re-marriage of widows than formerly because of the difficulties which unqualified or inexperienced females had in order to live on their own earnings.

4. The effects of marriage patterns,^{2,3} age patterns of fertility⁴ and declining mortality⁵ on the birth rate and other demographic measures such as the rate of growth, reproduction rates, mean length of generation etc. have been discussed by a number of authors. It has also been emphasized that the effects of these variables on fertility indices are more significant in the pre-industrial countries where the age at marriage is very young and the birth rate very high.

5. The birth rate in Korea was very high, reaching nearly 50 per thousand population before World War II. The death rate, which was over 30 per thousand in the nineteen-twenties had dropped to about 10 per thousand by 1960. The quantitative effects of changes in age patterns of marriage and declining mortality in Korea on the birth rate and related fertility indices are examined when the age-duration-specific fertility rates were held constant.

6. Assuming that the proportion single recorded in the census is the cumulative result of the marital experience by a cohort and that a linear relationship between age and proportion single exists within each age interval and between age intervals, the proportion of females marrying at each age has been calculated for

² N. B. Ryder, "The conceptualization of the transition in fertility", *Cold Spring Harbor Symposia on Quantitative Biology*, vol. XXII (1957), and *Nuptiality as a Variable in the Demographic Transition*, paper presented at the 1960 meeting of American Sociological Association.

³ W. J. Leasure, "Malthus, marriage and multiplication", *Milbank Memorial Fund Quarterly*, vol. XLI, No. 4, part 1 (October 1963), pp. 419-435.

⁴ A. J. Coale and C. Y. Tye, "The significance of age-patterns of fertility in high fertility populations", *Milbank Memorial Fund Quarterly*, vol. XXXIX, No. 4 (October 1961), pp. 631-646.

⁵ K. G. Basavarajappa, "Effect of declines in mortality on the birth rate and related measures" *Population Studies*, vol. XVI (March 1963), pp. 237-256.

1925, 1930, 1935, 1955 and 1960. Using a hypothetical schedule of age-duration-specific fertility rates prepared for the population which is not practising birth control⁶ and the proportion marrying by age, the age-specific fertility rate has been computed, since the age-specific fertility rate is the sum of the products of the age-duration-specific fertility rate and proportion married in each duration. Because of the changes in marriage schedule of females, i.e. 25.8 per cent increase in singulate mean age at marriage from 17.0 in 1935 to 21.3 years in 1960, the total fertility rate (*TFR*) has declined about 16.4 per cent between 1935 and 1960. However, the age-specific fertility rate of women aged 15-19 and 20-24 years declined as much as 87 and 26 per cent respectively while the fertility of older women increased up to 59 per cent.

7. From the enumerated population in the census and the estimated age-specific fertility rates, the average age at childbearing (*A*) was calculated and the net reproduction rate (*NRR*) was also computed using the mortality schedules estimated from the successive census age distributions, assuming that the sex ratio at birth in Korea was 106 males per 100 females. (The changes in the age structure of female population were very minor throughout the period). The indices of marriage, fertility, and mortality are summarized in table 2.

8. A change in marriage patterns, during a period of about one generation between 1935 and 1960 while the age-duration-specific fertility rates remained constant, results in (a) a 12.4 per cent increase in the average age at childbearing, i.e. 25.1 to 28.1 years, (b) a 16.4 per cent fall in the gross reproduction rate (*GRR*), (c) a 19.5 per cent decline in the crude birth rate (*CBR*) and (d) a 17.8 per cent decline in the net reproduction rate (*NRR'*) when the mortality remained unchanged at the level of 1935-1940.

9. However, mortality in Korea declined considerably during this period. The expectation of life at age 15 years for the female population rose by 63.1 per cent from 35.0 in 1935 to 57.1 years in 1960.

10. Therefore, when the changes in marriage pattern and mortality are considered simultaneously, the net reproduction rate (*NRR*) has increased by 8.2 per cent from 2.82 to 3.04 instead of declining by 17.8 per cent as shown above. If the *NRR* in 1960 was the same as that of 1935 (i.e., 2.82) or, in other words, if

the women were not to reproduce more even though their life span has increased, the *CBR* would have further declined by 14.7 per cent (total decline of 31.4 per cent) to 43.5 in 1960 instead of 51.0.

11. Assuming that the observed intercensal rate of population growth (*r*) approximates the intrinsic rate of growth, and that the average age at childbearing equals the mean length of a generation (*T*) in the stable population,⁷ the net reproduction rate (*NRR''*) has been calculated from the formula $NRR'' = e^{rT}$. The *NRR''* has increased by 22.8 per cent from 1.78 to 2.19 between 1935 and 1960. According to the analysis made above, an increase of about 8 per cent in *NRR* is caused by the decline in mortality and the changing age pattern of marriage. The adjusted crude birth rate of Koreans declined only by 7 per cent from 40.9 in 1935 to 38.0 in 1960 [the intrinsic birth rate (*IBR*) for females declined by 14 per cent] compared with the 19.5 per cent decline as evidenced by the above analysis. Therefore, it seems that the age-duration-specific fertility rate in Korea has increased somewhat between 1935 and 1960, possibly due to the post Korean War baby boom. The age structure of the population revealed by the 1960 census also suggests some increase in fertility.

12. However, there is a greater chance in Korea that the singulate mean age at marriage which was still low in 1960 (21.3 years for females) will increase further in subsequent years because the proportion single aged 20-24 and 25-29 years for females in 1960 was only 32.5 and 2.8 per cent respectively. If the singulate mean age at marriage increases so that the average age at childbearing (or alternatively, the mean length of generation) reaches 30 years, the rate of population growth will decline by 7.7 per cent from 27.9 to 26.1 per thousand population provided the *NRR* of 1960, i.e., 2.19, remains unchanged. At the same time, the birth rate may decline as much as 5 per cent from 35.8 to 34.0 per thousand female population because the net reproduction rate of Korean women is unlikely to rise much further either because of declining mortality or an increase in the age-duration-specific fertility rate (see *NRR''* in table 2, which rose only by 2.3 per cent between 1955-60). It is very unlikely that the mortality of Korean females which is already at a very low level (death rate of about 8 in 1960) will fall by a notable degree. Moreover, there is a strong possibility that the

⁶ W. J. Leasure, "Malthus, marriage and multiplication", *Milbank Memorial Fund Quarterly*, vol. XLI, No. 4, part 1 (October 1963), pp. 419-435.

⁷ A. J. Coale, "A new method for calculating Lotka's *r*—the intrinsic rate of growth in a stable population", *Population Studies*, vol. XI (1957), pp. 92-94.

proportion of women who never marry may increase considerably as the marriage pattern changes further, therefore contributing a larger decline in fertility (the proportion of women never married by age 50 in Korea in 1960 was only 0.1 per cent compared with more than 10 per cent in many Western countries). Furthermore, if the ever increasing family planning campaign which was commenced in 1961 and directed by the government organizations is effective and is able to reduce the NRR somewhat, say, to the level of 1935 (i.e., 1.78), the rate of population growth will be reduced to 19.3 and the birth rate will become below 27 per thousand population. As pointed out by some experts,⁸ the prospects of the family plan-

ning programme in Korea are very promising due to a number of favourable factors such as a high literacy rate (72 per cent of population aged 13 years and above in 1960) and a relatively high proportion of urban population (about 28 per cent of the total population lived in cities with more than 50,000 inhabitants in 1960). Therefore, in the next few years, say 5 or 10, the birth rate in Korea may fall below 27 and produce a surprise in world demographic history by proving that the demographic transition can happen in a short period in a country where the economic conditions are still relatively backward due to the combined effects of the changes in marriage patterns and intensive family planning.

⁸ M. C. Balfour, J. Whitridge, V. H. Whitney, and B. Berelson, *The family planning program of Korea*, a report to the Ministry of Health and

Social Affairs, Republic of Korea (The Population Council, 1963). Mimeographed.

Table 1. Age at marriage and the birth rate, Korea

Year	Mean age at marriage ^a		Singulate mean age at marriage		Registered crude birth rate	Adjusted crude birth rate ^b
	Male	Female	Male	Female		
1913	23.13	20.02	—	—	26.87	47.45
1920	22.79	19.40	—	—	30.70	43.52
1925	23.16	20.18	20.46	16.00	38.08	49.13
1930	23.23	20.19	20.81	16.52	36.19	48.51
1935	22.27	19.05	21.12	16.96	29.29	40.91
1955 ^c	28.06	23.24	24.60	20.47	10.32 ^d	38.02
1960 ^c	28.74	24.00	25.14	21.33	22.70 ^d	

^a All figures are 5-year averages centred on the years indicated except that of 1913.

^b The adjustment made is based on the results of extensive analysis of census and registration data using the quasi-stable population technique and the model life tables. Details will be presented in my Ph.D. thesis, *The Population of Korea*, under preparation.

^c For South Korean population only.

^d Calculated from unpublished data supplied by the Bureau of Research and Statistics, Korea.

Table 2. Indices of marriage, fertility^a and mortality, Korea

Year	SMAM	A	Per cent single at age 50	TFR	GRR ^b	CBR	$\frac{a}{e_0}$	NRR ^c	NRR' ^d	IBR	r^e	NRR'' ^f
1925	16.00	24.67	0.7	8.55	4.15	65.26	34.6	2.243	2.872	47.11	17.78	1.551
1930	16.52	24.80	0.0	8.53	4.14	65.31	37.2	2.368	2.862	45.43	18.83	1.595
1935	16.96	25.01	0.1	8.42	4.09	63.37	46.6	2.820	2.820	41.62	23.14	1.784
1955	20.47	27.26	0.2	7.33	3.56	54.85	58.2	2.889	2.423	—	27.90	2.140
1960	21.33	28.10	0.1	7.05	3.42	51.01	65.9	3.041	2.317	35.80		2.190

^a The level of fertility indices does not necessarily represent those of Korean populations.

^b Sex ratio at birth of 106 males per 100 females was assumed.

^c The life table values of 1925-1930, 1930-1935, 1935-1940, 1955 and 1960 were used for 1925, 1930, 1935, 1955 and 1960 respectively.

^d The life table values of 1935-1940 were used for every year.

^e For the period 1925-1930, 1930-1935, 1935-1940 and 1955-1960.

^f Estimated from the formula $NRR = e^{rT}$ assuming that $A = T$ and the intercensal rate of growth of female population equals the intrinsic rate of growth of female population.

Factors affecting Moslem natality

DUDLEY KIRK

1. Most Moslem populations have in common certain distinctive demographic characteristics shared only in part by other major religious groups. What follows is a summary of a longer study¹ of (a) the distinctive aspects of Moslem natality, (b) their possible explanation, and (c) evidences of prospective changes, from field studies of knowledge, attitudes and practices relating to family planning.

2. Islam, or the community of Moslem peoples, includes some 500 million adherents. The heartland of Islam is a solid bloc of Moslem countries extending from the Straits of Gibraltar and Dakar in the west some 5000 miles into Chinese Sinkiang and the boundaries of India in the East. About 40 million Moslems live in the enclave of East Pakistan and as many more are scattered through India. In Southeast Asia, even further removed from the Moslem heartland, is a bloc of close to 100 million Moslems in Indonesia, Malaysia and the southern Philippines. Mohammedanism is the dominant religion in at least 22 nations and is important in many more. The chief areas of Moslem occupancy cover a territory roughly equal to the North American continent, with about twice the population.

I. MOSLEM NATALITY

3. Few Moslem countries have vital statistics that are complete and accurate enough to provide finely calibrated measures of natality. But progress in measurement is being made by national and international agencies even in the frequent absence of reliable official vital statistics. Where the latter are absent, estimates are often derived from sample surveys or indirectly computed from census age distributions by the "reverse-survival" method.

4. The available data indicate that Moslem natality is (a) almost universally high, (b) relatively uniform, (c) with little evidence of important trends over time, and (d) generally higher than that of neighbouring peoples belonging to other major world religions. Among

the continuous bloc of Moslems living in the huge region from North Africa to West Pakistan and Central Asia the annual birth rates reported or computed by the United Nations fall in the range of 40-50 per thousand. The gross reproduction rates so computed fall within the narrow range of 2.8-3.4.² There appears to be greater variability among Moslems south of the Sahara, where the Moslem religion and way of life fuse in different degrees with tropical African cultures and religions. Also natality in East Pakistan appears to be somewhat higher than in the Moslem heartland, and the information for Indonesia does not permit firm conclusions other than that the birth rate is undoubtedly high.

5. The relative uniformity and high level of Moslem natality contrasts with that of all other major religious groups. In most of these natality is more variable (as among Roman Catholics and among Buddhists and other Oriental peoples) or generally low (as among Protestants, Jews, and peoples of Orthodox background, including the Slavs of the Soviet Union and the Communist countries of Eastern Europe). Hindus are most comparable among major religious groups, but the Moslems of the Indian sub-continent have higher reproduction rates than their Hindu neighbours. It would seem that Moslem institutions, more than those of other world religions, favour a uniformly high natality. Religion and natality are perhaps more highly correlated for Moslem populations than for any other major religion.

II. GENERAL CULTURAL FACTORS FAVOURING HIGH BIRTH RATES IN MOSLEM COUNTRIES

6. Moslem countries are all in the category of developing nations. Factors contributing to high birth rates generally in these nations are linked in several ways with Moslem influences:

(a) Moslem influence is strongly con-

¹To be published in proceedings of the International Conference on Family Planning Programs, Geneva (1965).

²United Nations, "Conditions and trends of fertility in the world", *Population Bulletin*, No. 7 (United Nations publication, Sales No.: 64.XIII.2); "World-wide source-book of statistics of area and population, vital statistics and international migration statistics", *Demographic Yearbook 1963* (United Nations publication Sales No.: 64.XIII.1).

servative. In many ways all religions are conservative, but it is often noted that this is especially true of Islam, in which religion and way of life are so intertwined as to be inseparable. Mohammedanism shares with other religions injunctions to marry and multiply. Children are among the richest blessings that Allah bestows—He will provide for the souls He permits to come into the world. Moslems share with other religions important fatalistic themes that might well dispose them against conscious efforts to control family size or on occasion to adopt health measures that would reduce illness and postpone death. But these ideas are characteristic of many traditional societies; the difference is the tenacity with which old beliefs and practices are maintained by Moslems and influence life today. The contribution of this general conservatism to the maintenance of pre-modern natality is diffuse, difficult to measure, but probably very important;

(b) All Moslem countries have low indices of material development, and except in tropical Africa these are usually lower than those of non-Moslem neighbours. High levels of education, industrialization and other aspects of modernization associated with declines in the birth rate have not made strong headway as yet in Moslem countries. In fact, class differentials in natality in the United Arab Republic, for example, suggest that a general rise in the level of living would at first tend to raise the birth rate, because of better nutrition, health, etc.;

(c) Islam partakes of the pronatalist social forces that exist generally in peasant and pastoral societies. High mortality, especially of infants and children, have in the past called for unrestricted reproduction. Sons are valued for many purposes: for continuity of family line and land ownership; for contribution to agricultural labour; to strengthen family numbers in village rivalry and strife; for support in old age; for religious intervention at and after death. As in other developing societies, particularly in Asia, the joint family system in Islam buffers the direct burdens of child-bearing on the parents.

III. SPECIAL MOSLEM CHARACTERISTICS FAVOURING HIGH BIRTH RATES

7. Three of these will be discussed briefly below: (a) marriage institutions, (b) emphasis on sexuality, (c) subordination of women.³

³ These subjects are discussed, with extensive citations to other sources, in Mahmoud Seklani, "La fécondité dans les pays arabes", *Population*, No. 5 (Paris, Oct-Dec. 1960), pp. 831-856; and William J.

8. The traditional Moslem family is strongly patrilinear and patrilocal with male dominance and responsibility specifically prescribed by the Koran. The Moslem family derives from the agnatic family of Mohammed's day. Polygamy was customary and Moslem doctrine prescribes that in the event of plural marriage the husband must treat his wives equally; there has been much dispute as to whether this also means that he should distribute his favours equally among them. Divorce is theoretically easy, but in fact restrained by the fact that the husband must return the dowry with the wife or otherwise pay a substantial penalty. Doctrine is favourable to early remarriage of the widowed and the divorced; the Scriptures require only a sufficient interval (3-4 months) to determine whether or not the woman was pregnant at the time of separation and thereby establish legitimate responsibility for offspring.

9. Moslem doctrine holds that pleasures of the flesh, and specifically sexual intercourse, are a God-given virtue to be enjoyed and conjugal obligation to be fulfilled. While Mohammedanism imposes dietary restrictions and puristic injunctions relating to art and music, there is a striking absence of the value that is placed on sexual asceticism in Christianity, in Buddhism and in Hinduism. A celibate clergy or celibate religious orders are foreign to Islam. In traditional Moslem belief the permanent state of celibacy is abnormal for men and unthinkable for women.

10. The place of women in traditional Moslem society was an unusually subordinate one. In some widespread Moslem sects women were not permitted to enter the mosques or to participate in religious ceremonies. They were supposed to wear the veil, and on the Indian subcontinent to observe the often unhealthful seclusion of *purdah*. These restrictions were not always practical or enforceable, especially among the poor, but they have had prestige and were applied most rigorously among the upper and middle classes that otherwise would have been most receptive to modern influences. While the position of women is changing rapidly in the more progressive Moslem states, earlier attitudes are reflected, for example, in the very low level of education of Moslem women. Less than ten percent of the women over age 15 are literate in Morocco, Iran, Iraq, Pakistan, and doubtless most of the Moslem countries for which there are no data. In each case the number of male literates is three to four times greater. Only in the Soviet Moslem

Goode, *World Revolution and Family Patterns* (New York, Free Press-MacMillan, 1963), especially chap. III.

Republics, in Albania and in Indonesia are more than a fourth of the women reported as literate. Male dominance within marriage is thus strengthened by the greater education of males and by the differences in age at marriage—women are characteristically married very young to more mature men, usually in their twenties.

11. These traditional family institutions and the traditional role of women affect natality through (a) the proportion of the reproductive life that is spent in marital or other sexual unions and (b) within such unions the practices determining exposure to pregnancy. Statistical information is available on the first but not generally on the second. In the ten Moslem countries for which data are available 70-86 per cent of all females at ages 15-44 are married.⁴ This is a higher proportion than exists in the Far East and Southeast Asia and in almost all Western countries, which range from a low of 47 per cent in Ireland to a high of 71 per cent in the United States. It is apparent that Moslem women spend a larger part of their reproductive life in marriage than do their sisters in these other major regions. This is the result of the following several influences:

(a) In accordance with Moslem doctrine marriage of women is well-nigh universal. In those countries for which data are available three per cent or less (more often only one per cent) do not marry by end of the reproductive period;

(b) Age at marriage is low for women in Moslem countries; in the countries having statistical information the great majority of women are reported as married before age 20. However, there are important differences as between Moslem countries, and perhaps only in Pakistan and in certain tropical African countries is there an approximation to the traditional rule of marriage at puberty. There is evidence that the age at marriage has been rising in the more progressive Moslem countries in recent years;

(c) Widowhood is more common than in the West owing to higher mortality, which of course varies from country to country. It is generally declining with reductions in mortality;

(d) As might be expected, divorce is more common in Islam than elsewhere. The reported figures, which probably understate the fact, show substantially higher divorce rates than

in the West and in the non-Moslem countries of Asia;

(e) The effects of widowhood and divorce on natality are tempered in Moslem countries by institutions favouring the early remarriage of widows and divorcees. The proportions of marriages involving a widow or a divorced person are much higher than in the West (except in Albania and Turkey, which more closely follow the European pattern). In the United Arab Republic where vital statistics are fairly reliable, eight per cent of all Moslem grooms were in 1955 reported as marrying an additional wife, suggesting that at least here polygamy was an appreciable factor in increasing the possibilities for women of marriage and remarriage;

(f) Nevertheless polygamy is probably more a spectacular feature of Moslem institutions than a decisive factor in Moslem natality. There is inadequate evidence on its prevalence but available information suggests that some nine tenths of Arab farmers, for example, are monogamous, and polygamy is most commonly adopted when the first wife fails to produce a child. Polygamy is more common among the Arab Beduins and the Moslems south of the Sahara, where Moslem customs in this matter converge with earlier tribal practices. But among the more advanced Moslem countries polygamy is in disrepute and is presumably declining.⁵

12. There is only the most fragmentary evidence on the relation of Moslem institutions to practices determining the risk of pregnancy within marriage. Ritual abstinence is apparently less common among Moslems than, for instance, among Hindus. Moslem customs do not require prolonged abstinence following childbirth, and Moslem women do not so frequently return to their parents' home for confinement as, for example, among Hindus, so post-partum separation is likely to be shorter. Such factors may explain the somewhat higher birth rates of Moslems than Hindus in the Indian subcontinent despite similar patterns of early marriage, high rates of widow remarriage and high proportions of reproductive life spent by women in marriage.⁶ Moslem women indulge in prolonged lactation after childbirth; there is evidence that the risk of pregnancy is some-

⁵ United Nations, "Levels and trends of fertility in Africa", *Population Bulletin*, No. 7 (chap. III (United Nations publication, Sales No.: 64.XIII.2). There is extensive and inconclusive literature about the effects of polygamy on the general birth rate of the society concerned.

⁶ Census data for India and Pakistan suggest little difference in the proportion of widows remarrying despite the Brahmin prohibition against this practice.

⁴ Data in this paragraph were computed from compilations in the United Nations, *Demographic Yearbook*, recent issues.

what reduced by this practice and that this may be a factor in keeping Moslem natality below physiological potentialities.

13. In sum, the Islamic way of life is culturally favourable to high natality in the absence of voluntary restriction of births within marriage. The maximum potential fertility is reduced by high mortality and widowhood and probably by adverse physiological factors such as malnutrition and disease and by certain practices such as prolonged lactation. The general effect of modernization should be to ameliorate the adverse factors and hence raise the birth rate in the absence of voluntary control of family size.

14. Mohammedan doctrine does not prohibit the voluntary restriction of births, though as a militant religion Islam historically put pressure on men to produce numerous children and especially sons. Nevertheless there are clear authoritative statements, for example by the highly respected mediaeval theologian Al-Ghazzali, that would permit the practice of birth control (i.e., coitus interruptus) under certain conditions.⁷ Also important are the *fatwas* made by religious authorities in the light of modern conditions. Because Islam does not have the hierarchical structure of the Roman Catholic Church, these pronouncements do not have the authority of a papal encyclical, but they have significant influence. One of the clearest and most authoritative of these, by the Mufti of Egypt, comes to the conclusion that "It is permissible for either husband or wife, by mutual consent, to take any measures to prevent semen entering the uterus, in order to prevent conception."⁸ While this conclusion has not gone unchallenged, the preponderance of religious authority has not been unfavourable to birth control. On the other hand, abortion after the "quickening" of the embryo is absolutely forbidden. The existing pronouncements on family limitation did not contemplate and hence do not pass judgment on the use of radically new methods such as the oral contraceptives and intrauterine devices.

IV. FIELD STUDIES OF KNOWLEDGE, ATTITUDES AND PRACTICES RELATING TO FAMILY LIMITATION

15. There is now a rapidly growing number

⁷ Akhter Hameed Khan, *Islamic Opinions on Contraception* (Comilla, East Pakistan, Pakistan Academy for Village Development, 1961). Includes translations of extracts from Al-Ghazzali and Ibn Kaiyim.

⁸ "A Mohammedan 'fatwa' on contraception", *Human Fertility*, 10(2) (June 1945), pp. 45-46. Includes translation of Arabic original published in the *Journal of the Egyptian Medical Association*, 20(7) (July 1937), pp. 54-56.

of such studies of general populations in Moslem countries. The most ambitious of these is a survey of a national sample in Turkey, taken preparatory to the adoption of a government programme to promote family planning in that country. There are several studies in Pakistan, which has had a government family planning programme for several years. Two studies were conducted on a comparable basis in the United Arab Republic and in Lebanon. Studies are being conducted in Tunisia and in Indonesia, but the results have not yet been published. While these various studies were conducted under different auspices and are in some respects non-comparable they lead to certain consistent results. These are summarized below, though so brief a statement cannot hope to do justice to the individual studies involved.⁹

16. Such studies are feasible: they can provide valuable and reliable information for general populations, as opposed to clinic or other unrepresentative groups. This is true despite initial skepticism encountered in every country concerning the feasibility of obtaining responses on such delicate subjects in a household survey.

17. Knowledge: men and women in Moslem countries, as elsewhere, display ignorance about the physiology of reproduction, as, for example, the time of ovulation and the fertile period in the menstrual cycle. Knowledge of modern methods of birth control (i.e., other than abstinence or abortion) is largely confined to the small educated minority in the cities. In Turkey, perhaps the most advanced Moslem country, only 43 per cent of the national sample said that they know of any method of contraception.

18. Desired family size: all of the studies show that a substantial proportion of couples in both urban and rural areas are concerned about

⁹ Results of the studies are available in the following publications: "Turkey: national survey on population", *Studies in Family Planning*, No. 5 (New York, Population Council, December 1964); Social Sciences Research Centre, University of the Punjab *Knowledge of and Attitudes Towards Family Planning* (Lahore, Family Planning Association of Pakistan); A. Majeed Khan, *Rural Pilot Family Planning Action Programme: First Annual Report, March 1961-May 1962* (Comilla, East Pakistan, Pakistan Academy for Rural Development); Beryl J. Roberts, David Yaukey, William Griffiths, Elizabeth W. Clark, A. B. M. Shafullah, Raisunnessa Huq, "Family planning survey in Dacca, East Pakistan" *Demography*, vol. II (1965); Hanna Rizk, "Social and psychological factors affecting fertility in the United Arab Republic", *Marriage and Family Living*, 25(1) (February 1963), pp. 69-73; David Yaukey, *Fertility Differences in a Modernizing Country: A Survey of Lebanese Couples* (Princeton, New Jersey, Princeton University Press, 1961).

the size of their families and do not want more children. In each of the studies where the appropriate questions were asked, a large proportion of the respondents gave as an ideal family size a smaller number of children than the actual number in completed families in their own society. Women in Moslem countries apparently want fewer children than their husbands though the difference is not large. Families with one or more sons are more interested in limiting family size than those having only daughters. Among Moslem countries only in Turkey has the small family norm gained general acceptance though even here only in principle, not in fact. The modal number of children desired by both men and women is three, the average (mean) being 3.7 for men and 3.2 for women. In actual fact Turkish women completing the childbearing period report an average of 6.3 pregnancies, 5.8 live births and 4.1 living children. Only about one-fourth of the Turkish couples in their thirties, married 10-14 years, and already having three children want more children. This position is not now representative of more than the most progressive Moslem populations, but probably indicates the direction in which the more advanced Moslem countries are going. A very different atmosphere of opinion still exists in the more rural populations: in the U.A.R. study, for example, one third of the women in the younger reproductive ages thought questions on desired size of family meaningless "because God alone determines the number of children a wife might have".¹⁰

19. Practice of family planning: despite widespread favourable attitudes toward the restriction of family size, the actual practice of birth control by Moslems is very limited. As stated by the author of the U.A.R. study, "It is evident from this analysis that while more than half the wives in this study consider their families too large, yet they could not or would not limit them to the desired size".¹¹ Among the rural Moslem populations studied the existing practice of contraception was negligible except in Turkey, where there was a definite progression from 6 per cent practicing in rural areas, 18 per cent in the towns, 21 per cent in the cities and 29 per cent in the metropolitan areas. In the urban Dacca sample the proportion ever having practiced family planning was 36 per cent or 21 per cent depending on whether one relies on the reports of the hus-

bands or of the wives, and in Lahore the comparable figures are 18 per cent and 8 per cent. The highest figures reported for any Moslem population are those reported by Yaukey for Beirut, which is a cosmopolitan and Westernized city: for women married ten years or more 60 per cent of the uneducated and 83 per cent of the educated reported some attempts at control of conception.¹²

20. Reduction of the birth rate owing to family planning. Where such information was obtained, the studies show smaller family size for the better educated urban couples included in the samples. In Moslem countries as everywhere education is highly correlated with knowledge of contraceptive methods, with favourable attitudes toward their use and with the actual practice of family planning. As in most Western countries the educated were the first to adopt family limitation. But as yet these groups are too small to have much impact on the birth rate of Moslem populations as a whole. It is possible that among the Moslem populations most exposed to European influence (in Albania, in Western Turkey and among the Soviet Moslem Republics) the birth rate has begun to decline on the Western model, and that this may soon become evident in statistical data.

V. POPULATION POLICIES

21. Several of the above studies were undertaken as result of government concern about population growth and of government interest in the possibility of introducing family planning programmes. In 1958 Pakistan embarked upon a modest government family planning programme that has been progressively enlarged in recent years. Turkey adopted a national programme in the spring of 1965. The United Arab Republic and Tunisia support experimental programmes though these do not now have national scope. While it is not the purpose of the present paper to evaluate these programmes, it is fair to say that they have not yet been on a large enough scale to affect the national birth rates concerned. However, the results of the above studies suggest that in each country there is a major reservoir of couples already motivated to adopt family planning if given the relevant information and services suited to their needs. The latter would seem to be the primary task of government programmes rather more than that of stimulating motivation.

VI. CONCLUSION

22. The uniformly high birth rates of Mos-

¹⁰ Hanna Rizk, "Social and psychological factors affecting fertility in the United Arab Republic", *Marriage and family living*, 25(1) (February 1963), p. 72.

¹¹ *Ibid.*

¹² David Yaukey, "Some immediate determinants of fertility differences in Lebanon", a *Marriage and Family Living*, 25(1) (Feb. 1963), pp. 27-34.

lem communities is related to the influence of Islam. Islam has been a powerful conservative force against the introduction of family planning as well as many other forms of innovation. But in Moslem countries, as in others in the developing world, there is solid evidence of interest in the possibility and in the practice of family limitation. Already there are the strong beginnings of family planning among the educated and urban elite on the Western model

and family planning will certainly spread, accelerated by government programmes and the development of contraceptive technology more suited to the needs of poor and predominantly rural people. We may expect the spread of family planning and reductions in the birth rates first in the more advanced Moslem countries and ultimately in them all but, owing to the nature of Moslem institutions, generally later than among neighbours of other major religions.

Some causes of the high fertility of the population of developing countries

V. I. KOZLOV

[Translated from Russian]

1. The population of most countries in Asia, Africa and Latin America belonging to the group known as "developing countries" is noted for its high fertility—usually twice as high as that of the population of the economically developed countries. Most European countries have 300-400 children under five—some less than 300—to every thousand women aged 15-49, but many developing countries have over 500 children to every thousand women in this age-group, and a number of countries (in Asia—Pakistan, Turkey and others; in Africa—Morocco, Tunisia and others; in Latin America—Venezuela, the Dominican Republic and others) 600-700 or even more.

2. The economies of most developing countries bear the imprint of colonialism, which seeks to transform them into sources of cheap raw materials. The great majority of the inhabitants of these countries—usually over 75 per cent—are still employed in various as yet inefficient branches of agriculture. With widespread relative agrarian over-population, on the one hand, and under-developed industry, on the other, the high fertility of the population of the developing countries creates complex and serious demographic and economic problems. By increasing the child population (the 0-14 year age-group accounts for over 40 per cent of the total population in Africa and Latin America but only about 25 per cent in Europe) it adversely affects the ratio between the economically active and economically inactive population and necessitates the diversion of considerable energy and resources to the upbringing of children, although much of this outlay is irrevocably lost because of the high infant mortality. Length of life is at present short in almost all the developing countries (approximately half or two-thirds that of the population of the economically developed countries), owing both to public health and medical services and the resulting prevalence of various diseases and to heavy labour and chronic malnutrition.

3. The high fertility of the population of the developing countries and the problems associated with it are attracting the attention of students in various fields. Unfortunately, the study of some questions is hampered by the backward state of demographic statistics and medical and sociological research in these countries and the consequent scarcity of factual material. Although more than a hundred works have now been published on the high fertility of the population in the developing countries, the concrete material they contain covers only a comparatively small segment of that population. Here the correctness of any general conclusions depends on the correctness of the methodology of research to a much greater extent than in the study of demographic, economic and social patterns in the developed countries, with their abundance of factual material. Yet there has been no noticeable success over the past decade in the work on general methodological questions. Although in his work *Culture and Human Fertility* Frank Lorimer outlined what he called a general theory of the influence on fertility of "cultural" factors (traditions, religion, kinship systems, etc.), the most recent substantial work on the subject—*Factors Affecting Human Fertility in Non-Industrial Societies* by Moni Nag—makes no systematized theoretical generalizations; the author limits himself to an analysis of the factors affecting fertility, placing special emphasis on biological factors, but hardly deals with the actual role of each factor or its interrelation with other factors; he ranks the desire for children together with post-widowhood celibacy and the influence of "psychological" factors together with that of the blood group. In our view, there are enough data available to permit us to avoid the eclectic theory of "equal factors" and to outline a theory which, by distinguishing between primary and secondary factors and taking into account their causal connexions, will help to throw light on the basic means of solving the demographic and economic problems of the developing countries.

4. Fertility is determined by an elaborate complex of diverse factors—biological, psychological, socio-economic, etc. It is directly dependent on the physiological ability of married couples to have children, on their desire for children—and when they do not want children or try to limit their families, on their opportunities for using precautionary devices or obtaining abortions—on the economic conditions for supporting and raising children, etc. Each of these direct factors affecting fertility is connected with a whole series of other factors of various kinds. For example, the degree to which fertility is affected by a factor as purely biological, it would seem, as the physiological ability of married couples to have children, depends on the duration of conjugal relations; that, in turn, depends on the age at marriage, and that is usually determined by socio-economic causes. Economic factors usually affect fertility not directly but indirectly; yet it is they which ultimately determine the extent of the influence of other factors and often their very existence.

5. Turning to a concrete analysis of the causes of the high fertility of the population of developing countries, we must point out that biological factors, which normally have an important influence on fertility, are here not sufficient to explain the high fertility level. It is true that in almost all developing countries, for a number of reasons (the racial characteristics of the population, the hot climate, etc.), puberty and consequently the ability to reproduce the species occurs earlier than in most economically developed countries; but the difference is relatively small (two or three years), and its effect on the length of the reproductive period is secondary to that of differences in age at marriage, which we consider below among the social factors. So far as the physical condition (health) of married couples is concerned, this factor should have had a negative rather than a positive effect on the fertility of the population of developing countries. Because of frequent disease, heavy labour, malnutrition and other reasons, the health of the population in these countries is obviously worse than that of the population of the economically developed countries. The wide prevalence in many developing countries of venereal diseases, which often cause sterility, is particularly influential in this connexion. In the economically developed countries the percentage of sterile women is usually lower than 10 per cent, and only in exceptional cases as high as 15 per cent; in the developing countries it is often twice as high.

6. The explanation for the high fertility of

the population of developing countries must be sought among the socio-economic and psychological factors involved. In particular, these factors affect the average age of entry into conjugal relations. In most developing countries it is the tradition to marry early, usually shortly after puberty. In India, for example, according to figures assembled, by the committee which supervises the observance of the act forbidding the marriage of girls under fourteen, about one out of every three Indian girls marries between the ages of fourteen and fifteen; and about 80 per cent of Indian girls are married by the time they reach the age of twenty, while in the United Kingdom, for example, more than one out of three women are still unmarried at the age of thirty. In African countries, usually over 50 per cent of women are married by the age of twenty. Early marriages may adversely affect women's health, but they considerably increase fertility, both because they prolong the actual child-bearing period and because the younger female age-groups have the highest fertility. However, the latter correlation is not an absolute one: a survey of early marriages in certain regions of India has shown, *inter alia*, that the fertility of married women in the 15-18 year age-group is lower than in the 19-21 year age-group.

7. Nor is the low age at marriage prevalent among the population of developing countries enough in itself to explain the high fertility (any more than the high age of marriage prevalent among the population of the economically developed countries is enough in itself to explain the low fertility in those countries, since the married couples still have enough time to have relatively large families). The positive influence of early marriage on fertility, assuming a normal sex life, can be said to be fully operative only when no family planning is practised. It is an established fact that family planning methods (various means of preventing conception, abortion) have been known to many peoples in the developing countries for a long time, although they have not been widely used. Nor are the newest and more convenient contraceptive devices in wide use in the developing countries, although in a number of them—particularly certain States in India—extensive propaganda in favour of such devices has been carried on by local and international organizations. Thus the absence of large-scale family planning in the developing countries cannot be regarded as due solely to the "darkness and ignorance" of the population of these countries; it may be explained by the fact that the majority of the population consider child-bearing a natural and necessary result of conjugal

relations and quite consciously try to have large families.

8. The tradition of large families apparently originated in primitive society, as a natural reaction to the very high death rate then prevailing; its purpose was to preserve and further develop the existing social groups—the family and the tribe, whose very survival depended primarily on their numbers. It is characteristic that the large-family tradition has been most clearly preserved in societies in which the married couple is closely connected with a wider social group—in particular among peoples whose social structure is based on the tribal family with patrilineal or matrilineal systems of kinship. Studies of peoples retaining vestiges of matriarchy (the Ashanti of the Guinea coast, the Yao of Southern Nyasaland, etc.) and of peoples with clear patrilineal systems of kinship (the Zulus and Xosa in the Republic of South Africa, etc.) show that they have various social institutions encouraging high fertility. Marriage is considered among them to be the sacred responsibility of each member of the tribe; an unmarried adult man or woman is an object of mockery and censure. Childlessness is regarded by men and women as the worst of all personal tragedies and humiliations. The fertility of women is glorified; women with many children command universal respect, and special festivities are sometimes organized in their honour. Roughly the same situation is found in countries where large patriarchal families are common (India, Pakistan, etc.). It should be pointed out that marriages among members of tribal and patriarchal families are greatly facilitated by the fact that often the partners are not expected to be economically self-supporting and the husband need not have any independent household.

9. The persistence of the historically rooted tradition of large families found among the peoples of developing countries is to a large extent connected with their religions. This applies to both local tribal and national religions (particularly those connected with ancestor worship) and “world” religions. Hinduism, the religion predominant in South Asia, encourages high fertility by a number of its precepts, going back to the laws of Manu; it approves of early and universal marriage, early child-bearing and the begetting of sons. Because a man must have a male heir (for according to the tenets of Hinduism only a son can and must perform the prescribed rites for the father after his death) a family must “in any event”, given the high death rate, have two or three sons, and consequently (since the chances of daughters being

born are even) there must be at least four children. One of the most traditional wishes addressed to an Indian girl on her marriage is: “Be the mother of eight sons!”. The negative influence on fertility of certain tenets of Hinduism—particularly the condemnation of remarriage by widows, however early they may have lost their husbands—ultimately has comparatively little effect on the over-all fertility indices. Islam, which is widespread in Western Asia and North Africa, has equally firm precepts in favour of high fertility. The Koran forbids celibacy and advocates large families, particularly of sons. The Koran permits contraception only where the birth of a child would clearly endanger the mother’s life; and barrenness is one of the main grounds for divorce it specifies. It is characteristic that Hinduism and Islam—the two religions which most strongly advocate large families—are also noted for their dogmas of woman’s subordinate status, which are dogmas important in this context because, as many sociologists have pointed out, the desire to limit the number of children is much more frequent among women than among men. Buddhism has no dogmas revealing a clear-cut attitude towards fertility and, in any case, does not advocate large families. However, students who have investigated the causes for the high birth rate among the inhabitants of South-East Asia, most of whom follow the southern branch of Buddhism known as Hinayana, consider it to be definitely connected with the negative attitude of the Buddhist priests towards contraception and, even more, abortion: any birth control is considered to be equivalent to the murder of a living creature, which, of course, is strictly forbidden by Buddhism. Christianity—the most widespread religion—has on the whole significantly deviated now from the biblical injunction “Increase and multiply!”. However, the Catholic Church—dominant in almost all the Latin American countries, which are noted for their high birth rate—is characterized by stricter observance of that injunction than the other Christian churches; it was only comparatively recently that certain methods of birth control were “officially” authorized by the Pope.

10. In considering the direct social and socio-psychological causes of the high fertility of the population of developing countries, we must emphasize that all these causes are ultimately conditioned by material factors—in particular by the level of development of the productive forces and the forms of economic activity. This applies especially to the principal cause of high fertility—the tradition of large families, whose emergence in the past was

closely connected with the extremely rigorous material conditions of social life. The tradition of large families was supported by public opinion, moral canons, the rules of marriage and, lastly, the precepts of religion, which, of course, did not create the tradition but only strengthened established national customs. The complex of ideological factors which formed around the institution of the large family, like the other ideological patterns, could and in due course did become relatively independent of the material factors which gave rise to it. As a result, the tradition of large families continues to exist even when the basic material factor underlying it—a high death rate—has ceased or is ceasing to be operative; for it is well known that in recent years the death rate in many developing countries has been reduced considerably—in some of them to the level obtaining in the economically developed countries—by a number of measures (vaccination against smallpox and other diseases, protection of water supplies, use of DDT preparations against insect vectors, etc.). The fact remains, however, that certain material factors causing high fertility still exist today; particularly noteworthy in this connexion is the persistence of factors deriving from the nature of the economic activity of the population of the developing countries. For example, the early marriage prevalent among the inhabitants of India or the Arab countries is apparently due not so much to the tenets of Hinduism or Islam as to the agrarian economies of the countries concerned. The primitive agriculture in which the vast majority of their populations are employed requires no long agricultural training or specialized education. Thus, people marry early largely in order to acquire rapidly an extra pair of hands for work in the fields (among farmers) or at home (among nomadic cattle-breeders).

11. Two of the indirect factors affecting fertility stand out as of special importance: the degree of urbanization and the level of education. In most countries of the world, fertility is considerably lower in towns than in rural localities. In the developing countries this is due in particular to the dissolution of family and blood ties and the breaking off of small families from the large tribal families in the towns, the great difficulty of supporting large families and the availability of more information about the newest methods of family planning. The life in closed rural communities so typical of the population of developing countries is undoubtedly conducive to the preservation of the traditional large family. It is a characteristic fact that the effect of urbanization on the fer-

tility level in these countries is far from immediate. In Lebanon, for example, the average number of childbirths per Moslem woman of fifty or over is 7.49 in rural areas and 6.75 in the towns—in other words, only slightly less. The delayed effects of urbanization on the level of fertility have also been noted in other developing countries, such as India, but their nature and ultimate result are quite clear. There is an equally obvious link between fertility and the level of general and specialized education of the spouses, particularly the wife: as the level of education rises, fertility usually declines in both economically developed and developing countries. This is due to the higher average age at marriage and greater social and cultural mobility of the spouses (particularly their efforts at social advancement), their liberation from the sway of religious dogma and outmoded traditions, and other factors reducing the level of fertility.

12. The influence of economic and cultural development on demographic processes may be illustrated by the example of the Soviet Union, Tsarist Russia was economically at the same level as many developing countries today. After the establishment of Soviet rule, the Soviet Union inaugurated a policy of industrialization, agricultural collectivization and cultural revolution. Economic development went forward rapidly: by 1963, industrial output in the Soviet Union exceeded the 1913 figure by a factor of 52. Before the revolution about 80 per cent of our population aged nine or over were illiterate. Now, the Soviet Union has become a country of universal literacy. By the beginning of 1964, 32 per cent of the total population (50 per cent of all working people, including about 44 per cent of all manual workers, 26 per cent of all collective farmers and 92 per cent of all specialists and office and professional workers) had received higher and secondary education. During the years of Soviet rule, the Soviet Union has trained 5.8 million specialists with higher education and 9.1 million with specialized secondary education. The direct result of the socialist industrialization of the Soviet Union, collectivization and the related wide-scale mechanization of agricultural production has been a considerable increase in the urban population. The proportion of the urban to the total population was 18 per cent in 1913 and 1926, 32 per cent in 1939, 48 per cent in 1959 and 52 per cent in 1963. Industrialization, the growth of the urban population, the rise in the cultural level of the population and, in particular, the influx of large numbers of women into employment have brought about a decline in the birth rate. The figures below

show the difference between the birth rate in the Soviet Union and in Tsarist Russia:

	<i>Number of births per 1,000 population</i>
1900-1904 (50 provinces of European Russia)	48.6
1905-1909 (50 provinces of European Russia)	45.8
1913 (present territory of the Soviet Union)	45.5
1926-1928	44.4
1937-1939	37.7
1940	31.2
1950-1954	26.4
1960	24.9
1963	21.2

13. The fact that the high fertility of the population of the developing countries is ultimately determined by socio-economic factors should be taken into account both in theoretical research and in dealing with practical problems. This high fertility cannot be significantly reduced, but the demographic and economic problems it creates can be tackled at their root by influencing biological or psychological factors (propaganda for preventive measures, etc.). All these problems can be effectively solved only by solving the over-all problem of the socio-economic and cultural development of the countries concerned in the course of their industrialization, urbanization and educational development.

Family type and fertility

MONI NAG

1. The institution of joint family is considered to be one of the main cultural factors favouring high fertility in India, but this hypothesis has not yet been tested with adequate data. Davis has isolated a few characteristics of joint families which are expected to be conducive to abundant reproduction.¹ Lorimer states that "the whole cultural context in which extended families tend to be idealized is likely to be conducive to high fertility."²

2. The purpose of the present paper is to determine whether joint families in contemporary India have actually higher fertility than single families. The analysis is based mainly on the unpublished data collected by Uma Guha from seven villages of West Bengal.³

3. Statistical data already available are very meagre in this respect. The data collected from a village called Singur in West Bengal is reported to show no significant difference between family size of couples living in simple families compared to those living in joint families.⁴ Poti and Datta found from their data (collected in 1956 from 600 rural households of West Bengal and 500 urban households of Calcutta) that out of four types of families defined by them, the one-generational joint family complex has the lowest fertility level.⁵ The data collected from 796 couples in a few villages of Orissa also revealed that the women living in joint families were less fertile than those in nuclear families.⁶

4. The data collected by Uma Guha from seven villages of West Bengal in 1960-1961 relate to 3,725 ever married women belonging to a number of Hindu and Muslim castes which are classified into the following six groups on the basis of socio-economic homogeneity: (a) Sheikh Muslims (245); (b) Non-Sheikh Muslims (2,518); (c) Muslim Fishermen (288); (d) Hindu Brahmins (177); (e) Hindu Satchashi and Ghosh (285); and (f) Other Hindus (212). The average number of children born to women belonging to simple and joint families in various age categories for each group mentioned above is shown in table 1. Instead of making a detailed typological classification, we have considered all families with more than one ever-married person related to another as joint families, and the rest as simple families.

5. It may be seen from table 1 that for each group the average number of children in joint families is less than that in simple families, when women of all ages are considered. This is also true for the majority of women's age-categories. Although the differences in average are quite small and are not likely to be statistically significant, the same trend in each group indicates that these cannot be explained only by chance factors. It is, therefore, necessary for us to investigate whether there are any institutional or biological factors which effectively counteract the factors mentioned by Davis and are responsible for the observed phenomenon.

6. Although a positive association between income and fertility up to a certain critical level and a negative association beyond that level have been found to be generally true for Indian communities, the contention of Poti and Datta that the families with lower income have a greater propensity to live together cannot be supported from the data collected by Guha.⁷ In a survey of families in four villages of West Bengal and in Calcutta, Sarma also found that

¹ Kingsley Davis, "Institutional patterns favouring high fertility in underdeveloped areas", Lyle, W. Shannon, ed., *Underdeveloped Areas* (New York, Harper and Bros., 1957).

² Frank Lorimer, et al., *Culture and Human Fertility* (Paris, UNESCO, 1954), p. 201.

³ I am grateful to Mrs. Uma Guha of the Anthropological Survey of India, Calcutta, for allowing me to use her unpublished data.

⁴ K. K. Mathen, "Preliminary lessons learnt from the rural population control study of Singur", Clyde V. Kiser, ed., *Research in Family Planning* (Princeton, New Jersey, Princeton University Press, 1962), p. 43.

⁵ S. J. Poti and S. Datta, "Pilot study on social mobility and differential fertility", *Studies in Family Planning* (New Delhi, Government of India, Directorate General of Health Services, 1960), pp. 60-61.

⁶ P. C. Bebart, "Family structure and fertility", *Proceedings of the 51st and 52nd Session of the Indian Science Congress, Part III* (Calcutta, Indian Science Congress, 1964), p. 503.

⁷ S. J. Poti and S. Datta, "Pilot study", op. cit., p. 61.

simple families are poorer than joint families.⁸ Hence, income level does not seem to be a relevant factor in explaining the difference in fertility between joint families and simple families.

7. As regards ages of women at marriage consummation and birth of the first child, the data collected by Guha do not reveal any difference between joint families and simple families. This is also true for educational level and marital status.

8. There is not much difference between rural Bengali women in joint families and those in simple families concerning their use of Family Planning Centres. Guha found that the husband's indifference or opposition was a greater hindrance in this respect than the mother-in-law's. Mathen also found in Singur that the "force of the barrier against acceptance of family planning lessons due to the presence of mother or other relatives in the joint families was not so strong as supposed".⁹ But a fertility survey conducted in Bangalore city indicated that a slightly higher proportion of couples in simple families were practising methods of family limitation than those in joint families.¹⁰

9. The variation in the normal frequency of coitus is one of the direct factors which may be responsible for the variation of fertility level.¹¹ Guha succeeded in collecting data on frequency of coitus from 2,882 women.

10. A very interesting fact relevant to our present problem is illustrated clearly in table 2. The average coital frequency for simple families is consistently higher than that for joint families. It is true not only when all groups and ages are considered together, but also separately for almost every age category in each of the six groups. Although the differences in average frequencies are not large, the remarkable consistency in their trend direction leaves very little doubt about the higher coital frequency among women in simple families than those in joint families.

⁸ Jyotirmoyee Sarma, "The nuclearization of joint family households in West Bengal", *Man in India*, 44 (1964), p. 205.

⁹ K. K. Mathen, "Preliminary lessons learnt from the rural population control study of Singur", Clyde V. Kiser, ed., *Research in Family Planning* (Princeton, Princeton University Press, 1962), p. 43.

¹⁰ United Nations, *The Mysore Population Study* (United Nations publication, Sales No.: 61.XIII.3), p. 168.

¹¹ Moni Nag, *Factors Affecting Human Fertility in Non-industrial Societies: A Cross-cultural Study* (New Haven, Yale University, Department of Anthropology, 1962), pp. 72-73.

11. Two main reasons which seem to be responsible for a lower coital frequency among women in joint families are: (a) lack of adequate privacy, due to overcrowding in the house; and (b) relatively more adherence to the traditional taboos on sexual intercourse on particular days, due to the presence of in-laws and other relatives. The privacy necessary for the sexual act is ordinarily much less frequent in Indian households than in Western households. Very often the husband and wife have to share a room with their children and sometimes with other relatives. Even when there are separate bedrooms in rural houses, the partitions between them provide very little privacy. The size of a house is not made larger to correspond to the increase in the size of the household, due to poverty and other factors. Thus, the lack of privacy for coitus is more acute in joint families than in simple families.

12. Almost every society in the world has taboos forbidding sexual intercourse on particular days. The restriction of sexual intercourse during a woman's menstrual period is a custom followed practically universally.¹² In the seven villages surveyed by Guha, it was found that the menarchial taboo is more rigorously observed among Muslims than among Hindus. Muslim women are expected to abstain from coitus for six to seven days after the completion of the menses, because they are considered to be polluted up to the end of that period. After the period of abstinence elapses, the women wash their bedding, in addition to cleansing their body and hair thoroughly. Hindu women are expected to abstain from coitus for two to three days after completion of the menses. Hindu and Muslim women are also expected to abstain from the sexual act on particular days of the year which are considered to be auspicious by their respective religions. For Hindus, these include fixed days for worship of certain gods and goddesses, the new moon, full moon, *ekadashi* (the eleventh day of the lunar cycle), solar and lunar eclipses, etc. There are variations among Hindus of different Indian regions in this respect. In the Singur area of West Bengal, it was estimated that there are nearly 100 days in a year when couples should abstain from coitus, according to Hindu religious sanctions.¹³ The number of such days for the Hindus of the villages surveyed by Guha is estimated to be around 80. All the taboos and

¹² Moni Nag, op cit., pp. 82-83.

¹³ K. K. Mathen, "Preliminary lessons learnt from the rural population control study of Singur", Clyde V. Kiser, ed., *Research in Family Planning* (Princeton, Princeton University Press, 1962), p. 42.

restrictions on sexual intercourse mentioned above are observed much less by younger women than by older women. But the younger women in joint families must observe these days of abstinence more carefully than their counterparts in simple families, owing to the presence and social control of mothers-in-law and other older women.

13. It is generally a matter of shame for women to give birth to children after they become mothers-in-law, particularly in joint families. Mothers-in-law are subjects of popular jokes if they become pregnant during the pregnancy of their daughters or daughters-in-law. Hence, women in joint families tend to limit the frequency of coitus after their sons are married.

14. The difference in the frequency of widows' remarriage between women in joint families and those in simple families may contribute partly towards the difference in their fertility levels. Among the Hindu upper castes

particularly, widows do not usually remarry. Davis has shown that this is one of the main cultural factors responsible for lesser fertility among Hindus than among Muslims in India.¹⁴ The restriction on widows' remarriage is more carefully observed in joint families than in simple families, because social control is more effective in the former group. Cases of widow remarriage are too few in Gulha's data to offer a valid comparison.

15. A few recent surveys in India have revealed that joint families still exist in large numbers, not only in rural, but also in urban areas. But the high fertility level in India cannot be explained by this factor, since the data available so far indicate that women in joint families have a lower fertility level than those in simple families. The disintegration of joint families does not necessarily lead to a lower fertility level.

¹⁴ Kingsley Davis, *The Population of India and Pakistan* (Princeton, Princeton University Press, 1951), p. 80.

Table 1. Average number of children born to rural Bengali women of various age categories in simple and joint families

Age category	Simple family		Joint family	
	Number of women	Average number of children	Number of women	Average number of children
<i>Sheikh Muslims</i>				
10-14	2	0.50	2	1.00
15-19	17	1.59	15	1.73
20-24	18	2.56	24	2.96
25-29	28	4.71	16	4.06
30-34	21	4.95	10	4.90
35-39	19	6.84	8	5.75
40-44	17	7.35	6	5.33
45 and above	25	6.80	17	7.71
TOTAL	147	5.00	98	4.29
<i>Non-Sheikh Muslims</i>				
Below 10	1	0.00	16	0.00
10-14	39	0.33	222	0.08
15-19	216	1.49	304	0.99
20-24	331	2.72	164	2.40
25-29	226	3.47	98	3.49
30-34	188	4.56	66	3.98
35-39	119	4.52	75	4.61
40-44	76	5.38	86	4.74
45 and above	100	4.88	191	4.87
TOTAL	1296	3.33	1222	2.46
<i>Muslim Fishermen</i>				
Below 10	—	—	4	0.00
10-14	6	0.33	18	0.00
15-19	45	1.33	12	0.58
20-24	63	1.60	5	2.00
25-29	32	2.59	5	2.00

Table 1. Average number of children born to rural Bengali women of various age categories in simple and joint families (*continued*)

Age category	Simple family		Joint family	
	Number of women	Average number of children	Number of women	Average number of children
<i>Muslim Fishermen (continued)</i>				
30-34	22	3.27	3	2.33
35-39	12	4.58	3	4.67
40-44	16	3.56	2	6.50
45 and above	28	3.25	12	5.50
TOTAL	224	2.33	64	1.98
<i>Hindu Brahmins</i>				
15-19	1	1.00	12	0.83
20-24	10	2.50	24	1.38
25-29	13	2.46	22	2.91
30-34	19	5.42	13	4.62
35-39	13	6.62	4	5.50
40-44	2	6.00	6	6.50
45 and above	6	6.50	32	6.38
TOTAL	64	4.66	113	3.82
<i>Hindu Satchashi and Ghosh</i>				
10-14	—	—	5	0.00
15-19	20	1.65	42	1.07
20-24	26	2.85	38	2.66
25-29	29	4.62	15	4.00
30-34	20	5.50	7	4.43
35-39	11	4.55	12	6.42
40-44	9	4.67	12	6.67
45 and above	10	7.80	29	7.86
TOTAL	125	4.17	160	3.89
<i>Other Hindus</i>				
10-14	2	0.00	9	0.11
15-19	9	1.44	24	1.21
20-24	25	2.40	19	2.11
25-29	27	3.70	6	3.83
30-34	13	4.23	12	3.75
35-39	12	5.67	6	3.83
40-44	11	6.82	2	7.50
45 and above	8	3.75	27	5.22
TOTAL	107	3.75	105	3.02

Table 2. Average frequency of coitus per week of rural Bengali women by age category and family type

Age category	Sheikh Muslims		Non-Sheikh Muslims		Muslim Fishermen		Hindu Brahmins		Hindu Satchashi and Ghosh		Other Hindus	
	S.F.	J.F.	S.F.	J.F.	S.F.	J.F.	S.F.	J.F.	S.F.	J.F.	S.F.	J.F.
10-14	0.5	0.0	0.4	0.1	0.5	0.0	—	—	—	0.0	—	0.0
15-19	1.8	1.6	3.0	2.3	2.3	1.8	1.6	—	1.5	1.2	1.6	1.5
20-24	2.6	2.1	4.0	2.6	3.2	2.8	2.1	2.1	2.4	2.8	2.7	2.3
25-29	2.7	2.1	3.3	2.9	3.3	2.3	1.8	1.7	2.6	2.5	2.9	1.9
30-34	2.1	1.5	3.2	2.8	3.4	1.8	1.3	1.0	0.9	0.9	2.6	2.0
35-39	1.7	0.9	3.0	2.3	2.1	1.5	1.0	0.2	0.8	0.4	2.0	1.3
40-44	1.1	0.8	1.7	1.1	1.2	1.0	1.0	0.0	0.8	0.4	0.8	0.3
45 and above	0.4	0.3	0.8	0.6	1.0	0.6	0.2	0.0	0.3	0.1	0.2	0.1

Attitudes towards family size and fertility control in India — an assessment

M. V. RAMAN

I. DEMOGRAPHIC PICTURE OF INDIA

1. With about 2.4 per cent of the total land area of the world, India holds nearly 14.6 per cent of the world population. The country's population increased from 236 million in 1901 to 439 million in 1961, the major increase of about 78 million having taken place during the decade 1951-1961, showing an all-time record decadal increase of 21.5 per cent. There are 373 persons per square mile and the sex ratio is 941 females per 1,000 males. Nearly 82 per cent of the population reside in 600,000 villages. More than 70 per cent of the workers are engaged in the agricultural sector. The over-all literacy is about 24 per cent (male = 34 and female = 13 per cent).¹ The estimated birth and death rates for the decade 1951-1961 are 41.7 and 22.8 while the general and marital fertility rates are 197 and 232, respectively. The median age at marriage estimated from the *Registrar General's Fertility Survey* in 1961-62 are 16.1 and 17.1 years for the rural and urban women, respectively. The completed family size is of the order of 5.5 children.²

II. THE PROBLEM

2. The current rate of population increase in India, over 2 per cent annually, is unprecedented. The expected decline in the death rate will naturally accelerate the rate of growth which is liable to get a further boost with a possible increase in the birth rate for which there exist some fairly convincing indications.^{3,4} The government recognizes that the manner in which the population is growing threatens to defeat efforts toward national development and that there is need to stabilize

the population at a level consistent with the requirements of national economy. This realization has brought to the fore the question of lowering the birth rate. For achieving this, major national programmes are being promoted. Lowering the birth rate is a novel objective for a government and hardly any country could boast of having achieved fertility control on a large scale through planned social effort. Our current programmes are, therefore, necessarily experimental.

3. The task of preparing the population for the acceptance and adoption of fertility regulation is by no means simple in the developing countries. It is essential to know first of all how the people concerned feel about family size and limitation and their attitudes toward the use of contraceptives. According to Balfour "the most important elements in determining action for fertility control in any country are the knowledge and attitudes of the people and their decision to act in the regulation of family size".⁵ The available information in these respects, though patchy, requires careful consideration and guarded interpretation to be useful in planning future programmes. In the following paragraphs an attempt is made to critically examine the findings of some of the recent surveys to obtain a comprehensive picture. While stressing the importance of such endeavours, some of the difficulties in an objective assessment of the situation have been briefly considered in earlier communications.^{6,7}

4. Action in the area of fertility control, as stated earlier, is governed by a host of variables in the fertility complex, such as attitudes and beliefs relating to family size and limitation, knowledge and availability of means of fertility control and above all motivation. Some of these are inter-related and modified by social and

¹ "Final population totals", *Census of India: 1961*, paper No. 1 (1962), pp. 5-15.

² Registrar General of India, Ministry of Home Affairs, *Vital Statistics for India for 1961*, vol. XLV (New Delhi, 1964).

³ M. V. Raman, "Some social practices and attitudes and their effect on fertility", *Report of the Fifth All India Conference on Family Planning* (1964), pp. 25-30.

⁴ M. V. Raman, *Some aspects of fertility in Kerala*, paper presented at the Seminar on Demography (Trivandrum", 1964).

⁵ M. C. Balfour, "Family planning in Asia", *Population Studies*, vol. XV, No. 2 (1961), p. 102.

⁶ M. V. Raman, "Knowledge and practice of contraception in India: a survey of some recent studies", *Artha Vijnana*, vol. V, No. 2 (1963), pp. 81-96.

⁷ M. V. Raman, "A study of current attitudes towards family planning", *Journal of Family Welfare*, vol. IX, No. 4 (1963), pp. 18-29.

economic changes. In developing countries, therefore, effective planning, execution and extension of family planning programmes largely depend upon a proper assessment of the above mentioned factors.

III. ATTITUDES TOWARD FAMILY SIZE

5. One of the factors influencing fertility is the desire for children. By and large, this is governed by traditional values and personal circumstances, the former usually having a greater sway in less developed countries particularly in the rural sector. Nevertheless, the character of the fertility factors tend to change under the impact of modernization forces.

6. In view of the deficiencies in the information on attitudes toward fertility, we could only indicate, within limits, the broad pattern of these attitudes and how they are likely to be affected by socio-economic development.

7. In India religion is still an important factor to be reckoned with and not a spent force as some believe it to be. It is often said that the Hindu religion (about 84 per cent are Hindus in India) is not antagonistic to the practice of birth control. This is, however, a moot point. In fact, it is rarely that we come across active, explicit and clear support to the idea of family size regulation in the tenets of the Hindu religion. On the contrary, there are substantial indications of religious sanctions and encouragement for larger families.⁸ No doubt, some of these attitudes and sentiments toward fertility have certainly outlived their utility and have become anachronisms. It is the failure of the people to realize this that constitutes one of the arresting forces in the development of a small family ideal and the adoption of fertility control methods. Further, it is relevant to observe that there are certain religious practices and injunctions, such as objections to widow re-marriage and taboos on sex relations, though not prescribed for their effect on fertility, which tend to lower fertility.

8. The over-all impression gained by a perusal of the information on attitudes of couples toward family size is that most couples desire to have a small family. But does this imply that the motivation for a small-sized family is really strong? The experience of the developing nations does not provide a clear-cut and easy answer to this. If motivation had been strong, normally it would have been reflected

in the behaviour itself. But behaviour aimed at controlling fertility is almost absent or of very little consequence as we may see later in this discussion. It may, however, be conceded that in the absence of a general lack of knowledge of fertility control, as is the case in less developed areas, behaviour cannot be taken as a fair test of motivation. Nevertheless, one would expect that if motivation had been high, husband-wife communication on the number of children desired would have been more frequent. The broad picture that emerges indicates that there is lack of such husband-wife communication.

9. A clear formulation of the social class differential in family size preferences in India is rather difficult in view of the vagaries in the existing information, presumably due to regional and other effects. Some of the fertility investigations have indicated that with the rise in the socio-economic status the number of children desired also increased. Responses of women in Calcutta show that under "existing" conditions they would prefer 2 children while under "ideal" conditions they would prefer 4.⁹ This attitude calls for closer study particularly in the light of the expected improvement in the economic situation consequent upon the operation of development plans.

10. On the other hand, contrasting results have been obtained from other studies. For instance, in Kanpur, an industrial city in Uttar Pradesh, while there was no difference in the number of children desired by illiterate and primary educated women, the number desired was less in the case of secondary and college educated women.¹⁰ In Bangalore City, a high educational level and high economic status were found to be correlated with desire to have a small family.¹¹ The implication is, that with the rising levels of living, large numbers of couples will begin to accept the small family norm and may also make attempts to implement it to the extent possible. However, the diverse nature of information precludes any firm statement being made in this regard. Further, conclusions from survey results have to be drawn with certain amount of reservation. Stephen has aptly observed that "When we ask people about their preferences and attitudes what we actually obtain is not a set of data on motivations but a set of expressed opinions—that is, statements people make in answer to questions.

⁸ N. V. Sovani, "The problem of fertility control in India: cultural factors and development of policy", *Approaches to Problems of High Fertility in Agrarian Societies* (New York, Milbank Memorial Fund, 1952), p. 64.

⁹ S. B. Mukherjee, *Studies on Fertility Rates in Calcutta* (Bookland Private Limited, 1961), p. 102.

¹⁰ D. N. Majumdar, *Social Contours of an Industrial City (Social Survey of Kanpur)* (Asia Publishing House, 1960), p. 198.

¹¹ United Nations, *The Mysore Population Study* (United Nations publication, Sales No.: 1961.XIII.3), p. 158.

They are expressions of attitudes but not always clear in their behaviour." ¹²

IV. ATTITUDES TOWARD FERTILITY CONTROL

11. A close second look at the available data reveals the conflicting nature of information in this regard and the consequent difficulty in arriving at pointed conclusions.

12. Some of the inquiries seem to suggest that a fair proportion of men and women are receptive to the idea of fertility control. ^{13, 14} A significant finding of another study is that about 60 and 40 per cent of the females in the rural and urban parts respectively of Kolaba District (near Bombay) wanted a controlled family without any deliberate attempt at limitation. ¹⁵ This attitude is ambivalent and cannot be taken as indicative of family planning. On the other hand, such an attitude expressed after recognizing the desirability of a regulated family possibly reflects the great aversion these women have for making deliberate attempts at limitation. It is known that some women are unable to take practical steps because of husband's opposition to contraception. ¹⁶ It is rather difficult to explain in simple terms the negative attitude of these husbands. Perhaps, to some extent, the questions of prestige and self-fish considerations are involved. Some husbands seem to think that contraception is their prerogative and any initiative in this field must rest with them. It may also be possible that husbands generally have a greater desire for children than wives. The findings of *The Mysore Population Study* lend some support to the latter view. ¹⁷ Both in Bangalore City and in the rural areas, among women with 4-6 living children, 17 and 33 per cent, respectively, desired to have more children while among the

husbands interviewed, the corresponding percentages were 32 and 45. A similar pattern was displayed in all the family-size groups. In view of the established male dominance in the Indian family system, the implications of the above observations cannot be under-rated in planning fertility regulation programmes.

13. The barriers to the active promotion of family planning include beliefs such as contraception is against religion and that it leads to immorality. ¹⁸ Besides, there might be social, psychological and cultural objections to the adoption of methods for limiting fertility. It is frequently stated that lack of knowledge and facilities are major hurdles to the active practice of contraception. This argument appears to be only partially tenable as action ultimately depends on motivation and not on mere knowledge or availability of methods.

14. It has been observed that a large majority of the couples are in favour of learning family planning methods. In rural Singur near Calcutta about 80 per cent had expressed some willingness to learn methods of fertility control or at least had no objection to learn such methods. ¹⁹ But it may be remembered that approving the idea of family planning or even accepting supplies, though a necessary prelude to practise, is not tantamount to practice. The India-Harvard-Ludhiana Population Study has clearly brought out the wide divergence between acceptance and practice of birth control. While 80 per cent of the couples reported willingness to learn a contraceptive method, only about 45 per cent used some method at some time during the study period and after about 2-1/2 years of sustained effort only 17 per cent of the couples were found practising. ²⁰ It is, therefore, necessary to view this expressed willingness to learn about family planning in the light of the existing wide gap between knowledge or availability of methods on the one hand and practice on the other. In this context, Agarwala's observations merit repetition. He says "the large difference between the proportion who knew a method and those using birth control, leads one to interpret the figures relating to willingness to learn a method with caution. It is quite likely that many who expressed willingness to learn would not use a method, even if facilities were made available to them". ²¹

¹² F. K. Stephan, "Possibilities and pitfalls in the measurement of attitudes and opinions on family planning", *Research in Family Planning*, C. V. Kiser, ed. (Princeton University Press, 1962), p. 5.

¹³ K. Dandekar, "Family planning studies conducted by the Gokhale Institute of Politics and Economics, Poona", *Research in Family Planning*, C. V. Kiser, ed. (Princeton University Press, 1962), p. 5.

¹⁴ S. N. Agarwala, "A family planning survey in four Delhi villages", *Population Studies*, vol. XV, No. 2 (1961), p. 115.

¹⁵ N. V. Sovani and K. Dandekar, *Fertility Survey of Nasik, Kolaba and Satara (North) Districts*, publication No. 31 (Gokhale Institute of Politics and Economics, 1955), p. 122.

¹⁶ K. K. Mathen, "A survey on the attitude of men and women of Calcutta on certain aspects of the population problem", *Alumni Association Bulletin* (A.I.I.H. and P.H., 1954).

¹⁷ United Nations, *The Mysore Population Study* (United Nations publication, Sales No.: 1961.XIII.3), p. 142.

¹⁸ N. V. Sovani and K. Dandekar, op. cit., p. 102.

¹⁹ The Population Council, *Studies in Family Planning*, No. 1 (1963), p. 3.

²⁰ *Ibid.*, p. 6.

²¹ S. N. Agarwala, "A family planning survey in four Delhi villages", *Population Studies*, vol. XV, No. 2 (1961), p. 116.

15. Any substantial reduction in the birth rate could be achieved only by involving the vast rural masses. In this context, the findings of a survey in Uttar Pradesh are significant. It has been pointed out that agriculturists as a class are more indifferent to birth control, as a relatively greater proportion (61 per cent) of this group is in favour of large families.²² Similar findings were observed elsewhere also.²³ These findings are indeed discouraging if read against the fact that about 70 per cent of the workers in India are agriculturists.

16. Even after more than 10 years of exposure to family planning programmes, the results of some of the recent surveys, briefly reported in the Press, are highly disconcerting and they call for a re-examination of the psychological and cultural environment. A recent survey in a village in Madras has revealed the astounding fact that only about a quarter of the couples expressed that they were in favour of family planning, while the remaining were indifferent or against it.²⁴ The results of a study in West Bengal showed that about 54 per cent of the women interviewed disapproved of family planning because of their conservative social outlook.²⁵ This study has

further indicated that as large as 65 per cent of the couples who practise family planning do so for economic reasons. An earlier study in Calcutta has also indicated that most of the few couples who practise contraception do so because of adverse economic pressures.²⁶ If the above assessment is correct, one wonders how the expected improvement in the economic situation arising out of the operation of the development plans will affect the progress of family planning in this country. Perhaps, with the improvement in the economic conditions there might also be a corresponding and favourable change in the social and mental outlook.

17. In the foregoing paragraphs the attitudes to family size and fertility regulation were briefly reviewed. In the face of apparent contradictions and inconsistencies in the expressed attitudes, it is rather difficult to come to firm conclusions. Further, these attitudes are not always translated into action, showing thereby that they are not properly set and possibly some problems of conscience and conflict are involved. It is the removal of these problems that will eventually lead to the popular acceptance and adoption of birth control and not the mere availability of cheap and effective contraceptives. A revolution in the mental, psychological and cultural attitudes which alone can lead to a conscious control of fertility is, therefore, urgently needed.

²² G. B. Saxena, "Latent practices of family planning and motivation—a sample study in rural Uttar Pradesh", *Family Planning News*, vol. III, No. 3 (1962), p. 58.

²³ N. V. Sovani and K. Dandekar, op. cit., p. 109.

²⁴ *Amrita Bazar Patrika* (Calcutta, January 3-4, 1965).

²⁵ *The Statesman* (Calcutta, December 23-24, 1964).

²⁶ S. J. Poti, C. R. Malakar and B. Chakraborty, "An inquiry into the prevalence of contraceptive practices in Calcutta City", *Studies in Family Planning* (New Delhi, D.G.H.S., 1950), p. 78.

Birth control in some of the developing countries of the Far East

JOHN Y. TAKESHITA

1. The countries in the Far East, like many other developing countries in the rest of the world, have experienced rapid population increases in the aftermath of World War II due to sharp drops in their death rates. Since the war, Japan alone of these countries has effected a sharp drop also in the birth rate to reduce her annual rate of increase, which was above 2 per cent until recently, to less than one per cent. The other countries have yet to achieve this feat. In most of these countries the prospect is for continued growth at an accelerated rate. There are signs, however, that Taiwan may soon follow Japan's lead. Her birth rate has been falling quite rapidly in the last five to six years and indications are it will continue to fall even more rapidly in the coming decade. There is also reason to expect that South Korea's birth rate may come to fall in the very near future, if it has not already. These expectations are based on the observation that in Taiwan and Korea birth control, which has played a decisive role in Japan's success, is likely to find its way into their peoples' modes of life at a quick pace to effectuate the decline in their birth rates needed to slow down their growth in population.

2. This paper documents in a summary fashion the status of birth control knowledge, attitude, and practice among these peoples as it can be assessed from several surveys that have been taken in recent years (see table on page 169). Although many gaps exist in our data and we are haunted by questions of representativeness, comparability, reliability, and validity of the survey-type data on which we base our discussion, we can discern trends that are worth noting.

3. A satisfactory interpretation of the trends in birth control to be discussed here probably would require their being placed in the historico-cultural context in which these countries have long been implicated as well as in the developmental context in which they have been involved more recently. While this paper will be confined to a description of the trends, it is offered with the hope that we can soon find an interpretation that will answer one of the burning questions of our time: Why is the

prospect for population control much brighter in these countries than in many others in this and other parts of the world?

4. Once known to the outside world as countries of large families maintained by joint living of married relatives and by high fertility, the peoples in these countries today are expressing less desire for their traditional ways of family life and for large numbers of children than our past knowledge about them would lead us to expect. In Japan, for example, progressively fewer of the married men and women¹ surveyed biennially since 1950 have expressed an intention to "depend on their children in old age." While as many as 55 per cent expressed such an intention in 1950, only 35 per cent did so in 1961. In Seoul, Korea, also only about a third of the married women in the ages 20-44 surveyed in 1964 thought "sons are more important than daughters ... because they can be depended on in old age, to carry on the family name and to continue the rites of ancestral worship." Even in rural areas, according to a survey made of married men and women in 1962, less than half thought this way about sons and their dependability for traditional family ways. Only in Taiwan is there still rather widespread endorsement of the importance of male heirs and desire for dependence on children in old age and for joint family living even among the urban residents. A survey in 1962 of married women aged 20-29 in Taichung, one of its major cities, revealed that these traditional attitudes are still prevalent among them. There too, however, a significant minority were looking to changed ways of family living.

5. Most of the married couples in these countries prefer to have small families in the range of 2 to 4 children. Very few want to remain childless or have large families. Among all Japanese couples with wife under 50 years of age in 1961, less than 20 per cent had more than 3 children and less than 10 per cent of those who had 3 wanted to have more. In

¹ Married men with wife under 50 and married women under 50. Unless the samples involved women of younger ages, the age specification is usually omitted in the discussion.

SELECTED DATA ON FAMILY SIZE VALUES AND ATTITUDES AND PRACTICES OF BIRTH CONTROL
FROM SAMPLE SURVEYS IN JAPAN, SOUTH KOREA, AND CHINA (TAIWAN): 1961-1964

Items	Japan			South Korea			China (Taiwan)		
	All	Urban	Rural	All	Urban	Rural	All	Urban	Rural
<i>Ideal number of children:</i>									
Mean	—	2.9 ^a	—	4.1 ^b	3.7 ^b	4.2 ^b	4.3 ^e	3.8 ^f	4.4 ^e
Median	—	2.9 ^a	—	—	3.2 ^c	4.3 ^d	4.4 ^e	3.8 ^f	4.5 ^e
Q1	—	2.6 ^a	—	—	2.7 ^c	3.6 ^d	3.7 ^e	3.1 ^f	3.8 ^e
Q3	—	3.3 ^a	—	—	3.9 ^c	5.1 ^d	5.3 ^e	4.4 ^f	5.4 ^e
Per cent 5+	—	2 ^a	—	—	10 ^c	45 ^d	48 ^e	22 ^f	51 ^e
<i>Ideal number of sons:</i>									
Mean	—	—	—	2.5 ^b	2.3 ^b	2.6 ^b	—	2.2 ^f	—
Median	—	—	—	—	2.0 ^c	2.6 ^d	—	2.1 ^f	—
Q1	—	—	—	—	1.7 ^c	2.0 ^d	—	1.8 ^f	—
Q3	—	—	—	—	2.4 ^c	3.1 ^d	—	2.6 ^f	—
Percentage approving birth control	71 ^g	71 ^g	70 ^g	—	95 ^c	—	71 ^e	92 ^f	—
Percentage ever used contraception (including percentage sterilized)	68 ^g (5)	69 ^g	67 ^g	12 ^b (2)	20 ^c (5)	10 ^d	15 ^e	34 ^f (9)	6-10 ^e
Percentage ever had induced abortion ...	41 ^g	42 ^g	39 ^g	7 ^b	25 ^c	4 ^b	7 ^e	12 ^f	—

SOURCES: The data are from those surveys based on samples of some scientific validity and taken, in all but one case, since 1960. Only those data that are reasonably comparable are selected for presentation. The headings "all," "urban," and "rural" refer only to the types of area in which the samples were taken. Unless specifically indicated, they are not representative samples of the types of area, though they may be of the specific communities, in which they were drawn. If the surveys included both men and women as respondents, only the responses from the women are used, as indicated below, to permit better comparability among these various surveys. For the ideal numbers of children and sons, the first and third quartiles (Q1 and Q3) are given along with the medians. These quartiles define the range in which 50 per cent of the cases fall on these items. The means, it must be cautioned, sometimes underestimate the ideal as those who responded "more the better" are excluded from the computation. The alphabetical notations describe the samples as follows:

^a Probability sample survey of 1,433 married women aged 20-44 in metropolitan Osaka, 1956. Source: Yuzuru Takeshita, "Socio-economic correlates of urban fertility in Japan", unpublished doctoral dissertation, University of Michigan (1962).

^b Probability sample survey of 3,966 married men (wife under 50) and 4,008 married women under 50 in South Korea, 1964. Used only responses from women. Source: T. I. Kim, *et al.*, "The early stage of family planning in Korea", *Ministry of Health and Social Affairs*, Government of Korea (1964).

^c Probability sample survey of 3,204 married women aged 20-39 in Sungdong Gu, Seoul, 1964. Source: marginal tabulations made available to the author by Dr. E. Hyock Kwon, Director, Seoul Urban Population Study Project, Seoul National University.

^d Probability sample survey of 922 married men (wife under 50) and 962 married women under 50 in Kimpo and Wondong Townships, 1962. Used only responses from women. Source: marginal tabulations made available to the author by Dr. Sook Bang, Associate Director, Koyang Family Planning Research Pilot Study Project, Yonsei University.

^e Pilot survey with somewhat arbitrary samples of married couples with wife under 50 in a coal mining village (n=63), a fishing village (n=70), a farm village (n=75), and a rural district (n=78) in Taichung City, 1962. Used only responses from wives. Source: Taiwan Population Studies Center, Taiwan (unpublished tabulations).

^f Probability sample survey of 2,718 married women aged 20-39 in Taichung, 1962. Source: University of Michigan Population Studies Center and Taiwan Population Studies Center (unpublished tabulations).

^g Probability sample survey of 2,669 married men (wife under 50) and 2,897 married women under 50 in all of Japan, 1961. Used only responses from women. Source: *Sixth Opinion Survey on Family Planning and Birth Control*, Population Problems Series No. 18 (Tokyo, Japan, the Population Problems Research Council, the Mainichi Newspapers, 1962).

Additional sources: S. Bang, M. G. Lee and J. M. Yang, "A survey of fertility and attitude toward family planning in rural Korea", *Yonsei Medical Journal*, Vol. IV (1963), pp. 77-102; R. Freedman, J. Y. Peng, Y. Takeshita and T. H. Sun, "Fertility trends in Taiwan: tradition and change", *Population Studies*, Vol. XVI (March 1963), pp. 219-236; R. Freedman, J. Y. Takeshita and T. H. Sun, "Fertility and family planning in Taiwan: a case study of the demographic transition", *American Journal of Sociology*, Vol. LXX (July 1964), pp. 16-27; *Kazoku Keikaku no genjo* (Present status of family planning), Maternal and Child Health Section, Children's Bureau, Ministry of Welfare, Government of Japan, and the Japan Family Planning Association (1962).

metropolitan Osaka in 1956, 85 per cent of the married women aged 20-44 regarded 2 to 3 children as ideal. Nearly all of them (96 per cent) gave their ideals in the range of 2 to 4 children. In Korea a 1962 rural survey showed that more than 85 per cent regarded 3 to 5 children as their ideal, while in a 1964 survey in Seoul of married women 20-44 nearly 90 per cent gave 2 to 4 children as their ideals. In Taiwan, too, most preferences range from 2 to 4 children in urban areas and 3 to 5 in rural areas.

6. Sons are still important in Korea and Taiwan. Most of the people surveyed expressed the desire to have at least two sons. In Japan, however, few investigators have inquired about sex preferences with respect to children, which fact perhaps is indicative of the people's indifference about it.

7. Few of these people think that family growth is a matter subject to the dictates of fate, god, or nature. Even in Taichung, where preference for traditional family life is fairly strong, less than 3 per cent of the married women 20-39 thought "more children the better" or "it is up to god or nature" how many they would have.

8. Under existing mortality and fertility conditions, most women in these countries probably have their desired number of children, including sons, by the time they are in their early thirties, if not earlier. In Taichung, for example, the survey in 1962 revealed that 63 per cent of the women in the ages 30-34 already had at least 4 living children and 68 per cent at least 2 living sons. While comparable data are not available for Japan and Korea, there is no reason to believe that the situation would be any different there.

9. Most people in these countries are now not only familiar with ways to keep from having more children than they want but also most of them approve of the idea, though in many cases in Taiwan and Korea with qualifications that they have a few children before they do something. In Japan 71 per cent of all married men and women in 1961 approved. Approval is equally prevalent in Korea and Taiwan. Ninety-five per cent of the married women aged 20-44 surveyed in Seoul in 1964 and 92 per cent of the married women aged 20-39 surveyed in Taichung in 1962 approved with or without qualifications. Scattered data do suggest that in rural areas in Korea and Taiwan neither knowledge nor approval is so prevalent as in the urban areas, but still the majority even in the rural areas know about birth con-

trol and do approve. In Japan there is hardly any difference between urban and rural areas in this respect.

10. Birth control, when it is adopted, takes three different forms in these countries: contraception, induced abortion, and sterilization. In Japan, 68 per cent of all married couples in 1961 had already used some form of contraception, including approximately 5 per cent sterilization. Forty-one per cent reported at least one induced abortion. Differences in these rates between urban and rural areas are small in Japan. In Korea only about 12 per cent of all married couples had used contraception or had been sterilized (less than 2 per cent) by 1964. Seven per cent admitted at least one induced abortion. Urban areas are considerably ahead in these regards in Korea. In Seoul, for example, about 20 per cent of the married couples with wife in the ages 20-44 reported having used contraception or being sterilized (about 5 per cent). Twenty-five per cent reported at least one induced abortion. National figures are not available for Taiwan. However, a small survey in 1962 of four different types of community there did show that 15 per cent had contraceptive experience and 7 per cent induced abortion. The larger survey in Taichung in the same year revealed that 34 per cent of the subjects (married women aged 20-39) had already used some form of contraception, including 9 per cent sterilization. Induced abortion was reported by about 12 per cent of these urban women.

11. Consistent with their ideals about family size and attitudes toward birth control and its timing, resort to any one of these methods occurs most often after age 30 and about ten years of marriage and after at least 3 or 4 children and at least 1 or 2 sons. Except in Japan, few couples take up these methods early in marriage before any children are born. In all of these countries, induced abortion is quite frequently taken up to deal with contraceptive failures. Many in Korea and Taiwan, however, often try induced abortion even before they come to know and use contraception. As a matter of fact, those who do take up methods in these two countries more often do so after rather than before they exceed, by one or two (or more), the numbers of children and sons they prefer to have.

12. Induced abortion is still illegal in all but Japan among these and other countries in the Far East, and it is disapproved by most of the married in Korea and Taiwan, even by the wives who have resorted to it. For example, 85 per cent of the married women in the ages

20-39 in Taichung and 70 per cent of those in the ages 20-44 in Seoul expressed disapproval. What is more, 78 per cent of the Seoul women who had already resorted to induced abortion disapproved it.²

13. The proportions of married couples with actual birth control experience in Taiwan and Korea still are not high by comparison with Japan and the Western countries. However, not a few of those who have yet to take up control measures want to have more children and do express a desire to learn more about contraception and an intention to start something in the future. For example, among all married women under 50 in 1964 in Korea, 44 per cent wished to practice, although only 12 per cent had already done so. In Seoul, where about 20 per cent had already done something, 73 per cent wanted to learn more about the various methods available. In Taichung, where about 34 per cent were past users, 66 per cent wanted to learn more about different methods and all but a few of those who hadn't as yet wanted to do something in the future.

14. It is interesting that the methods used most widely by the married couples in these countries have differed somewhat. In Japan condom and the rhythm method have far out-run the others in popularity. In Korea foam tablets have diffused even more widely than

condom and the rhythm. In Taiwan the Ota ring and tubal ligation have prevailed.

15. In all of these countries those who might be characterized as being in the vanguard of modernization have led the others in the adoption of the small family ideal and of birth control. They are the better educated, the professional and other white-collar workers, and the urban residents. Japan, however, has demonstrated that the diffusion of the small family ideal and of birth control to the less educated, the lower class working people, and to the rural areas need not be a slow process. The socioeconomic differentials in these have been narrowed considerably in Japan in recent years. In Korea and Taiwan massive national family planning programmes, started only recently, are also demonstrating that those who are interested but who for various reasons have been slow to take up birth control on their own can be helped in large numbers into doing something. With mounting social support for the legitimacy of birth control among these peoples, facilitated by formal governmental programmes, and increasing demonstration among them of successful use of birth control of one type or another, the prospect for much wider and quicker diffusion of practices is bright in both Taiwan and Korea. Thus, it may not be too long before they, too, like Japan, will succeed in slowing down their population growth, as they apparently wish to, to a level more in keeping with what their current economic potentialities can do to fulfill their social and economic aspirations.

² From a preliminary report on an induced abortion study in Seoul made available to the author by its investigator, Dr. Sung Bong Hong, Soodo Medical College, Seoul, Korea.

SUMMARIES OF PAPERS

Effect of a rise in female marriage age on birth rate in India

S. N. AGARWALA

Late marriage appears to have a significant effect on the fertility of Indian women. There is sufficient evidence to suggest that while the females marrying between ages 14 and 19 have the same completed maternity, those marrying after 19 have a lower number of children.

Calculations have been made in this paper on the basis of a number of assumptions to find out the likely decline in female birth rate if females in India marry at mean age slightly higher than 19, instead of the present average of 15.6. It is assumed that proportions married by age in the former is that of the Kerala females for 1931-1941 and in the later that of the Indian females for 1951-1961. It is also assumed that married females are exposed to the fertility rates of the two groups as obtained in the Delhi survey and that female age specific fertility takes thirty years to change from the early marriage pattern to the pattern of late marriages. Calculations show that birth rate in 1961-1962 would be 47.8 and it would decline by 21.1 per cent during 1966-1967 and by 29.2 per cent in 1991-1992.

Another set of calculations have been made by using stable population concept. Two stable populations have been obtained by using age-specific mortality rates of Indian females for the decade 1951-1961 and the two sets of age specific fertility rates, one corresponding to early marriage and the other relating to late marriage pattern. They give female birth rates of 48.1 and 31.0 respectively, that is, a decline of 27 per cent as a consequence of a rise in female marriage age to 19.3 years. The calculations, though rough in view of the assumptions, do highlight the importance of late age of female marriage in reduction of Indian fertility.

Male attitudes towards family limitation in East Pakistan

MOHIUDDIN AHMED

This paper attempts to analyze various socio-economic and demographic characteristics of

an interviewed population of 195 married males aged 20-54 years believed to be associated with desire for additional progeny on the one hand and with willingness to adopt birth control on the other. While 34.9 per cent of the population desired no more offspring, 73.3 per cent expressed direct and indirect willingness to adopt birth control if possible. All variables under consideration: ever-born children, living children, living sons, years married, age, income, education and occupation showed significant association with attitude towards desire for additional progeny, while four of eight: education, occupation, living children and living sons showed significant association with attitude towards birth control.

In the attitude formation towards desire for no more offspring, demographic factors: number of living children and particularly number of living sons, age and years married were more important than factors such as income, education and occupation. On the other hand, the latter set of factors tended to generate increased desire for offspring by expanding father's capability to effectively support hitherto impossible larger family size. However, this contrasting phenomenon could be a short run one in a rapidly developing economy with its tradition-bound population still adhering to age-old ideas and thoughts.

Various practices of intentional family limitation are still quite unknown among the vast masses of population in East Pakistan. However, many people indirectly feel the unusual burden of increasing family size of recent years, do not deliberately desire unlimited number of children and consciously think of family planning, wondering if they could get some means quite easily and secretly at no cost whatsoever. This favourable attitude towards birth control strengthens with educational betterment and occupational uplift.

Fertility in relation to the profession of the head of the household and the age of the mother

ABDELLAH BERRADA

The analysis of the demographic survey taken in Morocco during the year 1962 shows that

the town-dwelling Moroccan woman has had 5.1 children by the end of her reproductive life and that married women in the group of merchants and retailers have had 6.2 children during the same period. The wives of miners and quarrymen come second with a total of 6.1 children on reaching the menopause. The same figure applies to the wives of workers in the transport and communications sector. The population at present economically inactive comes third with 5.6 children. The corresponding figures for the population in agricultural and artisan occupations are 5.5 and 5.4, respectively.

In the group comprising office employees and workers engaged in sports and recreation services, the women have 5.3 children. In the last place are married women in the liberal professions group, with a total of 5 children.

Changing virility, virginity complexes as related to fertility patterns of middle strata wives: Costa Rica

E. GORDON ERICKSEN

This paper presents a preliminary synthesis of five field techniques used to measure the relationship between virility, virginity complexes and fertility patterns of middle strata wives in Costa Rica, 1963-1964. The preliminary findings support the following three hypotheses. First, there is a "genteel revolution" in quiet progress within the female population of middle strata urban Costa Rica—an inveighing against the neurotic self-deception of an earlier era, rather than a bolt to socio-sexual free enterprise. It is a quest for a new sex ethic. Second, socio-sexual morality is increasingly situational, with "moral character" yielding to "good taste," and with "Maria-virginity" yielding to half-virginal cautious opportunism. Third, the maintenance of a high fertility rate can be explained by the absence of alternatives suited to human interests and organizational schemes, not by fixed tradition.

One of the five techniques is reported in the paper in some detail: a neighbourhood modernization scale, equated to fertility values and spouse rights. It was found that the higher the modernization rank of a middle strata neighbourhood, the smaller the mean size of family, the closer the age-spacing of children, the greater the tendency to encourage parity in ages of bride and groom, the less the difficulty experienced by spouses in discussing sexual and birth control matters.

Fertility level and trends in Taiwan

T. H. FAN

The level of fertility in a community is determined by the interplay of social and cultural factors in addition to the biological factors. China has a rich social and cultural background which has greatly influenced the level of fertility.

Taiwan is a province of China. The level of birth rate in Taiwan was as high as 42 births per 1,000 population during the last fifty-five years. Important reasons for that are the influence of Confucianism on the duty of perpetuating the large family, the effect of joint or stem families, high proportion of females in the childbearing ages, universal marriage, prevalence of remarriages, low incidence of divorces, low proportion of childless women.

During the last eighteen years, crude birth rates and total fertility rates declined by 9.9 and 6.2 per cent respectively. The age specific fertility rates increased in the age groups 20-29, but declined in all other groups. The trend has not been of a uniform nature. During the period 1947-1951, the crude birth rates and the total fertility rates increased to the high level of 50 and 7055 respectively due mainly to family reunion, increase in marriage rates, and better economic condition. Since 1952, it had a rapid decrease owing largely to acceptance of family planning, increase in age at marriage, decrease in marriage rates and changes in age composition.

The norm of small family size is getting accepted in Taiwan. The demand of knowledge and supply of family planning methods is growing. Private organizations and the Government are increasingly supporting the family planning movement. Improvements in economic and educational levels of the people are likely to furnish a suitable background for accelerating the trend in the acceptance and effective use of family planning methods. Under such circumstances, it is reasonable to expect a rapid acceleration in the decline of fertility rate in Taiwan.

Religion, education and fertility control in Latin American societies

CARLOS J. GÓMEZ

This paper tests the hypothesis that the knowledge and practice of family planning is not taboo among religious groupings in Continental Latin America.

The data used for the evaluation of the above hypothesis, was collected in El Salvador,

August 1964, as part of the *Economic and Social Survey of the Family in the Metropolitan Area of San Salvador*. In this survey a 5 per cent stratified random sample design was utilized to study labor force and fertility characteristics of the population. These data on 2,255 women in the childbearing ages 20 to 50 years old, who declared their religious affiliation and frequency of communion, indicated that:

(a) Women in the reproductive ages are highly devoted to a religious faith regardless of their affiliation;

(b) Women are more inclined to be affiliated to the Catholic than Non-Catholic Church, at a rate of 50 to 1;

(c) The more devoted women (those who participate in Church services more frequently) are inclined to take communion more often than the less devoted ones, which indicates that the propensity of devotion is closely related to the frequency of attendance at Church services;

(d) Women with a high degree of devotion are better educated, legally married, born in urban centres, and descendents of small families with a better standard of living, which suggests that the most deprived classes are indeed not the most but the least spiritually comforted by religion.

Taking into account this religious environment, it is interesting to find that the fertility variations between the more religiously devoted women and those who are less devout, whether they are Catholic or Non-Catholic are negligible. In fact, religion appears to be a less important factor than education for explaining the variations on fertility rates. The fertility of the more religiously devoted women is greatly affected by their educational achievements: it decreases greatly among the most educated group. The poorly educated showed the highest fertility rates.

Moreover, if religion and education are held constant, the importance of education remains extremely prominent in explaining fertility variations whether age, religious affiliation, civil status or place of birth is considered independently.

With respect to the influence of religion in the growth of the family, (a) there is more practice of birth control among the more religiously minded women with higher educational achievements than among those who are at a lower level of the social scale; and (b) the educated person who is more religiously devout, is the most frequent user of artificial techniques of family limitations. These findings stress the fact then that education tends to give religious

people the same liberal attitude toward family planning, as held by those who are less attached to the Church.

Contrary to the widely held views, the study of the Salvadorean family reveals, then, that the degree of religiousness is not an obstacle in family planning. What is important is the gap between the knowledge of birth control methods and the practice of family planning techniques, which proves to be much greater among the classes that are more deprived of educational achievements.

The problem of fertility control in India

P. B. GUPTA

The rural sector includes the vast majority of the Indian population and must, therefore, receive prior consideration in any programme of fertility control. Moreover, its literacy rate is quite low. The continued practice of contraception entails strong motivation for family planning, which can only be the product of education. That the Family Planning Programme has not yet succeeded to produce any noticeable impact on the rural birth rate can, therefore, be readily explained by this lack of education. Similar considerations apply to other programmes like sterilisation etc.

In rural India, the marital fertility rate of a region varies with the average level of living in the way of a second degree curve, rising to a peak value at a critical average level and falling thereafter. For any region, therefore, the attainment of an average level in excess of its critical average supplies the clue to the reduction of fertility, even without the exercise of artificial controls. With continued economic growth (as under the National Plans) involving the improvement of living standards, the critical averages will ultimately be crossed in all regions, accompanied by an accelerated fall in the birth rate of rural India as a whole. Calculations about the falling birth rate of rural India during 1951-1961, based on the rate of increase of per capita consumption at 1½ per cent per annum in the same period, estimated by the Planning Commission, agree fairly well with National Sample Survey results. It is also shown that the birth rate would fall by about 25 per cent by 1985 if the same rate is assumed to continue afterwards, but by say 1970 if the rate were 3½ per cent per annum and had been in operation throughout.

To control fertility in India, stress should be given on rural education and rural economic growth. The first is a 'motivation-generating force', necessary to make a success of family

planning and similar programmes. The second, self-sufficient and independent of the family planning methods, is expected to produce surer and quicker results in the present conditions of India.

Some aspects of the effects of economic development on fertility in the Sudan

ROUSHDI A. HENIN

Using data from the 1955-1956 Population Census fertility in six census areas located in the Gezira Scheme (which has been subjected to heavy investment in the shape of irrigation works), were selected and compared with that in five predominantly nomadic census areas. The average size of completed family were compared and were found to be equal and from this we concluded that fertility for the older cohorts, was probably the same in the two groups. Comparison of the general fertility rates, that is, for women who were in the reproductive ages at the time of the census, has shown that the "settled" rate was almost 80 per cent higher than the nomadic rate, signifying a rise in fertility as a result of settlement and economic development.

An attempt was made to explain some of the factors behind these differences. Data on marriage were examined and have shown that the settled population has higher proportion ever-married, higher proportion actually married and higher stability of marriage (as manifested in lower divorce rates). This applies for both sexes.

In the light of the above, family planning was recommended to be incorporated in any settlement scheme for the nomads, who are responsible for about 30 per cent of the Sudan population, to avoid a high rate of population growth which would burden any future economic development plan.

Cultural factors affecting fertility control in Latin America

OFELIA MENDOZA

The complexity of a Latin American fertility control movement cannot be understood without recognition of the cultural differences among the diverse social groups of the twenty countries and Puerto Rico, and their implications in the establishment of local programmes. The double moral standards, extreme poverty, ignorance and social injustice have been contributing factors to the high birth rate. The concern of a few professional groups about the

increasing abortion rate is turning their attention to the use of contraceptions as a preventive abortion measure.

The Church has used its power and pressures to influence national and international policies for fertility control, and to prevent the teaching of contraception in medical schools and sex education in public schools. In most cases the reluctance of policy making people to participate in or promote birth control movements in their countries is due to fear of endangering their positions rather than adherence to Church doctrines.

The Church has very little influence in the daily life of the lower classes. Church attendance is rare, consensual unions are the general practice and all kinds of superstitious practices opposed by the Church are customary. The strongest barrier against birth control is not adherence to Church doctrine, but ignorance about contraception and lack of availability of contraceptives.

Dramatic changes in population, social and economic structures, politics, religion, education and the role of women in society are bringing about changes in customs, values, attitudes and institutions that stimulate fertility control. The new role of women in Latin American society, with the recognition of their civil and political rights and of their economic and social contributions, is one of the most influential factors favouring fertility control.

Demographic analysis of illegitimacy in Chile

JULIO MORALES VERGARA

Reliable conclusions on trends, level and structure of illegitimacy in Chile may be obtained through the available vital statistics series.

The following are some of the results of the analysis carried out in the present document:

(a) The relative importance of illegitimacy has considerably decreased in the country's total number of births since 1920;

(b) This decrease is not caused—at least in the last decade—by a descent in the specific rates of illegitimate fertility, but by a change in the population's marital status;

(c) The present illegitimacy level in Chile corresponds to a gross reproduction rate of 0.36;

(d) Approximately 50 per cent of illegitimate births are firstborn's, which leads to assume that an important proportion of these do not proceed from stable consensual unions;

(e) Illegitimate fertility occurs as an average at younger ages of mothers than legitimate fertility, but the relative importance of illegitimate fertility rates, as compared to legitimate rates, is greater in women of 30-39 years of age.

The geographical distribution of illegitimacy shows that the provinces in the North (down to Aconcagua) have higher levels than the rest of the country.

It appears that illiteracy has no direct, conclusive influence on the prevailing illegitimacy levels. But, with the exception of the northern provinces, there is a certain connection between illegitimacy and the degree of urban concentration, illegitimacy being lower in small urban communities. Illegitimacy increases when the size of communities grows and when the population is sparsely settled.

None of the factors discussed in the present document and considered as being related explain nevertheless in a satisfactory way the high illegitimacy level of the northern provinces.

On the problem of measuring the strength of social norm concerning family size in developing areas

N. KRISHNAN NAMBOODIRI

In areas where family planning action programmes have been organized, researchers are finding that the conventional measures of fertility behaviour are not suitable to indicate short-run changes. This paper suggests as a possible measure for the purpose indices of strength of social norm concerning family size. Inferences regarding family-size norms have often been made on the basis of data on ideal and preferred family size. But such data are likely to be deceptive. Even when attitude toward family size is not crystallized, data on ideals and preferences with respect to family size may indicate that the norms have been stabilized. Hence ideals and preferences should be supplemented with data on the ambiguity and ambivalence of attitude toward family size. When these supplementary data are also available it may be possible to find out at what stage in the transition from strongly rooted large-family-mindedness to crystallized small-family-mindedness a population has reached at a given point in time. An alternative measure suggested in this paper has to do with the difference between expected family size and ideal or preferred family size. When norms are crystallized, expectations are likely to be the same as ideals and preferences on a group average basis. In anomic situations,

expectations are likely to be different from ideals and preferences. When cross-cultural data on the mode of convergence of expectations to ideals and preferences in populations in which family planning action programmes have been organized become available, the reliability and validity of the above measure can be satisfactorily tested.

Age at marriage, parental responsibility and the size of the family

A. NEVETT

Observations made in this paper about age at marriage, parental responsibility and family size in India would seem to be applicable to many developing countries.

Although there is a centuries-old tradition of respect for women, this respect is based largely upon wives having many children, particularly sons. The desire for male children, coupled with the fear that an unmarried girl will get spoilt, led to the widespread custom of early, even pre-puberty marriages, which has been prevalent for about two thousand years.

A tradition of female subjugation was established and strengthened by such factors as the subordinate position of the young wife in a joint household, and the practice of *sati* (widow immolation).

A nation-wide inquiry made in the nineteen twenties revealed how widespread was the custom of early, even pre-puberty marriage, and how ineffective were legal measures without social sanction.

Other factors contributing toward early marriage and large families are: widespread female illiteracy—the lower the literacy rate, the earlier the marriage (this fact is corroborated by the example of the Christian community, which has a comparatively high literacy and marriage rate); sex imbalance, creating a shortage of marriageable girls; and more especially, an attitude of irresponsible fatalism regarding the bearing and rearing of children.

Remedies

A greater extension of free education for females would foster parental responsibility, as would more male employment outside the home, which is negligible at present. A greater sense of responsibility is still very much lacking, especially among illiterates. Education will develop a sense of responsibility toward parenthood, which is the most vital of all elements in the problem.

The Catholic Church desires a rational fertility, which would give children an equitable chance to develop in a manner befitting human dignity. The Church's centuries-old insistence on celibacy, virginity and sexual restraint have had an influence on the birth rate.

There seems to be little reasonable doubt that later marriage does reduce the size of the completed family; various surveys confirm this fact. There does not appear to be any well-grounded proof for the thesis that early marriage does not generally increase family size, nor does the fear seem justified that re-marriage of widows will cancel out all the gain derived from the postponement of marriage.

Education as preparation for fertility control

VEDA PRAKASHA

In their exploding populations many developing countries face one of their most critical challenges on the road to social and economic progress. Regrettably the educational planner has not shown much awareness of or interest in the problem so far. Because of the involvement of sex in any discussion of population control and family planning, it is not fashionable in most educational circles to raise the issue, let alone identify the role of education in standing up to it. If education is not to indulge in fence-straddling on a major issue of our times, this must change. And it can change.

To illustrate the kind of contribution education can make to the lowering of birth rates, one has only to consider adult education. In many of the developing countries such education concerns itself with a great variety of adult interests—literary, vocational and cultural, to name a few—but does little to increase the adult's awareness of the problem or to raise his motivational level to reduce the number of births in his family. There is no reason why in some of the countries population control and family planning could not serve as a major focus in adult education programmes. Likewise, curricular offerings in secondary school, college and teacher preparatory institutions offer much scope for improving the individual's understanding of the problem and making him aware of his personal and social obligations in meeting it.

These and similar educational reforms are not going to be easy. But if education has to justify itself in the name of individual happiness, material well-being and all-round development, the price of innovation must be paid.

Age at marriage as a demographic factor in conditions of high fertility

R. I. SIFFMAN

Our studies of the age at marriage as a demographic factor are based on data from the rural areas of two Transcaucasian Republics—Armenia and Azerbaijan for a period covering some time before the Revolution and the beginning of the Soviet period. Information was obtained as a result of sample demographic survey carried out in 1947 with a view to studying the birth rate and death rate among children in retrospect. The survey was carried out by interviewing women (anamnesic method) with the total number of interviewed being 17,500 in both republics.

In the processing of the collected data estimation was made of the number of years lived by different generations of the interviewed women (total number of years lived, and duration of married life) in various calendar periods and age groups. Comparisons with these data of the number of births in the same calendar period and female age groups permitted to calculate general and legitimate age-specific fertility rates by calendar periods.

An extremely high level of these rates for the period under study gives grounds to believe that actual fertility was in this case close to the realization of fecundity. During the fifteen years of the Soviet period prior to World War II total fertility rates of the interviewed female population averaged 8.5 births per woman in Azerbaijan and 9.1 births in Armenia. Apart from an insignificant or totally lacking birth control the high rates of fertility were due to an early age at marriage. Among the total number of women who married within the last five-year period prior to the war 87-88 per cent fell on women married before they were 20, with an average age at marriage around 17.

At the same time a number of studies carried out in the beginning of the Soviet period among the nationalities where early age at marriage was customarily established, as our studies did, that women who married very early had the longest photogenetic interval and that infant mortality was particularly high with very young mothers.

The purpose of our studies was to find out whether or not early marriages were due to the physiological peculiarities of Armenian and Azerbaijanian women, i.e., whether their early marriages were due to their early pubescence. Information on the age at menarche did not confirm the widespread belief that southern

women reach the stage of pubescence earlier. The average age at menarche was 14.95 ± 0.02 in Azerbaijan and 15.89 ± 0.02 in Armenia.

The campaign against premature marriages as a vestige of the past that was started in Soviet years with a view to protecting women's health and emancipating them has had an invigorating effect on the female organism, raised fecundity and brought down infant mortality. A comparison of the age at marriage in the different generations of women under investigation has revealed that already before the war the relative number of women who got married before the age of sixteen was gradually declining. Comparisons of the family status of women of younger age groups based on the census returns of 1939 and 1959 in Azerbaijan and Armenia as well as in other Soviet republics where early marriages were customary show that this custom was abandoned in the post-war period.

Since the greater age at marriage resulting from the involvement of women into studies and public life concerned not only the youngest age groups (under 16) but also, to some extent, the age groups with the highest fertility rates, it contributed, among other factors, to a decrease in the birth rate.

Similar changes in the married state of the population will undoubtedly take place in developing countries in connection with their general economic and social progress, the rising cultural level of women and their greater employment. The greater age at marriage must bring down the birth rate (although the fertility of women of the most fertile ages may increase owing to the improved health of the female population).

Differential fertility levels in Chile

RUBÉN TALAVERA GOIBURU

Chile is a country with a moderately high fertility rate. However, among the Latin American countries this is one of the lower registered birth rates.

This study indicates that:

(a) The birth rate of 35.0 per 1,000 has not changed in the past two decades;

(b) At present, the gross reproduction rates are: 1.56 in urban areas, and 2.49 in rural areas;

(c) Also, at the present time, the gross reproduction rates according to economic activity are: 1.06 among active women, and 2.06 among inactive ones;

(d) Rural population decreased both in relative and absolute size. For example, 68 per cent of the total population today (1960) lived in urban areas, while in 1952 this was only 60 per cent. Another striking fact is that 3 out of 4 women (74 per cent) in the fertile age-group (15-49) were registered as living in urban areas in 1960.

Since, general fertility in urban areas tends to be lower than that of rural areas, one would expect that increasing urbanization in Chile would have brought about a decrease in the birth rate, rather than the constant rate experienced in the past two decades. The present study considers some of the factors involved.

First of all, urbanization has taken place largely on squatter areas (as narrowly defined by the Census) where the gross reproduction rate is 2.5, *i.e.*, identical to that of rural areas (2.49). The Census has registered 13 per cent of urban growth in those squatter areas; however, this figure is in all probability much higher if one takes into account other peripheral, non-integrated areas where reproductive behavior is very similar to that of simple squatters.

Secondly, there has been an increase in economically inactive women in the 20-49 age-group. This is relative to the percentage of inactive women over the total female population in that age-group, as can be ascertained from figures taken from the Census in 1952 and 1960.

A preliminary conclusion that might be drawn is that the apparent paradox in the Chilean case could be resolved, at least in part, by focusing attention on a growing relative economic inactivity of the female population, a fact which happens to coincide with the localization of urban growth in marginal areas which are not being integrated into urban patterns properly.

Fertility rates and intervals between births in a population in Delhi

SAVITRI THAPAR

It has been suggested by several authors that Indian fertility is kept low by some cultural practices prevalent there. In this article the possible effect of these culture factors has been evaluated by a comparative study of the characteristics of fertility in a Ward in Delhi, with those of European populations where no family limitation was practised. The fertility characteristics in the Delhi Ward were found to be similar to those shown by the fertility

studies carried out in other parts of India. The results of comparisons show a more rapid decline with advancing age in the Delhi Ward Fertility Rates (per 1,000 exposure years) as compared with those of the European ones. This is due to the much earlier onset of permanent childlessness in the Delhi Ward.

The interval between births in the Delhi Ward, though similar to those prevalent in Yunlin (Rural Taiwan), is distinctly longer than those in Europe before the spread of family limitation.

With economic development and advancement in education leading to a modernisation in the outlook of the people, there is a likelihood that the importance of ritual abstention from sexual intercourse might decrease. Also with an improvement in the standard of living of the people, and in the medical care of women, the early impairment of fecundity might stop. These are likely to lead to a rise in the fertility rates in the country, unless counteracted by deliberate attempts towards family limitation with a desire for a small ultimate family size.

Effects of social and family patterns on the population increase in Togo (West Africa)

GABRIELE WUELKER

According to the 1958-1960 census, Togo is among the countries with the highest rates of fertility as well as population growth. Its inhabitants number about 1.5 million and their birth and death rates are 55 and 29 per 1,000 respectively. A very slight decline in later births, i.e., 4th and 5th onwards, is noticeable in the higher urban social strata. Yet a general change in the reproductive attitudes may not be foreseeable the near or even the distant future. Traditions, family customs, and religious beliefs influence procreation strongly. Among the factors which influence attitudes towards family patterns are the following:

Polygamy is, in principle, still existing and recognized although its statistical extent is difficult to establish, yet its influence on the family attitudes is considerable. Illegitimate mothers and their children are not discriminated, even if the children have different fathers. A marriage is considered to be concluded only when a child is conceived. Fertility is also a part of the traditional animistic beliefs and is closely related to the religious belief that nature is animated by the ancestors' souls who descend to the world in their offspring. The

prestige of a person, male or a female, depends on the number of children that he has procreated and raised. According to various observations, no fertility difference has been observed between women living in polygamous and monogamous marriages.

The economy of the country is still stagnant. Education and vocational training are not sufficiently developed. Development plans for the country face a rapidly increasing population, and because of the above traditional influences, demographic change may not be considered as probable in the near or distant future.

Fertility differentials of the United Arab Republic women

ABDEL-KHALIK M. ZIKRY

This study investigates the reproductive behaviour of the Egyptian women of different socio-economic classes in both the rural and urban sectors of the population. The aim is to determine their differential fertilities. Reproductive data from the 1960 census as well as the 1960 Vital Statistics of Egypt are the major sources of information for this study.

The results of the findings can be summarized as follows:

(a) Fertility indicators in 1960 indicate higher fertility rates in urban areas than in rural areas;

(b) Level of fertility of Moslem women exceeds that of their Christian counterparts in urban areas, whereas there is almost no fertility differential between the women of the two religions in rural areas;

(c) There is an inverse relationship between the educational attainment of married women and their levels of fertility, as indicated by their standardized duration specific reproduction rates for 1960;

(d) There is an inverse relationship between the socio-economic status of urban women and their duration specific reproduction rates, whereas the duration specific reproduction rates of rural women are directly related to their socio-economic status.

Finally, the increase in Egyptian population is caused by her high stable fertility, and her steadily declining mortality rate. The death rate, even though high by western standards, will continue to drop because of the continuing improvement of the health facilities.

FACTORS AND PATTERNS OF FERTILITY IN AREAS WHERE FERTILITY IS RELATIVELY LOW

PAPERS

Demographic variables as a source of differences in the fertility of low fertility countries

GYÖRGY ACSÁDI

I. INTRODUCTION

1. Within the limits of the physiological possibilities, the fertility of the individual is determined, in its essence, by social, economic and psychological factors, which thus can be considered as the sources of differences in the fertility of the different female populations.

2. However, the fertility of the female population is not independent of the demographic variables either. Being inter-connected with the factors mentioned, the demographic variables exercise their influence through the social, economic and psychological factors. Moreover, from the point of view of the differences in fertility, also the consequences of the demographic changes manifesting themselves directly in the total fertility of the female population, in the natality and in the population growth, deserve our attention.

II. INTERACTION OF THE REPRODUCTION PROCESSES

3. The connexion between natality and mortality or of the fact that both births and deaths react upon some events, is one of the earliest results of demographic research. Even Graunt mentioned in the *Observations* that "The more sickly the year is, the less fertile it is of births",¹ etc.

4. In the connexion between the two basic processes of reproduction, the impact of mortality on fertility can be regarded as primary. The changes in mortality influence fertility in several ways:

(a) The decline of mortality lengthens the

period of fertility. This impact is quite obvious in developing countries, for at the beginning of this century in many places, life expectancy of the fifteen-year old females did not reach even 35 years, i.e., on the average they did not live through the whole fertile life period. This factor cannot be neglected in the European countries either, where at the end of the nineteen thirties the life expectancy of the fifteen-year old females exceeded, in general, by more than ten years, the 43-52 years of the beginning of the century;

(b) Mortality may influence fertility not only through the period of fertility; its development, together with its socio-economic determinants, is a factor historically determining fertility. The radical changes in the level and structure of mortality in modern times play, for instance, an important role in the fertility of both the individual and the population. From the point of view of the individual, due to a decline in infant mortality, the mothers can bring up as many children as before but by fewer deliveries. From the population aspect, the decrease of mortality quickens the increase of the population for a while. If, however, the population development reaches the limits of the possibilities offered by the socio-economic development, the consequences of this fact manifest themselves in the field of fertility. The population reactions are of course, not uniform and as a result of the inertia of the social factors determining fertility, the decline of high fertility may be slow as in the developing countries. The trend of the declining fertility may surpass the level ensuring the balance of reproduction as in a number of European countries. The impact of the decrease in mortality is felt

¹ J. Graunt, *Natural and Political Observations* (Oxford, Royal Society, 1665), 4th ed.

in some degree also at present in connexion with the differences in fertility in low fertility countries; in fact, such differences can be found within some European countries, too, in areas with different demographic development and different ethnical groups;

(c) The changes in mortality have, no doubt, a significant impact on the age composition and sex proportion of the population,^{2,3} which influences fertility partly through socio-economic transmissions and partly exercises a direct impact on natality and the increase of the population.

5. The mortality factor can be mentioned also by the role it played in the past in the compensation processes following epidemics and wars. Of course, the changes in fertility and natality also have their consequences on mortality. The very significant impact these changes will bring about 25 years later in fertility and natality⁴ by means of changing the age structure should not be disregarded.

III. IMPACT ON FERTILITY OF THE CHANGES IN THE DEMOGRAPHIC STRUCTURE

6. In the structure of a population, sex and age influence fertility, first of all, as biologically determining factors, while age also plays a role as the criterion of differential fertility. Beside fertility and mortality, it is migration that influences the sex and age composition of a population and, thus, it has an impact also on fertility. Other changes in the population structure also have an impact on the development of fertility.⁵

7. In low fertility countries where the monogamous family system prevails, the fact that the proportion of one of the two sexes becomes predominant within the propagative age causes a decline in fertility. Such a considerable shift in the sex ratio comes about mainly as a result of mortality and the migratory movements, and can be observed often in the countries of immigration or during wars. The concomitants of wars—military losses, the surplus mortality during wars, deportations, captivity, forced

migrations and population transfers, the loss of births in wars, etc.—decrease, first of all, the number of the male population and thus increase the surplus of females. World War II has caused such a significant loss of men in numerous European countries (Germany, the Soviet Union) that at the same time it has considerably decreased the level of the birth rates.

8. In low fertility countries, age-specific fertility is highly differentiated. For this very reason, the changes of the age composition of the female population in the child-bearing ages may modify both the birth rate and the general fertility rate. This impact can be seen in table 1, which gives a comparison of the crude birth rates of twenty four countries and of the number of the births per thousand females in the age of 15-49 years with standardized data. Standardization was based on the young, Hungarian age structure of 1900, having the form of a regular pyramid. In the greater part of the countries, the standardized rates indicate how unfavourably their age composition has changed with regard to high fertility as compared with the standard, which used to be similar with all populations. In certain countries (Greece, Italy, Japan, Portugal, Spain or Yugoslavia) the actual rates are higher than the standardized ones, and in some populations the difference between the two rates is small. The differences between the actual and standardized rates indicate that in the low fertility countries, the differences or changes in the age composition are significant sources of the fertility differences.

9. In all low fertility countries, the aging of the population can be observed.⁶ This process may modify the value of the birth and fertility rates also in itself, but it may influence the female fertility also by virtue of its socio-economic consequences. The impacts affecting the age composition—as for instance the changes in fertility mentioned at the end of paragraph 5 or the war impacts indicated under paragraph 7—very often reach the field of fertility with a phase shift through the age composition.

10. Due to the peculiar composition of the migrants which differs from that of the population as a whole, migrations modify the population structure, influencing thereby fertility in the low fertility countries affected by migrations. On the basis of the results of Hungarian demographic research which correspond with

² A. J. Coale, "The effects of changes in mortality and fertility on age composition", *Milbank Memorial Fund Quarterly*, Vol. 34 (1956), pp. 79-114.

³ G. Stolnitz, "Mortality declines and age distribution", *Milbank Memorial Fund Quarterly*, Vol. 34 (1956), pp. 178-215.

⁴ F. W. Notestein, "Mortality, fertility, the size-age distribution, and the growth rate", *Demographic and Economic Change in Developed Countries* (Princeton University Press, 1960), pp. 261-275.

⁵ *Bevezetés a demografiába* (Introduction to demography) (Budapest, Közgazdasági és Jogi Könyvtár, 1964).

⁶ United Nations, "The causes of the aging of populations: declining mortality or declining fertility?", *Population Bulletin*, No. 4 (United Nations publication, Sales No. 55.XIII.1), pp. 30-38.

the results of other investigations,^{7,8} migrations can be connected with fertility also due to the fact that, in general, the fertility of those leaving their residence (emigrants) is lower than that of the residents and a certain role can be attributed also to the fact that persons with many children migrate more frequently than those with fewer children.

11. Fertility reacts especially sensitively to the changes in the composition of the population that are connected with the criteria important from the point of view of differential fertility. Thus, the fertility differences of low fertility countries depend on the population's socio-occupational, income, cultural, urban-rural composition, educational standard, etc., on their development.

IV. CONNEXION BETWEEN THE MARRIAGE AND FERTILITY AGE-PATTERNS

12. One of the basic aspects of fertility investigations is the marital status. The changes in the composition by marital status of the population and nuptiality are equally connected with fertility. The connexions between the marrying age and the age-patterns of fertility have been examined in the developed countries with regard to the post-war upswing, whereas recent examinations^{9,10} have pointed to the fact that the question is important in the developing, high fertility countries, too. In the nineteen-fifties new fertility tendencies were unfolding in the European countries; it seems to be timely, therefore, to examine this problem on the basis of the present characteristic features of the low fertility countries.

13. The question is whether the age at the conclusion of the marriage influence the general level of fertility or the age-patterns of fertility. On the basis of the 1961 data of 22 European countries with a relatively low level of fertility and of one Asian country (the countries included in table 1 and Austria), no connexion can be found between the average marrying age of the brides and the general fertility rate; there is a connexion, however, between the average marrying age and the fertility of the individual female age groups. Since, however, the exact value of the average marrying age is not avail-

able with regard to all countries, further, since the value of the average age is influenced in a different way by the remarriages which are of a secondary importance for fertility, it is more advisable to carry out the examination on the basis of the percentage of the brides marrying young.

14. Figure 1 shows that in the countries with a small proportion of females marrying under 20 years of age, the age-specific fertility of the 20-24 year old females is also low. The proportion of the females marrying under 20 years is in direct connexion with the fertility of the 20-24 year old females, whereas according to figure 2, it has no connexion with the level of fertility, the general fertility rate. (Figure 2 shows the data of the countries enumerated on table 1, figure 2 contains the same including also Austria.)

15. In respect of individual fertility, from figures 1 and 2, the lesson can be drawn that in low fertility countries the females give birth to a certain number of children independently of their marrying age but the age at which they give birth to their children depends on the former (i.e., on their age at the conclusion of the marriage).

16. In table 1, whose last column contains the quotient of the age-specific fertility of the 20-24 and the 25-29 year old females, three

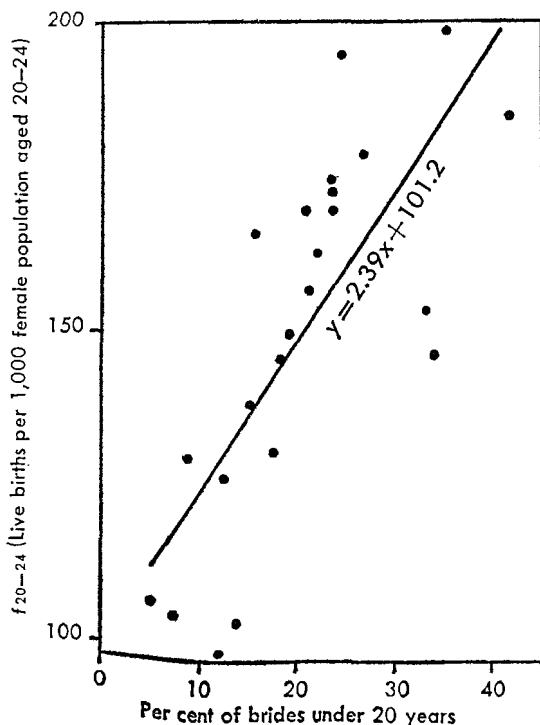


Figure 1

⁷ C. V. Kiser, "Residence and migration", C. F. Westoff, *The Third Child* (Princeton, 1963), pp. 157-182.

⁸ P. H. Rossi, *Why Families Move* (The Free Press of Glencoe, Ill, 1955).

⁹ N. B. Ryder, "The conceptualization of the transition in fertility", *Cold Spring Harbor Symposia on Quantitative Biology*, No. 22 (1957).

¹⁰ A. J. Coale and C. J. Tye, "The significance of age-patterns of fertility in high fertility populations", *The Milbank Memorial Fund Quarterly*, Vol. 39 (1961), pp. 631-646.

types of low fertility countries can be observed on the basis of the behaviour of the two age groups playing the greatest role in fertility. The

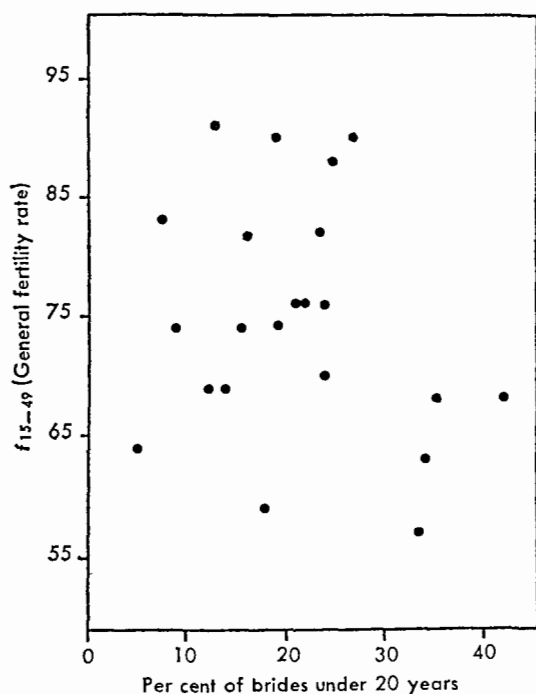


Figure 2

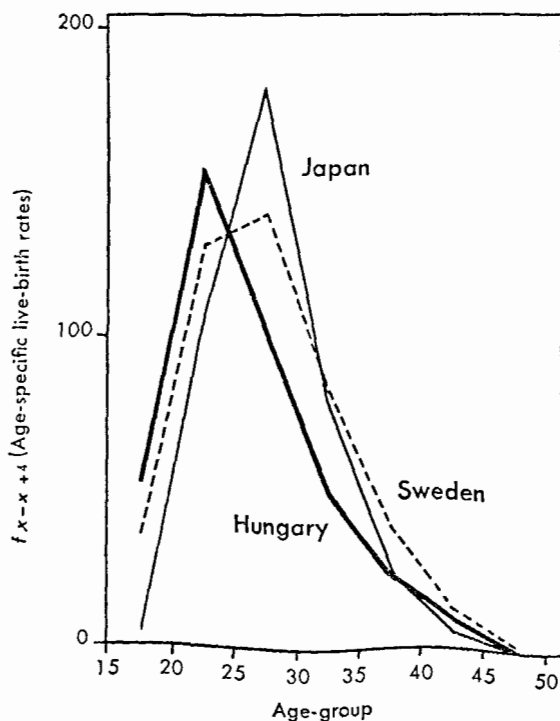


Figure 3

group contains the countries in which fertility is the highest in the age of 20-24 years, the second group includes the countries in which the fertility of the 20-24 and 25-29 year old is nearly the same, whereas in the third group, it is the 25-29 year old that reveals the higher fertility. These three types of fertility are shown in figure 3, where the first type is represented by Hungary, the second by Sweden, and the third by Japan.

17. On the basis of the data of table 1, it should be noted that these three types of fertility are independent of the level of fertility but are in a rather close linear functional connexion with the marrying age. Figure 4 shows this linear connexion ($y = 2.87x + 39.75$) between the quotient of the fertility of the 20-24 and 25-29 year old age group, on the one hand, and the percentage of females marrying under 20 years of age, on the other hand. In figure 4, group I, with a quotient surpassing 110 and with a higher than 24 per cent proportion of the brides under 20 years, includes Bulgaria, Czechoslovakia, Hungary, Romania, Poland and Yugoslavia. Middle group II, with a quotient between 90 and 110 and with a 16-23 per cent proportion of the young brides, consists of Denmark, Austria, Finland, England and Wales, Scotland, Sweden, Norway, France, Belgium and Portugal. The German Federal Republic, Switzerland, Italy, Greece, Nether-

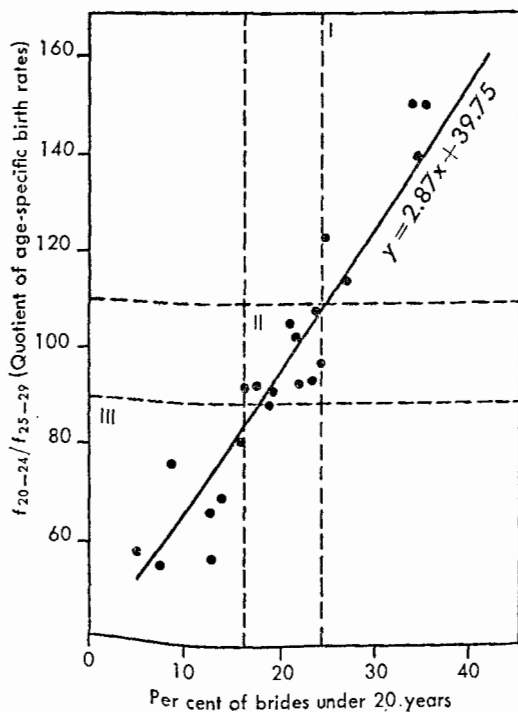


Figure 4

lands, Japan and Spain form group III (with a quotient under 90 and with a proportion of young brides under 16 per cent).

18. Thus in low fertility countries, the marrying age is an important determining factor of the age-patterns of fertility, though the level of fertility does not depend on any of them.

19. It is clear from what has been said above that in low fertility countries, the process of the demographic development is different; this reveals itself in the fertility differences. Besides, in these countries, the differences in fertility prevail in respect of the additional characteristics of fertility also (order of birth, interval, duration of marriage, etc.).

Table 1. Birth rates and fertility of low fertility countries, 1961

Country	Birth rates		Fertility rates f_{15-49}		Ratio of f_{20-24} f_{25-29}
	Crude	Standardized ^a	General	Standardized	
Belgium	17	19	74	75	0.93
Bulgaria	17	18	68	73	1.55
Czechoslovakia	16	18	68	75	1.52
Denmark	17	19	70	77	1.09
England and Wales.....	18	21	76	84	0.98
Finland	18	19	76	79	1.03
France	18	20	82	83	0.93
Federal Republic of Germany.....	18	18	74	75	0.83
Greece	18	15	69	63	0.68
Hungary	14	15	57	62	1.52
Italy	19	16	69	67	0.71
Japan	17	15	67	59	0.59
Netherlands	21	23	91	92	0.59
Norway	17	21	76	85	0.94
Poland	21	21	88	86	1.24
Portugal	25	21	90	87	0.90
Romania	18	17	68	69	1.40
Scotland	20	21	82	87	0.95
Spain	21	19	83	79	0.57
Sweden	14	16	59	67	0.94
Switzerland	18	18	74	73	0.77
Yugoslavia	23	21	90	85	1.15

SOURCE: United Nations, *Demographic Yearbook*, vols. 1961, 1962, 1963 (United Nations publication: Sales Nos. 62.XIII.1, 63.XIII.1, 64.XIII.1).

^a The standardized rates have been computed on basis of the 1900 age-distribution of the Hungarian population. (The percentage distribution of the Hungarian female population in the child-bearing age was in 1900 the following: $P_{15-19} = 20.78$; $P_{20-24} = 16.62$; $P_{25-29} = 14.25$; $P_{30-34} = 13.84$; $P_{35-39} = 12.49$; $P_{40-44} = 12.14$; $P_{45-49} = 9.88$ per cent).

Social and psychological factors influencing the control of fertility in Europe

HÉLÈNE BERGUES and JEAN SUTTER

[Translated from French]

I

1. A glance at a map of Europe showing birth rates reveals a certain amount of variation. "We find," say J. N. Biraben, Y. Péron and A. Nizard, authors of a recent exhaustive study of fertility in European countries,¹ "an area with a low birth rate of 10-17 per thousand covering the north-eastern quarter of Spain, all of southern and central France, the south-western half of Switzerland and a large part of northern Italy Another large area with a low birth rate covers the Scandinavian peninsula—all of Sweden, Norway and Denmark apart from the North Sea and Atlantic coasts. Embracing the whole of Central Europe is a wide area with a medium birth rate (18-21 per thousand), while an area with a rather low rate takes in England, Wales, Scotland and the coastal areas of Denmark and Norway. Finally, around the periphery of Western Europe, there are regions with a fairly high birth rate (22-32 per thousand) in Ireland, Iceland, Finland, southern Italy, Sardinia and Sicily, central and southern Spain, and the northern half of Portugal, where it is highest."

2. It may be helpful to bear this distribution in mind when considering the behaviour of the populations with regard to birth control.

3. "However," the same authors note, after describing birth-rate trends since before the First World War, "a new situation seems to have prevailed since about 1953 which is even more stable than the birth rates indicate; the relative position of the countries shows little variation and their range is diminishing, those with the highest fertility (with the exception of Ireland, the Netherlands and Italy) growing little or not at all, those with medium fertility (France, Norway, Switzerland and Belgium) tending to grow slowly and those with the lowest fertility (England, the Federal Republic of Germany and Austria, but not Sweden) growing rapidly. The over-all impression is that the countries concerned are moving

towards a common medium fertility rate of 2.5 or 2.6 children per marriage which will be reached some time between 1970 and 1975."²

4. There can be no doubt that the findings of social psychology are essential in order to investigate and predict individual behaviour with regard to the various problems of reproduction—contraception, abortion, desired number of children, actual fertility, general opinions. Reactions inevitably differ according to the social status and role of the persons in question. If we seek to define these two characteristics for each individual, we may say that "his status is the sum total of the behaviour that he can legitimately expect from others, while his role is the sum total of the behaviour that others can legitimately expect from him".³

5. With these definitions established, it is logical to expect that, depending on differences in their status and role, the individuals, couples, small social groups and different strata which together make up a great modern nation will react differently towards the problems of reproduction and fertility.

6. Research workers have only recently begun to study the problem posed at the national level by these different kinds of behaviour with regard to fertility. In the United States, Norman Hines published a detailed study of contraception in 1936,⁴ which was, however, approached in historical terms and more or less from an ethnic and anthropological standpoint. The book contains little on Europe and virtually nothing on France, although the latter is a country where contraception was practised on a wide scale very early and with an effectiveness which was soon reflected in the population statistics.

7. It is this lack of information, not merely on the historical development of contraception but on the motives for it, which led one of us, Hélène Bergues, to undertake an exhaustive study of the situation in France, where a desire

² *Ibid.*, p. 454.

³ J. Stœtzel, *La psychologie sociale* (Paris, 1963), p. 178.

⁴ Norman Hines, *Medical History of Contraception* (New York, 1936).

¹ J. N. Biraben, Y. Péron and A. Nizard, "La situation démographique de l'Europe occidentale", *Population*, No. 3 (1964), p. 451.

to limit their families has gradually taken hold among married couples.⁵ This study showed that the forces underlying birth control are difficult to analyse in practice, since what is involved is, among other things, a gradual change in the mentality of small groups and social strata whose motives are extremely difficult to determine. From the study of this historical process in France, it appeared that the best basis for a study of motives would be to ascertain, for a large country, the exact state of the fertility of the main social and other groups making up the population. It is essential to have this information at an early stage so that effective research into the processes underlying the observed demographic situation can be undertaken.

8. It is not surprising that there have been so few studies of motives and behaviour, since, for the most part, we have only a doubtful picture of the true state of fertility. No European country has had a fundamental study comparable, for example, to those made for the United States by Freedman, Whelpton and Campbell using a representative sample.⁶ If such a tool were available, it would be much easier to conduct investigations into motives, which might explain why and to what extent attitudes towards one thing or another differed among the different social groups considered.

9. If reliable basic documentation is lacking in Europe, there have nevertheless been a number of studies which are interesting precisely because they bring out the importance of the psycho-social substratum in attitudes towards the matters with which we are concerned.

II

10. Status and role being the essential basis for explaining behaviour towards the different aspects of fertility, it can be assumed at the outset that age, sex, occupation, level of education, religion (whether practised or not) and the whole social context in which the individual lives will influence his behaviour and the behaviour of married couples.

11. This is what has been found in the surveys made so far in various European countries. In other words, behaviour can be observed to differ in accordance with the three types of factors encountered when any population problem is being studied, namely (a) biological factors (sex, age, mental condition);

(b) socio-economic factors (occupation, income, wage or salary, housing); and (c) cultural factors (level of education, religion, ethnic origin).

12. One can imagine, on this basis, all the differences that might be found between the behaviour of various individuals and various groups. However, it must not be forgotten that other phenomena affect individual reactions to status, such as, for example, mass information. Daily newspapers are read more and more widely, particularly in urban environments, and this, combined with radio and television, has had a great impact on personal opinions about the various problems of reproduction. We quickly become involved here in the problem of propaganda and publicity, which can produce profound changes in attitudes. The influence of the dissemination of ideas and information is crucial in this area.

13. The motives of the two sexes are definitely not the same with regard to contraception, abortion, limitation of families, and opinions on population questions. Men react differently from women to all these problems. Since Kinsey, we know how much sexual motivations differ from one sex to the other, so that it is not surprising to find this contrast; yet, there has still been very little research in this field. It is to be expected, however, that the use of contraceptive methods, to confine ourselves to this one subject, will vary from one region to another. For example, C. van Emde Boas reports that when he visited Italy to set up an organization, the meetings were attended only by men, and when he asked them why they had left their wives at home, they replied that birth control was a man's affair with which women had nothing to do.⁷

14. So far, the surveys undertaken have concerned women. However, there is no doubt that very valuable information can be obtained by questioning men, as was pointed out by S. Siebert, and then by Siebert and J. Sutter in connexion with a study made in Grenoble in 1962.⁸ This point is very important, since it involves the problem of the spread of contraceptive methods through personal relations and communications. These methods can probably be disseminated more easily by men than by women.

15. Age is certainly the factor whose influence has been most apparent. It affects:

⁵ H. Bergues, *La prévention des naissances dans la famille* (Paris, 1960).

⁶ R. Freedman, P. K. Whelpton, A. A. Campbell, *Family Planning, Sterility and Population Growth* (New York, 1959).

⁷ C. van Emde Boas, *Excepta Medica* (International Planned Parenthood Federation, The Hague, 1960).

⁸ S. Siebert and J. Sutter, "Attitudes devant la maternité: une enquête à Grenoble", *Population*, No. 4 (1963).

- (a) The desired number of children;⁹
- (b) The actual number of children and thus the size of the complete family;¹⁰
- (c) The use of contraception and the contraceptive method used;¹¹
- (d) Acceptance of induced abortion, legal or otherwise;¹²
- (e) Sterilization;¹³
- (f) Actual or possible acceptance of "the pill".¹⁴

16. The influence of age is closely bound up with marital status, age of marriage, fertility at the time, interval between births, etc. Each of these factors should be taken into consideration along with age.

17. Among biological factors, the mental condition of the individual surely also plays a leading role in his behaviour with regard to reproduction. If we grant that in general persons suffering from mental disorders practise contraception little or not at all, it must be said that there is little information on their actual fertility. In Norway, Ø. Ødegård¹⁵ has published interesting data on the connexion between marriage and mental disorder. Such studies are still too rare.

⁹ J. Stoetzel, "Les attitudes et la conjoncture démographique; la dimension idéale de la famille", *Proceedings of the World Population Conference, 1954*, papers: vol. VI (United Nations publication, Sales No.: 55.XIII.8); J. Sutter, *Rapport global* (France, Commission de la famille, 1960).

¹⁰ R. Pressat, "The ideal and the actual number of children", *Studies on Fertility and Social Mobility* (Budapest, Akadémiai Kiado 1964).

¹¹ S. Siebert and J. Sutter, "Attitudes devant la maternité: une enquête à Grenoble", *Population*, No. 4 (1963); W. Srb, M. Kučera and D. Vysusilová, *Démographie*, Nos. 1, 2, 3 and 4 (Czechoslovakia, 1961); Központi Statisztikai Hivatal, *T.C.S. Study* (Budapest, 1963). D. V. Glass, "Family limitation in Europe: a survey on recent studies", *Research in Family Planning* (Princeton, 1962).

¹² J. Sutter, "Résultats d'une enquête sur l'avortement dans la région parisienne", *Population*, No. 1 (1950); A. M. Dourlen-Rollier, *La vérité sur l'avortement* (Paris, 1963); J. Sutter, "Bilan de la politique néo-malthusienne en Suède", *Population*, No. 4 (1960); M. R. Mangin, "La politique néo-malthusienne au Danemark", *Population*, No. 1 (1962); W. Srb, M. Kučera and D. Vysusilová, op. cit.; Központi Statisztikai Hivatal, *T.C.S. Study* (Budapest, 1963).

¹³ J. Sutter, "Bilan de la politique néo-malthusienne en Suède", *Population*, No. 4 (1960); M. R. Mangin, "La politique néo-malthusienne au Danemark", *Population*, No. 1 (1962).

¹⁴ J. Sutter and F. Morin, "Attitudes devant la maternité: une enquête à Paris en service hospitalier", *Population*, No. 2 (1960); S. Siebert and J. Sutter, "Attitudes devant la maternité: une enquête à Grenoble", *Population*, No. 4 (1963).

¹⁵ Ø. Ødegård, "New data on marriage and mental disease", *Journal of Mental Sciences* (Norway, 1953).

18. Among socio-economic factors, occupation plays an important role. Examples abound. During the nineteenth century and until very recently, the fertility rate was higher in rural than in urban areas in all countries. Recently this has become less apparent almost everywhere, from Western Europe, including France, to the countries under communist rule. This phenomenon of fertility equalization is at present particularly visible in Eastern Europe—Hungary, Yugoslavia, Romania. The opposite tendency has even been observed in those countries, where occupational migration combined with the upheavals due to socialization have most profoundly affected individual status.

19. Just as the influence of age is related to the couple's fertility, that of occupation is directly related to the level of wages and salaries. In the studies in which occupation and wages and salaries were investigated at the same time, the correlation between the effects of these two factors was found to be very close.¹⁶ Inadequate pay and housing have been cited everywhere as a cause of induced abortion, particularly in France, Czechoslovakia and Hungary.

20. In all the studies referred to above, it is striking to find that contraceptive practices vary in a more or less uniform manner according to occupation. Whether in the United Kingdom, France, Sweden, Denmark, Czechoslovakia or Hungary, the further one moves from manual towards intellectual occupations, the more complicated the methods become, the more different ones are tried and the greater use is made of natural methods. One also finds that the methods are applied better and better and that they are more effective as one goes up the occupational scale. Failures are always more frequent among the more manual occupations. This seems to be a general rule.

21. In Hungary, a sample survey was made (2 per thousand of the population of Budapest) in order to determine the effect on fertility of movement from one occupation to another.¹⁷ The fertility of couples in which neither the husband nor the wife has changed occupation during their lives is 18 per cent higher than that of couples which have made such a change. This is true for all segments of the population. Those who move from a manual to an intellectual occupation have fewer children than

¹⁶ J. Sutter and F. Morin, "Attitudes devant la maternité: une enquête à Paris en service hospitalier", *Population*, No. 2 (1960); S. Siebert and J. Sutter, "Attitudes devant la maternité: une enquête à Grenoble", *Population*, No. 4 (1963).

¹⁷ *Studies on Fertility and Social Mobility* (Budapest, Akadémiai Kiado 1964).

those who have always had an intellectual occupation. This effect of social mobility has not received sufficient study. Among cultural factors, the level of education plays a leading role. Whether it is measured by the number of years of schooling, the level reached or the qualifications obtained, the results are the same. The frequency of contraception increases as the level of education rises. Effectiveness, variety of methods and use of natural methods follow the same trend. Similarly, induced abortion is less common at the higher levels.

22. Attention should also be drawn to the close parallel in this field between the effects of the level of education and of occupation, which is not surprising.

23. The religious factor plays an important role. The religious uniformity of individual countries makes it difficult to compare the role of different faiths in Europe. In a survey conducted in France,¹⁸ however, different behaviour was found among Catholic women, whether practising or not, including women of Italian origin and Frenchwomen. It was possible at the same time to study the behaviour of some Moslem couples.

24. In the above-mentioned studies concerned with the religious factor, we find in the case of Catholics that the practice of their faith leads them to use natural methods (Ogino and

temperature) in preference to adjuvants. The more devout the Catholic couple, the less use is made of condoms, diaphragms and chemical products.

25. Other cultural factors may have a powerful effect on fertility trends. J. William Leasure,¹⁹ for example, found that, in Spain, Barcelona and the neighbouring rural areas had a uniformly low fertility rate whereas Madrid, itself with a low fertility rate, was surrounded by a high-fertility area. In Leasure's view, these phenomena are partly connected with the language and history of the region, which influence behaviour with regard to the family. Here we find again the influence of ethnic origin, which is so well brought out in Norman Hines's book.²⁰

26. The individual opinions collected by public opinion surveys might be the subject of a special study in this field. Unfortunately, we can do no more within the limits of this paper than indicate how interesting they are. Let us merely say that the opinions expressed are in full accord with all the findings described above.

27. These public opinion surveys are further proof of the cohesiveness which exists, allowing for the different factors at work, in personal motivations affecting reproduction and fertility. They give us valuable pointers for future research.

¹⁸ S. Siebert and J. Sutter, "Attitudes devant la maternité: une enquête à Grenoble", *Population*, No. 4 (1963).

¹⁹ J. W. Leasure, "Factors involved in the decline of fertility in Spain", *Population Studies*, vol. XVI, No. 3 (London, 1963).

²⁰ Norman Hines, op. cit.

Prevailing fertility situation and its causes in western Europe

JEAN-NOËL BIRABEN

[Translated from French]

Geographical scope. The countries included in this study are: Iceland, Faroe Islands, Denmark, Norway, Sweden, Finland, Ireland, United Kingdom, France, Belgium, Luxembourg, Netherlands, Federal Republic of Germany, Switzerland, Austria, Portugal, Spain, Italy and Malta.

Chronological scope. An analysis of the crude birth rate in western Europe as a whole shows that, after remaining almost stationary at 33 or 34 per 1,000 population up to 1876, it began to decline, slowly at first until 1901, and then rapidly until 1933 by which time it was only 18.0 per 1,000. It then fluctuated about this figure but did not deviate from it in any appreciable degree. There has been a slight upward movement since 1953, the rate in 1963 being 18.9 per 1,000. This recent ten-year period will be the main subject of this study (table 1, diagram I).

I. GEOGRAPHICAL DISTRIBUTION

1. The regional differences are considerable; in France, the birth rate began to fall as early as the end of the eighteenth century, but in

Ireland only in the middle of the nineteenth century. In 1876, the two extremes in the birth rate were 40.6 per 1,000 in Germany and 26.6 in France. From then until 1933, there was an increasing dispersion in this distribution of rates among the nineteen principal countries of western Europe, the range in the latter year being from 13.7 to 33.3 per 1,000. There was then a very rapid regrouping of the countries as a whole around the modal value of 19.0 to 20.0 per 1,000; in 1963 the range was from 14.7 to 24.0 per 1,000 (table 2, section 1; diagram II).

2. Descending to the level of the large administrative units, we find in 1960 (apart from certain eccentric units—such as the Azores, Madeira, the Canary Islands and the Netherlands polders—where the population structure is exceptionally transitory in character) a homogeneous distribution which obeys the

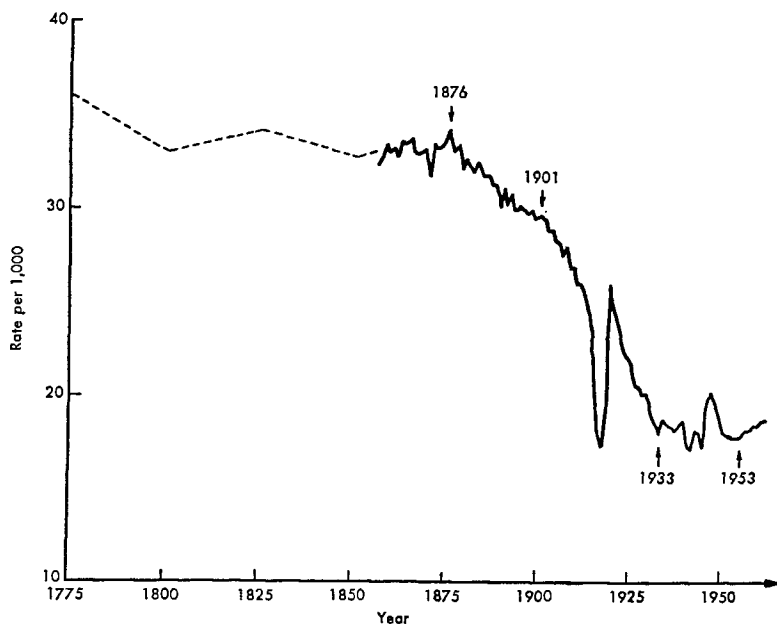


Diagram I

Birth rate in western Europe from 1776 to 1963 (per 1,000 population)

Gibrat (logarithmic-normal) law (diagram III). This distribution is similar from country to country, with the exception of the four southern-most countries where it is bimodal by virtue of a contrast between north and south. In France and Portugal, the birth rate is high in the north and low in the south; in Spain and Italy, the situation is the reverse.

3. In general, the birth rate is low in northern Italy, in southern France and in

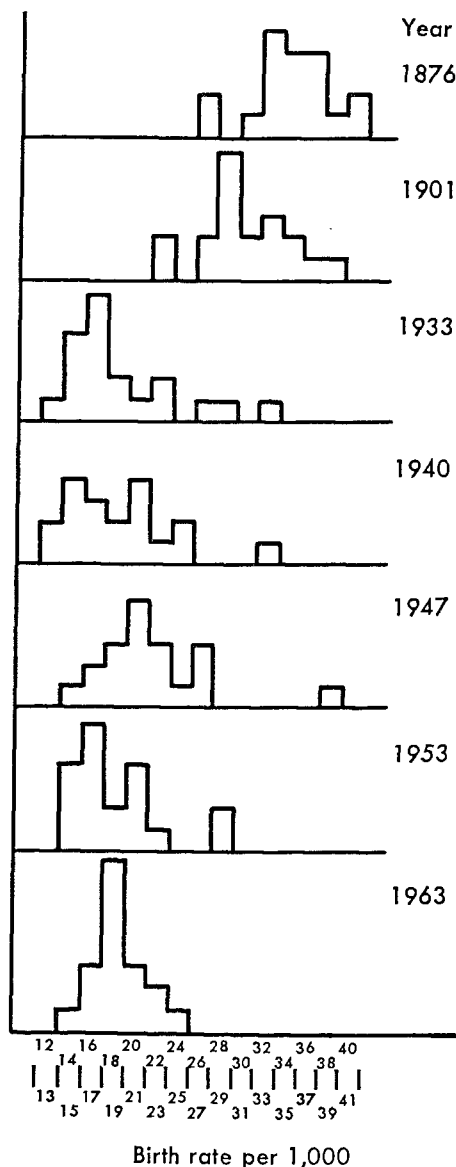


Diagram II

Distribution of 19 countries of western Europe according to their birth rates (per 1,000 population)

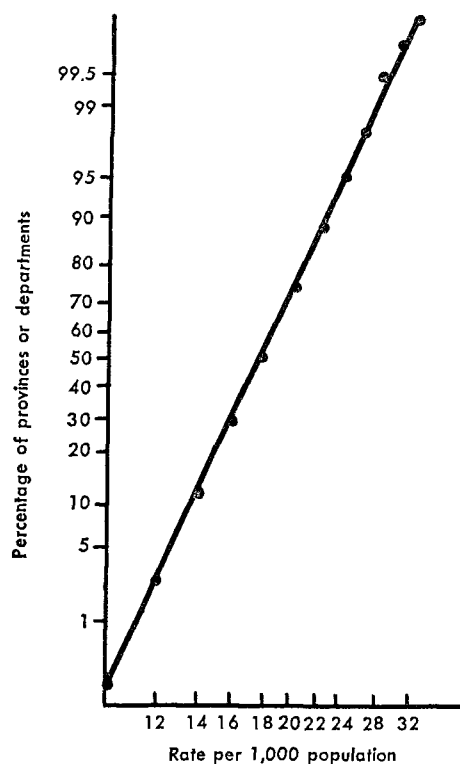


Diagram III

Birth rate at the level of large administrative units in 1960

Sweden. Apart from some provinces of the Netherlands, it is high in the peripheral regions, viz., Portugal, Spain, Ireland, Iceland, Finland and southern Italy. It is in the medium range—between 16.0 and 21.0 per 1,000 population—throughout the rest of Europe (diagram IV).

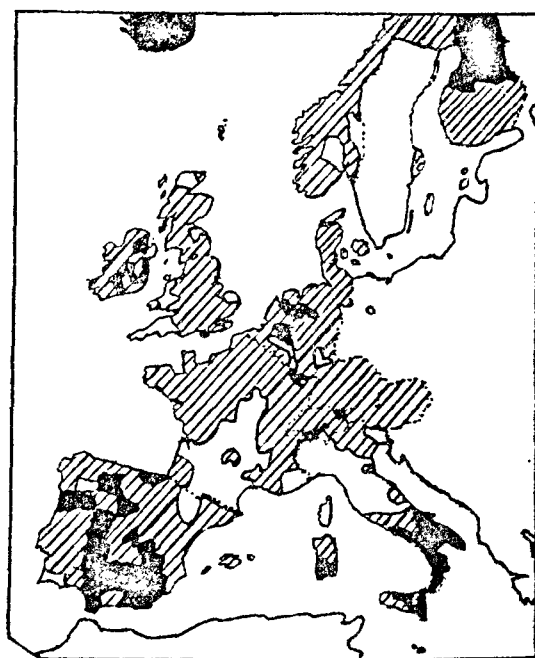
II. FERTILITY

4. The illegitimate birth rate declined rapidly after the Second World War, attaining, between 1955 and 1960, a level generally below that of the pre-war period. It is generally low except in Iceland, where illegitimate births represent one quarter of the total; in four countries only does it exceed 10 per cent. The rise in nuptiality among the youngest members of the marriageable population has probably influenced this trend. In any event, as legitimate fertility represents the bulk of general fertility, it will be the type of fertility dealt with in detail in this paper. In comparing the various countries, we must remember that an appreciable proportion of illegitimate children are legitimized in the year following their birth through the marriage of the mother and that therefore legitimate fertility will appear to be

lower to this extent. This is the case with Iceland, Sweden, Austria, Portugal and, to a lesser extent, the Federal Republic of Germany and France (table 2, section 2).

5. Although nuptiality precedes legitimate fertility, it is, unfortunately, difficult to measure because of the disturbed age structure of most countries—which is reflected in considerable differences as between the number of marriageable young men and young women—and because of migratory movements. It seems, however, that the proportion of never-married persons is tending downward in almost all the countries along with the age at marriage. Although it is difficult to give any definite opinion, the reverse trend appears to be entirely out of question. Furthermore, in no country does the divorce rate play any very important role (table 2, sections 3 and 4).

6. Marital fertility can be measured by the final average number of children per marriage cohort, but the period of observation is long.



Rates per 1,000 population



Diagram IV

Birth rates in western Europe in 1960

It can also be measured by a current index giving the number of live births in relation to a constant annual number of marriages equal to 1.00. On the basis of the latter standard of measurement, it appears that a new and relatively stable order became the rule about 1950 in the countries of western Europe. There emerges a general trend towards an average fertility of 2.5 or 2.6 children per marriage which would be attained in about ten years by

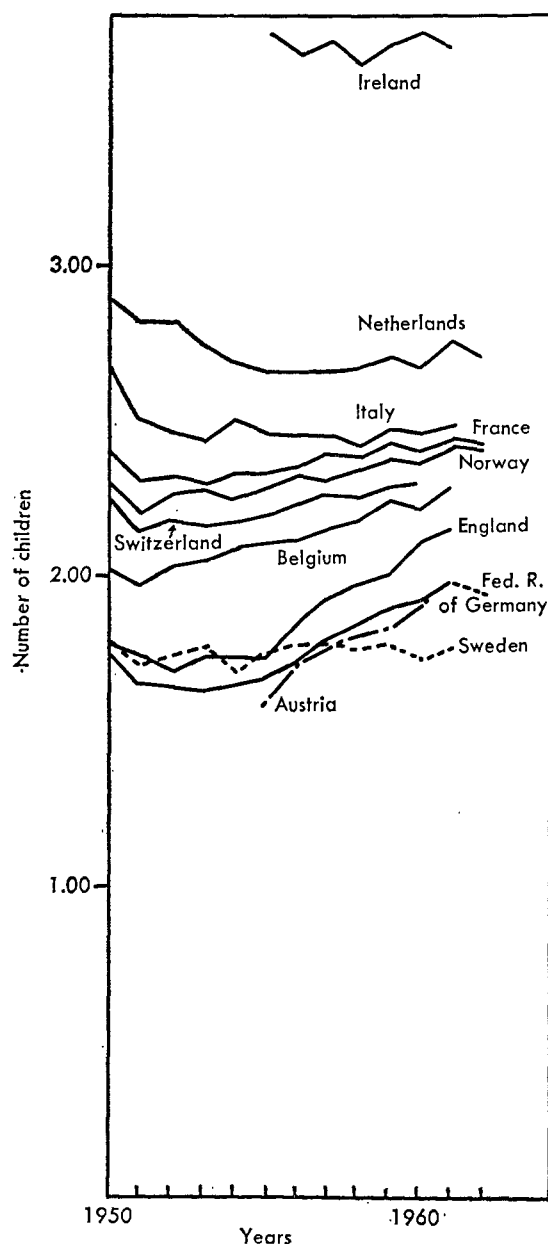


Diagram V

Average number of children per 1.00 marriage

almost all the countries on the assumption of a continuation of this trend (diagram V; table 2, section 5). The fertility rate has risen most rapidly in the countries where, in the years 1951-1955, it was lowest, viz., England, Austria and the Federal Republic of Germany. In countries, such as Belgium, Switzerland, Norway and France, where the fertility rate was average, there has been a slow rise, and in those, Italy and the Netherlands, where it was highest, it has risen only slightly if at all. The result has been a lessening of the dispersion of the various countries.

7. A longitudinal study covering merely the six years 1955-1961 confirms these trends. The rates for the formation of households in the case of households established less than five years ago and of those established fifteen years ago seem to be levelling off in the countries where fertility is highest, viz., Ireland, Netherlands, Italy and France, whereas they are continuing to rise in the countries where fertility is lower—Austria, Federal Republic of Germany, Sweden and Belgium.

8. As a means of analysing these trends, we would have liked to study the family increase probabilities,¹ but we had recent data at our disposal for only four countries: Norway, Switzerland, France and Italy. In the case of these countries, it is observed that the different probabilities follow a generally parallel course (diagram VI). To the extent that the results are not unduly influenced by the method of calculation and migratory movements, there is observed a rather strong increase in a_0 and a_1 , a certain amount of stability in a_2 , and a slow decline in a_3 and in the a_i probabilities of higher rank. In relation to the pre-war period and to 1950, the observations for the four countries show a rise in the a_i of lower rank, a decline in the a_i of medium rank, and stability (except in Norway) in the a_i of higher rank.

9. This trend has considerably modified the distribution of families according to number of children or rather the distribution which would be observed on the assumption that the current probabilities of increase remained unchanged. A very powerful trend towards two-child and three-child families² has become

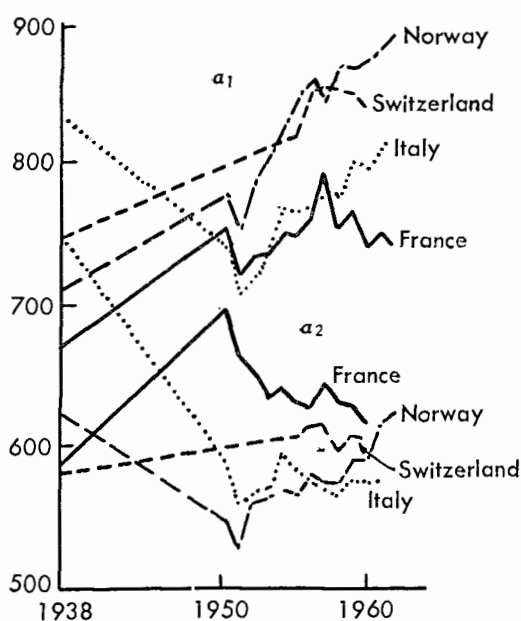
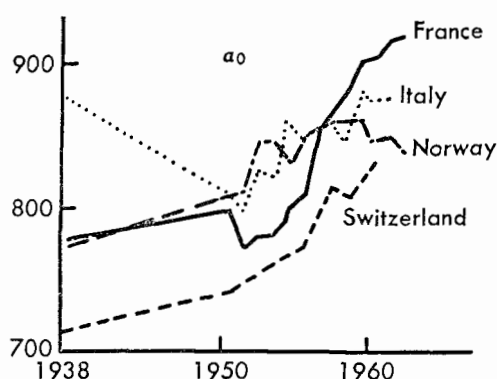


Diagram VI

Family increase probabilities in childless, one-child and two-child families

evident in all four countries. It began very early in Norway, where it seems to have run its course: few childless or one-child families, very high proportion of two-child and three-child families, low proportion of four-child and five-child families, and almost complete disappearance of families with six or more children. In Switzerland, the situation is very much the same as in Norway. In France, a similar change has been rapidly taking place since 1954 among newly married couples. Italy seems to be travelling, although less precipitously, in the same direction (diagram VII). According to diagram VIII, the situation in the four coun-

¹ The probability of an increase at a given time, where a_0 is the probability of childless households having one child in the course of the year, a_1 the probability of one-child households having a second child, and so on.

² Already noted in the case of Norway and Sweden in 1961 by R. Pressat, "Tendances récentes de la fécondité en Europe occidentale," *International Population Conference, New York, 1961*, vol. I (London, International Union for the Scientific Study of Population, 1963).

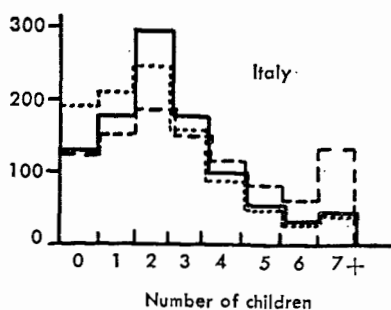
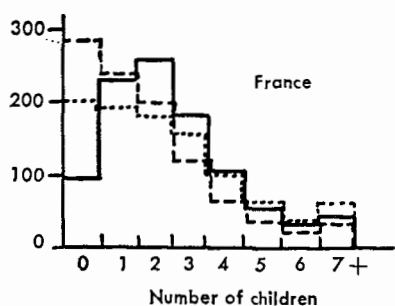
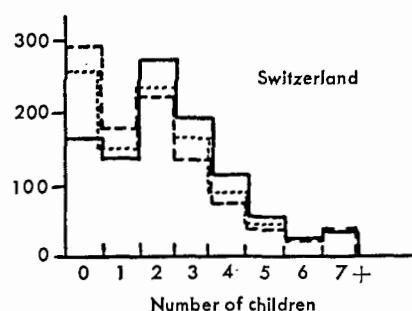
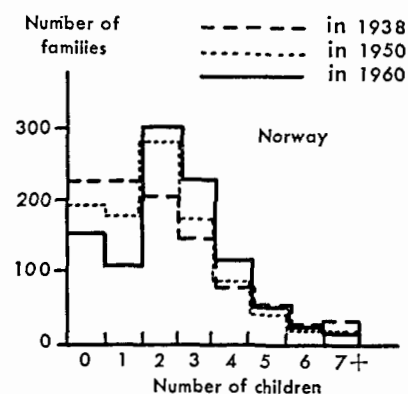


Diagram VII

Distribution of 1,000 families according to number of children

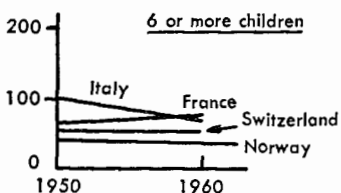
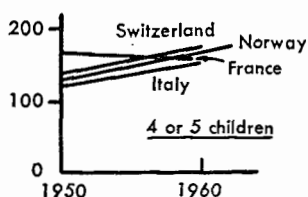
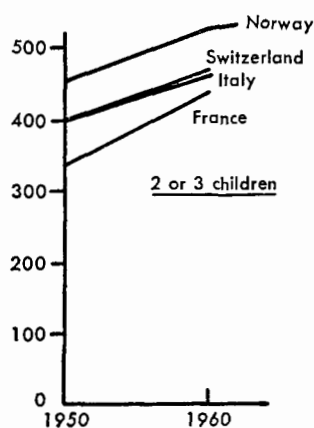
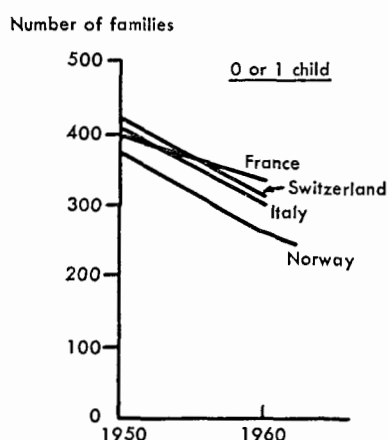


Diagram VIII

Changes in the distribution of families according to number of children between 1950 and 1960

tries since 1950 has been as follows: the greatest decline has been among the childless and one-child families, and the greatest increase among the two-child and three-child families; the proportion of families with four or five children has remained unchanged or has slightly increased; and the proportion of families with six or more children has slightly declined or has remained stable.

III. TENTATIVE INTERPRETATION AND POSSIBLE FUTURE TRENDS

10. Without entering into details, we may say that the principal factors in human fertility are as follows.³ The first group of factors are those which determine the social norms regarding desirable family size. These comprise social factors such as the ideal number of children corresponding to a balance between social rewards and penalties; psychological factors such as the behaviour desired by others, since the general optimum is not the personal optimum; and demographic factors such as infant mortality. A second group of factors consists of those which are referred to as "intermediate" because they are situated between the expressed norms and actual fertility. These comprise biological factors such as the duration of marriage during the reproductive period, the proportion of never-married persons, abstinence, fecundity and use or non-use of contraceptives; social factors such as the attitudes of society or the individual towards the biological factors, towards sexuality and so on; and environmental factors such as sanitation and nutrition. It must also be borne in mind that in many instances attitudes or decisions depend mainly on affective motivations.⁴

11. Many studies have shown that the reduction in the dispersion of fertility has occurred not only among nations but also among social groups⁵ and among the members of different religions.⁶ This trend must apparently be attributed in part to the lessening importance of the intermediate factors. The biological and environmental factors are, after all, becoming increasingly and more widely known, and this tends to reduce the affective

element and the element of superstition in the social norms connected with the intermediate factors.

12. A thorough study⁷ made in France has shown that the actual number of children born clearly exceeds the ideal number and that if fertile couples were able to limit their offspring to the number actually wanted, the average number of children for all couples would be between 79 and 87 per cent of the number wanted, owing to the effect of intermediate factors such, in particular, as age at marriage and involuntary sterility. The birth rate would thus no longer be adequate to ensure the replacement of the generations.

13. In addition, opinion surveys⁸ show that average number of wanted children remains rather stable over time in relation to the social status category of the informants and that the number held ideal in a given category becomes smaller in relation to the general ideal as the financial and social situation of the informants becomes more precarious. An analysis of the average number of live-born children in marriages of completed fertility where the mother's age at marriage was less than thirty years (1954 census) indicates that the higher the social standing, the more closely does the actual number of children approach the personal ideal.

14. It appears that these trends will become more pronounced in the coming years and that, as has happened in Norway, there will be a rapid decline in the dispersion of the number of children around the ideal average. In these circumstances, the probability of more children in already large families will become smaller, and almost all births will be attributable to increases in the childless, one-child and two-child families, thus reflecting perhaps a greater sensitivity to economic conditions and trends of opinion. Is it in this direction that an explanation must be sought for the abrupt rise in the birth rate in England since 1955? Any rise in the birth rate after effective birth control becomes available to the entire population may be the result of family planning with shorter intervals between births, in which case it will be temporary, or it may be the result of a higher marriage rate and a lower average age at marriage or of a reduction in spontaneous sterility, and in these cases it may be

³ See on this subject the detailed study by Ronald Freedman, "The sociology of human fertility", *Current Sociology*, vol. X-XI, No. 2 (1961-1962).

⁴ J. Sutter and F. Morin, "Attitudes devant la maternité", *Population*, No. 2 (1960), p. 235.

⁵ M. Febvay, "Niveau et évolution de la fécondité par catégorie socio-professionnelle en France", *International Population Conference, Vienna, 1959* (Vienna, International Union for the Scientific Study of Population, 1959).

⁶ P. de Wolf and J. Meerdink, "La fécondité des mariages à Amsterdam selon l'appartenance sociale et religieuse", *Population*, No. 2 (1957).

⁷ R. Pressat, "The ideal and the actual number of children", *Studies on Fertility and Social Mobility* (Budapest, 1964).

⁸ Alain Girard and Louis Henry, "Les attitudes et la conjoncture démographique", *Population*, No. 1 (1956); Alain Girard and Henri Bastide, "Les problèmes démographiques devant l'opinion", *Population*, No. 2 (1960).

more lasting. At the present time, the last-mentioned possibility can no longer be regarded as negligible—witness the fact that a_0 has increased considerably in the four countries studied—and the “birth control” clinics are known to be providing increased counselling in this direction. With regard to family-aid poli-

cies, their effectiveness will likely be limited to reducing the gap between the environmental ideal and the general ideal in so far as the gap is attributable to financial difficulties, because, in the domain of public opinion, any attempt to modify the general ideal will encounter greater difficulties.

Table 1. Crude birth rate in western Europe (per 1,000 population)

	1776	1801	1826	1851	1876	1901	1933	1953	1963
Rate....	(36.0)	(33.5)	34.2	32.8	34.2	29.6	18.0	17.7	18.9

Table 2

	Section 1: birth rate per 1,000 population			Section 2: illegitimate birth rate ^a 1958	Section 3: nuptiality ^b		Section 4: divorce rate 1962	Section 5: live births in relation to a constant annual number of marriages equal to 1.00			
	1876	1933	1963		About 1950	About 1960		1950	1960	1961	1962
1. Federal Republic of Germany....	40.6	14.7	18.6	6.7	(87.4)	90.7	0.82	1.75	1.91	1.97	1.93 ^c
2. France	26.6	16.4	18.2	6.1	89.7	90.8	0.65	2.40	2.40	2.44	2.42
3. Italy	39.3	23.7	19.1	2.8	(85.2)	—	—	2.66	2.46	2.48	—
4. Netherlands ...	37.1	20.8	20.9	1.2	86.3	89.0	0.49	2.89	2.67	2.76	2.70
5. Belgium	32.7	16.6	17.1	2.0	89.5	—	0.51	2.02	2.21	2.29	—
6. Luxembourg ...	(32.0)	16.2	(16.0)	3.0	(85.4)	—	0.40	—	—	—	—
7. England and Wales	36.3	14.4	18.2	4.9	85.3	—	0.54	1.77	2.10	2.15	—
8. Scotland	35.6	17.6	19.7	4.1	80.5	—	0.35	—	—	—	—
United Kingdom.	36.3	14.9	18.5	—	—	—	—	—	—	—	—
9. Ireland	26.4	19.4	22.2	1.6	73.5	78.0	—	—	3.77	3.73	—
10. Spain	(37.0)	27.9	21.5	2.9	—	85.4	—	—	—	—	—
11. Portugal.....	(34.0)	29.0	23.5	10.5	82.1	84.1	0.09	—	—	—	—
12. Switzerland ...	32.8	16.4	18.9	3.6	80.9	—	0.86	2.24	2.30	—	—
13. Austria	40.0	14.3	18.7	13.2	(85.7)	—	1.12	—	1.91	—	—
14. Norway	32.0	14.7	17.5	3.5	80.6	87.1	0.68	2.29	2.36	2.42	2.41
15. Sweden	30.8	13.7	14.8	10.0	83.0	89.0	1.16	1.79	1.72	1.76	—
16. Denmark	32.6	17.3	17.6	6.9	87.0	90.7	1.38	—	—	—	—
17. Iceland	(35.0)	22.5	(24.0)	25.1	(78.2)	—	0.69	—	—	—	—
18. Finland	36.7	18.4	18.1	4.0	(81.0)	—	0.89	—	—	—	—
19. Malta	(35.0)	33.3	20.4	0.7	(76.1)	75.8	—	—	—	—	—
West Berlin....	—	—	11.9	15.3	—	—	2.01	—	—	—	—

^a Illegitimacy rate per 100 live births (1957 for Italy and Iceland).

^b Percentage of ever-married women aged 45 to 54 years.

^c Including West Berlin, where the proportion of illegitimate births is rather high.

Female fertility in industrialized countries (present situation, trends and future outlook)

DUŠAN BREZNIK

1. It is known which populations, in a breakdown by degree of industrialization and level of economic development, have high and which have low fertility rates. Within each of these groups, the rate can vary considerably. The variations are found to be greater among populations with low fertility than among those whose fertility rate is high. In addition to these two main groups of populations, with their own demographic characteristics, there are several intermediate groups. Thus, in some developing countries a decline in the death rate has been observed without an accompanying decline in the fertility rate. According to some studies, the fertility rate would even appear to have risen. On the other hand, in certain countries where the rate of industrialization and changes in the economic and social structure of the population have been both profound and rapid, the fertility rate has fallen more quickly than in countries where these changes have been taking place gradually.

2. Would it be possible, on the basis of the types of population described, to put forward a bolder hypothesis about future trends in fertility in the developing countries? If the rate of industrialization were faster in those countries and the changes in the economic and social structure more marked (with a simultaneous rise in the level of education), it is likely that the hypothesis of a decline in fertility would be confirmed and that it would be even more rapid than among the populations which now have a low fertility rate.

3. A population's fertility is influenced by biological, social and psychological factors. However, their influence cannot be observed separately, and it is their reciprocal action that must be studied. It seems to us undeniable that the differences in the fertility rates of populations are primarily a result of the interaction of socio-economic and psychological factors. In the view of most demographers and sociologists, the decline in the fertility rate in the industrialized and economically advanced countries is due to the transfer of certain functions of the family to other institutions (so that there

is a decrease in the number of children required to achieve socially valued goals) and to the decline in infant mortality (which reduces the number of births necessary in order to have any desired number of children).¹ Some studies dating from before the Second World War put forward the hypothesis of a decline in the biological fertility of the white race. This theory is now rejected as being without foundation.²

4. In view of the complex effect of different factors on a population's fertility, the importance of each factor cannot be precisely measured by quantitative analysis. Similarly, it is difficult to generalize about the role of each factor in relation to different types of population. Even when the populations in question have similar fertility rates (general and age-specific), the influence of each factor varies from one to another. That is why demographers try to define the role of these factors by indirect methods. They study the fertility of particular population groups in relation to certain variables such as social and occupational status, ethnic group, religion, education, urban or rural residence and income. Other variables (age of marriage, duration of marriage, use of contraceptive methods, frequency of abortions) are then investigated in each of the groups studied. In connexion with this research, it is hoped that a more detailed breakdown of the existing material will be possible with electronic units.

5. *Interpretation of past trends (1950-1960).* The following table shows the variations in general fertility rates³ for sixteen industrialized countries:⁴

¹ R. Freedman, "The sociology of human fertility", *Current Sociology*, vol. X/XI, No. 2 (1961-1962), p. 53.

² L. Chevalier, *Démographie générale* (Paris, 1951), p. 134; R. von Ungern-Sternberg and H. Schubnell, *Grundriss der Bevölkerungswissenschaft*, pp. 279-280.

³ The general fertility rate is the ratio of the number of births among the female population aged fifteen to forty-nine to the number of women in that group.

⁴ United Nations, *Recent Trends in Fertility in Industrialized Countries* (United Nations publication, Sales No: 1957.XIII.2).

Table 1. Trends in general fertility rates in sixteen countries, 1950/54-1960

<i>Variation in fertility rate</i>	<i>Country</i>
Decline	Denmark, Finland, Sweden
More or less constant (± 3 per cent)	Canada, France, Italy, Netherlands, Norway
Increase of 3 to 6 per cent.	Australia, New Zealand, Portugal, United States
Increase of 6 to 12 per cent.	Belgium, Switzerland
Increase of over 12 per cent.	England and Wales, Scotland

SOURCE: for 1960, *United Nations Demographic Yearbook* (United Nations publication, Sales Nos.: 62.XIII.1, 63.XIII.1, 64.XIII.1).

In 1950-54, the general fertility rate in the sixteen countries in question varied from 64 per thousand (in Sweden) to 113 per thousand (in Canada). In 1960, the variation was between 58 per thousand (in Sweden) and 109 per thousand (in Canada). Generally speaking, the rate in most of the countries rose or remained steady. Age-specific fertility showed an increase in the younger groups (women between fifteen and twenty-nine) and a decline in the older (women between thirty and forty-nine). In those countries where the rise in the

general fertility rate was highest, the age-specific rates were stable during the period studied for women in the higher age groups. In countries where the general fertility rate declined, it was in the younger groups that the rates remained stable. In order to illustrate the intermediate type of population, whose fertility declines more rapidly—this is mainly characteristic of countries where substantial changes occur in the social and economic structure of the population—we shall now give figures for the fertility of certain regions of Yugoslavia:

Table 2. Variations in the general fertility rate in four regions of Yugoslavia (per thousand)

<i>Year</i>	<i>Slovenia</i>	<i>Serbia (excluding Vojvodina)</i>	<i>Croatia</i>	<i>Bosnia and Hercegovina</i>
1953.....	84	92	80	145
1957.....	74	68	73	123
1961.....	71	66	68	129

SOURCE: Federal Statistical Institute (Belgrade), *Demographic Statistics for 1961*.

Slovenia and Croatia are more economically developed than the other regions of Yugoslavia. In these regions the general fertility rate is relatively low. It is also declining, however, in Bosnia and Hercegovina, although intensive economic development of this region did not begin until after the Second World War. In Serbia proper, a decline in fertility is to be found both in the towns and in crowded rural areas.

6. *General fertility rate (c. 1960)*. The general fertility rates for twenty-nine countries⁵ vary between 60 and 110 live births per thousand women between the ages of fifteen and forty-nine:

⁵ These countries are in the most highly developed regions of the world (Europe, USSR, North America, Oceania and Japan). United Nations, *Report on World Population Prospects, as assessed in 1963* (United Nations publication, Sales No.: 66.XIII.2).

Table 3. General fertility rates in twenty-nine countries (c. 1960)

<i>Number of live births per thousand women of child- bearing age</i>	<i>Country</i>
60-80.....	Denmark, Sweden, Japan, Czechoslovakia, Greece, Hungary, Romania, Belgium, Finland, England and Wales, Italy, Norway, Switzerland, Austria, Bulgaria, Federal Republic of Germany, East Germany
80-90.....	France, Scotland, Netherlands, Spain
90-100.....	Australia, Portugal, Poland, USSR, Yugoslavia
100-110.....	Canada, United States, New Zealand

The fertility rate in most of the countries studied varies between 60 and 80 per thousand,

which is between a third and a half of the rate found in the developing countries. As far as age-specific fertility is concerned, the differences between the twenty-nine countries under con-

sideration are considerable and their main features (average value, standard deviation, coefficient of variation) are given in the following table:

Table 4. Average values ($\bar{x}$), standard deviations and coefficients of variation in fertility in twenty-nine countries

<i>Age group</i>	$\bar{x}$	$\sigma \bar{x}$	Kv (per cent)
15-49	79	14.1	17.8
15-19.....	39	18.6	47.7
20-24.....	166	42.3	25.5
25-29.....	168	34.6	20.6
30-34.....	103	29.3	28.4
35-39.....	53	17.8	33.5
40-44.....	18	8.3	46.1
45-49.....	2	1.24	62.0

These data show that in the populations in question there is still a marked tendency for the birth rate to rise among the youngest age groups and during the first years of marriage. This is partly due to changes in the average age of first marriage. If general fertility rises, the fertility of the youngest groups also rises, whereas the rate for the older groups remains stable or even shows a slow but steady decline. In order to compare the variation in age-specific fertility rates in the twenty-nine countries studied and in countries with high fertility, we give below the age-specific fertility rates for the population of the Kosovo-Metohija region of Yugoslavia, which has a population of about 1 million, with a high birth rate—41 per thousand—and a very high general fertility rate—196 per thousand:

Table 5. Comparative age-specific fertility rates

<i>Age group</i>	<i>Average rate for the twenty-nine countries</i>	<i>Rate for Kosovo-Metohija region</i>
15-19.....	39	73
20-24.....	166	282
25-29.....	168	314
30-34.....	103	252
35-39.....	53	171
40-44.....	18	128
45-49.....	2	43

This comparison shows that the differences are much greater in the older groups. This is because birth control is practised more frequently and effectively by the older groups, after long years of marriage, when they have reached the desired family size.

7. *Future outlook.* The trends in fertility during the past decade (1950-1960) do not confirm the frequently expressed view that the rate for populations with low fertilities remains constant. This hypothesis has been borne out only in certain cases (Italy, for example). If we wish to formulate a more exact hypothesis, it will not be enough—as the studies made hitherto have shown—merely to analyse trends in fertility by age group or other demographic factors and phenomena (age of first marriage, interval between births, age-specific fertility, fertility in relation to years of marriage, etc.). It will also be necessary to examine the effects of the interaction of demographic phenomena and social and economic factors. If these effects cannot be quantified, it will be necessary to put forward bolder hypotheses based on qualitative reasoning. In addition, a study of the intentions and desires of young couples with regard to family planning and size would afford a better understanding of the psychological factor, which is no less important in establishing the most “probable” hypothesis regarding the future fertility of a population.

Recent fertility trends in the United States and Canada

ARTHUR A. CAMPBELL

I. INTRODUCTION

1. Since the end of World War II, the United States and Canada have had higher fertility rates than most other modern industrial nations. During the seventeen-year period 1946-1962, the gross reproduction rate averaged 1.67 for the United States and 1.80, or eight per cent higher, for Canada.

2. Although their levels of fertility differ, the United States and Canada have followed similar trends for the past four decades. Both countries showed a rapid decline in gross reproduction rates from the 1920s to the late 1930s, some increase during the war, and a sharp increase soon after the war. After 1950, fertility continued to rise steadily until 1957-1959. Since then, it has declined.

3. The purpose of this paper is to examine the nature of the changes during the postwar period. We shall rely heavily on data from the United States because cohort fertility rates, which are necessary to help us understand what is happening, are readily available for the United States but not for Canada.

II. THE TEMPORARY INFLATION OF BIRTH RATES

4. An essential part of the explanation of high postwar fertility in the United States and Canada is that birth rates were temporarily inflated by certain changes in the timing of births.

5. First, the cohorts of women who reached the ages of childbearing during the 1930s and early 1940s had higher rates at the older childbearing ages than the cohorts preceding them.¹ This increased fertility at the older childbearing ages is thought to be due in part to delays in marriages and childbearing at earlier ages.

6. The major change in the timing of births, however, was the considerable increase in the proportion of women marrying and having children at relatively young ages. For example,

¹ A cohort is a group of women born in a 12-month period centred on January 1 of the year by which the group is identified. The women of the 1920 cohort, for example, were born between July 1, 1919 and June 30, 1920.

the number of children ever born up to exact age twenty was 273 per 1,000 women for the 1920 cohort, and 487 per 1,000 women for the 1940 cohort. This is an increase of 78 per cent in the average number of children born while the mother is still in her teens.

7. It is in the nature of such a change that fertility, as expressed by annual gross reproduction rates, cannot remain high indefinitely. When the cohorts exhibiting the younger childbearing patterns reach the older childbearing ages, we can expect their age-specific birth rates to be lower than those for preceding cohorts at the same ages simply because they have already had a higher proportion of all the children they intend to have.

8. It must be emphasized that this change in timing accounts only for the recent declines in fertility at the older ages. As we shall see, fertility has also declined in the United States at the younger ages since the late 1950s, and the reasons for this are not yet clear.

9. The changes in the timing of marriage and childbearing in Canada are similar to those in the United States, but have probably not been as great. It is not yet possible to make precise cohort comparisons between the two countries, but at most ages the relative increases in age-specific rates were not as great in Canada as in the United States between 1940 and 1957. In general, age at childbearing has been higher in Canada than in the United States, and this is still true.

III. TRENDS IN COMPLETED FERTILITY

10. We have noted above that the reduction in age at childbirth has been an important cause of high fertility in the postwar period, but that this cause is necessarily temporary. However, there is another factor that helps maintain high fertility: the rise in completed fertility.

11. The lowest average number of children ever born in the United States was reached by women of the 1906-1915 cohorts, approximately. They had borne an average of 2,200 to 2,300 births per 1,000 women by the end of the childbearing period. Many later cohorts have already surpassed these rates. We cannot be

certain how high the completed fertility of these later cohorts will be, but it appears that the average number of children ever born will reach an upper limit of about 3,100 to 3,400 births per 1,000 women for the cohorts born in the nineteen thirties.²

12. At present, the big unknown is what will happen to the completed fertility of women who have recently begun their childbearing (for example, the cohorts of 1940 and later). Will they maintain the average of 3,100-3,400 births per 1,000 women that we expect the cohorts of 1931-1940 to reach, or will they have fewer children altogether? Tentative answers from various fertility surveys are not entirely in agreement. The birth expectations collected in the 1960 Growth of American Families Survey suggest that the cohorts of 1936-1940 and 1941-1942 will have fewer children than the cohorts of 1931-1935. However, more recent national data on birth expectations collected by the Population Studies Center of the University of Michigan suggest that the completed fertility of the cohorts of the early nineteen-forties will be about the same as that projected for cohorts of the nineteen-thirties.³ Actually, it is still too early to make any precise predictions. The most we can now say is that there is no indication that there will be a sharp reduction in completed fertility.

13. Since 1957, age-specific birth rates in the United States have declined at the younger ages. The reasons for this trend are not clear. Although it could presage a fall in the completed fertility of the cohorts of 1940 and later, it could also mean that the shift toward younger childbearing is now reversing. At present, we have no overriding reason for preferring either explanation. A similar trend has not appeared in Canada.

14. Any satisfactory evaluation of trends in the fertility of a national population must involve more than a summary outline of the changes that have taken place in timing and completed family size. We must also know how the distributions of women by parity have changed, the extent to which various socio-economic groups have participated in the

trends, and how couples control their fertility. These subjects will be treated in the following sections.

IV. THE RETREAT FROM CHILDLESSNESS

15. It is very important to recognize that the rise in completed fertility was not brought about by an increase in the proportion of couples with large families. This is the mistaken connotation of the popular explanation of the post-war baby boom, "families are getting larger." The major reason for the increase in completed fertility is the fact that fewer couples are having no births or only one, and more are having moderate-sized families of two, three, or four children.

16. These facts can be illustrated by a comparison of the 1909 and 1928 cohorts in the United States. By the time the women in the earlier cohort had reached the end of the childbearing period (taken here as age 50), 23 per cent of them, or nearly one in four, had never borne a child. In contrast, by the time the women of the 1928 cohort had reached age 35 (as of January 1, 1963), the proportion who had never borne a child was only 12 per cent.

17. The cohort difference is almost as great for the proportion bearing only one child; 22 per cent for the 1909 cohort by age 50, and 12 per cent for the 1928 cohort by age 35.

18. Altogether, then, 45 per cent of the women in the 1909 cohort had borne no children or only one, as compared with 24 per cent for the 1928 cohort. The difference will probably widen as the members of the 1928 cohort reach the end of the childbearing period.

19. The greatest increases between the 1909 and 1928 cohorts are in the proportion of women with three or four children: 21 per cent for the earlier cohort and 35 per cent for the later. The proportion of women with six or more children has changed little so far: 8 per cent for the 1909 cohort and 9 per cent for the 1928 cohort.

20. In a sense, the remarkable feature of these comparisons is not so much the higher fertility of the more recent cohort as the lower fertility of the earlier cohort, and particularly its high prevalence of childlessness. In the final analysis, it may be more difficult to seek explanations for the fact that so many women in earlier cohorts remained childless than it will be to explain why completed fertility increased among later cohorts.

V. TRENDS BY SOCIO-ECONOMIC STATUS

21. To what extent have various social and economic groups participated in the increase in

² These projections are based in part on the number of births expected by a national sample of wives in the childbearing period who were interviewed in 1960 for the second Growth of American Families Study. The results of this study appear in the following reference: P. K. Whelpton, A. A. Campbell, and J. E. Patterson, *Fertility and Family Planning in the United States*, (Princeton University Press, 1966).

³ R. Freedman, D. Goldberg, and D. P. Slesinger, *Current Fertility Expectations of Married Couples in the United States*, Population Index, Vol. 29, No. 4 (1963).

completed fertility? Until data on children ever born from the 1960 Census of the United States were published, we had only sketchy information on this subject.⁴ Now, however, we are able to make more definitive statements about trends for various groups. The particular socio-economic criterion used in this discussion is educational attainment. There are several reasons for preferring this variable to alternative indicators. One is that educational attainment has been shown to be closely and independently related to fertility by a number of studies. Another reason for preferring educational attainment when describing cohort trends is that educational attainment seldom changes

⁴ The 1961 Census of Canada also collected data on number of children ever born, but the writer had not obtained these data at the time this paper was written.

after a woman begins childbearing, but other indicators often change.⁵

22. The data presented here are based on average numbers of children ever born for white ever-married women in the United States. In essence, we assume that childbearing is virtually complete for the women who have reached their forties, but make some allowance for additional births for women who were still in their thirties at the time of the 1960 census. The method of estimation is described in the footnote to the table.

⁵ For a more detailed discussion of the problems of describing socio-economic differentials in cohort fertility trends see the following reference: O. D. Duncan and R. W. Hodge. *Cohort Analysis of Differential Natality, Proceedings of the International Population Conference, New York (1961)* (London, John Wright and Sons, Ltd., 1963), pp. 59-66.

Estimated number of children ever born per 1,000 women by the end of the childbearing period, for ever-married white women by educational attainment. Cohorts of 1901-1905 to 1926-1930, United States^a

Educational attainment	Cohort group							
	1901-1905	1906-1910	1911-1915	1916-1920	1921-1925		1926-1930	
					Low	High	Low	High
TOTAL	2,456	2,329	2,354	2,515	2,706	2,786	2,867	3,170
Less than 8th grade.....	3,422	3,265	3,205	3,328	3,473	3,532	3,580	3,907
8th grade	2,643	2,589	2,601	2,769	2,957	3,022	3,118	3,407
High school 1-3.....	2,290	2,274	2,332	2,539	2,776	2,867	2,950	3,221
High school 4.....	1,818	1,829	2,013	2,275	2,557	2,664	2,758	3,081
College 1-3	1,698	1,813	1,970	2,279	2,550	2,649	2,802	3,200
College 4 + ...	1,437	1,595	1,828	2,195	2,447	2,541	2,546	2,945

^a Based on data on average number of children ever born from the 1950 and 1960 censuses (1950 census, part 5, chapter C, "Fertility;" 1960 census, "Women by number of children ever born," final report PC (2) — 3 A). The assumptions for each cohort group are as follows:

Completed fertility assumed to equal the average number of children ever born for the following age groups:

Cohort group	
1901-1905.....	45-49, 1950 census
1906-1910.....	40-44, 1950 census
1911-1915.....	45-49, 1960 census
1916-1920.....	40-44, 1960 census

Allowance made for additional births as follows:

1921-1925..... High — average number of children ever born for women 35-39 in 1960 census multiplied by the ratio,
Children born by ages 45-49 in 1960 census

Children born by ages 35-39 in 1950 census

Low — average of high assumption (above) and the number of children ever born to women 35-39 in 1960 Census.

1926-1930..... High — average number of children ever born for women 30-34 in 1960 census multiplied by the ratio,
Children born by ages 40-44 in 1960 census

Children born by ages 30-34 in 1950 census

Low — average of high assumption (above) and the number of children ever born to women 30-34 in 1960 census.

23. Although there may be some legitimate question about the accuracy of our estimates for the younger cohorts, there can be little doubt about the general picture that these estimates present: all educational attainment groups have participated in the increase in average family size. However, we must be cautious in making this statement about the lowest educational category because other fertility-related characteristics of this group may have changed from earlier to later cohorts. This is because as educational levels improve, the people who remain in the bottom category become more highly selected for certain characteristics that make it difficult for them to achieve a better education. Insofar as these characteristics are related to fertility, the cohort comparisons may simply reflect the process of selection, rather than an increase in the fertility of women who are alike.

24. The upward trend in completed fertility is strongest among college graduates. If our estimates are approximately correct, the increase between the cohorts of 1901-1905 and 1926-1930 will be on the order of 75 to 100 per cent for college graduates. The projected increase for high-school graduates will probably be on the order of 50 to 70 per cent.

25. In general, then, the higher the educational attainment, the greater the increase in completed fertility. This relationship is narrowing considerably the fertility differences between education groups. Among white ever-married women in the 1901-1905 cohorts, for example, those who failed to complete elementary school had 138 per cent more children than those who graduated from college. In the 1926-1930 cohorts, the comparable excess will be reduced to about 30 or 40 per cent.

26. These statistics suggest that a change has taken place in couples' attitudes toward having children, and that the change has been especially great among the better-educated. Few couples now want a childless marriage, and the majority at all educational levels want to have two to four children.

VI. THE CONTROL OF FERTILITY

27. It must be made very clear that the increase in completed fertility is not due to any growing reluctance on the part of couples to use contraception. On the contrary, the Growth of American Families (or GAF) Studies of 1955 and 1960 clearly show that nearly all couples who are able to have children have used or intend to use some method of limiting their fertility. The 1960 GAF Study shows that 96 per cent of the couples with normal

reproductive capacity have used or intend to use some method to limit their fertility.⁶

28. This means, of course, that fertility is largely under voluntary control in the United States. Even among couples who have more children than they want, the excess is usually no more than one child.

29. Because fertility is under voluntary control, we could reasonably expect fertility to vary rather widely in response to the various social and economic changes that a national population is continually undergoing. Do we have any evidence that this is happening?

VII. SOCIAL AND ECONOMIC FACTORS INFLUENCING FERTILITY

30. Various studies have shown that year-to-year changes in fertility are affected by economic conditions, as measured by indexes of unemployment, income, and industrial production.^{7,8,9} Evidently more couples marry and more married couples try to have children when economic conditions are good. Marriages and births are often postponed under less favourable circumstances.

31. However, there is as yet no evidence that the total number of children couples have is influenced by economic conditions *per se*. This conclusion is based on a study of the relationship between the completed fertility of cohorts and measures of the economic conditions prevailing while those cohorts were in the most fertile years of the childbearing period.¹⁰

32. It is possible, however, that some aspect of our changing economy affected couples' desires for children. Obviously, the shift away from childless and one-child families is strong and widespread. It must be related to some equally impressive changes in our culture, and these changes may well be economic in nature even though they are not measured by the commonly used indexes of economic conditions. However, we have not yet established what they are.

⁶ Whelpton, *et al.*, *op. cit.*

⁷ V. L. Galbraith and D. S. Thomas, "Birth rates and the interwar business cycles", *Journal of the American Statistical Association*, vol. 36, No. 216 (1941), pp. 465-476.

⁸ D. Kirk, "The influence of business cycles on marriage and birth rates", *Demographic and economic change in developed countries* (Princeton, Princeton University Press, 1960), p. 241-260.

⁹ R. A. Easterlin, *The American baby boom in historical perspective*, Occasional Paper 79 (National Bureau of Economic Research, 1962), p. 60.

¹⁰ This study was begun several years ago by the author at the Scripps Foundation for Research in Population Problems. It has not yet been completed.

VIII. CONCLUSION

33. The experience of the United States and Canada demonstrates that economic development and the widespread practice of family limitations do not necessarily cause fertility to descend permanently to the replacement level. These countries show that it is possible, in populations where family planning is widespread, for fertility to rise or fall rapidly over a relatively short time.

34. In years to come, we will learn a great

deal about the social and economic forces affecting fertility by observing the reproductive performance of other countries as their industries develop and as their people adopt family planning practices. Will any of them also experience a rapid decline in fertility followed by a return to moderate levels? Or will this pattern remain unique to a few Western countries in the middle of the twentieth century? Such questions remind us that the study of fertility under modern conditions of voluntary control is still young, and that we have much to learn.

Factors associated with the development of low fertility: an historic summary

ANSLEY J. COALE

I. INTRODUCTION

1. Malthus proposed that fertility be checked by what he called "moral restraint"—the postponement of marriage combined with virtuous behaviour on the part of unmarried women. In effect, he proposed that fertility be lowered by reducing the number of women of childbearing age living in sexual unions. Low fertility caused by reduced proportions married can be called Malthusian low fertility.

2. A source of reduced fertility characteristically found in modern industrialized nations is deliberate limitation of the number of births occurring to couples cohabiting while potentially fertile: the limitation of fertility through various forms of contraception employed before, during, or after intercourse, limitation through the timing of intercourse to reduce the probability of conception (the safe period), and limitation through abortion when conception has occurred. Low fertility caused by birth control can be called neoMalthusian low fertility because the early advocates of birth control called themselves neoMalthusians, even though Malthus himself was strongly opposed to contraception and of course to abortion.

3. The highest fertility a given population could plausibly be expected to attain would occur if all women at each age experienced live births at the rate characteristic of married women in the most fertile population on reliable record. A population with strictly Malthusian limitation of fertility would fall below this maximum because, with some potentially fertile women nonmarried, only married women would exhibit the maximum fertility schedule. A population with strictly neoMalthusian limitation would fall below the maximum through the practice of birth control among women of childbearing age (all of whom would be married).

4. Low levels of fertility are actually achieved in most instances by a combination of Malthusian and neoMalthusian limitation, modified by two complicating considerations: (a) nonmarried women do not usually have zero fertility, although they often contribute an unimportant fraction of all births; (b) in the

absence of birth control, marital fertility does not reach the same high level in every population. There are differences in the incidence of sterility and subfecundity; the frequency of intercourse varies from population to population; and the frequency and duration of nursing (which affects the duration of postpartum subfecundity) is different in different populations.

5. Special indexes (described in detail below) can express the level of fertility in ways that show the contribution of Malthusian and neoMalthusian reduction. These indexes record how closely a given population approaches the maximum fertility it might plausibly attain, and the degree to which the reduction from the maximum is Malthusian and to what degree neoMalthusian.

II. INDEXES OF FERTILITY

6. The index of overall fertility is the ratio of the observed number of births in the given population to the number that would occur if women in every age interval had experienced the "standard" or maximum fertility schedule. The schedule selected as "standard," representing, approximately, the highest fertility any whole population might be expected to attain, is the fertility of married Hutterite women during 1921-1930. This is the highest schedule cited by Henry in a discussion of fertility unaffected by contraception. Below age 20 a fertility rate of 0.300 has arbitrarily been substituted for the rate of over 0.700 experienced by teen-age married Hutterite women, because the very high fertility observed among the few Hutterite women married before age 20 could scarcely be representative of a whole population aged 15-19, since adolescents have a reproductive capacity well below that of women 20-29. The standard schedule is shown in table 1.

7. The index of marital fertility is the ratio of the number of births occurring to married women to the number that would occur if married women experienced the standard (i.e., the married Hutterite) fertility schedule. An analogous index of fertility of nonmarried women can also be calculated.

8. The index of the proportion married (among women of childbearing age) takes a form directly related to fertility; it is the ratio of the number of children married women would bear if subject to the standard schedule to the number all women would bear if subject to the standard schedule. It is a weighted index of proportion married, with a large weight being given to married women who are in the most fertile years, and a small weight to married women above age 40.

9. Note that in terms of the symbols given in table 2

$$I_f = I_g I_m + (1 - I_m) I_h \quad (1)$$

I_g shows the extent to which marital fertility falls short of the maximum, and thus reflects the effect of neoMalthusian fertility reduction. I_m shows the extent to which marriage is less than universal, and thus reflects the effect of Malthusian fertility reduction. In societies in which fertility of nonmarried women is negligible, equation (1) reduces to a form ($I_f = I_g I_m$) that factors the index of fertility into Malthusian and neoMalthusian components.

10. Table 3 shows fertility indexes in 1870, 1900, 1930 and 1960 for selected populations. Observe that in this table indexes of overall fertility as high as .50 are found only in eastern Europe around 1900, in the recent experience of Taiwan and Mexico and, of course, among the Hutterites.

11. The range from the highest to the lowest national I_m in table 3 (2.8 to 1) is surprisingly large, although not as great as the range in I_g (3.5 to 1). India's I_m of .88 in 1960 epitomizes a tendency toward almost complete avoidance of the single state by age 30 combined with very early marriage. Ireland's 0.31 in 1900 is the extreme example of a primarily European tendency to remain single or marry late.

12. Few populations approach the Hutterites in marital fertility. No national I_g higher than .85 has been calculated to date, but values above 0.93 are found in provinces of Russia and Belgium in the 19th century. Recent I_g 's in Mexico and Taiwan (before the decline in the Taiwanese birth rate) fall within the range (0.67 to 0.83) found in western Europe (with the exception of France) in the late nineteenth century. The lowest values of I_g are found in western Europe and the United States just before World War II, and in present day Japan and eastern Europe.

III. THE DEVELOPMENT OF MALTHUSIAN LOW FERTILITY

13. Evidence of when Malthusian restriction began in western Europe is scanty. An I_m well below that characteristic of the rest of the world is found in eighteenth-century Scandinavian data. In Sweden, for example, I_m was 0.49 in 1750, not as low as the 0.41 of 1900, but much below Asian, African, or east European levels.

14. After analysing a large volume of historical research on European populations, Hajnal concludes that "such evidence as there is suggests that with the exception of Ireland there has been no substantial change in either direction in the age at first marriage in Europe for perhaps 250 years before 1930. (There is some suggestion in the data that fewer people remained single throughout life in the eighteenth century than after 1850.)", and also "it has been shown (a) that the distinctively European pattern can be traced back with fair confidence as far as the seventeenth century in the general population; (b) that its origins lie somewhere about the sixteenth century in several of the special upper class groups available for study and in none of these groups is the pattern European before the sixteenth century; (c) the little fragmentary [evidence] which exists for the Middle Ages suggests a non-European pattern, as do scraps of information for the ancient world."

15. The avoidance and postponement of marriage became normal patterns of behaviour in Europe, and also appear to have been an accepted response to worsened circumstances. In Tuscany the birth rate fluctuated in a long cycle between 1815 and 1865 with a low point 25 per cent below the maximum. The fluctuation is wholly explained by variations in the proportion of women married. At the end of the nineteenth century, values of I_m well below 0.60 were universal in Europe except in Turkey, the Balkans, and Russia. I_m in Europe was between 0.31 and 0.55. The proportions married in areas settled by west Europeans—Australia, New Zealand and northern America—were at the high end of this range. However, the populations of Asia, Africa and eastern Europe had not developed the customs of late marriage and the avoidance of marriage that reduced the proportions married in Europe. In every Asian and African population for which estimates can be made, I_m was 0.70 or higher in 1900. In Latin America proportions of women married (including women in consensual marriages) were apparently higher than in Europe but lower than in Asia or Africa—an I_m between 0.60 and 0.70.

16. In the twentieth century Russia and Japan reduced fertility partly by Malthusian restriction, but in other parts of eastern Europe (e.g., Bulgaria and Turkey) and in much of Asia and Africa there is no evidence of substantial decreases in I_m . In fact I_m rose in India because of the decreased incidence of widowhood brought about by lower mortality rates.

IV. THE DEVELOPMENT OF NEOMALTHUSIAN LOW FERTILITY

17. Although no national populations began neoMalthusian fertility reduction before the last half of the eighteenth century, and only one or two before 1850, there is a clear statistical record, from the genealogies of leading families of Geneva, of a reduction of marital fertility among women in these families that began in the seventeenth century and continued into the eighteenth.

18. The first nation to record a sustained decline in marital fertility was France, beginning in 1770 or 1780. By 1850 I_g had fallen to 0.50, well below the levels characteristic of eighteenth century France, or of other countries of western Europe.

19. Marital fertility probably fell in the United States before the middle of the nineteenth century. The index of overall fertility was somewhat lower than in England and Wales by 1870, and I_m was almost certainly higher. Thus I_g in the U.S. had likely fallen well below the English level (0.68) by 1870, and must have been 0.80 to 0.85 in 1800. It is possible that a decline from very high levels began during the American colonial period.

20. Outside of France, no important decline in national marital fertility occurred in Europe until after 1850. A sustained decline began between 1870 and 1900 in nearly every European country, including many in southern and eastern Europe.

21. In most countries of western Europe, Oceania, and northern America, I_g reached a low point in the nineteen thirties, and has since recovered slightly (Sweden, Norway) or substantially (France, England and Wales, the U.S.). In southern and eastern Europe the decline in I_g has continued, so that the level in 1960 was typically well below that of the nineteen thirties. In Japan a precipitous fall in I_g was compressed into a very short interval after World War II, with the result that by 1960 marital fertility in Japan was below all but the lowest in Europe.

22. Finally, marital fertility has declined in a few of the developing countries in the last

decade—notably in Singapore, Malaya and Taiwan.

V. TRENDS IN I_m WHEN I_g REACHES A LOW LEVEL

23. A possible, though far from certain, generalization emerges from examining the course of I_m in countries that at some moment combined a long history of Malthusian restriction with a newly achieved reduction of marital fertility to low levels. If I_m has long been below 0.55, and I_g falls below 40, I_m tends to rise to 0.60 or higher. In France I_m rose from 0.52 in 1886 to 0.66 in 1959, interrupted only by post-war declines. In other European countries where the decline in marital fertility came much later, the rise in I_m also occurred later. It is remarkable that in England and Wales, Scotland, Sweden, and Norway (for example) proportions married were higher in 1940, at the end of a depression decade, than any recorded in the preceding ninety years. The rise in I_m continued in those countries (with interruptions during World War II) so that by 1960 (I_m 's of 0.60 to 0.70 were the rule. The development of neoMalthusian fertility reduction seems to have released a propensity to marry in populations that had long practiced substantial Malthusian limitation.

VI. FACTORS ASSOCIATED WITH FERTILITY REDUCTION

24. The development of late marriage and abstinence from marriage in Europe took place before the evolution of trustworthy demographic data, so that the date and pace of the original decline in I_m are matters of rough estimation and conjecture. There is little basis, then, for a confident attribution of causes of the decline. Malthus was probably representing the customs of his time in suggesting that men postpone marriage until they can support the children their wives will bear in the fertile years remaining. Hajnal suggests that this attitude may have originated in special features (e.g., higher average levels of living) in the economy of western Europe, and the special prevalence of the "stem-family".

25. Explanations of neoMalthusian fertility reduction are scarcely more satisfactory, even though birth control within marriage is in general a much more recent development, and the statistical record of the onset of reduced marital fertility is generally much more complete. The statistical data are in the form of recorded births, however, and do not include information on the extent to which different means were employed to reduce fertility. Such information is available for other than clinical

populations only since about 1940, and primarily in the United States. But indirect or partial evidence strongly indicates that reduction of marital fertility in most European populations was accomplished primarily by folk methods of contraception, especially *coitus interruptus*. Since such methods have long been known in almost every society, the part they have played in fertility reduction implies the importance of changed attitudes or motives rather than the discovery of new devices or techniques.

26. There are few, if any, universally valid generalizations about the circumstances under which neoMalthusian fertility reduction occurs. Some of the factors demographers have suggested as associated with fertility are:

(a) The decline in mortality. With more children surviving, fewer births are needed to achieve a given family size;

(b) The rising cost and diminished economic advantages of children in urbanized industrial societies. In rural families children assist in production at an early age and are a source of support for parents in their old age; in an urban environment children contribute less and cost more, especially after the establishment of universal primary education and the prohibition of child labour, both characteristic of advanced industrialization;

(c) Higher status of women. The extension of education to women, women's suffrage, and the employment of women in occupations formerly reserved for males are objective indications of wider opportunity and higher status for women. Since the burdens of pregnancy, parturition and child care are all women's burdens, these changes in opportunity and status promote the spread of birth control;

(d) Religious changes and differences. The early reduction of marital fertility in France compared to Spain and Italy on the one hand, and England and Scandinavia on the other, has been explained by the fact that Italy and Spain remained under the direct influence of the Vatican, and the Protestant countries had willingly accepted their religion, but France had dissented from Catholicism without breaking away. The unique continuation after 1900 of high marital fertility in Ireland has been attributed to the character of Irish religion;

(e) The development of a secular, rational attitude. Such an attitude favours the voluntary control of fertility, and has been considered as a natural part of industrialization and modernization, and also as a feature of revolutionary and pre-revolutionary France.

27. Examples can be found illustrating the presumed influence of each of these factors, but counter-examples or exceptions are nearly as prevalent. Every nation in the world today in which no more than 45 per cent of the labor force is engaged in extractive industry, in which at least 90 per cent of the children of primary school age attend school, and which is at least 50 per cent urban has experienced a major decline in fertility. But France reduced its fertility before attaining any of these characteristics, and England had most of them before its marital fertility fell at all.

28. Fertility fell in Spain, Bulgaria, and other Southern and Eastern European countries when mortality was still very high; in many countries rural fertility declined as early and as much as urban fertility; in some countries industrialization was far advanced before marital fertility fell, in others a major decline preceded substantial industrialization. Catholics in the United States and the Netherlands have higher fertility than Protestants, but some Catholic populations, e.g., in North Italy—have fertility as low as any other in the world.

29. In European national experience, the only factor apparently always changing at the same time that fertility declined was literacy, but the onset of fertility decline has no consistent relationship with the proportion literate at the time.

30. Fertility reduction seems to be a nearly universal feature of the development of modern secular societies, but its introduction and spread cannot yet be explained by any simple, universally valid model or generalized description.

31. Current research tracing the decline of fertility more systematically, and by geographic units smaller than nations, will certainly establish a fuller record of fertility reduction, and will perhaps make possible valid generalizations about causes of the decline.

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Table 1. Standard schedule of births per woman in each age group

	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Births per woman	0.300	0.550	0.502	0.447	0.406	0.222	0.061

Table 2. Definition of symbols in fertility indexes

Symbol	Definition
f_i	Births per woman in i^{th} age interval
g_i	Births per married woman in i^{th} age interval
h_i	Births per nonmarried woman in i^{th} age interval
w_i	Number of women in i^{th} age interval
m_i	Number of married women in i^{th} age interval
u_i	Number of nonmarried women in i^{th} age interval
F_i	Births per woman in i^{th} age interval in the standard population (married Hutterites, 1921-1930)
I_f	$\Sigma f_i w_i / \Sigma F_i w_i$ the index of overall fertility
I_g	$\Sigma g_i m_i / \Sigma F_i m_i$ the index of the fertility of married women
I_h	$\Sigma h_i u_i / \Sigma F_i u_i$ the index of the fertility of nonmarried women
I_m	$\Sigma F_i m_i / \Sigma F_i w_i$ the index of the proportion married

Table 3. Fertility indexes for selected populations

Population	Index of overall fertility				Index of marital fertility				Index of proportion married			
	1870	1900	1930	1960	1870	1900	1930	1960	1870	1900	1930	1960
Western Europe:												
Norway	0.33	0.33	0.17	0.22	0.76	0.73	0.38	0.32	0.40	0.42	0.42	0.66
Sweden	0.33	0.30	0.15	0.17	0.71	0.64	0.30	0.24	0.42	0.41	0.42	0.63
England and Wales ..	0.37	0.27	0.15	0.22	0.68	0.54	0.29	0.29	0.51	0.48	0.50	0.71
Ireland	0.29	0.23	0.24	0.29	0.67	0.74	0.66	0.60	0.42	0.31	0.35	0.47
France	0.28	0.24	0.19	0.22	0.48	0.38	0.30	0.31	0.54	0.57	0.58	0.67
Eastern Europe:												
European Russia	—	0.55	0.42	0.24	—	0.77	0.65	0.35	—	0.70	0.63	0.62
Bulgaria	—	0.52	0.31	0.20	—	0.70	0.41	0.24	—	0.73	0.75	0.78
Overseas European:												
United States	0.37	0.29	0.20	0.28	—	0.49	0.31	0.36	—	0.58	0.63	0.75
Australia	—	0.29	0.19	0.28	—	0.58	0.33	0.38	—	0.47	0.54	0.71
Hutterites	—	—	0.70	—	—	—	1.00	—	—	—	0.70	—
Asia:												
Japan	—	—	0.37	0.17	—	—	0.51	0.29	—	—	0.68	0.58
Taiwan (1956)	—	—	0.54	0.50	—	—	0.66	0.68	—	—	0.78	0.72
India	—	—	—	—	—	—	—	—	—	0.80	0.83	0.88
Latin America:												
Mexico	—	—	—	0.50	—	—	—	0.76 ^a	—	—	—	0.61 ^b

^a Illegitimate births assumed to occur to consensual unions.^b Includes consensual unions.

Marriage and family variables related to fertility

PAUL C. GLICK

I. INTRODUCTION

1. Among the marriage and family variables which help to explain patterns of human fertility are size of parental family, age at marriage, stability of marriage, failure to marry, spacing of children, similarity of characteristics of husband and wife, status of husband, and work experience of wife outside the home. These topics are discussed on the basis of research findings reported in the footnotes.

II. SIZE OF PARENTAL FAMILY

2. Studies of family size in two successive generations have been designed to test the hypothesis that size of family tends to be similar in the current and parental generations. Berent,¹ basing his study on 1,483 married female hospital patients (nonmaternity cases) in Great Britain who had been married 15 years or more, concluded in 1953 that "the size of the family from which the parents came holds an important place among the biological and social factors influencing the number of children born to them." The relationship was closer when the comparison was made to the wife's family of origin than to that of the husband. The fertility of the second generation was shown to depend to some extent on that of the first even when the data were controlled for use or nonuse of birth control methods (in the second generation) and for social class. Berent pointed out, however, that the factor being investigated explained only a small amount of the variance in fertility (less than 5 per cent), perhaps partly because the data did not permit the control of such related variables as age at marriage and whether the older generation practiced family planning.

3. Another study of family in two successive generations was reported in 1954 by Kantner and Potter² on the bases of data for the urban

white Protestant sample surveyed in the Indianapolis Study of Fertility. When they controlled such relevant factors as age of wife at marriage, duration of marriage, and contraceptive effectiveness (of the younger generation), they found that "less than 10 per cent of the variation in the fertility of the younger generation is attributable to the size of the family of origin. Except among the efficient planners, what relationship there is appears to be partially dependent upon differences in socio-economic status".

4. Additional factors, not mentioned above, which complicate the study of fertility in successive generations include changing secular trends in fertility rates (which may arise in part from negative reactions to being a member of a parental family that was too large when fertility rates are high or too small when the rates are low) and the obvious inability to include childless families in the older generation in such a study. An analysis of data is now in progress on intergenerational changes in fertility wherein the variables include occupation and education of husbands in two successive generations and size of place where the husband in the younger generation resided during his childhood and youth. This analysis is being made by Otis Dudley of the University of Michigan and Peter M. Blau of the University of Chicago on the basis of supplementary data from the Current Population Survey conducted by the United States Bureau of the Census in 1962.

III. AGE AT FIRST MARRIAGE AND STABILITY OF MARRIAGE

5. In this and subsequent sections, the data cited are from the U.S. census of population for 1960. To keep the presentation brief and to concentrate the analysis on women of nearly completed fertility in areas of low fertility, the discussion will deal only with white women ever married 35 to 39 or 35 to 44 years old in urbanized areas, unless otherwise specified. Because of the generally upward trend in fertility in the nineteen-forties and nineteen-fifties, women who were 35 to 44 years old in 1960 (with one to ten or so more years of child-

¹ Jerzy Berent, "Relationship between family sizes of two successive generations", *Milbank Memorial Fund Quarterly*, vol. XXXI, No. 1 (1953), pp. 39-50.

² John F. Kantner and Robert G. Potter, Jr., "Social and psychological factors affecting fertility. XXIV. The relationship of family size in two successive generations", *Milbank Memorial Fund Quarterly*, vol. XXXIV, No. 3, pp. 294-311.

bearing ahead of them) had already borne more children on the average (2.35 children ever born alive per woman) than those ten years older, virtually all of whom had completed their fertile period of life (2.02). The women 35 to 44 who had married only once had slightly higher fertility (2.37 children per woman) than those who had remarried (2.23); those still married and living with their first husband had the highest fertility (2.42) among the numerous categories of marital status classified according to whether married more than once.

6. Women who married for the first time before the median age at first marriage (21.9 years of age for the universe of women covered) had higher fertility rates, and those who married after that age had lower rates, than the overall average (mean) of 2.35 children per woman. Women in the youngest age group at first marriage, 14 to 17 years, had the highest fertility rate (2.90) and those in the oldest group, 30 to 44 years, had the lowest (1.22). Although women who had married only once by the age of 35 to 44 had been three years older at first marriage than those who had remarried, the once-married women with nearly completed families had higher fertility rates than the remarried in each age-at-first-marriage group except the oldest.

7. Thus, early marriage is associated with high fertility, and remarriage is associated with early marriage; yet remarriage is associated with low lifetime fertility. One hypothesis regarding this seeming paradox is that it probably reflects, in part, a tendency for women who have remarried by age 35 to 44 to have lived a smaller number of years with a husband than those still in their first marriage, though data are not available from the 1960 census to demonstrate the point. Even if this explanation accounted for a substantial part of the fertility differential, the practical fact would evidently remain that broken marriage adversely affects the average size of completed family. An alternative hypothesis is that the presence of children of their own in the home tends to encourage husbands and wives to stay together. This explanation is reinforced by the high per cent childless among divorced women (24 per cent), which is mentioned again in the following section.

IV. MARITAL STATUS AND CHILDLESSNESS

8. A sharp reduction in childlessness has been one of the most striking changes in fertility behaviour in the United States since 1940. This reduction has amounted to between one-third and one-half of the 1940 figure, depending

on the age group or other category examined. By 1960 only 13 per cent of the white women ever married 35 to 44 years old in urbanized areas were childless. An even smaller value, 11 per cent, was found in 1960 for women of the same age who were still living with their first husband; there is evidence that the corresponding figure may dip to 8 per cent or less for women five or ten years younger by the time they reach age 45. Among women 35 to 44 not still living with their first husband, the marital status group with by far the highest per cent childless in 1960 was the divorced (24 per cent). Intermediate values (17 to 18 per cent) were found for women living with their second or subsequent husband and for separated women, "other married women with husband absent", and widows.

9. Fertility rates among the several marital groups bear an inverse relationship with rates of childlessness. Thus, women 35 to 44 living with their first husbands had the highest fertility rate (2.42 children per woman) and the lowest per cent childless (see above), whereas divorced women had clearly the lowest fertility rate (1.69) and the highest per cent childless. If women with marriages disrupted by marital discord (that is, separated and divorced women) are further classified by education of the women, some of the most extreme variations in fertility rates are revealed. Separated women with less than eight years of schooling had a high fertility rate (3.17) and divorced women with four years or more of college had a very low rate (1.22). Rates of childlessness for the corresponding groups of women were 14 per cent and 37 per cent. These extreme groups are characterized by the lower status mother with several children whose husband has deserted her and the upper status woman—generally childless—who has chosen to free herself of marital ties.

V. WOMEN WHO NEVER MARRY

10. The recent decline in spinsterhood has contributed to the rise in fertility. In 1940, 10 per cent of all white women in the United States 35 to 44 years old were single (never married); by 1950 this figure had dropped to 8 per cent and by 1960 to 6 per cent. When the sharp decline in spinsterhood during the last two decades is analyzed in combination with the simultaneous decline in childlessness and increase in fertility among women ever married, the far-reaching expansion in the participation of women in the childbearing process during this period becomes impressively evident.

11. Only brief mention is being made here about the children of unved mothers because

the attention is focused on women nearing the end of their reproductive years of life, and illegitimacy is primarily a phenomenon of young adulthood in the United States. Although the numbers and rates of illegitimate children have increased considerably since 1940, the current proportion of white children born to unwed mothers is only about 2 per cent, according to vital statistics for the United States, and probably nearly all of these mothers will marry long before they reach 35 years of age.

VI. SPACING OF CHILDREN

12. The interval between marriage and the birth of the first child was somewhat longer, on the average, during the depression years of the nineteen-thirties and the war years of the nineteen-forties than it was before these periods or after them. Thus, while size of completed family declined from 3.47 children per white woman first married in 1910 to 2.38 for those first married in 1930, the median interval from marriage to birth of first child varied little around 1.5 years.^{3, 4, 5} For those who entered first marriages during the depression years of the nineteen-thirties, the corresponding figure rose to 1.7 years and remained nearly as high (1.6 years) for women who married during the war and early postwar years of the nineteen-forties. Projections for women married for the first time in the nineteen-fifties, however, suggest that the average size of completed family for these women may rise again to roughly the 1910 level, yet their median first birth interval may drop sharply to only 1.3 years. If actual experience bears out the projection, this short spacing of the first child will have occurred despite an approaching universality of knowledge about family limitation and ample means available to most women for implementing the knowledge. These observations are consistent with the results of private research which indicate that the practice of family limitation is being applied much less in planning the spacing of the first birth than in planning the number and spacing of later births.⁶

³ U.S. Bureau of the Census, *U.S. Census of Population: 1960, Subject Reports, Women by Number of Children Ever Born*, Final Report PC (2)-3A (Washington, D.C., U.S. Government Printing Office, 1964), table 20.

⁴ Wilson H. Grabill and Robert Parke, Jr., "Marriage, fertility, and childspacing: August 1959", *Current Population Reports*, Series P-20, No. 108 (Washington, D.C. U.S. Bureau of the Census (July 12, 1961), table 16.

⁵ Paul C. Glick and Robert Parke, Jr., "New approaches in studying the life cycle of the family", *Demography*, vol. II (1965), p. 187.

⁶ Ronald Freedman, P. K. Whelpton, and Arthur A. Campbell, *Family Planning, Sterility, and Popu-*

13. The average interval from marriage to the birth of the last child in the family—whatever the size (one or more)—tends to be considerably longer than the average interval from marriage to the birth of children of the same order who are not the last born in the family. These circumstances may result from such factors as the occurrence of unplanned births a few years after the couple considers its family completed and belated changes in the number of children desired.

14. The interval from first marriage to the birth of the last child appears to have followed roughly the pattern of change in completed fertility until recently. During a period of low fertility the children tend to be more widely spaced than they are during a period of higher fertility. Thus, during the two decades before the depression of the nineteen-thirties the average size of completed family declined by about one child per family and the interval from marriage to birth of last child declined by approximately two years. During more recent decades the level of the interval from marriage to birth of last child appears to have increased slightly then decreased slightly, and during the years ahead it may increase again. The net effect of the current changes seems to be a movement in the direction of a somewhat smaller average spacing interval per child.

VII. AGES OF SPOUSES

15. Fertility rates tend to be highest if the husband and wife are in the same age group or the husband is in the next older 5-year age group. This finding relates to urban white women 35 to 39 years old with husband 35 to 44 years old in 1960. Where the husband was younger than the wife, the difference in childlessness and average number of children per woman was greater than that where the husband was older than the wife. To some extent duration of marriage within the span of reproductive years may have been a factor in these differentials. In any event, the results tend to support the thesis that—within the framework of the customary tendency for the husband to be slightly older than the wife—homogenous marriages are the most fertile.

16. A new development is emerging which relates directly to usual differences between the ages of spouses. This is the fact that women born on the wave of the postwar upsurge in number of births are now reaching ages when marriage rates for women are the highest (about ages 18 to 20), whereas men born in

lation Growth (New York, McGraw-Hill Book Co., 1959), pp. 92-95.

the same period will not be reaching the ages when marriage rates for men are the highest (about ages 21 to 23) until three years later. It will be interesting to see what effect this development has on marriage and fertility patterns. Will the young women tend to delay marriage more than the young men tend to hasten marriage? Will the young women during the next few years tend to marry older men who had been "passed over", and three years later will the young men tend to marry older women who had likewise been passed over? The effects of these marital developments on fertility are difficult to anticipate.

VIII. EDUCATION OF SPOUSES

17. Completed fertility rates vary inversely with the education of both the wife and the husband. This conclusion is supported by data for white women married once and husband present 35 to 44 years old in urbanized areas of the United States in 1960. In a table of fertility rates for the wife with education of wife cross-classified by education of husband, the figures show that where the wife has attended college, the fertility rate is higher where the husband has also attended college than it is where he has not. This evident (positive) relationship between fertility and education of husband where the wife is college-educated reinforces the position that homogamous marriages are more fertile—perhaps because they generate less tension as a consequence of conflicting values. When the analysis is limited to husbands and wives who have attended college, however, there is a slight negative relationship between fertility and amount of college education of the wife but a (stronger) positive relationship for the husband. This interesting contrast suggests that, among married couples of upper status, the husband tends to place a higher premium on having a large family than the wife does.

IX. STATUS OF THE HUSBAND

18. Women with husbands who are not only in upper education groups but also in upper

occupation groups tend to have higher completed fertility where the husband has a high income than where he has a low income; but women with husbands who are not only in lower education groups but also "labourers, except farm and mine" tend to have lower completed fertility where the husband has a high income than where he has a low income. These relationships, stated in a somewhat oversimplified manner, hold true more consistently where the wife was at least 22 years old at first marriage. The positive relationship between income and fertility for upper status husbands reinforces the results cited for college men in the preceding section.

X. WORK EXPERIENCE OF THE WIFE

19. Among all women 35 to 54 years old in 1960, the proportion who had worked in 1959 outside the home was greatest for those who had college degrees (64 per cent) and least for those who had never attended high school (45 per cent). Moreover, the rate of childlessness for white women 35 to 39 years old in urbanized areas was three times as high for those currently employed (20 per cent) as for those who had never worked outside the home (7 per cent); the corresponding fertility rates were 1.63 children per woman for those employed and 2.88 for those who had never worked. Freedman, Whelpton, and Campbell⁷ found that women most likely to be employed were subfecund women. Ridley⁸ demonstrated, in addition, that among fecund couples the wife's current employment status and the number of years the wife had worked after marriage were strongly (and positively) associated with the use of contraception in family planning; in turn, she found that length of employment varied inversely with fertility, even when the data were classified by such factors as duration of marriage, wife's education, wife's religion, and husband's income.

⁷ Freedman, *et al.*, *op. cit.*, p. 137.

⁸ Jeanne Clare Ridley, *The relationship of non-familial activities to fertility behaviour* (Ph.D. dissertation in Sociology, University of Michigan, 1957).

Current fertility patterns in Japan

MASABUMI KIMURA

I. INTRODUCTION AND SUMMARY

1. For three major reasons, world attention continues to focus on fertility in Japan. First is the fact that outside the Western world, Japan is the only sizeable country in which fertility is widely controlled. Second is the record-shattering rate of decline which marked the path leading to low birth rates. The data are well-known but are worth repeating. From a post-war high of 34.3 in 1947, the crude birth rate declined to 20.0 by 1954 and to 17.2 by 1957, representing annual rates of decline unprecedented in history. Third is the demographic value of analysing and following the course of these distinct developments.

2. Japan's net reproduction rate is at a level slightly below replacement. In some quarters this may cause concern for the future size of the population, but others are asking whether a rebound in the birth rate, such as occurred in the U.S. after the war, may be expected as a concomitant of mounting prosperity. Nothing in the current data suggests that this latter possibility is on the horizon, but whatever development is in store, it is important to investigate present trends, the extent to which the small size family has permeated the country, and the nature and degree of fertility differentials.

3. This paper will not dispose of these questions but it is prompted by them. The analytical approach is to examine fertility data since 1955, specifically birth, death and growth rates for the actual and implied stable population, age specific birth rates, distribution of births by birth order, and the relation between crude birth rates and some socio-economic variables. The major findings are as follows:

(1) The crude birth rate is among the lowest in the world, about 25 per cent below the level of the United States and on a par with the nations of western Europe. The net reproduction rate of about 0.9 is slightly below replacement, with an implied annual rate of decrease of the stable population of 0.3 per cent;

(2) Crude birth rates are now uniformly

low in all prefectures, regardless of the agricultural composition of the labour force;

(3) Fertility among women over 30 has undergone substantial decline since 1955. The total fertility rate dropped from 2.4 in 1955 to 2.0 in 1962;

(4) Completed fertility and socio-economic variables still show an inverse relationship, but differentials have been converging and are now not large.

II. RECENT AND CURRENT CRUDE RATES

4. It can be seen in table 1 that the low point in the crude birth rate, reached in 1957, has continued to prevail. In view of the recency of Japan's demographic and economic maturity, we can speculate that this is both a cause and consequence of rising per capita income. It may be hypothesized that the present level of the birth rate is compatible with the economic aspirations of the people and is therefore likely to continue, at least until these aspirations are achieved, unless some outside or unforeseen force intervenes.

5. The concomitance of declining or low birth rates with increasing industrial activity parallels the experience of the West. However, there is a difference which is worthy of note, although it may be nothing more than a historical accident. Whereas Japan's lowest birth rates are associated with its period of greatest per capita income, in the West the culmination of the long-time historical decline in births coincided with a period of economic depression. Subsequently, there was enough recovery (marked in the case of the U.S.) to insure replacement of the population in western Europe. At its depression time low, western Europe's crude birth rate was about 10 per thousand for the stable population, with a crude death rate of about 20 per thousand, which resulted in an annual rate of natural decrease of about 10 per thousand. Comparable figures today for Japan are about 12 and 16 for the crude birth and death rates, respectively, with a resulting 0.3 to 0.4 per cent annual decline in the stable population.

Table 1. Vital rates of actual and stable population, Japan 1955-1962

Year	Actual population			Stable population		
	Crude birth rate	Gross reproduction rate	Natural increase per 1,000	Crude birth rate	Crude death rate	Natural increase per 1,000
1955	19.4	1.150	1.060	15.4	14.0	1.4
1956	18.4	1.078	0.996	14.8	14.9	-0.1
1957	17.2	0.990	0.923	13.3	16.2	-2.9
1958	18.0	1.025	0.959	13.5	15.1	-1.6
1959	17.5	0.993	0.934	13.0	15.6	-2.5
1960	17.2	0.976	0.924	12.7	15.8	-3.1
1961	16.9	0.950	0.904	12.2	16.1	-3.9
1962	17.0	0.964	0.924	12.4	15.8	-3.4

SOURCES: Special Issue of Welfare Index, vol. 11, No. 11 (1964), *Population Index*, vol. 30, No. 2 (1964).

Note: data on stable population from 1960 to 1962 computed by author using same method as for previous years.

6. By now Japan's low national average crude birth rate is characteristic of all prefectures, regardless of proportion dependent upon agriculture. Table 2 is a listing of selected prefectures ranked by percentage of the labour force engaged in agriculture. It will be noticed that in 1955, rates were relatively high in prefectures with high agricultural proportions. Continued decline has reduced these rates to levels consistent with those in the prefectures containing the large, urbanized areas. Presently, the latter have rates of about 2 to 4 points above their 1957 low. A possible explanation

for this increase is a greater propensity for marriage among urban industrial workers provided by growing economic opportunity. Nevertheless, it should be pointed out that age at marriage continues to increase and that at ages 20 to 24, two thirds of the women are still single.

7. Further discussion of inter-prefectural differences would involve, at the least, standardization for age, but the raw data shown in table 2 leave no doubt that the crude birth rate is universally low in all prefectures.

Table 2. Crude birth rates by selected prefectures, Japan, 1955-1962

Year	Kago-shima	Aomori	Yamagata	Ooita	Nagasaki	Hokkaido	Tokyo	Oosaka	Kanagawa	Kyoto	Aichi	Hyogo
	Percentage of labour force in agriculture											
	60.3	55.9	52.0	48.4	39.8	34.0	2.2	4.4	10.2	18.2	18.8	20.4
1955	24.5	25.5	20.2	20.7	24.7	21.7	15.9	15.9	17.7	14.4	17.3	17.2
1956	23.2	23.6	19.1	19.6	23.0	20.4	15.2	15.9	16.9	14.2	17.2	17.0
1957	21.5	22.2	18.0	17.2	21.2	19.0	15.1	15.2	16.6	13.6	16.0	15.7
1958	21.0	22.7	18.2	18.2	22.2	18.9	16.2	16.8	17.3	14.5	17.5	17.1
1959	19.8	22.0	17.3	17.6	21.4	18.9	16.4	16.8	17.4	14.7	17.3	16.8
1960	19.3	20.9	16.9	16.2	20.7	18.6	17.0	17.3	17.6	14.6	17.4	16.5
1961	18.0	20.4	16.1	15.8	19.6	18.2	17.2	17.7	18.1	14.6	17.6	16.6
1962	16.4	19.8	15.8	15.7	18.6	18.0	17.8	19.2	18.6	15.4	18.4	17.3

SOURCES: *Vital statistics of Japan, 1962*; *Population census of Japan, 1960*. Summary of the results.

III. ANNUAL FERTILITY RATES

8. Age specific fertility rates show evidence of widespread family planning practice, especially among women over age 30. By 1955, these rates were already relatively low, but they have, nevertheless, continued to decline. As can be calculated from the data in table 3, between 1955 and 1962, childbearing decreased by 31 per cent, 62 per cent, and 70 per cent among women aged 30 to 34, 35 to 39, and 40 to 44 respectively. During the same period, there was some recovery among women in the

prime reproductive age group 25 to 29, amounting to 10 per cent from the low point of 169.6 children per 1,000 women in 1957 to the high rate of 187.2 in 1962.

9. It is interesting to note that only among women in the 25- to 29-year age group do Japanese and American women have comparable fertility. Among all other age groups, Japanese fertility is decidedly lower. For younger women, the difference is explained largely by later age at marriage in Japan; among older women, the likely explanation can

Table 3. Age specific birth rates, Japan 1955-1962 and the United States 1962

Year	Age group of women						45 and over	Total Fertility Rate
	15-19	20-24	25-29	30-34	35-39	40-44		
Japan (per 1000 women):								
1955	5.9	111.5	180.6	112.1	49.4	12.6	0.8	2.36
1956	5.1	106.9	176.3	100.7	43.3	12.6	0.6	2.23
1957	4.3	99.3	169.6	89.8	35.6	8.3	0.6	2.04
1958	4.0	106.3	181.3	89.1	32.5	7.5	0.5	2.11
1959	4.0	107.1	179.0	83.5	28.1	6.4	0.4	2.04
1960	4.3	106.6	181.1	79.7	23.8	5.2	0.4	2.01
1961	4.4	100.0	182.6	78.4	20.9	4.5	0.3	1.96
1962	4.1	99.7	187.2	77.8	19.0	3.9	0.3	1.96
United States (per 1000 women):								
1962	82.1	243.8	191.3	108.7	52.6	14.8	0.9	3.47

SOURCES: *Vital statistics of Japan, 1962*; United States Department of Health, Education and Welfare, Public Health Service, *Natality statistics analysis*, series 21, No. 1 (1964), p. 15.

be attributed to differing concepts of desired family size, not to differences in family planning practice which, being somewhat more extensive in the United States, would operate to produce higher, not lower fertility in Japan.

10. The effect of declining fertility on birth order can be seen in table 4. From a third of all births in 1955, first births now constitute 45 per cent of the total. This is in sharp contrast to the United States where only about

one fourth of all births are first births. In Japan only about 3 per cent of the births are currently of fifth or higher order, compared with almost 20 per cent in the United States. Nevertheless, because many of the older women in Japan passed through their major reproductive ages in an era of higher fertility, the average number of children ever born to ever married women 15 and over, is greater in Japan than in the United States, 3.22 compared with 2.50.

Table 4. Per cent distribution of live births by birth order, Japan 1955, 1961, compared with United States 1961

Birth order	Japan		United States
	1955 ^a	1961 ^b	1961 ^c
1	33.1	45.4	26.5
2	26.3	34.1	24.2
3	19.1	13.0	19.1
4	11.2	4.2	12.4
5	5.2	1.7	7.2
6 and over	5.1	1.6	10.5

^a United Nations, *Demographic Yearbook 1959* (United Nations publication, Sales No.: 59.XIII.1), table 15.

^b Health and Welfare Minister's Secretariat, *Vital statistics of Japan, 1961*.

^c United States Department of Health, Education and Welfare, National Center for Health Statistics, *Natality statistics analysis*, series 21, No. 1 (1962), p. 13.

IV. DIFFERENTIAL FERTILITY

11. The rapidity of social and economic development in Japan is evident in the decline of fertility among erstwhile high fertility groups and in the changing occupational structure.

Both trends are toward lower fertility levels and a narrowing of differentials. In the five-year period between 1955 and 1960, total fertility among farmers and fishermen, for example, declined from 4.2 to 3.0 children. At the

same time, their proportion in the male labour force declined from a third to a fourth. As a consequence of these developments, fathers in agriculture and fishing accounted for 38 per cent of total births in 1955, but only 22 per cent of the births in 1962.

Table 5. Total male fertility rate by occupation of father, and proportion of occupation in male labour force, Japan, 1955 and 1960

Occupational category	Total fertility rate		Percentage of occupation in labour force	
	1955	1960	1955	1960
Total (includes unoccupied) ..	3.0	2.3	100.0	100.0
Professional, technical	2.2	2.2	5.4	5.2
Managers, officials	1.4	1.7	3.4	3.7
Clerical	3.4	2.7	9.0	10.8
Sales	2.3	2.1	10.6	10.1
Farmers, fishermen, etc.	4.2	3.0	33.0	25.9
Mining	3.3	2.3	1.4	1.3
Transport, communication ...	2.6	2.1	4.0	4.7
Craftsmen, labourers, etc....	2.4	1.8	29.3	34.0
Service	2.0	1.8	3.9	4.3

SOURCES: *Vital Statistics of Japan, 1955, ibid., 1960; Population Census of Japan, 1960*, one per cent tabulation report.

12. The narrowing of differentials by occupational groups and the trend toward occupations characterized by lower fertility can be noted in table 5. The data showed not only a decline in total fertility by various occupational groups (except among professionals and managers, whose levels were already low at the earlier date), but a decrease in the dispersion from the average. In 1960, the standard deviation of the total fertility rate by occupation of father (weighted by the proportion of the occupation in the labour force) was only .16 child from an average of 2.3 children. This compares with a standard deviation of .90 in relation to an average of 3.0 in 1955.

13. Urban-rural fertility differences may to a large extent be a matter of differences in age at marriage, at least among younger women. Measured by average number of children ever born to ever married women in 1960, rural fertility exceeded urban fertility by 25 per cent among women under 35 and by 20 per cent among women 35 and over (see table 6). With the growing sophistication of the rural as well as urban population in successful contraceptive practice, this differential may ultimately disappear. That is, even if women in rural areas get an earlier reproductive start, in the future, completed family size may not differ to any significant extent between the two areas.

Table 6. Average number of children ever born per ever married woman, by urban and rural residence, Japan, 1960

Age group	Total	Urban	Rural
15-34 years	1.63	1.50	1.88
35 and over	3.98	3.69	4.42
All ages	3.22	2.95	3.66

SOURCE: *Population census of Japan, 1960*, vol. II, one per cent sample tabulation, part I, table 10, p. 362.

14. The 1960 census data suggest that at present urban-rural differentials in number of children ever born per ever married woman amount to about $\frac{3}{4}$ of a child. Another way of examining this differential is to dichotomize households into agricultural and non-agricultural groups, based on head's occupation. If the households are further sub-divided into self-

employment and non-self employment of head plus comparable groupings of a related family member, some interesting observations emerge. It can be noted in table 7 that the agricultural non-agricultural differential based on head's occupation fails to appear when a related family member is engaged in an agricultural pursuit. According to the 1960 census, average number

of children ever born per ever married woman was 3.65 among non-agricultural heads who had a related family member in agriculture, but only 2.92 when the related family member was also in a non-agricultural undertaking. A plausible explanation is that the latter implies urban, the former, rural residence.

15. Among women 35 to 39, urban-rural

differences are smaller than the economic differences. Agricultural households in cities have about 3.0 children ever born per ever married woman, 3.4 in towns and villages; non-agricultural households have 2.5 to 2.8 children per woman.

16. The data do not show any association between fertility and employment status.

Table 7. Number of households, women ever married, and children ever born per woman, by labour force characteristic of household head and related family member, Japan, 1960

<i>Labour force characteristic (S, self employed; E, employee; O, not in labour force)</i>	<i>Households (in thousands)</i>	<i>Ever married women (in thousands)</i>	<i>Children per woman (standardized) ^a</i>
TOTAL	19,571	24,198	3.23
I. Agricultural households	3,574	5,249	3.76
1. Head (S)	3,317	4,960	3.77
2. Head (E)	257	289	3.62
II. Mixed households	2,479	3,922	3.76
Head in agriculture, member in non-agriculture			3.80
3. Head (S)	1,371	2,265	3.81
4. Head (E)	76	99	3.66
Head in non-agriculture, member in agriculture			3.65
5. Head (S)	218	341	3.68
6. Head (E)	815	1,216	3.64
III. Non-agricultural households	12,767	14,370	2.92
7. Head (S), member (O)	2,532	2,906	2.78
8. Head (E), member (E) or (O)	8,944	9,761	2.91
9. Head (S), member (E)	813	1,076	3.21
10. Head (E), member (S)	479	627	2.97
IV. Head (O)	739	637	2.43
V. Not classifiable	13	21	—

SOURCE: Computed from *Population Census of Japan, 1960*.

^a Each group standardized for age on the basis of the age distribution of the women for all groups combined. The effect of standardization was to narrow differences.

V. FERTILITY SURVEYS AND FINDINGS

17. Recent fertility surveys include the 1962 Japanese Health and Welfare Ministry special vital statistics survey with reference to socioeconomic variables, the "Fourth Fertility Survey" in 1962 of the Population Problems Institute, and the "Seventh Opinion Survey on Family Planning" in 1964, conducted by the Population Problems Research Council of the Mainichi newspapers. These, plus the research findings of individual scholars, indicate a continuing decline in the rates of childbearing and a convergence among the various social and economic strata. The surveys further disclose that the dominant motives for the small size

family are first, the desire for high educational attainment for the children, followed by economic considerations and protection of mothers' health.

18. In rural districts, traditional society is still to be found. More and more, however, they too are learning the new values of a modern society. With increasing economic activity, industry in the large cities is now absorbing a high proportion of the younger generation. The trend is toward high mass production and consumption. With wage levels still insufficient to meet prevailing material and cultural aspirations, a continuation of the current low level of fertility is in prospect, at least for the immediate future.

Social, economic and religious factors in the differential fertility of low fertility countries

CLYDE V. KISER

1. This paper undertakes to describe the principal differences in fertility within countries of low fertility by such factors as residence, occupation, education, and religion. For present purposes the "low fertility countries" include those of Europe, the U.S.S.R., Australia, Japan, Canada, and the United States.

2. *Europe.* Several summaries have emphasized the lessening of class differences in fertility in Europe in recent years. Johnson has stated, "The often-observed inverse association of fertility with socio-economic status is still present in some, and possibly in the majority of the industrialized countries of Europe. But where it does exist, it has, with few exceptions, been significantly modified. In general, the higher professionals and the wealthier classes no longer have the smallest families; this position is now occupied by intermediate occupational groups and by married couples of average means." Likewise, "In Sweden, England and Wales, and the Netherlands, fertility rates of the better-educated class are clearly above the average rates for these countries."¹

3. At the 1961 International Population Conference, Pressat concluded that "the recent increase of fertility in different groups of populations of countries of western Europe are marked by contraction".² As a rapporteur at this same conference, Colombo also observed "a contraction of differentials among the various [European] countries—a phenomenon parallel to what is apparent for different socio-economic strata in the American context—and, though information on this point is scanty, to a growing uniformity of fertility behaviour among groups different for geographic, ethnic or socio-economic factors within each country".³

¹ G. Z. Johnson, "Differential fertility in Europe," *Demographic and Economic Change in Developed Countries* (Princeton, Princeton University Press, 1960), pp. 53 and 72.

² R. Pressat, "Tendances récentes de la fécondité en Europe Occidentale", *International Population Conference, New York, 1961*, vol. I (London, John Wright and Sons, 1963), p. 127.

³ B. Colombo, "Report," *International Population Conference, New York, 1961*, vol. I (London, John Wright and Sons, 1963), p. 37.

4. Two of the most persistent types of fertility differentials found in Europe are those by labour force status and religion. As an example of strong differentials in fertility by labour force status, Johnson cited data for Copenhagen.⁴ In data of this type, of course, cause and effect are mixed up. It is difficult to know whether the fertility of working wives is low because they work or whether they work because their fertility is low. As for differentials by religion, Johnson cited the Netherlands census of 1947 to indicate persistence of the differential in fertility between the Roman Catholic and Protestant groups from year of marriage 1891 to year of marriage 1922-1926.⁵

5. Hungary's fertility history has been the subject of much recent research. During 1940-1941, her gross reproduction rate was 1.19. In 1954, it was 1.43. Since that year there has been a consistent annual decrease and in 1962 Hungary probably had the lowest gross reproduction rate in Europe (0.87).⁶ According to Klinger, the agricultural-non-agricultural differential in fertility in Hungary has been reversed. Before World War I the fertility rate for the agricultural women surpassed that for the non-agricultural women by 30-40 per cent. The excess was 50 to 60 per cent in the inter-war period. However, since World War II this difference has disappeared and in 1959 the fertility of non-agricultural women surpassed that of agricultural women by more than 10 per cent. Furthermore, among the non-agricultural women there has been a contraction of the differential as between manual and non-manual workers. In 1959 the fertility of manual workers was less than 50 per cent higher than that of non-manual workers.⁷

6. According to Good, "Several surveys have been conducted by the Central Statistical Office since 1958 to investigate attitudes as well as behaviour with regard to childbearing and

⁴ G. Z. Johnson, op. cit., p. 61.

⁵ G. Z. Johnson, op. cit., p. 49.

⁶ *Population Index*, vol. 30, No. 2 (1964), p. 276.

⁷ A. Klinger, "Trends of differential fertility by social strata in Hungary", *International Population Conference, New York, 1961*, vol. I (London, John Wright and Sons, 1963), pp. 91 and 95.

birth control in the regions of Hungary. . . . In general the published findings of the surveys show a prevailing preference for the small family of two to three children, and acceptance of family planning as a means to that end, and the reduction of long-standing differentials between urban and rural, and between agricultural and non-agricultural, manual and non-manual occupations. Preliminary data of the 1960 census appeared to confirm the results of the surveys."⁸

7. On the basis of two studies carried out in 1956 and 1959 by the State Statistical office in Czechoslovakia, Srb found that proportion of couples who were planning the size of their family was 70 per cent in 1956 and 95 per cent in 1959. By occupation of husbands, the range in 1956 extended from about 55 per cent for individual farmers to 76 per cent for the "intelligentsia." In 1959 the range was from about 79 per cent for individual farmers to 97 per cent for the "intelligentsia." For industrial workers, the proportion of planners was 67 per cent in 1956 and 94 per cent in 1959. Despite increases in the proportion of planners the average number of children planned for each broad occupational group also increased. In 1959 the average ranged from 2.73 for individual farmers to 2.06 for "health personnel." It was 2.33 for industrial workers and 2.22 for the "intelligentsia."⁹

8. Recent studies of the above mentioned and other countries of eastern Europe and the Soviet Union were reported at the International Demographic Symposium held November 20-30, 1962 at the Hungarian Academy of Sciences in Budapest.¹⁰ Collectively, the studies indicate that the factors affecting fertility in countries of eastern Europe and the Soviet Union are much the same as those operating

in countries of the West. Thus, Vostrikova reports that in the Soviet Union fertility rates are lower for town dwellers than for those living in rural areas, lower for women in towns who work than for household women, and lower for families in urban settlements who have medium-size or higher income than for those who have smallest income.¹¹

9. *Australia.* In his recent study of a 20 per cent sample of the Australian census data of 1954, Lincoln Day found that the conventional variations in fertility of Catholics by residence, country of birth, and other variables are much the same as those observed for Protestants. "They, too, would seem to have been affected—and in much the same way as other segments of the society—by those forces that have served to reduce the number of large families and to concentrate childbearing within the relatively narrow range of 2-4 issue." His analysis did not include occupational or educational variables.¹²

10. *Japan.* Japan seems to be an exception in not exhibiting any substantial reduction in fertility differentials by socio-economic status. Although her gross reproduction rate fell from 1.76 in 1950 to 0.95 in 1961¹³ there is a marked persistence of differential fertility according to occupational and educational attainment. According to Kuroda, birth rates have shown a remarkable reduction during a relatively short time, and yet the variations in fertility by socio-economic status and residence have been strongly preserved. However, he states, "A sort of leveling-off process of differential fertility is expected in the future. Several factors may be expected to push this process further. [Among these] is the huge concentration of population in urban areas; a process of unprecedented magnitude."¹⁴

11. Thus it is possible that even the exceptional case of Japan may prove the rule regarding universal contraction of fertility differentials. Implemented largely by abortions, Japan's fertility decline has been recent and drastic. Koya has emphasized, "The evidence suggests that if women cannot avoid pregnancy they will resort to induced abortion. The high incidence of induced abortion therefore seems to reflect on the one hand the permeation of the small family concept into all segments of

⁸ D. Good, "Some aspects of fertility change in Hungary", *Population Index*, vol. 30, No. 2 (1964), pp. 162-163.

⁹ V. Srb, "Research regarding marriage and parenthood in Czechoslovakia", *International Population Conference, New York, 1961*, vol. 1 (London, John Wright and Sons, 1963), pp. 138-147.

¹⁰ See the following papers in *Studies on fertility and social mobility*, International Demographic Symposium, 1962, E. Szabady, ed. (Budapest, Akadémiai Kiadó, 1964): G. Nultsch, "Trend of age-specific fertility in the German Democratic Republic and its probable development up to 1960", pp. 101-104; E. Rosset, "New tendencies in the reproduction of the population in Poland", pp. 105-111; I. Ferenbac, "The impact of the technical development and the new socialist relations of production on the birth and death rates in the Romanian People's Republic", pp. 135-140; A. Kjurciev, "The demographic effects of the economic and social development of Yugoslavia", pp. 141-145; A. M. Vostrikova, "Examinations of fertility, marriages and the family in the USSR", pp. 214-228.

¹¹ A. M. Vostrikova, *ibid.*, pp. 221, 223 and 225.

¹² L. H. Day, "Fertility differentials among Catholics in Australia", *The Milbank Memorial Fund Quarterly*, vol. XLII, part I (1964), p. 81.

¹³ *Population Index*, vol. 30, No. 2 (1964), p. 280.

¹⁴ T. Kuroda, "Fertility differentials in Japan", *International Population Conference, New York 1961* vol. 1 (London, John Wright and Sons, 1963), p. 101.

Japanese society and on the other, the lack of experience and skill in the use of other techniques for achieving this goal."¹⁵

12. *United States.* During the 1950-1960 decade the differentials in fertility within the United States became wider by colour and religion and narrower by residence and socio-economic status. The expansion of the differentials by colour was due to the greater increase in the fertility of nonwhites than of whites during this period. The relative excess of the fertility of nonwhites over that of whites in 1960 was greatest (70 per cent) at youngest ages (15-19). It decreased with age and was about 18 per cent at ages 40-44. However, the extent of the widening of the differential during 1950-1960 was smallest at youngest ages and largest at ages 25-39. Thus at ages 20-24 the excess of the fertility rate of nonwhites over that of whites was 43 per cent in 1950 and 46 per cent in 1960. At ages 25-29 the excess was 19 per cent in 1950 and 28 per cent in 1960.

13. The evidence regarding the strengthening of differentials in fertility by religion comes from private surveys, not from decennial census data. On the basis of data from the 1955 and 1960 surveys of the "Growth of American families" study and their own 1962 data from the Survey Research Center at the University of Michigan, Freedman, Goldberg, and Slesinger stated in 1963 "In contrast to the contraction of fertility differentials for most of the variables discussed here, religious differences in fertility are large and are apparently growing larger The differences in live births exist in both the younger and older age groups."¹⁶

14. Characteristically, the fertility rates are highest for Catholics, intermediate for Protestants, and lowest for Jews. The authors of the Princeton Fertility Study stated that "Religious preference, that is preference for the Protestant, Catholic or Jewish faith is the strongest of all major social characteristics in its influence on fertility." They also concluded, "The influence exerted by religion operates primarily through its effects on the number of children desired and only secondarily through fertility-planning success." Nevertheless the Princeton Study did indicate that the practice of contra-

ception is less frequent and less effective among Catholics than among non-Catholics.¹⁷

15. Although the decennial census of the United States contains no question on religion, Neusse provides indirect evidence of the strengthening of fertility differences by religion in rural Wisconsin by comparing the trends during 1940-1960 in fertility ratios among townships estimated to be 50 per cent or more Catholic with those of townships estimated to be under 50 per cent Catholic.¹⁸

16. The narrowing of the differentials in fertility by type of residence was due to the greater increase in the fertility of urban than of rural women during the decade 1950-1960. The rural-farm couples are still characterized by conspicuously high fertility but they comprise only a small proportion of the population.

17. There are complex factors in the relation of residence to fertility. In this connexion the author has previously stated: "Census and official data generally indicate fertility rates to be lower in urban than in rural areas, lower in central cities than in other parts of metropolitan areas, lower in residential than 'mixed' neighbourhoods, and lower in apartment and multiple-dwelling houses than in single-family houses."¹⁹ However, there are frequently exceptions inherent in certain types of selection. Thus the outlying areas of certain large cities are weighted by middle-class Protestant families and the central cities by families of lower economic status and by nonwhites and non-Protestants.

18. Available evidence suggests that an expansion of differentials in fertility by occupation group had been under way in this country for some years prior to 1910. Between 1910 and 1940 there was some contraction of the differentials resulting from the greater declines in birth rates in the lower than in the upper socio-economic classes. Following World War II a marked increase in fertility occurred in the United States, as in virtually all of the countries of low fertility. The increases in fertility of the younger women during the 1940-1950 decade tended to be greatest in the classes previously characterized by lowest fertility. Hence there was a continuation of the contraction in class differences in fertility but this time in the context of rising fertility instead of declining fertility.

¹⁵ Y. Koya, "Why induced abortions in Japan remain high", *Research in Family Planning*, C. V. Kiser, ed. (Princeton, Princeton University Press, 1962), p. 109.

¹⁶ R. Freedman, D. Goldberg and D. Slesinger, "Current fertility expectations of married couples in the United States", *Population Index*, vol. 29, No. 4 (1963), p. 378.

¹⁷ C. F. Westoff, R. G. Potter and P. Sagi, *The Third Child* (Princeton, Princeton University Press, 1963), p. 238.

¹⁸ J. C. Neusse, "Recent Catholic fertility in rural Wisconsin", *Rural Sociology*, No. 28 (1963), p. 391.

¹⁹ C. V. Kiser, "Residence and migration", C. F. Westoff, R. G. Potter and P. Sagi, op. cit., p. 181.

19. Farm occupations are still characterized by relatively high fertility in the United States but these affect such a low proportion of the population that they are not of much significance. Likewise, the unskilled labourers (except farm and mine) are characterized by high fertility but they constitute a low proportion of the population. In general, white-collar workers have lower fertility than the manual workers. Within the white-collar group the classes characterized by lowest fertility tend to be the clerical and sales workers rather than the more affluent professional and proprietary classes. Within the class of manual workers, unskilled labourers are characterized by highest fertility. There was not much difference between the skilled and semi-skilled workers with respect to fertility in 1960.

20. The differentials in fertility rates by education within the United States were still strong in 1960 although they lessened somewhat over the previous decade. Although the relative increase in fertility of the ever-married college graduates tended to be larger than that of women of lower educational attainment, the college graduates still had lowest fertility rates at all ages. The ever-married white women whose education was limited to elementary school were of conspicuously high fertility. The college 1-3, high school 4, and high school 1-3 groups fell into expected position except for the similarity of the rates for college 1-3 and high school 4 groups at ages 30-49.

21. By age, the marked contraction in fertility differentials by occupation and by education during the 1940-1950 decade was restricted largely to women under 35 years of age. There was some enhancement of the fertility differentials for women 40 to 44 and 45 to 49 years of age. During 1950-1960 the most marked contraction of the fertility differentials by occupation and education was observed for women 40 to 49 years old. Among the youngest women the differentials in fertility by education of the wife appeared to be reasserting themselves or at least holding their own.

22. Thus in 1950 the number of children ever born per 1,000 ever married urban white women was 371 for those who completed four or more years of college and 1,277 for those of elementary school status or no education. In 1960 the comparable rates were 509 and 1,877 respectively.²⁰

23. As with occupation group of the husband the differentials in fertility by educational attainment of the wife were much wider in 1960 among the nonwhites than among the whites. The fertility rate of nonwhite college graduates tended to be lower than that of white college graduates. The fertility rate of nonwhites with less than eight years of school tended to be higher than that of whites with this limited amount of education.

24. Fertility rates computed for cohorts of ever-married white women on the basis of 1940, 1950 and 1960 United States census data, indicated little change in the absolute range of fertility differentials by education as the women passed through the childbearing ages. For instance, the actual spread of the rates by education at ages 20 to 24 in 1940 was approximately the same as that at ages 30 to 34 in 1950 and 40-44 in 1960. On a relative basis, however, the same data indicated a sharp narrowing of the differentials as the women passed from ages 20-24 to 30-34, but relatively little change as they passed from ages 30-34 to 40-44.

25. As for the broad significance of the closing of differentials, one possibility is that the classes are becoming more similar themselves. "The trends suggest that as family planning becomes more common, class differences in fertility may become less pronounced. However, under conditions of fairly universal planning of fertility greater sensitivity of births to business conditions might occur and hence more short-time fluctuations in fertility levels".²¹

26. Basing his case largely upon data for Canada, England, and the United States Wrong has stated "middle-class standards of living have been brought within the reach of the least privileged strata and made popular by the new mass media. Accordingly, it is not surprising to find that class fertility-differences have diminished in the past thirty years . . ."²²

²⁰ W. H. Grabill, C. V. Kiser and P. K. Whelpton, *The fertility of American women* (New York, John Wiley and Sons, 1958), pp. 133 and 205; United States Census of Population 1960, *Women by number of children ever born*, tables 25 and 31 (Washington, D.C., U.S. Government Printing Office, 1964).

²¹ C. V. Kiser, "Birth control", *Encyclopaedia Britannica* (Chicago, Encyclopaedia Britannica Inc., 1964), p. 707.

²² D. H. Wrong, "Trends in class fertility in Western Nations", *The Canadian Journal of Economics and Political Science*, Vol. 29 (1958), p. 229.

Reducing abortion rate and increasing fertility by social policy in the German Democratic Republic

K. H. MEHLAN

I. INTRODUCTION

1. Interest in human fertility has increased greatly in the post-war period among demographers, medical and social scientists, administrators, political leaders, and the informed public in many countries. The background of this increasing interest is an inter-related complex of changes in society itself and in knowledge about population and society. With the development of human society families are more anxious to determine the number of their offspring in advance, i.e., to plan the size of their families at the time of the conclusion of marriage. When examining female fertility we must increasingly consider family planning including abortions as an indirect and direct factor.

II. LIVE BIRTH RATE

2. If one considers the crude live birth rate one receives only a rough insight into repro-

ductive behaviour. In the area of the German Democratic Republic, the live birth rate reached its lowest level with 10.4 in 1946 at the end of the disastrous Second World War. In 1951 the rate was 16.9. After a small reduction to 15.6 there was a continuous increase to 17.9 in 1963. The dependence of the number of births on the structure of age, the change in the age distribution of the fertile population and on the socio-political measures will be examined. If one considers the number of fertile women (15-45 years of age) one observes a decline of about 1 million in the period 1948-1962, i.e., 25 per cent (1948 = 4.36 million, 1962 = 3.36 million). This decrease results from the reduction of women, within the age groups under 20 and over 35 years of age. The increase of the live birth rate is based on a real growth of fertility, which increased from 55.7 in 1947 to 89.9 in 1963, i.e., 62 per cent. From 100 pregnancies 66 were continued to maturity in 1948 compared to about 75-80 in 1962.

Table 1. Age-specific fertility rate

Year-average	Number of births per 1,000 women in the corresponding age						
	15-20	20-25	25-30	30-35	35-40	40-45	15-45
1947-1950	37.4	124.1	111.6	64.3	33.1	8.9	66.6
1951-1954	51.7	170.0	134.2	83.5	38.6	10.7	77.7
1955-1958	57.5	165.1	119.0	70.8	35.5	7.8	76.0
1959-1962	75.6	176.4	130.0	69.1	31.7	8.6	87.4

On the basis of table 1 we may speak of increasing fertility over the last sixteen years. Nearly all age groups play a similar part in the increase of fertility within the period 1951-1954. The growth of fertility in the age group 30-45 years of age is caused by an increase in the number of marriages in this group as a consequence of war. The recent growth of fertility since 1958 is based on an increase of births in the age group 15-under 20 of age. An important cause of this fact is a steady increase of early marriages in the group 18-21 years of age. In the last ten years there was an absolute

and relative increase of live birth with higher birth rank (table 2). The number of large families has increased. Considering simultaneously table 1 and table 2 it may be concluded that the earlier the first birth the shorter the birth intervals and the higher the expected number of children per family. This conclusion has already been pointed out by Koller, Mehlan and Falkenthal. In contrast to earlier decades these high numbers of children were already born to women before their thirtieth year of age. A shift to earlier child-bearing and a quicker course of reproduction is to be noted.

Table 2. Live birth order—live birth rank

Year	Total	1st	2nd	3rd	4th	5th	6th	7th	8th	9th child	10th and more
1952.....	100	43.0	29.3	14.3	6.5	3.3	1.6	0.8	0.5	0.3	0.4
1962.....	100	41.0	27.8	14.7	7.6	3.9	2.2	1.3	0.7	0.4	0.4

3. *Legal abortion.* Concern for the life and health of women and a recognition of their equal legal status led to the introduction of a temporary enlargement of the indication for interruption of pregnancy in the German Democratic Republic in 1947. Besides health reasons, social reasons were also taken into consideration in the question of interruption. Criminal abortion was to be replaced by legal abortion in order to protect women from death and grave damage to health. In 1946 more than 500 women died as a consequence of illegal abortion; in 1947 more than 400. Illegal abortion was followed by grave complications, chronic diseases or sterility in nearly 30,000 to 40,000 cases. The number of legal abortions reached its highest level in 1950 with 26,400 operations. Per 10,000 inhabitants there were 15.6 legal abortions. The desired reduction of illegal abortions was, however, not achieved, for at the same time (as the increase in legal abortions) there was also an increase in illegal abortions.

4. The number of deaths, however, was reduced by two thirds. After overcoming the social emergency and as a result of the improvement of the standard of living the indication for legal abortion was changed at the end of 1950. The law for the protection of mother and child and the rights of the woman guaranteed generous financial support at the birth of each child (per birth up to 1,000 MDN) and supported large families in different ways. Discrimination against the unmarried mother and her children was abolished; interruption was only allowed on strict medical and eugenic indications. In the following years there was a sharp reduction of legal abortions. Since 1959 there have been only 700 to 800 interruptions per year or 0.5 per 10,000 inhabitants. The German Democratic Republic is one of the European countries with the lowest rate of legal abortions. Physicians show a very conservative attitude towards legal abortion.

III. EXTENT AND COURSE OF ABORTION

5. The present study enables us to make statements concerning the course of abortion and give a rough estimate of its extent. A continuous reduction of abortions can be assumed as certain.

6. The number of fertile women declined by 25 per cent in the period covered by this report, while the absolute number of births has been constant during the whole period. Measures of health and social policy succeeded in augmenting the number of births by reducing the number of abortions even though there was a steady decline in the number of fertile women. In order to estimate the reproductive behaviour of the population, the Institute for Hygiene in Rostock carries out representative inquiries at regular intervals. The inquiry in the period 1946 to 1954 included 287 or 50 per cent of all hospitals. The selection was based on a sample and it is representative of the whole German Democratic Republic. Based on the proportion of hospital births to hospital abortions the total number of hospital abortions was calculated; 7,000 women were intensively interviewed by their family doctors in order to register the number of abortions outside the hospital. The choice of physicians and patients was also based on a sample (Dtsch. Ges. wesen 1955, Nr. 51). In the period 1955 to 1959 and 1960 to 1963, 80 per cent of all hospitals were included in the inquiry. Based on interviews with 287 gynaecologists about the extent of outpatient and secret abortions, a minimum estimate (a) 50 per cent and a maximum estimate (b) 100 per cent of hospital abortions was reached (table 3).

7. *Period 1946-1954:* the absolute number of hospital abortions doubled up to 1950 and reached an extent of 82,000. The change of the abortion law in 1951 caused a slow reduction. Apart from legal abortions, there was a continuous increase of hospital abortions from 30,000 in 1946 to 61,000 in 1954. This increase was caused by an augmentation of births and reduction of outpatient and secret abortions. Simultaneous with the increase of hospital births there was a steady improvement of the proportion of abortions to births. In 1947 there was one abortion per one birth in hospital, in 1954 the number of births was three. In contrast to hospital abortion the number of outpatient and secret abortions was reduced by admission to hospital, increase of legal abortions and change of age structure.

8. *Period 1955-1962:* the number of hospital abortions is decreasing slowly but continuously.

Table 3. Births and abortions inside and outside hospitals, German Democratic Republic, 1946-1962

Year	Births, including stillbirths		Hospital abortions		Number of births per one abortion	Abortions outside hospitals (estimated)		Number of births per one abortion total	
	Total (in thousands)	Hospital (in thousands)	Total (in thousands)	Legal (in thousands)		(in thousands)			
1946	194	52	46	16.0	1.1	54		1.9	
1947	254	68	47	12.5	1.4	54		2.5	
1948	249	69	58	17.5	1.2	60		2.1	
1949	281	88	74	26.3	1.2	70		1.9	
1950	311	118	82	26.4	1.4	63		2.1	
1951	318	141	64	5.0	2.2	52		2.7	
1952	313	151	62	3.6	2.4	46		2.9	
1953	305	173	64	2.4	2.7	43		2.8	
1954	299	195	63	1.7	3.1	36		3.0	
1955	299	212	50.3	1.24	4.2	^a 25	^b 50	^a 3.9	^b 2.9
1956	286	215	46.9	0.99	4.6	23	47	4.0	3.0
1957	278	219	44.2	0.93	4.9	22	44	4.1	3.1
1958	276	229	44.2	0.23	5.2	22	44	4.1	3.1
1959	297	257	44.3	0.77	5.8	22	44	4.4	3.2
1960	298	266	39.0	0.77	6.7	19	39	5.1	3.8
1961	306	280	40.5	0.83	7.0	20	40	5.0	3.8
1962	302	282	40.6	0.74	7.1	20	41	5.0	3.7

^a Minimum estimate. ^b Maximum estimate.

In 1962 only 40,000 hospital abortions were registered. As a result of this decline and the increase of births the proportion of abortions to births, is continuously improving. In 1962 there was 1 hospital abortion per 7 hospital births. In 1962 there were 302,000 births per *circa* 60,000 to 80,000 abortions, i.e., 4-5 births per one abortion. From 100 pregnancies 75 to 80 were terminated by birth. The number of pregnancies per 100 women in fertile age was calculated to be 110. Table 4 and figure I show the distribution of women undergoing abortion according to their age. It is a left inclined distribution. The most frequent ages are 22 and 23 years of age. The central value is 27 years

of age. A comparison of the age distribution of aborting value is 27 years of age. A comparison of the age distribution of aborting women with the age distribution of child-bearing women within the period 1960-1962 makes evident a steady deterioration of the proportion with increasing age.

9. Comparing the three periods a clear displacement of the distribution within the age groups can be seen, i.e., a considerable increase in the younger groups up to 25 years of age and a decline in the group over 35 years of age. This displacement can not be explained only by the increase of fertility in the younger age groups. Approximately one fifth of all abortions occur within the group under 21 years of age: 1960 = 18.6 per cent, 1961 = 19.0 per cent, 1962 = 18.5 per cent.

10. Figure II shows the development of the proportion of abortions to births in relation

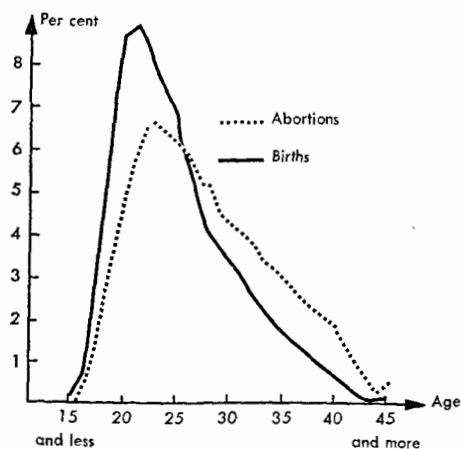


Figure I

Births and abortions by age of woman, 1960 to 1963

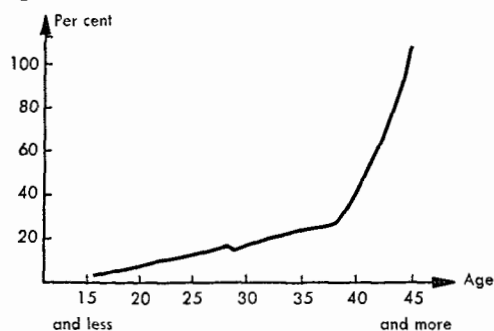


Figure II

Number of hospital abortions per 100 births according to age groups, 1960 to 1962

to the age of the woman. The number of hospital abortions per 100 births rose continuously from 6 to 27 up to the thirty-eighth year of age and then soared to four times that number. This rise is caused by the number of spon-

taneous and habitual abortions arising from physiological insufficiency of the genital organs. As will be shown it is not caused by an increase of secret abortions among older women with large numbers of children.

Table 4. Distribution of abortions according to the age of the woman

Age groups	Period: 1960-1963 total	1960-1963 per cent	1955-1959 per cent	1948-1950 per cent
15-20	3,297	7.5	6.4	4.7
20-25	13,254	30.2	26.7	17.0
25-30	11,703	26.7	26.4	26.1
30-35	8,126	18.5	20.0	19.0
35-40	5,199	11.9	14.1	23.2
40-45	2,137	4.8	4.3	—
45 and older	214	0.5	1.1	9.9
		100.0	100.0	100.0
Sample	43,930		25,388	36,200

11. There is a marked increase in the proportion of women without a previous birth or with only one child within these three periods. While in 1948 to 1950 only one third of all abortions fell in these two groups it was already 53 per cent in the period 1960-1963. In the earlier periods there was a steady increase of abortions up to the third pregnancy (two children); in the period 1960-1963 women without any child form the highest proportion. Abortion is shifting to younger and childless women and to those with a small number of children. This statement is confirmed by figure III. In this case the number of hospital abortions was related to 100 live births of the same group. The proportion of abortions increases up to the third child but then declines contrary to expectations (table 5). Women with a large number of children do not make up a larger part of those involved in abortions than women with 0-3 children. This statement corresponds with the increase of births of higher order (table 2); among other things it is a consequence of positive measures of social policy.

12. Detailed information concerning the personal status of the woman was available for 40,418 abortions. The proportion of unmarried women was in 1960 11.6 per cent, 1961, 11.2

per cent and 1963, 21.4 per cent. In 1962 the portion of this group in the whole number of births was 10.1 per cent. For women who terminated their first pregnancy by abortion the portion of married to unmarried was 1:1; whereas it was 9:1 in the case of births. The portion of illegal cases in the number of abortions is very high, especially in the abortion of first pregnancy.

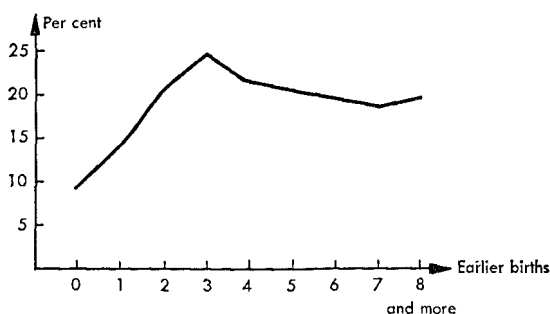


Figure III

Number of hospital abortions per 100 live births according to the number of earlier births, 1960 to 1962

Table 5. Registered abortions in relation to the number of births

Number of birth	Abortions in the period			
	1960-1963		1955-1959	1948-1950
	Total	Per cent	Per cent	Per cent
0	10,598	26.9	21.1	13.2
1	10,173	25.8	23.3	20.3
2	8,498	21.5	24.1	25.4
3	5,027	12.7	12.9	17.6
4	2,538	6.4	8.4	10.3
5	1,291	3.3	5.6	5.7
6	664	1.7	2.6	3.3
7 and more	683	1.7	2.0	4.2
		100.0	100.0	100.0
Sample	39,472		25,388	34,705

As far as the abortion situation is concerned there is also a significant difference between large and small towns. There were seven births in large towns and six births in small towns per one hospital abortion.

13. *Distribution of abortions by month of pregnancy.* For 100 abortions, 20 were terminated at the end of the second month, 48 at

the end of the third month, 19 at the end of the fourth month, 9 at the end of the fifth month, 4 at the end of the sixth month. An increase of late abortions during the fifth to the seventh months could not be observed in the period 1955-1963. The number of premature births (birth weight up to 2,500 grammes) also did not increase.

Some aspects of fertility in urban Greece

CONSTANTINA SAFILIOS-ROTHSCHILD

1. The overall crude birth rate in Greece has been gradually declining from 30.5 in 1928 to 18.0 in 1962 with the exception of a postwar "baby-boom" from 1945 till 1948. These four years of relatively high fertility (birth rate of 25.1-28.2) were not entirely peaceful years since a civil war (Communist uprising) was still being fought in rural Greece. The birth rate fell sharply in 1949, the first peaceful year, when American aid was put to work for the reconstruction of the country. This sharp decline in the birth rate coincides with an increase in the crude marriage rate. It seems that since 1950 the stabilization of the drachma, relative political stability, increasing industrialization, and a rising standard of living have contributed to unprecedented high marriage rates but to declining birth rates.

2. The declining birth rate has been explained by W. H. McNeil on the basis of: (a) the postponement of marriages, especially "the growing proportion of women who do not marry until after the age of thirty"; and (b) the increase in the percentage of single persons since 1907.¹ The first explanation although substantiated in part by a slight increase in the median age at marriage from 28.0 in 1926 to 28.6 in 1962 for males and from 23.1 to 24.2 for females, it is doubtful that the slightly observed increase in the proportion of women marrying after thirty could account for the decided decline of birth rates. McNeil's second explanation is not supported by recent statistics. The percentage of single people was increasing in Greece till 1951, but from then on the high marriage rates have reversed the trend and by 1961 there were fewer single males and females than ever before.

3. Greek social scientists deny the plausibility of McNeil's explanations; N. Polyzos, for example, attributes the declining fertility of the Greek population to "conscious and planned birth control". He explains the desire for birth control on the basis of: (a) the changing rôle of Greek women who may at present play alternative roles to that of a mother by actively

participating in various occupations and community activities; (b) the increasing opportunities for upward social mobility which may be made easier without the burden of many children; (c) the changing rôle of children from economic assets to economic liabilities for their parents; (d) the relaxation of religious beliefs, that encouraged large families as God's blessing.²

4. Polyzos's thesis about planned birth control being the explanation for declining birth rates is supported by the findings of a survey conducted in 1963 by the Athens Institute for Research in Communication on 400 randomly selected households. To the question: "Should married couples, in your opinion, practice birth control so that they have only as many children as they desire or should they leave it up to chance?", 86 per cent of the respondents agreed that couples should practice birth control, 8 per cent did not think couples should practice birth control, and 5 per cent answered in effect, that it depends upon the financial situation of the couple. The age of the respondents was an important variable; 92 per cent of those under 44 years accepted birth control while only 76 per cent of those over 44 years. The respondents' education and income, however, were not related to their attitude toward the use of contraceptives.

5. Similar findings resulted when the statement: "A married woman should have children only when she and her husband have decided to have children and not by chance" was put forth to 250 randomly selected Athenian couples in my study of the Greek urban family in 1964. In their answer, 85.7 per cent of the 133 interviewed wives and 81.2 per cent of the 117 interviewed husbands agreed with the statement. The few husbands and wives that disagreed with the family planning statement justified their position on the basis of religious beliefs and "natural" laws. It is not quite clear,

² N. J. Polyzos, "Elenhos Ton Yennisseon" (Birth control), in the *A'Etissia Ekthossis Tou Kentrou Koinonikon Spouthon tis A.B.*, (first yearly edition of publications of the Centre for Social Studies) (Athens, The Graduate School of Industrial Studies, 1957-1958), pp. 110-112.

¹ W. Hardy McNeil, *Greece: American Aid in Action, 1947-1956* (New York, The Twentieth Century Fund, 1957), pp. 210-211.

however, whether these opposing opinions refer to the use of contraceptives or rather to the practice of abortion. Age was found to be an important variable since men and women opposing family planning were much older than the median age of all respondents.

6. When these same 250 respondents were asked which spouse exerts more influence and has the final say in the number of children to have, more than half of the men and women

answered that the decision was a joint one (table 1). Decision-making in this area was perceived as wife-dominated more often by women than by men and as equalitarian slightly more often by men than by women. Possibly, even when the wife does exert more influence in this decision, the husband under the influence of traditional mores concerning masculine authority is unable to accept the fact of his minimal influence and therefore, can at best admit to an equally exercised power.

Table 1. Decision-making on the number of children in the Athenian family

Respondents' sex	Final decision made by						It is up to chance		Other ^a		Total	
	Husband		Wife		Both		Num-ber	Percen-tage	Num-ber	Percen-tage	Num-ber	Percen-tage
	Num-ber	Percen-tage	Num-ber	Percen-tage	Num-ber	Percen-tage						
Men	21	18.4	9	7.9	69	60.5	9	7.9	6	5.3	114	100
Women . . .	27	20.3	21	15.8	72	54.1	3	2.3	10	7.5	133	100
TOTAL . . .	48	19.4	30	12.1	141	57.1	12	4.9	16	6.5	247 ^b	100

^a The "other" category includes those who have no children (involuntary unfecundity) and those who did not answer because their children were already grown up and they did not consider the question relevant.

^b The overall total is, in this instance, 247 because there is no information in this area for three male respondents.

7. The wife's employment does not contribute toward more equalitarian decision-making. On the contrary, an inverse relationship seems to exist between the wife's employment and the amount of influence she is perceived to exert upon this area of decision-making. In husband-dominated couples 25 per cent of the wives work; in wife-dominated couples 16.7 per cent of the wives work and only 12.8 per cent of the wives work in equalitarian couples. Furthermore, it is a rather surprising finding that as many as 42.9 per cent of the wives of male respondents, who report husband-dominated decision-making, were working.

8. There are at least two plausible explanations, not necessarily mutually exclusive, that may explain the above findings concerning the influence of wife's employment on the family power-structure. Each explanation seems to be applicable to couples in different social classes. The first explanation could be that in low-income families, in the working and lower-middle classes, husbands are quite influential if not instrumental in their wife's decision to work. When additional income is needed to buy furniture, to buy or remodel a house, or for the general well-being of the family, the husband may persuade his wife to work in order to help meet the expenses. The

income from the skilled or semi-skilled work of these wives is low and it can practically never be higher than the husband's income mainly because of an often existing inequality in pay for men and women holding the same jobs. In these cases, her decision to work does not represent an assertion of independence on her part but is rather another largely husband-dominated decision. Within this context it is not surprising that the husband also has the final say about the number of children to have even when his wife is a working woman.

9. The second explanation applies to husband-dominated middle-class couples in which the wife works (only a few such cases represented in our data). In these couples the husbands may mildly or strongly disapprove of their wife's working—as the present data seem to indicate—because they find it unnecessary in view of their own personal income that could adequately provide for their family. They may feel worried lest their wife's employment be misinterpreted by others as inability on their part to be successful providers; or they may feel threatened about the potential influence of the wife's economic independence through her professional or semi-professional work upon the power-structure in the household. In these cases, the wives—who are above average in education—may consciously or unconsciously

operating leave many decisions up to their husbands in order to compensate for the threatening decision to work that they have often taken against his will or approval. Through this compensatory mechanism working wives indicate that despite financial independence they respect their husbands' judgement and do not intend to threaten their authority position in the household.

10. In the fall of 1964 in cooperation with the Athens Research Institute for Communication, several questions about actual or intended fertility behaviour were asked from 400 randomly selected Athenian households. The findings indicate that married respondents had on the average 1.9 children. Unmarried respondents intended to have an average of 2.2 children.

Respondents with at least a high school education and a monthly income of \$100 tended to have less children than respondents of lower educational and financial accomplishment. The small size of the sample does not permit further breakdowns and refinements.

11. A cross-tabulation of the desired number of children with the respondents' actual number of children suggests that a social norm may exist with respect to the socially "acceptable" number of children for urban Greeks. One, 2 or 3 children seem to be socially acceptable and desirable, while fewer or more children are not. Table 2 clearly indicates all married couples wish to conform to the 1-3 children ideal social norm, by desiring fewer or more children than they actually have depending upon the direction of their deviation.

Table 2. Number of additional children desired by Athenian married respondents, according to their actual number of children

<i>Desired number of additional children</i>	<i>Actual number of children</i>							
	<i>One</i>	<i>Two</i>	<i>Three</i>	<i>Four</i>	<i>Five</i>	<i>Six</i>	<i>Ten</i>	<i>None</i>
One more	42	25	6	—	1	—	—	7
Two more	13	13	1	1	—	—	—	16
Three more	5	2	1	—	—	—	—	3
Four more	—	1	—	—	—	—	—	1
Five more	—	—	—	—	—	—	—	1
More than five	1	4	2	1	1	—	—	2
Satisfied with actual number	8	52	29	5	5	1	1	—
Less than actual	—	—	5	1	2	—	—	—
None	1	2	2	—	—	—	—	5
Do not know	1	2	1	1	—	—	—	—
TOTAL	71	101	47	9	9	1	1	35

12. If one to three children is a social norm, as it would be expected, childless couples are not satisfied with their state of childlessness and they predominantly wish they had 1-3 children, preferably 2. The fact that some kind of normative pressure seems to operate against childlessness is also substantiated by the results obtained by asking: "Do you think that happiness is possible in married life when there are no children?" from the same 400 married and unmarried respondents. About 75 per cent of the interviewees thought that marital happiness was impossible in the absence of children. Women, older people, (over 35) better educated and high income people tended more often to find the presence of children non-essential for marital happiness than men, younger people and people with low educational and financial accomplishments.

13. Couples who deviate at the other extreme of the 1-3 children norm tend to either "accept"

the great number of children they bore or to wish they had fewer. Some respondents commented that it was all right to leave childbirth up to chance till the first two or three children but after that number the practice of birth control is mandatory. These comments may be suggestive that urban Greeks feel that all people should keep the number of children within the desirable one-to-three range.

14. The present norm of one-to-three desirable children may be a societal adjustment to occupational and economic conditions prevailing in urban Greece that keep salaries low and often make it necessary for wives to work in low-income families in order to raise the standard of living, and that creates the necessity for choosing between children and other durable goods. If economic necessity is the main force that keeps the birth rate low it is possible that with: (a) the recent and future adjustments in salaries that may render the wife's employment

unnecessary supplement or means to social mobility; (b) free high school and college education recently established; and (c) spreading credit and installments buying that may minimize the competition between children and other major expenses, the one-to-three children social norm presently operating may be upwardly adjusted. This may not happen if socio-psychological forces rather than economic ones motivate urban Greeks to have few children

and those forces continue to operate throughout a greater economic prosperity. The presence of socio-psychological motivations at play is suggested by the fact that other developing countries with similar socio-economic conditions with Greece have much higher birth rates. A further intensive study of the basic factors operating for the low Greek birth-rate may yield valuable information for family planning programmes in high-fertility developing countries.

Dynamics of the birth rate in the Union of Soviet Socialist Republics and factors contributing to it

B. T. URLANIS

[Translated from Russian]

I. DYNAMICS OF THE BIRTH RATE

1. During the nineteenth century the birth rate in Russia was extremely high. In the last decades of the century, when a decline had already begun in the West, the birth rate remained stable in Russia, fluctuating around a figure of 50 per mil. Not until the beginning of the twentieth century did the rate begin to fall in Russia; but it continued to be very high, the figure for 1913 being 46 per mil.

2. The reason for the high birth rate in pre-Revolutionary Russia was the very low age at marriage of the overwhelming majority of women. In 1910, for example, 55 per cent of all brides were under twenty years old. For the fifty provinces of European Russia the correlation between the percentage of brides under twenty years of age and the birth rate was high (0.7 per cent).

3. Among the peasantry, which then made up the greater part of the population, girls married early, and were married for an appreciable proportion of their child-bearing period.

4. The wars fought by Tsarist Russia before the First World War caused some temporary interruptions of conjugal relations, but their effect on the birth rate was very small, in view of the relatively small number of men called up. The First World War was a very different matter. Out of a total of 40 million men between fifteen and forty-nine years of age 16 million were called up, i.e., 40 per cent of the total male population under fifty years of age. The result was a marked decline in the birth rate. As against a birth rate of 45.5 per mil in 1913 (present frontiers), the rate, calculated approximately, had fallen to 39.7 per mil by 1915, and the figures for 1916 and 1917 were 29.9 per mil and 23.9 per mil respectively, showing a decline of almost half in the three war years.

5. After the Great October Socialist Revolution the birth rate rose slightly, climbing to over 30 per mil despite the severe economic conditions caused by the still recent imperialist

war and by foreign intervention in the Civil War. During the period of reconstruction, the birth rate gradually rose, and by 1927 it had reached 44.8 per mil, almost overtaking the 1913 figure.

6. The 1927 figure represented a peak following which the birth rate began to decline slowly but steadily. This was the direct result of the beginning of industrialization and the growth of the urban population.

7. Another direct cause of the marked decline in the birth rate was the very widespread practice of abortion.

8. Abortion has been authorized in 1920. The purpose was to protect women's health, for as a result of the then still surviving moral influences of the past and the severe economic conditions, numbers of women were compelled to abort themselves at home. These women frequently fell ill, and deaths among them were not uncommon: up to 50 per cent contracted infections, and of these as many as 4 per cent died.

9. By 1936, thanks to the rising standard of living and political and cultural level of the working people and the development of a broad network of medical establishments, it became possible to review the question of abortion. The decision was taken to prohibit abortion except under medical advice. At the same time, provision was made for increased State material assistance to mothers, special aid to mothers of large families and the expansion of the system of children's institutions—day nurseries and kindergartens—where working mothers could leave their children.

10. The number of births in 1937 was considerably greater than in 1935. In 1938 and 1939 the birth rate was again high (37.5 and 36.5 per mil); but in 1940 it fell to 31.2 per mil. The recent outbreak of the Second World War was already being reflected in a declining birth rate.

11. The invasion of the USSR by German fascism in 1941 was followed by the mobil-

ization of the majority of young men, with the interruption of a very large number of marriages. The war years saw an extremely sharp drop in the birth rate, but by 1944 the rate had begun to climb gradually. However, the pre-war level was not fully restored; it may be noted, moreover, that there was no massive reversal of the demographic situation, since the post-war demobilization was carried out gradually and over a fairly long period.

12. After the war the birth rate reached its peak in 1951, when the figure recorded was 27.0 per mil. After that, the rate remained relatively stable throughout the fifties, at a figure of 25-26 per mil, and began to decline somewhat in the early sixties, the figure for 1963 being 21.2 per mil. This decline is due largely to the effects of the war, the drop in the number of births in 1940-44 being reflected in a fall in the number of marriages in 1961-1963.

13. It should be noted that the birth rate in the fifties was 20 per cent lower than the pre-war figure, which in turn was 17 per cent lower than the figure for 1938. This decline in the birth rate was caused by a number of factors.

14. The present birth rate is about half the pre-Revolutionary figure; but as the death rate was reduced by a factor of four over the same period the fall in the rate of natural increase of the population in the fifties has been insignificant.

15. It is an interesting fact that the birth rate varies very considerably over the Soviet Union as a whole. In some Union Republics, such as the Azerbaijan and Turkmen Republics, the rate for 1962 was over 40 per mil, while in the Baltic Republics (Latvia, Estonia) it was 16 per mil, or 2.5 times smaller. While the rate is declining in a number of Republics, it is rising in others. The reason is that with the removal of the national oppression suffered by the peoples in Tsarist Russia, distinctive national characteristics began to assert themselves very clearly after the Revolution.

16. A more accurate picture of the birth rate may be obtained, of course, from the variation in the fertility rate. The over-all fertility rate for 1960-1961 may be calculated on the basis of the age-specific rates.

<i>Age group</i>	<i>Fertility rate</i>	<i>Mean fertility rate for each five-year age group, multiplied by 5</i>
15-19.....	0.0352	0.1760
20-24.....	0.1648	0.8240
25-29.....	0.1607	0.8035
30-34.....	0.1100	0.5500
35-39.....	0.0607	0.3035
40-44.....	0.0235	0.1175
45-49.....	0.0048	0.0240
TOTAL		2.7985

17. Thus, the over-all fertility rate for 1960-1961 was 2.8 children per female. As the proportion of female to total births is 48.5 per cent, the gross reproduction rate in the Soviet Union in 1960-1961 was $2.80 \times 0.485 = 1.36$.

18. The net reproduction rate is calculated in the table below.

<i>Age group</i>	<i>Number of births per 1,000 women over the indicated 5-year period</i>	<i>Number of female births over the indicated 5-year period</i>	<i>Aging factor</i>	<i>Number of female births after application of aging factor</i>
15-19.....	176.0	85.4	0.939	80.2
20-24.....	824.0	399.6	0.933	372.8
25-29.....	803.5	389.7	0.927	361.3
30-34.....	550.0	266.8	0.920	245.5
35-39.....	303.5	147.2	0.911	134.1
40-44.....	117.5	57.0	0.899	51.2
45-49.....	24.0	11.6	0.885	10.3
TOTAL				1,255.4

19. Thus the net reproduction rate in the Soviet Union in 1960-1961 was 1.26, so that if the 1960-1961 level of fertility is maintained each succeeding generation will be 26 per cent more numerous. This is much lower than the past reproduction rate in the Soviet Union but it is still higher than the rate in most countries of western Europe.

20. A further point of interest is the marital fertility rate. This can only be determined approximately.

Approximate marital fertility rates in the Soviet Union, 1958-1959

<i>Age group</i>	<i>Fertility rate (per 1,000 women)</i>	<i>Proportion of women married</i>	<i>Marital fertility rate</i>
15-19.....	29.2	10.0 ^a	292.0
20-24.....	162.2	50.1	323.8
25-29.....	164.8	75.9	217.1
30-34.....	110.1	77.6	141.9
35-39.....	66.6	72.5	91.9
40-44.....	24.1	62.3	38.7
45-49.....	5.0	54.9	9.1

^a The percentage of married women in age group 18-19 was 17.1, and the percentage in age group 16-17 was 2.9, which gives a simple arithmetic mean of 10.0 per cent. This figure was used as the basis for our calculation for age group 15-19, the reduction in the percentage due to the figure for 15 year olds being balanced by the increase due to the higher figure for 18-19 years old.

21. This calculation of marital fertility rates shows that one out of every three young married women in age group 20-24 and one out of every five in age group 25-29 gives birth in any one year.

22. Comparison with the pre-war rate of marital fertility shows that substantial changes have taken place.

Change in the rate of marital fertility

<i>Age group</i>	<i>1938-1939</i>	<i>1958-1959</i>	<i>1958-1959 as percentage of 1938-1939</i>
15-19.....	328.0 ^a	292.0	89.0
20-24.....	349.2	323.8	92.7
25-29.....	293.0	217.1	74.1
30-34.....	224.3	141.9	63.3
35-39.....	164.7	91.9	55.8
40-44.....	89.7	38.7	43.1
45-49.....	27.6	9.1	33.0

^a Here again the percentage of married women in the age group was assumed to be 10 (the percentage was 4 for age group 16-17 and 25 for age group 18-19. This gives a mean of 14.5 per cent; but in view of the rise in the birth rate in 1923 and, consequently, the number of 15-year old girls, there are grounds for assuming the general percentage for the group to be 10).

23. The older the married woman, the more marked is the decline in the marital fertility rate over the past twenty years: marital fertility in age group 35-39 has dropped by almost half and in age group 45-49 by as much as two thirds.

II. FACTORS CONTRIBUTING TO THE BIRTH RATE

24. In considering the determinants of a given birth rate we must make a clear distinction between the factors which contribute to it, on the one hand, and its causes, on the other.

25. By factors contributing to the birth rate we mean the pattern of conditions and circumstances having a specific influence on the number of births in a given country or part of it, or among a given ethnic group.

26. Among the social factors influencing the birth rate, the first which deserves note is the social position of women. The Great October Socialist Revolution brought the women of the Soviet Union emancipation from millennial oppression and complete *de jure* and *de facto* equality with men in all spheres of life and activity. The Soviet woman gained access to education and to literature, art, science and political activity; she became an active participant in the building of the new society. At the present time 79 per cent of all doctors,

70 per cent of all teachers and 38 per cent of all scientists in the USSR are women. The Soviet Union has 800 women professors, 700 women writers, 2,400 women architects, 2,300 women artists. Of the total number of women of working age in the Soviet Union only 17 per cent are housewives—as compared with a proportion of over one half in the United States of America. It goes without saying that this mass influx of women into the ranks of social labour has sharply affected the birth rate.

27. The influence of the social position of women in the Soviet Union on the birth rate may be judged from a comparison between the fertility of working women and that of dependent women (in 1958).

Fertility rate (per 1,000 women in each age group) in 1958

<i>Age group</i>	<i>Working women</i>	<i>Dependent women</i>
15-19.....	32.5	27.2
20-29.....	138.3	199.3
30-39.....	67.6	101.5
40-49.....	7.1	13.4

28. Only in the very youngest age group is the fertility rate lower for dependent women than for working women. In all other groups the fertility rate of dependent women is considerably higher than that of working women in the same age group. In age group 20-29 the rate for dependent women is 25 per cent higher than for working women, and in age group 30-39 almost 50 per cent higher.

29. These facts make it clear that the influx of women into social labour is a material factor in the decline of the birth rate.

30. Another powerful social factor is the degree of satisfaction of the people's material and cultural needs. In certain conditions efforts to improve the satisfaction of consumer needs tend to reduce the birth rate.

31. Married couples with few children are more comfortably placed than large families. For that reason, large families in the Soviet Union are granted substantial material assistance by the State, and this assistance is being increased with every year that passes. By about 1980 it is anticipated that 75-80 per cent of all expenditure for the maintenance and upbringing of children will be met from public funds.

32. A highly important factor affecting the birth rate is the number and availability of children's institutions. Significant also are the cultural level and health education of the parents, full employment and security—a most

important social and psychological factor—and other similar factors tending to raise the birth rate.

33. Another social factor which should not be overlooked is the influence of national characteristics. The specific national traditions, customs and way of life formed over a period of many successive generations strongly affect the birth rate in the country in question.

34. Particular stress must be laid on the growth of the urban population as a factor tending to reduce the birth rate. However, the process of urbanization cannot be regarded as a factor in the birth rate of the same nature as the social factors mentioned above. The migration of the rural population to the cities does not affect the birth rate independently but as a result of the fact that it brings with it an influx of women into industry and an improvement in cultural levels generally and levels of health and general education in particular. In other words, the conditions of urban life bring into operation the specific social factors mentioned above. Thus urbanization should be regarded as a general factor, as it were, which sets off a number of other specific factors.

35. The process of urbanization has undoubtedly had a powerful effect on the birth rate in the Soviet Union. The migration of the population from the villages to the towns has in most cases meant a transition to the small family system, and the rise in the ratio of the

urban to the total population has resulted in a fall in the birth rate for the Soviet Union as a whole.

36. The difference in the birth rate for urban as against rural residents may be seen from the following table:

Year	Birth rate		Percentage by which rural exceeds urban birth rate
	Urban population	Rural population	
1913.....	30.2	48.8	61.6
1928.....	30.2	47.5	57.3
1940.....	30.5	31.5	3.3
1950.....	26.0	27.1	4.2
1955.....	23.5	27.4	16.6
1958.....	22.5	27.9	24.0
1959.....	22.0	27.8	26.4
1960.....	22.0	27.8	26.4
1961.....	21.2	26.5	25.0
1962.....	20.0	24.9	24.5

37. Before and for as long as ten to twelve years after the Revolution the rural birth rate exceeded the urban birth rate by a factor of 1.6. Thereafter, during the years preceding and immediately following the war, the difference between the two rates disappeared almost completely, reappearing in the nineteen-fifties and early nineteen-sixties because of the much slower decline of the birth rate in rural than in urban areas. At present the birth rate in rural areas is 25 per cent higher than in urban areas. Thus the rising ratio of the urban to the total population continues to be a factor tending to reduce the birth rate.

38. A factor exerts a definite influence on the birth rate, but this influence is expressed in concrete terms through the operation of certain causes which, in the last analysis, determine the number of children born in the country. As has just been noted, the growth of the urban population usually tends to reduce the birth rate; but this effect is produced also through the spread of family planning methods. Thus the direct cause of the number of births is in this case the use of contraceptive devices or the artificial termination of pregnancies.

39. Family planning ideas are becoming increasingly widespread among the Soviet people. In the Soviet Union, every married couple is entirely at liberty to decide the size

of its family. The State exerts no pressure on husbands and wives; abortion is not prohibited in the Soviet Union and contraceptive devices are freely sold. However, the harmful effects of abortion on the female organism are brought to public attention through extensive educational propaganda.

40. Voluntary family planning is practised in the Soviet Union not only in urban but also in rural areas, and has spread to most regions of the country. In the Soviet Union, every child born is a wanted child, brought into the world in accordance with his parents' plans and desires.

41. A second cause which to some extent affects the birth rate is the age at marriage. The duration of the childbearing period is about thirty years, the probability of pregnancy diminishing with advancing years. Thus every increase in the age at marriage means a reduction in the number of children to which the woman can give birth—although, of course, the practice of family limitation deprives this factor of most of its significance.

42. The fact that Soviet girls try to complete their education before marriage, and have acquired economic independence, has resulted in a rise in the age at marriage in the Soviet Union.

Age	Percentage of women marrying, by age group	
	1910	1960
Under 20.....	54.5	26.3
21-25	31.0	40.7
26-30	7.3	11.6
31-40	4.7	10.9
41-50	1.9	4.2
Over 50.....	0.6	6.3
TOTAL	100.0	100.0

43. A half a century ago more than one out of every two girls married before her twentieth year, whereas now only one out of four girls marries so early. In 1910 the percentage of women marrying at over forty years of age was 2.5; today it is four times as great. That is of course to some extent due to the war, which prevented these women from marrying at the time. A half a century ago the average age at marriage was twenty-three; today it is twenty-seven. This difference of four years amounts to 15 per cent of the total childbearing

period, but its significance is still further increased in the light of the inverse correlation between age and fertility.

44. Another very important factor is the ratio of married women to the total female population. This figure depends to a considerable extent on the sex and age distribution of the population, itself the product of specific historical conditions. In the Soviet Union the ratio of married women to the total number of women of childbearing age has declined as a result of the war.

Age	Percentage of married women in total female population of childbearing age		Percentage decline
	1939	1959	
16-17.....	4.0	2.9	28
18-19.....	25.0	17.1	32
20-24.....	61.4	50.1	18
25-29.....	78.7	75.9	4
30-34.....	81.8	77.6	5
35-39.....	80.0	72.5	9
40-44.....	75.9	62.3	18
45-49.....	68.8	54.9	20

45. The percentage of married women has declined in all age groups. While the cause in the age groups up to thirty is the rise in the actual age at marriage, the decline in the case of the age groups over thirty is directly due to the 1941-1945 war.

46. The over-all number of births in the Soviet Union is the end product of all the above-mentioned causes.

47. The factors and causes determining a

given birth rate are shown in tabular form in the attached schema.

48. It may be assumed that as a result of the combined effect of all the factors influencing the birth rate, fertility will in the future settle down at a level which may be regarded as an *optimum* since it will represent the best possible compromise between women's needs for motherhood, on the one hand, and their desire to take part in national life and satisfy their cultural aspirations, on the other.

Schema of factors and causes contributing to the birth rate

Category of factors	Specific factors	Category of causes	Specific causes	Effects
Social and economic factors	Extent of participation of women in social labour	Age at marriage Voluntary family limitation	Change in duration of childbearing period	Number of births
	Degree of satisfaction of material and cultural needs		Artificial termination of pregnancy (abortion)	
	Number and availability of children's institutions		Artificial infertility (contraception, sterilization)	
	Degree of socialization of costs of rearing children		Interruption of normal sexual life	
	Full employment and security			
	Infant mortality rate			
	Cultural level of population			
	Standard of public health			

Schema of factors and causes contributing to the birth rate (*continued*)

<i>Category of factors</i>	<i>Specific factors</i>	<i>Category of causes</i>	<i>Specific causes</i>	<i>Effects</i>
Legal factor	Effects of family and marriage laws: conditions for divorce; maintenance liability Social insurance (pensions, etc.) Tax laws (taxes on childless couples, etc.) Laws relating to abortion, contraception, etc.	Marriage rate Voluntary family limitation		Number of births
Historical factor	Death of part of male population in war Reduced birth rate caused by war	Decline in number of marriages		
Ethnographic factor	National characteristics, customs, traditions, way of life	Age at marriage Voluntary family limitation		
Geographical factor	Climatic conditions	Interference with normal fertility	Duration of childbearing period	
Biological factor	Heredity		Infertility Stillbirths Miscarriages	

Female fertility and methods of studying it in the Union of Soviet Socialist Republics

A. M. VOSTRIKOVA

[Translated from Russian]

I. IMPORTANCE OF STUDYING THE BIRTH RATE AS A SOCIO-ECONOMIC PHENOMENON

1. The birth rate, as one of the most important socio-economic phenomena and a decisive factor in population growth, has long attracted the attention of society. History shows that attitudes towards population growth and towards the birth rate as its chief determinant have varied at different stages in the development of society.

2. The fact that the birth rate and attitudes towards it are determined by socio-economic conditions has been clearly apparent in the past. Thus, in the slave-owning States of ancient Greece and Rome, which were based on unproductive slave labour, every effort was made to restrict the birth rate and population growth. In the feudal states of the Middle Ages, whose rulers saw the source of their power in the number of inhabitants capable of bearing arms and paying tribute, procreation was encouraged. In the eighteenth century, the apologists of expanding capitalism preached sermons about "moral restraint" to the poor and tried to show that poverty and unemployment were the result of a high birth rate.

3. The twentieth century has seen exceptional progress in science and technology and in the growth of productive forces. As a result, it has become possible to achieve a much faster rate of increase in the provision of material and cultural goods and services for the entire population. The experience of all economically advanced countries, including the Soviet Union, shows that economic development is accompanied not only by a decline in the death rate and a rise in life expectancy but also by a decline in the birth rate.

4. A number of studies have been made with a view to determining the reasons for the decline in the birth rate in the advanced countries and suggesting means of countering the trend. These studies have shown that the decline in the birth rate is attributable to industrial development and the growth of the urban popu-

lation, wider use of female labour and later marriages, the decline in infant mortality, the rise in general living standards, particularly in matters of health and hygiene, and the resort to contraceptive devices and abortion. Some sociologists and demographers are concerned at the growth in population in the countries of Asia, Africa and Latin America, which in varying degrees, despite their low level of economic development, have a potential for economic and cultural progress. What factors influence the birth rate and how? Any study of these questions must rest on a solid foundation of accurate and reliable facts, which must be seen in their correct relationship to each other. Only in that way can meaningful results be obtained.

5. The purpose of this paper is to describe the methods used in studying the birth rate in the Soviet Union and to give a brief account of the results obtained, which reflect changes in the general indicators for the birth rate and fertility and their connexion with socio-economic conditions.

II. INFLUENCE OF SOCIO-ECONOMIC CONDITIONS ON THE BIRTH RATE IN THE SOVIET UNION

6. After the establishment of Soviet power in Russia in 1917, religious registration of births, deaths and marriages was replaced by civil registration, which provided a good basis for statistics of natural population movements, especially birth-rate statistics.

7. In the last decade of the nineteenth century, capitalism made vigorous strides in Russia. The development of industry in European Russia was particularly rapid, and the urban population increased accordingly. The religious registration records provide fairly reliable data on the movement of the population in European Russia from the late 1860's onward. In the first decade of the twentieth century, there was a clear downward trend in the birth rate. The rate of decline was, however, considerably lower than in the United

Kingdom, Germany, France and the United States, in which the process of industrial development had begun earlier. In 1908-1913, the birth rate in the United Kingdom was 12.9 per cent lower than in 1896-1905, in Germany 16.2 per cent lower, in France 11.6 per cent lower and in European Russia 8.6 per cent lower, while in the United States it was 22.6 per cent lower in 1915 than in 1900.

8. Between 1867 and 1904 the birth rate in the fifty provinces of European Russia fluctuated between 46 and 52 per thousand, while by 1913 it had fallen to 43 per thousand. The birth rate for the country as a whole was higher than for European Russia. In 1913 it was 47 per thousand, while by 1928 it had fallen to 44.3 per thousand—a drop of 6 per cent. At the same time, the new social conditions caused the death rate to fall sharply, by 23 per cent, and the death rate for children under the age of one by as much as a third.

9. After the reconstruction of the economy, which had been destroyed by the first imperialist war, the intervention and the blockade, and particularly after 1928, the country embarked on a process of industrialization which was accompanied by rapid growth of the urban population. The number of urban dwellers rose from 19 per cent of the total in 1929 to 33 per cent in 1939. In addition to a rise in the number of manual and non-manual workers, there was an increase in the number of women employed in social production.

10. The extension to women of equal rights to labour, payment for labour and education, the complete elimination of unemployment as early as 1930, the rise in women's cultural level and productive skills, drastic improvements in the working conditions of all workers, especially women, and the special concern shown by the State for mothers and children enable women to exercise more fully their right to work and education.

11. In pre-revolutionary Russia, 80 per cent of all women engaged in wage labour worked as domestic servants or as farm hands for landowners and kulaks, 13 per cent worked in industry and construction, and 4 per cent were employed in education and health. In 1929 the number of female manual and non-manual workers was 3.1 million, or 27 per cent of the total, while by 1940 their number had risen to 12 million, or 38 per cent of the total. In 1963 the number of female manual and non-manual workers in the Soviet Union was 34.3 million, or 49 per cent of the total. More than 6 million

women specialists with a higher and secondary specialized education were employed, or seven times as many as in 1940 and forty times as many as 1928.

12. The increase in material prosperity, the growth of culture and the development of health services, with skilled medical care provided free of charge to the entire population, brought about a sharp decline in the death rate (from 23.3 per thousand in 1928 to 17.3 per thousand in 1939). The drop in the birth rate was not as great. If 1928 = 100, the birth rate in 1939 was 82.4 and the death rate 74.2. Before the Second World War, the birth rate fluctuated between 36.5 and 38.7 per thousand.

13. The Second World War, which led to the loss of many millions of lives in the Soviet Union was a major factor in the decline in the birth rate and the change in the size and structure of the population. In 1944, wishing to protect the lives and health of children in war-time and bearing in mind the adverse effects of war on the birth rate, the Soviet Government enacted a law on increased State aid to pregnant women, unmarried mothers and mothers of large families and on increased maternal and child welfare. These measures helped to preserve the lives of the children born during the war and post-war years and to increase the birth rate to some extent.

14. After the war, the birth rate in the Soviet Union rose because of the compensation factor familiar to demographers, but it did not return to the pre-war level. The decline in the birth rate in recent years (from 25 per thousand in 1959 to 21.2 per thousand in 1963) is attributable mainly to the fact that there are fewer women reaching the age of child-bearing now because of the low birth rate during the war years. In addition, the war has had and will continue to have an adverse effect on the birth rate because of the unfavourable ratio between men and women that was created during the war by the great losses among the male population. The decline in the birth rate is also due to the availability of contraceptive devices and abortions, the latter being permitted in the Soviet Union for the sake of the woman's health but only in medical institutions. Doctors and other medical workers make great efforts to explain the harmfulness of abortions to women. It is possible that other factors—a further increase in the pre-school institutions available for children, improvements in housing and public services, etc.—will help to reduce the rate of decline in the birth rate to some extent.

III. THE SYSTEM OF STATISTICAL INDICATORS FOR THE BIRTH RATE AND METHODS OF OBTAINING THEM

15. The second copies of birth and death certificates are used for statistical purposes. Analysis of these documents is the most important means of studying the country's birth and death rates.

16. The programme for processing records of births makes it possible to obtain information on the distribution of births by sex, nationality, date of birth, birth order, and age and social group of the mother and father. The census data, the annual population estimates by age and sex, and the data obtained from processing the birth records can be used to obtain a whole series of relative indicators: general and age-specific birth rates (fertility), net and gross rates of reproduction, and so on. The data on the distribution of births by age of the mother for the years 1958-1959 and on the age structure of the female population according to the 1959 census were used as the basis for preparing age-specific birth-rate tables (fertility tables) for the country as a whole, for each Union Republic, for each large economic region and for Moscow and Leningrad.

17. In addition to the birth rate, a number of other closely connected phenomena are also studied in the Soviet Union, such as questions relating to marriage and the family, abortions, State aid to mothers to help them raise their

children, expenditure on maternity benefits and on supplies for the care and feeding of children, the award of orders and medals to mothers of large families, and the provision of pre-school institutions for children.

18. Birth rate and fertility indicators are calculated for the urban and rural population, for each Union Republic and region and for the different social groups in the population. This makes it possible to study the special features of the birth rate in various parts of the country and in the different population groups.

19. Every year, about 5 million children are born in the Soviet Union. Of these, 33-36 per cent are the third or subsequent children of their mothers. The birth rate was 32 per cent lower in 1963 than in 1940 and less than half as great as it had been in 1913. On the other hand, the general death rate in 1963 was a quarter of the 1913 figure, amounting to 7.2 per thousand, while infant mortality was at about 12 per cent of its 1913 level. There is no question that the decline in infant mortality tends, to some extent, to promote a decline in the birth rate.

20. The downward trend in the Soviet birth rate is reflected in a decline both in the total number of births per thousand inhabitants and in the fertility indicator (the number of births per thousand women between the ages of fifteen and forty-nine). The following table gives the birth rate for women in different age groups:

<i>Age of women</i>	<i>Number of births per thousand women in the age group in question</i>				<i>1962-1963 as a percentage of 1938-1939</i>
	<i>1938-1939</i>	<i>1958-1959</i>	<i>1960-1961</i>	<i>1962-1963</i>	
15-49.....	139.5	88.7	90.6	83.2	59.6
<i>Including:</i>					
15-19.....	32.8	29.2	35.2	24.1	73.5
20-24.....	214.4	162.2	164.8	162.1	75.6
25-29.....	230.6	164.8	160.7	151.4	65.7
30-34.....	183.5	110.1	110.0	101.3	55.2
35-39.....	131.7	66.6	60.7	54.2	41.2
40-44.....	68.1	24.1	23.5	22.3	32.7
45-49.....	19.0	5.0	4.8	3.7	19.5

21. An increase in the birth rate resulting mainly from the substantial reduction made in the Soviet Army in 1959-1960 was reflected in an increase in 1960-1961 in the fertility indicator for women under the age of twenty-five.

22. Using the current birth-rate statistics for the years immediately preceding and following the census, it was possible to calculate the following fertility indicators for individual social groups:

<i>Age of women</i>	<i>Number of births per thousand women in the age group in question in 1958-1959</i>		
	<i>Manual and non-manual workers</i>	<i>Dependants of manual and non-manual workers</i>	<i>Collective farm workers</i>
15-49.....	79.6	93.5	99.0
<i>Including:</i>			
Under 20.....	32.5	27.2	28.4
20-29.....	138.3	199.3	185.2
30-39.....	67.6	101.5	122.6
40-49.....	7.1	13.4	20.5

23. A comparison of the birth rates for female manual and non-manual workers and women who are dependants of manual and non-manual workers shows clearly the influence of women's social status and employment on the birth rate. The birth rate in all age groups except the youngest is considerably higher for non-working women than for manual and non-manual workers. The conditions of work on collective farms and life in the country evidently have less to do with the decline in the birth rate. In all age groups except the youngest, the birth rate is higher among collective farm workers' families than among the families of manual and non-manual workers (including dependents): 18 per cent higher for collective farm workers between the ages of fifteen and forty-nine and more than twice as high for those between forty and forty-nine.

24. For female manual and non-manual workers living permanently in rural localities (including those at State agricultural enterprises), the birth rate in all age groups is higher than for those living in towns. For the whole group between the ages of fifteen and forty-nine, the figure is 29 per cent higher, and in the upper reaches of that group the difference is even greater.

25. The future birth rate is determined to a considerable extent, of course, by the number of girls born to replace their mothers. The gross reproduction rate in the Soviet Union in 1938-1939 was 2.1 female births per woman on the average, while in 1961-1962 it was 1.3. The net reproduction rate (the average number of girls born to one mother during the whole period of her fertility and surviving to the age their mother was when they were born, i.e., allowing for mortality among girls), although less than before the war (in 1938-1939, it was 1.4), is still greater than unity (1.2).

26. The present birth and death rates in the Soviet Union ensure expanded reproduction of the population. The substantial decline in the

death rate has produced a change in the relationship between the net and gross rates of reproduction. In 1938-1939, the gross rate of reproduction was 50 per cent greater than the net rate, whereas in 1961-1962 it was only 10 per cent higher.

IV. THE USE OF SAMPLE SURVEYS IN STUDYING THE BIRTH RATE AND THE FACTORS THAT INFLUENCE IT

27. In addition to birth-rate indicators based on current registration, data obtained from sample surveys have also been used for detailed studies of the birth rate.

28. Since the very beginning of the period of Soviet rule, much attention has been given to conditions of health and hygiene at work and in everyday life, to the control of infectious diseases and to maternal and child welfare. A particular effort has been made to assist the population of those regions which in Tsarist Russia were backward provinces. In 1925, the Soviet Government instructed the education and health authorities to draw up, with the assistance of the Academy of Sciences, a general plan for a survey of the economic status and living conditions of those nationalities which in pre-revolutionary Russia had been in danger of degenerating and dying out as a result of the spread of social and epidemic diseases. Research teams were sent out to study the state of health of these peoples, the social and hygienic conditions in which they lived and their birth and death rates. In this survey, use was made of the anamnestic method, by which the required data are obtained by questioning people about events that occurred earlier in their lives.

29. In 1934, in order to determine what factors were behind the decline in the birth rate, a special survey was made of the families of manual, non-manual and engineering and technical workers. It covered nearly 10,000 women, who were questioned concerning a period of approximately twenty years. The birth rate

both in the country and in the towns was then considerably higher than in all the leading capitalist countries. Its downward trend, however, meant that more thorough study of the question was necessary. The survey yielded data on nuptiality, the birth rate and infant mortality for women in different age groups, on changes in the percentage of married women in different age groups over the whole period of the survey (1914-1933), on nuptiality, the birth rate and infant mortality for working and non-working mothers and for mothers long established in towns as compared with those who had arrived from the country relatively recently, on the distribution of families according to the amount of living space per person, and so on.

30. The results of the survey were used in considering new measures to protect women's health and provide increased maternity benefits, to introduce State aid to women with large families, to expand the system of maternity homes and pre-school institutions, and so on.

31. In 1960, a special sample survey was made of 37,000 families of manual, non-manual and collective farm workers keeping budget accounts. In these families, in addition to the usual budget survey, questions were put to 54,500 women aged seventeen and over (girls of fifteen and sixteen were not interviewed, since at that age they are all at school and not yet married).

32. The survey provided data on age, whether the woman was single, married, widowed or divorced, the date of first marriage and the woman's age at the time, how many years the first marriage lasted, the same for second and third marriages, and the total number of years of marriage. This information made it possible to eliminate any gaps between marriages for each woman. For children, information was obtained on the date of birth, birth order, single or multiple birth, whether the child was live-born or still-born, the date of children's death and the age at which they died. In addition, the questionnaire contained questions on the woman's employment and place of work or other source of subsistence, years of service, family income and housing conditions.

33. The results of the survey showed that in the families of manual and non-manual workers 77 per cent of the women between the ages of seventeen and forty-nine were working on the date of the survey. In the families of collective farm workers, the figure was 88 per cent (including those working on private farm plots).

34. In the families of manual and non-manual workers, the birth rate for women engaged only in housework was higher in all age groups than for working women. This confirmed the conclusion derived from the data obtained from complete coverage of the birth rate that for women in collective farm work employment does not have as great an influence on the birth rate and the number of children in the family as it does in the case of urban female manual and non-manual workers. The latter have fewer children in all age groups when they have had many years of service than when they have had a short period of service. For example, the average number of children for women between the ages of thirty-five and thirty-nine was 1.9, but for women in the same age group who had never worked it was 2.8. The average number of children for women in the age group thirty-five to thirty-nine with up to six years' service was 2.7, for those with between seven and fifteen years' service it was 2, and for those with sixteen or more years' service it was 1.7.

35. It cannot be concluded from this, of course, that in order to increase the birth rate women must once again be tied to their homes so that appropriate conditions will be created for the birth of a greater number of children. The age in which we live is far removed from that in which a woman's world was limited to the domestic scene. Women in all countries are becoming an increasingly active force in economic and social life. They are winning independence and equal rights with men. Society should concern itself with the problem of enabling women to combine happy motherhood with an ever more active and creative participation in social labour in the various sectors of the economy and culture and in scientific and artistic pursuits.

36. When the sample survey was carried out, efforts were made to determine the relationship between the birth rate and the family's income and housing conditions. A direct relationship between them was scarcely to be expected, since the birth rate is influenced by a whole series of closely interrelated factors, some of which operate in opposite directions. Nevertheless, the survey results are of some interest in this respect as well.

37. The birth-rate indicators are lower in all age groups for families with higher incomes than for those with lower incomes. Of course, higher family incomes are due in part to the fact that more women are employed and that their economic and cultural demands are greater. As far as housing conditions are con-

cerned, the survey data showed that persons living in their own apartment or house with two rooms had higher birth-rate indicators than those living in less favourable conditions. Can we conclude from this that an improvement in housing conditions alone will make it possible to maintain the present birth rate and even to raise it? Obviously not. In the Soviet Union as is well known, housing is being built on a vast scale. Over the past ten years, 108 million people, or nearly half of the total popu-

lation, have moved to new dwellings and improved their housing conditions. The birth rate, however, continues to fall. We can only suppose that if there had not been a widespread improvement in housing conditions the birth rate would have declined even further.

38. Both before and after the war, sample surveys to study aspects of the birth rate in individual republics, towns and regions and for women of different nationalities were also conducted by various scientific institutes.

Fertility control in the United States

CHARLES F. WESTOFF

I. OBJECTIVES

1. This paper has two objectives—to report the extent of family planning in the United States today and to describe the factors affecting the use of methods of fertility control and the effectiveness with which they are practised.

II. THE EXTENT OF FAMILY PLANNING

2. A number of recent studies¹ conducted in the United States provide us with statistical descriptions of family-planning practices of American couples. The most useful sources in this connection are the 1955 and 1960 GAF (Growth of American Family) studies which were interview surveys of national probability samples of married women of reproductive age.²

3. The data collected in these and other recent studies are derived from personal interviews conducted by professional female interviewers with the wife in her home. All of the considerable experience accumulated to date indicates that American women are very willing to cooperate with such scientific inquiries and to answer personal questions quite candidly. The refusal rates have been consistently low (6 per cent or less), refusals to discuss contraception negligible, and the reliability of responses encouraging.³

4. The main generalization to be drawn from data on the extent of family planning is that American couples are almost universally in favour of family planning—a fact reflected both in their attitudes and behaviour. Only two or three per cent of fecund white couples in the

1960 sample had never used, and did not expect to use, some form of fertility regulation. Only 2 per cent thought that all married couples should have as many children as they can. The couples not presently using any fertility control are mainly the newly married, and the sub-fecund who have no need for contraception. Although the proportion ever using any fertility control during marriage does not have much room to increase, there is considerable room for variation in the period of marriage and age at which contraception is first used and in the regularity of use. For example, about 2 out of every 3 American couples use no method of family planning before the first pregnancy.⁴ The evidence from a comparison of the 1955 and 1960 surveys suggests a definite trend toward earlier use, implying increased reliance on contraception for spacing purposes.

III. STERILIZATION

5. Surgical sterilization for contraceptive purposes still plays a minor but perhaps increasing role among American couples.⁵ In 1955, 4 per cent, and in 1960, 6 per cent of all couples (with wife 18-39) reported contraceptive operations. (An additional 4 per cent had undergone operations for various medical reasons which resulted in sterility.) The increase between 1955 and 1960 is due entirely to a higher proportion of husbands undergoing vasectomies. The incidence of contraceptive operations (in 1960) ranged from 2 per cent of couples with the wife 18-24, to 9 per cent with the wife 35-39 with the main factor associated with resort to surgical sterilization appearing to be lack of success in controlling fertility.

IV. ABORTION

6. Since induced abortion on all but narrowly interpreted therapeutic grounds is illegal

⁴ This is related undoubtedly to the incidence of premarital conception of legitimate births which may be as high as 20 per cent.

⁵ For a comprehensive international bibliography on the subject, see Christopher Tietze, ed., *Surgical Sterilization of Men and Women: A Selected Bibliography* (New York, National Committee on Maternal Health, 1962).

¹ Due to space limitations most of the citations and some documentation have been deleted.

² Ronald Freedman, Pascal K. Whelpton and Arthur A. Campbell, *Family Planning, Sterility and Population Growth* (New York, McGraw-Hill Book Co., Inc., 1959); Pascal K. Whelpton, Arthur A. Campbell and John E. Patterson, *Fertility and Family Planning in the United States* (Princeton, Princeton University Press, 1965). I am indebted to Arthur A. Campbell for this kind permission to incorporate findings described in the manuscript.

³ Charles F. Westoff, Robert G. Potter, Jr. and Philip C. Sagi, "Some estimates of the reliability of survey data on family planning", *Population Studies* (15 July 1961), pp. 52-69.

throughout the United States, reliable information on the incidence of abortion is lacking. The usual estimates vary from 200,000 to 1,200,000 per year, a ratio of illegal abortions to live births ranging from 0.05 to 0.30.

V. THE FAMILY PLANNING METHODS USED

7. The availability of the oral pill during the past four to five years and the recent development of new intra-uterine contraceptive devices makes estimates of the distribution of methods presently in use precarious. The 1960 GAF study, our last source of data on methods used for a national sample, is obviously dated on this subject since the pill was first marketed in 1960 and has made considerable gains in popularity. Estimates of the number of women currently using an oral contraceptive range from three to four million (between 12 and 15 per cent of all married women). Even if these estimates are accurate, they cannot be incorporated in the distribution of methods used because there is no information available on the methods used before by women now relying on the oral contraceptive. Some are undoubtedly young, recently married women who had never used any method; others are probably drawn primarily from the population using the most effective methods. There is some evidence that the use of the oral contraceptive is concentrated in the younger population. The answers to these questions will be provided by a currently projected 1965 sequel to the GAF studies.

8. As of 1960, the most popular methods in use in order of the proportions of users who ever used methods were: condom (50 per cent), diaphragm (38 per cent), rhythm (35 per cent), douche (24 per cent), withdrawal (17 per cent) and jelly alone (11 per cent). This rank order of popularity remained unchanged in the 5 years after 1955, with the general increase in contraceptive practice reflected in all of these methods except the douche which declined slightly.

VI. EFFECTIVENESS OF FERTILITY CONTROL

9. Studies of the effectiveness with which different contraceptive methods prevent conception have usually revealed the diaphragm and condom to be the most effective, withdrawal somewhat less effective, and the douche and rhythm methods the least effective.⁶ The oral pill and the intra-uterine ring constitute

such radical innovations in contraceptive technology that the relative effectiveness of the conventional methods may be of little significance for the future, so we shall concentrate on the question of how successful family planning in general is in the United States.

10. To meet their expressed goals of family size while following current norms of age at marriage and birth intervals, American couples would have to practice very effective contraception. More than three quarters are aiming at two to four children, and for most, because of early marriage and short birth intervals, there are 10 years or more of exposure to possible pregnancy after the desired size of family is reached. It is therefore interesting to report that while most pregnancies in the United States are unplanned, most couples seem to have the number of children they want.⁷ This paradox is understood by the relationship recently uncovered between the effectiveness of contraceptive practice and the family-size goals of the couple. This finding from the Princeton Fertility Study⁸ subsequently confirmed in the 1960 GAF study, indicates that the effectiveness with which contraception is practiced and the proportion practising contraception increase dramatically as desired family size is approached and achieved. Most contraceptive failures occur in the early years of marriage, reflecting a failure to control spacing rather than number. In the early years of marriage more couples wanting small families use contraception and use it more effectively than couples wanting larger families. When the number desired is achieved, failure rates decline sharply, regardless of the method used, one implication of which is that the use-effectiveness of particular contraceptive methods must be evaluated in terms of the number of children desired. Thus increased motivation appears to be an important element in the improvement of

⁷ Only 28 per cent of all pregnancies ever conceived by the GAF sample of 1960 are classified as "planned", defined as having occurred when contraception was interrupted in order to conceive. A tabulation kindly supplied by Arthur A. Campbell indicates that the same proportion obtains for women toward the end of their childbearing years (aged 35-39). On the other hand, only 17 per cent of all couples in this same study (about a quarter after 15 years or more of marriage) are classified as having more children than they wanted.

⁸ Charles F. Westoff, Robert G. Potter, Jr. and Philip C. Sagi, *The Third Child* (Princeton, Princeton University Press, 1963), pp. 38-44. This is a report of the second phase of a longitudinal interview study of the fertility couples living in the largest metropolitan areas of the United States. The first phase was conducted in 1957 when all of the couples in the sample recently had their second child. The second round of interviews occurred three years later, in 1960, and a third phase is now in process.

⁶ Numerous studies of the effectiveness of different contraceptive methods are listed in Christopher Tietze, *Selected Bibliography of Contraception, 1940-1960* and *Selected Bibliography of Contraception, Supplement 1960-1963* (New York, National Committee on Maternal Health, 1963).

fertility control observed in the later years of marriage. The chief mechanism by which such improvement occurs is apparently an increase in the regularity of contraceptive practice rather than a change of methods or increased proficiency of use. This process might be described as a change from a casual attitude toward whether a child is conceived that is wanted sooner or later in any event, to a more serious concern that an additional child might be conceived after the couple has decided that their family is completed.

VII. BIOLOGICAL FACTORS AND THE CONTROL OF FERTILITY

11. Couples are frustrated from achieving desired family size not only by failure to use contraception effectively, but also by subfecundity. The two, though not independent,⁹ may be roughly equal in statistical importance. Together they cause about 40 per cent to deviate from desired family size; that is, only about 60 per cent of American couples are able to achieve the family size they desire.

12. On the other hand, contraception obviously has a much greater effect than present levels of infecundity in reducing births below the theoretical maximum number that would occur if all couples were fecund and did not practice any contraception. The combined effects of infecundity and contraception reduce the average number of births to all couples married at least 15 years by an estimated 68 per cent; the corresponding figure for fecund couples is 62 per cent reduction. By inference, the comparative effect of infecundity is relatively slight.

13. In the United States today, about one third of all married couples of reproductive age have some problem of subfecundity. The subfecund include two nearly equal groups of couples who cannot have any future births (most of whom have had operations) and those for whom future childbearing seems improbable, and a third somewhat smaller group who can probably have children but show some evidence of impaired fecundity.

14. Impairments of fecundity are now the chief cause of childlessness in the United States; voluntary childlessness has all but disappeared. As a consequence, married women presently in their twenties will probably have fewer than 8 per cent remaining childless by the end of their childbearing period.

VIII. SOCIAL FACTORS

15. There is no evidence of any inherent socio-economic group differences in fecundity. All group differences observed can be attributed to differences in the proportions practicing contraception which imply different lengths of non-contraceptive exposure and thus differential probabilities of discovering subfecundity.

16. All socio-economic and religious groups in the population are in favour of some kind of fertility control. This description fits the Catholic population as well as other religious groups, although a significant proportion (one third) of Catholic women reserve their approval for the rhythm method only.

17. Generally speaking, family-planning behaviour which has been traditionally differentiated by various social factors, appears to be converging. Thus, large differences in family planning no longer exist among income or occupational groups, rural and urban areas, cities of different size, or in regions of the country. The social factors that still affect fertility planning are religion and education. There are also considerable differences between whites and non-whites in fertility-planning practices and, as a consequence, in fertility. The 1960 GAF Study indicates that white and non-white women want about the same number of children, but that non-white women have had, and expect to have, more births. This difference is due to the failure of many non-white couples to use contraception or to practice it regularly. The sociological source of this variation is, in turn, the recency of southern farm background, and the level of education. With the receding influence of southern rural heritage and with increasing education, white-nonwhite differences will presumably disappear.

18. In general, the increasing proportion of couples using contraception between 1955 and 1960 occurs in all segments of the population but especially among groups with lesser education. College-educated women still use contraception more than women with lesser education (88 per cent compared with 66 per cent of women with a grade school education only), but this contrast primarily reflects differences in the stage of marriage at which contraception is begun and the resultant differential discovery of subfecundity. Women who have attended college are much more apt to begin contraceptive practice prior to the first pregnancy than women with less education. Variation in proportions practicing contraception, however, is presently smallest in the youngest part of the married population.

⁹Robert G. Potter, Jr., "Some physical correlates of fertility control in the United States", *International Population Conference, New York 1961* (London, John Wright and Sons, 1963), pp. 106-115.

19. These suggestions of contraction should not obscure the fact that the problem of excess fertility are most severe at the most deprived socio-economic levels. Although women of different educational accomplishment are similar in the number of children they desire, they are quite different in the number of children they have had and in the total number they expect.

20. Differences in the family-planning practices of couples belonging to the major religions are sharp and persistent. Jewish couples, who want the fewest children, begin using contraception earliest in marriage (almost twice as high a proportion as the general population practice contraception before the first pregnancy) and are the most successful in planning fertility. Catholic couples, who want and expect the most children, practise fertility control the least of all groups in the early years of marriage (less than a quarter before the first pregnancy) but actually have fewer unwanted pregnancies than Protestants. This simply underscores the theory that religion affects the practice of family limitation (and thus fertility) primarily through its influence on the number of children desired.

21. Other more intensive research into social

and psychological factors affecting fertility within each major religious category has uncovered associations between various indices of fertility planning and religiousness, education in religious schools and nationality origins among Catholics, and the wife's participation in the labour force. Other areas of inquiry such as social mobility, the structure of social relations within the family, and personality characteristics have been less rewarding. This kind of research, however, is still being pursued in the United States and, with the rapid rate of innovation in contraceptive technology, promises to grow in interest as fertility becomes increasingly more responsive to couples' family-size desires. It will be interesting to see what changes occur in birth intervals and family-size preferences when new methods reduce the importance of erratic use. And, it will be especially interesting to see what happens to these variables when the new intra-uterine contraceptive devices become popular and the psychology of fertility is radically changed from the ordinary situation in which the decision making involves repeated steps to prevent pregnancy to a situation in which pregnancy must be the result of a deliberate decision and action to eliminate the obstacle to conception.

SUMMARIES OF PAPERS

Trends in age-duration-specific fertility rates in Australia, 1911-1961

K. G. BASAVARAJAPPA

An examination of trends in fertility during 1911-1961 on the basis of rates specific for age as well as duration of marriage showed that for the first three age groups 15-29, 20-24 and 25-29 within each age group, the rates at lower durations have remained at high levels and even exceeded their 1911 level in 1961, whereas the rates for other age groups at corresponding durations were considerably below those of 1911 in 1961. Also, it was found that the higher the age and the duration, the further the level of its fertility rate in 1961 fell below that of 1911.

The similarity of trends in the rates for females of the same group of durations but of different ages, indicated that the age as a determinant of fertility, even allowing for a tendency for fecundity to be reduced as age advanced, was seen to be not as significant as duration of marriage in Australia where rational control over fertility is an accomplished fact.

In the absence of direct field surveys to study the changes in the reproductive behaviour of women, this study has shown that the basic registration and census data could yield more refined measures with which to add something to previous knowledge in this field. In fact the changes in fertility rates specific for age as well as for duration of marriage suggested that the limitation of ultimate family size was much more effective in recent years than in earlier years. They further indicated a growing tendency among couples marrying in recent years to plan their families from the outset.

Recent changes in remarriages of women of childbearing age in the United States

HUGH CARTER

Over one and a half million marriages took place in the United States in 1960; almost one in four of them was a remarriage. The marital status of women 15-44 years of age in 1960 shows that three-fourths of them were in the ever-married group of whom about one in 9 had been married more than once. Census

records of marital status dating back to 1890 for women 15-44 years of age reflect important changes, including a marked decline in the widowed, a rise in the divorced, and an increased proportion married. Recent remarriage rates indicate that the divorced remarry more than three times as frequently as the widowed of corresponding ages, the highest rates being for the younger divorced group. It also appears that the widowed who remarry wait for a longer period of time to do so than is true of the divorced. During the past decade remarriage rates seem to have risen for divorced women and may have risen slightly for the widowed under 45 years of age. As remarriages include a substantial number of younger divorced women it seems probable that the remarried will continue to make an important contribution to the population.

Catholic teaching and Catholic fertility

LINCOLN H. DAY

Although Roman Catholic doctrine on birth control is essentially pro-natalist, there remains the question of whether this pro-natalist doctrine necessarily leads to higher levels of fertility. What data there are suggest that within any given segment of a society, Catholic fertility always exceeds Protestant fertility. Moreover, studies completed in the United States and Holland suggest that loyalty to one's church is positively associated with fertility among Catholics while bearing only a nil or even negative association with fertility among Protestants.

Yet, Catholic fertility has undergone substantial declines wherever control over births has been achieved; and there are numerous findings of sizable fertility differentials along social and economic lines among Catholics. Moreover, a growing body of evidence reveals that large proportions of Catholics resort to methods of birth control forbidden them by their church. Quite obviously, more than Catholic doctrine is at work.

On the basis of an analysis of available statistics we suggest that what may be at work is a feeling of group separateness, of group superiority, of one's group being threatened by

the numerical and social domination of another; and that, as a consequence, the pro-natalist teachings of the Catholic Church will be a factor leading directly to higher Catholic fertility only when: (a) there exists a high level of economic development, and (b) Catholics constitute a numerically and politically important, but not dominant, minority of the population.

For those concerned with overpopulation the problem seems not one of Catholic teaching in Catholic countries. The frequently voiced hope that the Church will change its position on birth control and thereby help solve the population problem in areas like Latin America, appears largely irrelevant. If what has happened elsewhere is any guide, high fertility populations will reduce their fertility when, and only when, their other conditions of life are conducive to it; and they will do so regardless of any church's opposition.

The effect of socio-economic factors on fertility

I. FERENBAC

A distinctive feature of the reproduction pattern of the Romanian population prior to the Second World War was the rapid succession of generations. This is a phenomenon peculiar to countries which are economically, socially and culturally under-developed, and where birth and death rates are high whereas the average life expectancy is low.

Under the democratic regime, the Romanian economy has evolved towards a complex, multi-lateral and rapid development based on socialist industrialization. The increase in production and the increased effectiveness of activity in all branches of the national economy have led to an increase in the national income and thus to a systematic improvement in the standard of living of the population.

The transformations made in the socio-economic life of the Romanian People's Republic have also caused major changes in the reproduction pattern of its population. The number of live births per thousand women between the ages of fifteen and forty-nine fell by almost 50 per cent between 1938 and 1963. During the same period, the general death rate fell by more than 50 per cent, while the infant mortality rate fell even more, to one third of the 1938 figure. In 1963 the average life expectancy was sixty-eight years, or twenty-six years more than in 1932.

The study of the social and economic factors which affect the level and trend of fertility rates is becoming increasingly important. Since there are many such factors, however, this paper deals only with those which have a marked effect on fertility.

The socialist industrialization of Romania has intensified the urbanization process, in that it has resulted in a movement of part of the rural population to the towns and in the establishment of new towns. This has increased the size of the urban population, whose demographic behaviour is different from that of the rural population. Industrialization has also led to a substantial increase in the number of women wage-earners.

The cultural revolution which has taken place in the Romanian People's Republic has extended the duration of education, through the expansion of technical education and higher education facilities which provide vocational training for the specialists required by the country's economy.

Some problem aspects of differential fertility measurement in the United States

ANDERS S. LUNDE

While basic information from which measures of differential fertility may be obtained is available on certificates of live birth as used in the fifty-six registration areas, certain limitations prevent the full use of the vital data for analytical purposes. The paper discusses these problems in terms of specific variables and suggests possible methods of solution.

Area fertility differentials reveal that differences between geographic areas are diminishing. However, fertility rates by rural-urban residence and by size-of-place are not reliable, chiefly because of the problem of residence allocation.

As regards fertility measurement by ethnic group, nonwhite fertility is consistently greater than white fertility. The development of more accurate rates for particular ethnic groups is limited by underregistration, incorrect reporting, changing census definitions, and coding procedures which affect the racial definition of children.

The occupational fertility differentials have not been tabulated from vital statistics data because of the incompleteness of reporting and the difficulty of coding. To provide a meaningful socio-economic variable the National Center for Health Statistics is considering entering an

item on education of parents on the Standard Certificates of Live Birth and Fetal Death.

Among the steps being taken by the National Center for Health Statistics to solve registration problems are: improvement of the reporting of residence on the certificate; establishment of procedures for detecting reporting error; and standardization of the relationship of vital statistics data to census data. Tests of accuracy of item reporting and follow-back sample surveys are being conducted.

Possible contributions of administrative and medical departments of social security in France to demographic studies

NORBERT MARX

We will draw the attention of the demographers to utilize the huge materials of the social security systems for demographic studies.

We indicate how the registration-number of the insured people permits to follow the migration from the place of birth to the actual working-place.

Combining the place of birth with certain diseases, we can study if a relation exists between some infectious, or chronic diseases and the origin of the diseased persons, for instance pulmonary tuberculosis. On the other hand we can find out if there are relations between the social status of the immigrants and the kind of work-accidents.

The branch "Maternity" gives us rich materials on natality. We give some results of studies made in Paris and in Berlin. The proportions between the number of declarations of pregnancy and the number of births differ, if the women are working during their pregnancy or stay at home. By the same occasion we can study the problem of not provoked abortions.

Then we stated that the general proportion of the sexes at birth is very different in Paris and in Berlin, but also differs with the general proportion of the country, and between the first-born, the second-born and so on.

In 1925 we studied the relation between the age of husband and wife and the fertility of the couple.

We stated that 13,73 per 100 of the couples, where the women were over forty-five, were sterile.

Conceptions: women under forty-five have an average of 2.68 conceptions and women over forty-five, 4.21 conceptions.

By calculating the percentage of abortions to conceptions, we find under forty-five, 39.18 per cent, and over forty-five, 24.70 per cent.

The contribution of families to the natural growth of the Belgian population according to the number of their children

C. MERTENS, S.J.

In what proportion do "large" families and "small" families influence population figures? For Belgium we find an answer to this question in the data of the last two censuses and in the annual statistics on births.

Grouping all Belgian families according to the number of children, we find that the proportion in each category, after a slight increase when passing from none to one child, decreases regularly and rapidly thereafter. But when the total number of children is considered, the categories of families with two, three and four children each include more children than the category with one child. From that point on the decrease is regular, but less rapid when the total number of children in each category is considered. These facts are illustrated from the 1961 census where families with four or more children represented 17.7 per cent of all families and included 47.2 per cent of the children. The number of children from one-child families was notably less than the number from families with seven children or more.

Interesting results are obtained by comparing the province of Hainaut, where birth regulation is widespread and of long-standing, and the province of Limbourg, where it is limited and recent. In Hainaut, 36.5 per cent of the children belong to families with four or more children; in Limbourg, 66.5 per cent (75 per cent in 1947, which shows a marked change between the last two censuses).

The results of this analysis show that in studying population growth from both demographic and social points of view, it is necessary to consider both the large number of families and the number of large families.

The reproduction rate of population in Japan

HARUO MIZUSHIMA

The vital statistics of Japan for the recent years show a vigorous natural increase of population amounting to about 900,000 each year despite a tremendous drop in the birth rate

since 1950. As long as this increase continues there is no fear of depopulation, but there may be an increasing pressure of over-population. The net reproduction rate has been declining sharply and has been less than 1.00 since 1957. It was 0.92 in 1962. If the current age-specific fertility and mortality rates of females continue unchanged in the future, the natural increase of population will cease in 2005. From then on, the trend would reverse itself, reducing the population by half in approximately 240 years or a period of nine generations. Even if it is assumed that the fertility and mortality rates change within reasonably expected ranges in the future, the estimation of the course of population growth does not materially differ from the above conclusions.

If Japan desires to avoid the threatened depopulation in the near future, the fertility must be raised to an adequate level, at least to net reproduction rate of 1.0. In order to raise the fertility to this level, socio-economic factors and the psychological attitude of the people which are excessively motivating birth restriction must be ameliorated by positive policies. The Eugenic Protection Law which has been abused widely for birth restriction must be amended strictly, not only from the view-point of demography, but that of morality and humanity as well.

A further look at Catholic fertility

BASIL G. ZIMMER and CALVIN GOLDSCHIEDER

Although research on Catholic-Protestant fertility differentials in the United States is both extensive and convincing, there remain aspects of the problem that have been largely neglected and at best have received only incidental attention. Specifically, research efforts to date have not attempted to assess what in-

fluence the widespread suburbanization movement, that is taking place in metropolitan areas, is likely to have on the fertility patterns of different religious groups. This paper attempts to make such an assessment. The first part of the study is an analysis of the fertility rate of Protestants and Catholics for the total metropolitan area population. The usual differences reported in the literature are clearly evident and persist when a number of relevant control values are employed. In general, Catholics have more children than Protestants. Catholics not only utilize more of the reproductive span but they also average less spacing between children. All of this has been frequently substantiated in the literature. However, after noting these patterns we turned to the questions of the influence of place of residence on fertility. Among Central city residents we continued to find the expected religious differentials but among suburban residents the difference tended to disappear. This pattern also holds when a number of control variables are used, and in both large and small metropolitan areas.

Our data clearly show that in the suburbs there is a convergence in the fertility rate of Catholics and Protestants. While the latter tend to have slightly larger families in the suburbs than do those who live in the city, the suburban Catholics tend to have fewer children than city Catholics. The net result is that there is a convergence between the two religious groups in the number of children ever born. It is suggested that Catholics living in the suburbs have likely become largely assimilated to the "American" or Protestant way of life. Consequently, the behavioral patterns, of the Catholics, including reproduction, tend to become very similar to those of the larger society. Since Catholics are likely to continue to move to the suburbs, it may be that overall Catholic fertility will decline in the future.

Meeting B.13

STUDIES RELEVANT TO FAMILY PLANNING

PAPERS

A review of major governmental programmes

BERNARD BERELSON

1. At the end of 1964, five countries had official governmentally-approved and -administered national programmes to implement family planning: India, Pakistan, the Republic of Korea, Tunisia and Turkey. China (mainland) may have a programme, as well. India was the first country to adopt a national policy of limiting population and, subject to lack of firm knowledge about China (mainland), India is the largest country to be working on this problem. India set up family planning boards in the mid-1950's both in the National Health Ministry and in the states. At the outset, and for some period thereafter, the programme consisted of the clinical approach, but it slowly became clear that an extensive community-aimed effort would be needed to take the programme to the people, rather than expecting them to come to it. In the past few years, the family planning agency in India has concentrated on setting up the administrative machinery to carry a programme to the people by assigning a medical family planning officer and supporting staff at the district level (1 to 2 million population) and organizing a small educational and field staff at the block level (70,000-100,000 population). The present governmental budget for family planning is more than 5 million U.S. dollars, or about one cent per capita, but plans for the next five years call for substantially increased expenditures.

2. A similar picture can be presented for the other large country with an official national programme, India's neighbour, Pakistan. The programme was set up in 1960—in a way, two programmes because of the organization of the country into two wings, geographically separated. The annual budget is again about one cent per capita, or about 8 per cent of the total budget for health. To date, this has consisted of a series of short training courses for

medical and para-medical personnel, the addition of family planning services to 1,600 medical units throughout the country, the establishment of the National Research Institute of Family Planning, limited clinical studies of the new methods of contraception, small-scale experimentation with mobile audio-visual vans in areas without medical centres, limited use of the publicity sources, and three major research studies. Progress has been slow, but institutions and personnel are being gradually developed; and the outlines of the Third Five-Year Plan, to begin in 1965, call for a much enlarged budget and an upgrading of positions and personnel. In addition, the newly appointed Commissioner of Family Planning is actively seeking ways to develop an intensive programme in Pakistan centred on the newly-developed intra-uterine contraceptive device (IUD), which promises to be extremely important in all the developing countries.

3. Both India and Pakistan have very large populations—the second and the fifth or sixth largest in the world—and it is partly due to their size that the progress desired and often anticipated has been held back. The third Asian country to organize an official national programme, the Republic of Korea, is much smaller than the others and at the moment, more successful in spreading family planning. Here the government has given a high priority to family planning, both in national budget (about 4.5 cents per capita) and in calling upon other resources. Three full-time family planning workers, nurse-midwives, are employed in every one of the country's 180 health centres. In addition, 1,400 assistant workers have been recruited from among village women with elementary education, or one for each sub-district of 10,000 to 20,000 population. In the summer of 1964, a special effort for the use of IUD

began, and it appears that this method, which is highly popular, for the time being, is limited only by available medical personnel and governmental subsidies.

4. Tunisia embarked upon its effort only in 1964, and hence (at this writing, in late 1964) is just getting underway. In the first months, it appeared that the demand for family planning was greater than the resources available to satisfy it, but training and organization have perhaps repaired the balance.

5. Finally, in Turkey, family planning has been given a prominent place in the current officially-approved plan for economic development, a programme has been laid out, a director of family planning appointed, a budget accepted, a fertility survey completed, a private family planning association formed—all before the repeal of an anti-contraception law dating from the difficult days that faced Turkey after World War I. The law was in process of repeal at the turn of the year, and an active programme was expected to begin in early 1965.

6. Those countries have official policies, but there are a number of others that are implementing family planning with governmental support in funds and facilities, but without an official declaration. Most notable in this category, perhaps, is China (Taiwan). After a highly successful effort in Taichung, a city of 300,000 population, the health officials expanded the programme in the spring of 1964 to about 10 per cent of the island's population in the more deprived rural and urban areas. After only a matter of months, that programme was expanded again to the entire island of 12,000,000 population. There is already careful documentation suggesting that the Taichung programme brought down the birth rate in that city. Here, again, as in the Republic of Korea, the programme is centred on the newly-developed IUD. And a similar concentration on IUD's is being expedited in Hong Kong through governmental support to the private family planning association. In these three areas—the Republic of Korea, China (Taiwan) and Hong Kong—far more than 100,000 IUD insertions had been made by the end of 1964.

7. Nor is that all. In several other countries, limited projects are going forward under governmental auspices—as in Ceylon, where the Swedish government is providing technical assistance; or in Thailand, where the first fertility survey of knowledge about family planning, attitudes on population questions and actual contraceptive practice was completed in

the fall of 1964, and where the first action programme got underway shortly thereafter; or in the United Arab Republic, where a small number of clinics are offering family planning services under governmental auspices; or in Indonesia, Fiji, Malaysia, Chile, Venezuela, Jamaica, Puerto Rico, Nigeria, Ghana and Rhodesia, where experimental IUD programmes are being undertaken in various medical installations.

8. Moreover, a number of so-called fertility surveys have been carried on over the past few years, so that we now have a good start towards more or less comparable data on knowledge, attitude and practice from a large number of countries throughout the world—Argentina, Brazil, Ceylon, Chile, Costa Rica, Czechoslovakia, United Arab Republic, Ghana, Greece, Hungary, India, Indonesia, Israel, Italy, Jamaica, Japan, the Republic of Korea, Lebanon, Mexico, Pakistan, Peru, Puerto Rico, San Salvador, China (Taiwan), Tunisia, Turkey, Uruguay, the United Kingdom, the United States and Venezuela. To my knowledge, this is the most substantial set of comparative social data ever collected across such a range of societies, and a few of the demonstration programmes in family planning are among the most elaborate and extensive social experiments ever carried out in the natural setting.

9. Naturally, not all the efforts thus far have been successful, but it is probably fair to say that we have learned from all of them. What has been gained from this experience to guide the continuing effort? Everything is always more complicated than this quick review will suggest, and others would summarize the experience differently, but to my mind, there are several conclusions that are justified by developments to date. Here are a few of them.

10. The straight clinical approach to the spread of family planning does not work well. A much more active programme of taking family planning to the people is required.

11. Substantial proportions of the people want family planning now; contrary to the usual belief, sufficient motivation exists to make a demographic difference if it could be implemented. To be sure, the actual practice of family planning is scarce in the typical developing country, and knowledge about contraception and reproductive physiology is not much better. With regard to attitudes toward family planning, however, the picture is different. Here is a rough picture of the situation in the developing countries:

	<i>In percentages</i>
Practice family planning now...	5-20 say, 10
Have some detailed information about reproduction and contraception	10-40 say, 20
Want no more children, of those with three or more.....	40-60 say, 50
Interested in learning about family planning	50-70 say, 60
Approve of birth control.....	65-80 say, 75

Hence there does appear to be a sizable reservoir of interest to be satisfied (even after discounting mere verbal expression). Many people in the developing world are now persuaded, at least in principle, of the desirability of limiting the birth of children to the number wanted, when they are wanted—and in all these countries, that means fewer children than are being born now.

12. The “ready” people are likely to be of two kinds: those of high socio-economic status, and particularly high education; and those of high parity, particularly those with three children or more, including one or more sons. Almost by definition, there are too few of the former for a sizable effect on the birth rate anywhere in the developing countries, but there are many of the latter. The evidence appears to show that highly-educated people will undertake family planning on their own, in the absence of any organized programme, but that a programme is needed to reach those of high parity. An organized programme will be able to reach this group.

13. A special target group, wherever they can be economically reached, is made up of post-partum women. Other special groups worth reaching are men in military service, persons in the schools, and industrial employees.

14. The character of the contraceptive technology makes a very big difference. Anything that can overcome the need for sustained motivation, repetitive action, and a system for continued supplies is a big step forward. Moreover, the easier and more effective the method, the less motivation is needed to achieve successful family planning. An improved technology means more effective contraception, and, hence, the intra-uterine device is a great advance.

15. The indicated strategy for spreading family planning, under most conditions, is to aim first at the already-motivated people, on the double ground that this group will yield the most return per unit of scarce resources, and that the best way to spread motivation is to satisfy existing motivation. Again, studies like China (Taiwan) are showing that word-of-mouth diffusion can be very effective, at

least with the new intra-uterine device. The principle of diffusion should be utilized wherever possible, not attempting to reach every couple, every neighbourhood, every village, but only every Nth (where N is perhaps 2-5). A corollary is that action programmes might well begin in the cities and towns, where there exists more medical support, better mass media, more modernized ideas, denser population, and more persons conveniently reached by field workers than in other areas; and then move out, more or less concentrically, from the towns. In general, the strategy is to start where the task is easier, and establish a successful base there. As for the informational content of the programme, it should be direct and factual, on the reasons for family planning and how to accomplish it, not clever or deep or “gimmicky”.

16. Given the likely realities, some family planning agency with autonomous or semi-autonomous status is usually found to be necessary as a way to get around bureaucratic restrictions of various kinds: salary limits, subsidy restrictions, speed of action, et cetera. Thus, there are semi-autonomous family planning institutes in some countries; in others, a specially-created private association for maternal and child health that channels medical fees for IUD insertion; in still others, a private family planning association to do the government's training and to provide other services.

17. On the cost side, it begins to appear that family planning can be implemented economically; that is, for far less than the strictly economic value of each prevented birth. The present run of costs for a family planning programme approximates \$15-20 per prevented birth the first year, and subsequently, perhaps less. In addition to the governmental programme, private channels, both medical and commercial, should be enabled to make a good-to-better fee or profit by extending family planning.

18. With an eye to the programme's over-all success, it is important to recognize that at any given time, a substantial proportion of married women in the reproductive ages are not “eligible” for family planning:

	<i>Per cent</i>
Currently pregnant or lactating.....	20-30
Sterile or sterilized.....	5-15
Currently practising satisfactorily ...	5-20
Miscellaneous reasons	5

Something like 50 per cent are simply not in the market at any particular time, although those who are pregnant and lactating will be soon, and those currently practising may well

wish to shift from a poor method to an improved one.

19. But even fewer are currently eligible, because a good proportion of the eligible—normally, from one third to one half of them—actively want another child now. So the 100 per cent of married women in the reproductive ages quickly shrinks to a potential, short-run target of, say, around 30-35 per cent. Thus, if a programme can get an additional 10 per cent of the married women to become effective contraceptors in the first year, that represents about a third of the currently eligible and is an achievement of note.

20. It will take a year from the authorizing decision until a field team is recruited, trained, organized, supplied, and ready for work on any substantial scale. It will take another year before the major problems are worked out and the programme settles into effective and efficient operation. It will take five years of action to make a major impact on the birth rate.

21. One should not leave the impression that it is an easy task to bring effective family planning to the population of a developing country—to a population often characterized by universal marriage, early marriage, subordinated

women, high infant mortality, illiteracy, the desire for sons to insure security in one's old age, sparse medical and administrative resources, lack of commercial channels for distributing supplies, poverty and associated apathy. In the programmes underway so far, there have inevitably been mistakes, false starts, disappointments and frustrations; in short, it sometimes seems, nearly as many errors as trials. Some people take such critical observations and occasional failures as demonstrating the impossibility of doing anything effective about the matter.

22. In less than a decade, however, we have developed a layer of experience, a solid body of knowledge, a number of trained personnel, an improved technology and a plan of strategic attack to deal with one of the world's most important problems. Governmental programmes are still near the beginning: at the end of 1964, for various local reasons, nowhere in the world had there yet been a maximum of effort in this field, an effort that is truly commensurate with the problem. Yet everything reported in this brief review has developed since the preceding meeting of the World Population Conference.

Evaluation of Tunisia's family planning programme

GEORGE BROWN, M.D. and AMOR DALY, M.D.

[Translated from French]

I. ORIGIN AND AIMS OF THE PROGRAMME

1. Discussions between the Ford Foundation and the Tunisian Government on family planning began early in 1962. On the basis of reports prepared by consultants from the Population Council, the Ford Foundation and the Tunisian Government, a preliminary plan was drawn up for a two-year experimental family planning programme.

2. The Tunisian Ministry of Health and the Ford Foundation are financing the programme, and the Population Council is providing technical assistance.

3. Execution of the programme began in May 1963.

4. The population of Tunisia, estimated at 4,280,000 in 1964, has been growing at 2.3 per cent a year for the past ten years.

5. The death rate, estimated at 21 per thousand, is declining as a result of the development of public health services.

6. Unless the birth rate, which is 47 per thousand, also declines, the general rate of population growth will continue to increase.

7. The Tunisian Plan economists regard this rate of population growth as bad for economic progress. A drop in the birth rate would help to promote economic and social development in Tunisia.

8. The experimental family planning programme has been launched in order to achieve these objectives.

9. The immediate aim of the programme is to establish a family planning service suited to Tunisia in order to provide the Government with information which will ultimately enable it to extend the programme in an effective manner to the entire population. The final programme will be adopted after a study has been made of the different services proposed and of methods of bringing them to the attention of the public.

10. A second aim of the experimental programme is to train personnel.

11. Finally, the importance of the programme's international repercussions has not escaped its organizers. It is hoped that, as the first official family planning programme in an Arab country or in Africa, the Tunisian experiment will serve as a pilot project for other countries and start a trend towards family planning in those countries.

II. PREPARATORY STAGE

12. Before the operational stage was reached, various measures were taken.

13. In September 1963, a group of Tunisian doctors and paramedical personnel visited family planning organizations in Asia and the United States in order to study recent family planning techniques.

14. Following this trip, a seminar on family planning problems was held at Tunis in January 1964. It was attended by doctors, demographers, midwives, health educators and social workers. Consultants from abroad had discussions with Tunisian specialists on population problems, modern methods of contraception and means of communication and health education in family planning.

15. In the spring of 1964, a demographic sample survey was undertaken by Professor Jean Morsa of the Free University of Brussels, which will serve as a basis for the future evaluation of the programme. Information was collected on attitudes towards and knowledge and use of contraceptive methods, together with data on the socio-economic status of the population and their level of education.

16. Married women of childbearing age and a small number of husbands were questioned. Twelve areas, distributed throughout the country, were selected for the survey and for the action programme that followed it.

17. A second survey will be carried out later, in two years, in order to evaluate the programme.

III. ACTION PROGRAMME

18. The action programme was begun in

June 1964. Twelve maternal and child welfare centres were selected throughout Tunisia to introduce family planning in their activities. Six were in urban areas and the other six in semi-rural areas. The purpose of choosing centres in different geographical areas and with different degrees of urbanization was to make it possible to evaluate the impact of the programme in different social environments. The maternal and child welfare centres were chosen as centres for family planning activities because there are a great many of them, because they are widely attended by mothers and because they have trained personnel, including midwives.

19. The family planning sections of such centres are run by a midwife and a full-time assistant. In large towns, the family planning centres work in collaboration with the gynaecological departments of hospitals, where plastic intra-uterine devices are inserted and tubes are cut.

20. Since more and more doctors are becoming familiar with these contraceptive methods, it is planned to carry out insertions at the family planning centres and in the gynaecological departments of all hospitals.

21. At the family planning centres, women obtain information on all modern methods of contraception. The main emphasis, however, is placed on the condom, vaginal jelly and aerosol, intra-uterine devices and sterilization of women. It may be anticipated that the preference of the Tunisian public will be for intra-uterine devices as a means of birth control.

22. Measures are being taken to increase the number of centres at which intra-uterine devices can be inserted and the number of doctors experienced in this contraceptive method.

23. The execution of an effective programme of education and information co-ordinated with the activities of the centres is an important aspect of the undertaking.

24. It is intended that health educators and social workers should work in each of the twelve areas and that effective means of communication should be established.

25. There has been a great deal of encouragement from leading organs of the Press, radio and television. President Bourguiba has frequently mentioned the importance of family planning in his speeches.

IV. EVALUATION

26. During the first six months of the active phase of the programme, 4,932 women

were given attention in eleven of the twelve family planning centres. During this period, staff were recruited and trained and problems of administration and supply dealt with. Although it is too early to make an evaluation of the programme in depth, certain major trends are already apparent.

27. Four of the six urban centres were more active than the others, with a total of 3,273 cases. Among the semi-urban centres, only one was very active, two were moderately so and two others had very few patients. The twelfth centre is not yet in operation because of lack of staff.

28. The "traditional" contraceptive methods (the condom, vaginal jelly, aerosol) have been offered to the public from the beginning at all the centres. Facilities for the insertion of plastic intra-uterine devices have been introduced recently, as the necessary personnel have become available.

29. At the present time, six centres and eight hospital gynaecological departments have such services. Where there was a choice between the traditional methods and the plastic intra-uterine device, 51 per cent of the women chose the latter. A slightly larger percentage have now chosen this method, but for various reasons it has not been possible to insert the device. In most cases, the insertion was postponed for medical reasons. In all, there were 617 insertions of plastic intra-uterine devices. The number of sterilizations of women was 252.

30. Among women who chose the traditional methods, 48 per cent opted for vaginal jelly, 28 per cent for aerosol and 24 per cent for the condom.

31. In general, the number of return visits among this group was less than 50 per cent, which indicates that many women did not persist in the use of these methods.

32. A great majority of the women who apply to the family planning services have three children or more. It is obvious that most of them are interested not so much in spacing out their pregnancies as in not having any more children. Most of these women come from the lower socio-economic strata of the population.

33. Among the urban female population with large families, there seems to be a great desire for family planning services to be developed.

34. The men show a certain interest, but in general male methods of contraception are not as popular as female methods. In the smaller towns, the programme has not been effective

on the whole. In view of the fact that its public information and educational aspects have not yet been developed, it is impossible to say whether the smallest communities can be induced to adopt family planning.

35. It would seem that in these areas public information has not made enough of an impression on families.

36. In the meantime, it can be said that the plastic intra-uterine device is the most popular contraceptive method. The medical profession has shown itself favourable to intra-uterine devices. Accordingly, the Government has taken steps to establish centres for the insertion of these devices at all maternity homes in Tunisia and has begun an information programme for all gynaecologists and surgeons.

Problems of research design and methods in studies of effectiveness of policy measures aimed at influencing fertility

C. CHANDRASEKARAN

I. INTRODUCTION

1. Interest in the control of human fertility has recently become widespread, and some countries, notably India, Pakistan and the Republic of Korea, have national policies aimed at a reduction in fertility through popularization of family planning. In many countries, policies or programmes which are likely to affect fertility have been pursued, although the aims of the programmes have been different. The passing of the Eugenic Protection Law in Japan in 1948 and its amendment in 1949, permitted the practices of induced abortion, sterilization and conception control primarily in the interest of the health of the mother. The legalization of abortion in Eastern European countries in recent times is said to have been necessitated by the prevalence of "blackmail abortions", and their effect on the life and health of the mother.

2. Even when the policy is clear-cut, the programme is often kept flexible. To cite India's example, the first Five-Year Plan outlined as the programme the provision of advice on methods of family planning in government hospitals and health centres. In the second Plan, private agencies were drawn into the programme by grants of financial assistance for the opening of clinics. A beginning was also made in the provision of facilities for surgical sterilization. By the beginning of the third Five-Year Plan, the programme was re-organized in the light of experience gained, and emphasis was shifted to strengthening the extension education aspects, facilitating free flow of supplies, assisting indigenous production of contraceptives, and strengthening administrative machinery at all levels.

3. Such changes tend to point out the difficulties, on the one hand, of singling out a policy measure whose effectiveness is to be studied, and, on the other hand, of describing precisely the over-all programme. Effectiveness of policies undertaken is sometimes sought in most general terms, such as when the effect of a family planning programme on national fertility is investigated. Sometimes the effect of a specific measure, such as the opening of family

planning clinics, is examined. Often—and this is particularly true at the present time, when national family planning programmes are still in the developing stage—the studies of effectiveness relate to experimental situations. It is in such situations that the problems of research design and methods of study assume great practical importance. The following discussion will relate primarily to such experimental situations. Some of the problems that arise in the assessment of the over-all effects of the major policy have been discussed elsewhere.¹

II. TYPES OF EXPERIMENTAL SITUATIONS

4. The types of experimental situations which have received attention have tended to vary in the last few years and have, in general, increased in complexity, as efforts to induce fertility changes under controlled conditions have not met with adequate success. To facilitate presentation, the situations may be classified into three groups. A discussion of these groups will follow, under separate headings.

(a) *Study of one or more elements related to a programme*

5. An experiment may, for instance, be undertaken to test which of a selected number of methods of communication for imparting knowledge of family planning or of family planning methods makes the greatest impact on a community. One such study is the Jamaican experiment, where the main objective was to test the relative effectiveness of three different educational techniques, namely, pamphlets, group meeting and case work, in achieving a change of attitude and behaviour with respect to fertility control.² As another possibility, an experiment may be designed for evaluating the acceptability and effectiveness of a specific contra-

¹ C. Chandrasekaran, "Statistical problems in evaluating the effectiveness of family planning programmes", *Report of the Asian Population Conference and Selected Papers* (United Nations publication, Sales No.: 65.II.F.11).

² J. M. Stycos and K. Back, "Prospects for fertility reduction" (New York, 1957). Mimeographed.

ceptive method. The pilot studies undertaken in India on the rythm method as far back as 1952, has such an aim.³ The Khanna study, which dealt primarily with the foam tablet method, also had this aim.⁴ Although these studies on the rhythm method or foam tablet focused their attention on methods, they had to take into account many other elements involved in the development of a family planning programme. Staffing patterns, frequency of home visits and educational materials to be used were only some of the other elements which were considered in planning the experiments. In later studies, such as the Singur study, these elements were still kept in the background, but their significance in an actual programme was not overlooked. The nature of staff appointed, the type of educational materials used, and even the family planning methods taught, were determined while taking into account their reproducibility in normal rural conditions.⁵ The Taichung programme, which can also be included in the type of situation under review, has been described as consisting of two major efforts, primarily using communication media: one that applies to the whole city, and another that varies by divisions within the city; provision of other requirements for spreading family planning practice, however, such as medical facilities or contraceptive supplies, has not been overlooked.⁶ Nevertheless, in experimental situations of the type under consideration, the researcher is inclined to highlight only one or more elements as being under study, unlike the consideration of several elements in the two situations described below.

(b) *Study with comprehensive coverage of factors*

6. Recently, it has been suggested that fertility control programmes have ignored the importance of cultural and social organization factors which are basic to changes in fertility. An elaborate design has been proposed, consisting of control groups, as well as experi-

mental groups.⁷ Independent variables regarding fertility change are divided into two categories: control independent variables and experimental independent variables. The control independent variables, which consist of social-psychological and cultural variables, are included, even though they cannot be manipulated in the experiment. The five categories of experimental independent variables—economic, environmental, community action, education and medical—are like “dosages” applied in a factorial experiment separately and simultaneously, in varying combinations.

(c) *Action-research setting*

7. A third approach is that of action-research, whose primary objective is to build an effective and feasible programme.⁸ A programme is taken to be a co-ordinated group of activities.⁹ Whatever its form, a programme is recognized as a system of inter-acting elements. Weakness of any of the elements may hinder programme success. It is the objective of action research to help to develop all aspects of such an entity. The programme is to be built through better understanding of factors which influence acceptance of family planning, and through full application of existing educational knowledge and skills, under conditions of maximum flexibility.

8. Studies described in sub-section (a) are useful in evaluating rather quickly some of the elements that might be used in the actual programme and can be carried out in relative isolation from a programme setting. The results of the experiment, however, are likely to help to a greater extent in the promotion of action if the study is conducted in a programme setting. For instance, the provision of supply facilities in an experiment designed to compare different methods of educating the public in the use of family planning might show that one method has not only high educational value, but also has success in increasing family planning practice to a satisfactory extent.

⁷ P. M. Hauser, “On design for experiment and research in fertility control”, in C. V. Kiser, ed., op. cit.

⁸ M. W. Freymann and H. F. Lionberger, “A model for family planning action-research”, in C. V. Kiser, ed., op. cit.

⁹ Component elements needed to build a programme would include, for example, recognition of a certain problem, knowledge of factors underlying the problem, availability of techniques needed to meet it, a decision to undertake large-scale action directed at the problem, sufficient public support to sustain action, addition of new personnel, or addition of new functions to existing personnel, special skills required for the application of available knowledge, materials, leadership, technical guidance, organizational structures, administrative routines, and so on.

³ World Health Organization, *Final Report on Pilot Studies in Family Planning*, vols. 2 (New Delhi, World Health Organization Regional Office for South-east Asia, 1954).

⁴ Population Council, “India: The India-Harvard-Ludhiana population study”, *Studies in family planning*, No. 1 (Population Council publication, July, 1963).

⁵ K. K. Mathen, “Preliminary lessons learned from the rural population control study of Singur”, in C. V. Kiser, ed., *Research in family planning* (Princeton, Princeton University Press, 1962).

⁶ Population Council, “Taiwan: the Taichung programme of pre-pregnancy health”, *Studies in family planning*, No. 1 (Population Council publication, July, 1963).

9. Studies described in sub-section (a) can help in the selection of elements that might be incorporated in more complex experiments, described above in sub-sections (b) and (c). Although the studies mentioned in (b) and (c) attempt to take into account the multiplicity of factors involved in programme development, their approaches are different. Studies in sub-section (b) essentially evaluate set procedures under the most general conditions of cultural setting and social organization, while studies described in sub-section (c) attempt to build programmes which seem most appropriate to specific groups of the population under existing levels of technical knowledge, cultural conditions and resources.

III. PROBLEMS OF RESEARCH DESIGN

10. Since the main aim of the studies in experimental situations, such as those described above, is to help in setting up feasible and effective programmes, the research design must permit sound evaluation of the results obtained. Modern experimental designs which find wide application, especially in the biological field, incorporate the following statistical procedures to ensure unequivocal evaluation of the effects of the treatment: use of matched experimental and control groups, random distribution of the treatments to different groups to avoid bias, and replication to enable the obtaining of valid estimates of error for testing the statistical significance of the treatment effect. Another procedure used in experimental designs of the factorial type is the inclusion of several factors in the same experiment in order to gain two advantages: avoiding the necessity of making several experiments using one factor at a time, and ensuring greater generality for the conclusions reached. (This procedure is possible because the effect of each factor is assessed under the varying levels of other factors.)¹⁰

11. For various practical and theoretical reasons, several problems arise in following strictly these statistical procedures in community experiments on fertility control. In attempting to adhere as closely as possible to the statistical principles underlying these procedures, certain modifications in the design seem necessary. Some of the problems arising from research design and the introduction of modifications are discussed below.

12. One problem is in the use of a matched external control group. In the pilot study of the rhythm method of family planning in Rama-

nagaram, a population of about 8,000, living in a cluster of villages, was selected as the treatment group and another such group was used as the control. Similarly, an external control group was used in the Khanna and Singur studies, which were also undertaken in rural areas. The use of external controls is becoming difficult, and some of the experiments undertaken recently have not made use of such controls. The main difficulty is in keeping a control group under no-treatment for the duration of the experiment. In countries where family planning is a national policy, the programme is being extended rapidly in all parts of the country. The control group is, therefore, also being exposed to some programme. This is now true of even rural areas in India. In the Taichung study, there has been no prior selection of the external control group, and the extent of decline attributable to the action programme is to be assessed by comparison with other areas, as indicated in the following statement: "Fertility data from the register for past and future years will permit an analysis of whether the decline under way in Taichung is accelerated by action programme to a rate faster than that found in other areas of Taiwan during the same period".¹¹ A similar procedure is also adopted in the Sweden-Ceylon Family Planning Project, where the fertility trends in the village experimental areas are compared with those of its own district, as well as those of Ceylon as a whole.¹²

13. The application of the principle of replication raises problems of resources, especially of finance and technical personnel. In some of the Indian studies mentioned above, a cluster of villages was taken as the experimental group. Replication of this group would have proved extremely expensive and, in the absence of some evidence that the programme would prove successful in the short run, the hesitancy to replicate the trial is understandable. Instead of a cluster of villages, the selection of the same number of villages at random would have made possible the use of the principles of replication; yet from the point of view of testing a programme, including allocation of work to a field staff, central direction, etc., the experience derived from using a group of villages as the unit was considered more rewarding than the use of a cluster. Within each density sector in the Taichung study, boundaries have been allotted

¹¹ Population Council, "Taiwan: the Taichung programme of pre-pregnancy health", *Studies in family planning*, No. 1 (Population Council publication, July, 1963).

¹² A. Kinch, "A preliminary report from the Sweden-Ceylon family planning pilot project", in C. V. Kiser, ed., op. cit.

¹⁰ W. G. Cochran and G. M. Cox, *Experimental design* (London, John Wiley and Son Ltd., 1957).

randomly to different treatments. But it is doubtful if the boundaries under each treatment have been intended to serve as replicates.

14. The main purpose of replication is to provide a measure of error and to ensure that the treatment effect revealed by the experiment is not due to chance factors. In experiments involving programmes, a variety of opportunities exists for knowing whether or not concomitant changes in attitudes or behaviour occurred which would justify the attribution of the observed effect to the programme. Such additional data obtained within the experiment might help in judging whether or not the observed effect is due to the programme, and whether it compensates, to some extent, for the deficiency arising from lack of replication.

15. A chief point of interest in experiments with programmes is the need for preserving flexibility. As new problems are experienced in the field, the need arises for instituting new measures or changing the old ones. The programme designer would like to have a design which would permit the making of such changes. The action-research model mentioned earlier is expected to meet this need.

16. There are fundamental differences between experimental situations, where the factorial type of design has proved most effective, and action-research situations. The factorial design uses basically one characteristic for measuring effect, the object of the experiment being to assess the effects of several factors, either singly or in combination, with respect to this characteristic. An underlying assumption in using the factorial design is that the assessment of the main effects is of major interest, and that the inter-actions, especially those of the higher order, are not likely to be of significance. The action-research situations are different, and the analogy between various elements in the programme, as conceived in action-research, and factors, as used in the factorial design, is superficial.

17. The action-research method of experimentation uses in its design a hierarchy of objectives.¹³ The programme is regarded as having an ultimate objective, from which is derived a descending and branching series of subsidiary objectives. Each of the sub-objectives is a means of achieving the objectives at the next higher level, and is the goal of an objective (or set of objectives) at the next lower level. The ultimate success of the pro-

gramme will depend on two factors: the extent to which the objectives in the programme network are met, and the validity of the assumptions upon which the various objectives are based.

18. The action-research programme at the Demographic Training and Research Centre, Bombay, has as its ultimate impact objective the reduction of the level of fertility. Next in the hierarchy are the three intermediate impact objectives: creating group acceptance of small family size; providing information about the feasibility of limiting the size of the family and about methods of family planning; and making family planning methods easily available. Under each intermediate impact objective, performance objectives and effort objectives have been defined.¹⁴

19. The different elements of the programme, as shown by the action-research model above, help in reaching the ultimate impact objective through a process of inter-dependence and the achievement of several lower-level objectives. The assessment of achievement with respect to each of the objectives is, therefore, an integral part of the research design.

IV. METHODS OF ANALYSIS AND EVALUATION

20. Problems arise not only in respect to the general research design, but also in respect to methods of analysis and evaluation. These are discussed below under the headings, indices of measurement, assessment of programme effects, and extent of precision desired.

(a) *Indices of measurement*

21. One of the chief problems facing the experimenter is the development of proper indices for studying important changes relevant to the experimentation. When the experiment assumes the programme type, there is special need for using a large number of indices relating to various aspects of attitude and behaviour.

22. Studies of changes in group norms concerning family size pose difficult problems. Even measurement of knowledge about contraceptive methods is not easy. The use of a scale for such measurement might be appropriate in some cultural settings.¹⁵ Terms such as acceptor must be used cautiously. Sensitive detection of trends in the total use of contraceptive methods

¹³ C. Chandrasekaran and M. W. Freymann, "Evaluating the effects of community efforts to modify family size", *Symposium: Research issues in public health and population change* (University of Pittsburgh, June, 1964).

¹⁴ Demographic Training and Research Centre of Bombay, "Report of the family planning communication action-research project" (presented at the Third Family Planning Communication Action Research Workshop, Bombay, April, 1965).

¹⁵ S. N. Agarwala, "Evaluating the effectiveness of a family planning programme", in C. V. Kiser, ed., op. cit.

is beset with difficulties. The validity of estimates of the extent of contraceptive use obtained through interviews with individual couples might require confirmation by checking with data on contraceptive consumption.

23. With respect to the measurement of ultimate impact on fertility, there is need to develop sensitive indices. An index called live birth pregnancy rate has been proposed for possible trial.¹⁶ In many situations where family planning experimentation is especially significant, routine vital statistics are grossly defective. Estimates of measures of fertility have then to be obtained through such procedures as sample surveys or sample registration.¹⁷

(b) *Assessment of programme effects*

24. The assessment of programme effects calls for information on the changes which have occurred in the programme or experimental area since the programme began. In order to study the extent of the change which can be attributed to the programme, it is useful to have, for comparison, a measure of the change in the control area over the same period of time. As pointed out earlier, however, there are situations in which it is either difficult or not

feasible to have such control areas. In such situations, and even generally, much information can be gained through interview surveys, incorporating questions which will throw light on how attitudes or behaviour became modified, and the extent to which such modifications can be attributed to one or more aspects of the programme.¹⁸ Such retrospective interview surveys offer unusual possibilities for understanding the mechanisms underlying acceptance and adoption of family planning practices; the potentialities of such surveys deserve to be investigated thoroughly. The retrospective interview surveys may be preceded by surveys before the programme starts.

(c) *Extent of precision desired*

25. At present, there is a considerable amount of variation in the rigidity of the designs used and the precision with which attempts are made to measure effects. As a rule, the closer the experiment gets to a programme situation, the less rigid the designs become. Action-research models of the type described in this paper are aimed more at achieving the objectives at various levels through one or more of several actions undertaken, rather than at establishing cause-effect relationships. Once a reasonably successful programme has been developed, further understanding of the basis processes involved is sought through diagnostic studies.

¹⁶ C. Chandrasekaran and M. W. Freymann, "Evaluating the effects of community efforts to modify family size", *Symposium: Research issues in public health and population change* (University of Pittsburgh, June, 1964).

¹⁷ B. Berelson, *et al.*, "Sample survey and population control", *Public Opinion Quarterly*, vol. XXVIII, No. 3 (fall, 1964), pp. 361-394.

¹⁸ H. Hyman, *Survey design and analysis: Principles, cases and procedures* (Glencoe, Illinois, The Free Press, 1955), chap. V.

Evaluation of a family planning programme in China (Taiwan)

L. P. CHOW

1. This paper attempts to evaluate a family planning programme in China (Taiwan) that uses the new intra-uterine contraceptive devices (IUD's). The Province of Taiwan, the Republic of China, with 12 million people on 14,000 square miles of land, has no formal government family planning policy. Family planning is available, however, through the voluntary China Family Planning Association, organized in 1954, and through the pre-pregnancy health programme (PPH), incorporated into the government maternal and child health programme in 1959.

2. During the past ten years, the Family

Planning Association recruited a total of 113,589 cases for traditional methods (condoms, foam tablets, jellies, and so on), but most of the cases did not return for renewal of supplies. The PPH programme, which started in eight townships in Nantou County in 1960, has now been extended to 115 of the 361 townships in the province. It has recruited a cumulative total of 63,249 cases, 77 per cent of whom use traditional methods. An evaluation of the PPH programme in Nantou County shows the following percentage decline in fertility between 1960 and 1963 in PPH townships, compared with non-PPH townships (table 1).

Table 1. Percentage decline in fertility between 1960 and 1963 in PPH and non-PPH townships of Nantou County

<i>Fertility measure</i>	<i>PPH townships</i>	<i>Non-PPH townships</i>
Crude birth rate.....	11.2	8.7
General fertility rate.....	7.9	6.1
Total fertility rate.....	10.5	6.8
Pregnancy rate of matched cases ^a	73	62

^a 1,361 PPH cases matching with 1,221 non-PPH matches on the basis of wife's age, duration of marriage, number of living children, and number of living sons; no match having a live birth within nine months of the corresponding PPH case's entry into the programme.

3. The figures suggest that fertility is declining in China (Taiwan), but they also indicate the inadequate impact of a programme that relies solely on traditional methods.

4. In 1962, the Lippes Loop and the Mar-gulies Coil, two IUD's, were introduced into China (Taiwan). To promote the use of IUD's, the Family Planning Extension Programme (FPE) was implemented in January, 1964, under the auspices of the Taiwan Provincial Department of Health, with the assistance of the Population Council (New York) and the Joint Commission on Rural Reconstruction (JCRR). The aim is to insert 600,000 loops in five years, with the ultimate objectives being a reduction in ten years of the crude birth rate from its present level of 36.3 to 24.0 (—34 per cent); a reduction of the total fertility rate from 5.4 to 2.9 (—46 per cent); and a reduc-

tion of the annual rate of natural increase from 3.02 per cent to 1.87 per cent (—38 per cent). The present high rate of natural increase is the result of the sharp decline in the crude death rate from 18.2 to 6.1 in the past sixteen years, while the crude birth rate changed little. Taiwan's population, including migrants, has been growing recently at about 4 per cent per annum, a rate at which numbers double in seventeen years.

5. Responsibility for evaluating the efficiency of the FPE programme rests with the Taiwan Population Studies Centre, which was established in 1961 to study population and related problems.

EVALUATION OF THE FAMILY PLANNING EXTENSION PROGRAMME

6. Evaluation of the programme promoting the Lippes Loop was built into its design. To

measure output (loop acceptors) on the basis of input of effort, different treatment densities were assigned to different townships, which were the units of observation.

7. *Pre-action surveys.* To obtain base line data for evaluation and to correlate characteristics of acceptors with those of women in the "universe", before starting an action programme in a village, the village health education nurses (VHEN's) conducted a survey on reproductive history and contraceptive practice among samples of married women twenty to thirty-nine years old. One of the findings was the high acceptability of the old type of IUD, the Ota ring. Of 14,189 respondents, 21 per cent were current users of contraceptives, of whom 34.3 per cent were Ota ring wearers and 4.1 per cent were IUD acceptors. Another survey undertaken in August, 1964, among 572 married women twenty to forty-four years old in two rural townships, showed that 25 per cent of the respondents were practising contraception, of whom 47 per cent had had tubal ligation, 1 per cent had husbands who had been vasectomized, and 33 per cent were IUD wearers, mostly of the Ota ring.

8. *Extension of use of new IUD's.* When the new IUD's were first introduced in 1962, they were made available to women in Taichung City, who received careful medical evaluation and follow-up. In an intensive nine-month educational campaign, 4,155 married women in the city accepted family planning practice, of whom 3,071, or 74 per cent, selected the new

IUD's. The extension programme was started first in Fengyuan Township, Taichung County, in January, 1964, and was extended by December to twenty of the twenty-two counties and cities in the province.

9. Two types of workers are currently employed: about 100 village health education nurses, who move monthly in teams of three persons from one village to another and integrate the subject into their regular health education activities, and 120 PPH workers (mentioned above), who are stationed in the assigned township. These workers refer motivated women to doctors trained in obstetrics and gynaecology (OBG's) for insertions. Of the 500 doctors specializing in obstetrics and gynaecology, 350 have been given one-day training. All levels of medical health personnel have been organized to support the programme.

10. A woman who wishes to have a loop inserted receives a coupon from a worker or an OBG doctor which entitles her to a 50 per cent discount on the cost, which is fixed at NT \$60 (\$1.50 in United States currency), including after-care. The coupon contains information concerning the characteristics of its holder, sources of referral, date, name of the person doing the insertion, and so on. Analysis of these coupons is being undertaken by the Population Studies Centre.

11. *Analysis of returned coupons.* Total acceptors in 1964 are estimated at 45,000, which is 90 per cent of the target. The increase by month is shown in table 2.

Table 2. IUD programme in Taiwan

Month	Cumulative number of townships participating	Cumulative number of OBG's trained	Acceptors	
			Monthly	Cumulative
January	8	62	516	516
February	19	71	478	994
March	39	184	1,534	2,528
April	76	223	2,631	5,159
May	97	253	3,351	8,510
June	116	253	3,613	12,123
July	123	279	4,122	16,245
August	138	279	5,111	21,356
September	153	310	6,319	27,675
October	165	312	6,462	34,137
November	182	329	5,490	39,627

12. Although the number of acceptors in a township increased with density of work, the efficiency seemed to reach a saturation point as the effort became more dense (table 3, table 4).

Table 3. Acceptors in response to the density of effort

Person-months of work in a township	Loop acceptors		Married women (ages 20 to 44) per township	Rate of acceptance (per cent) ^a	
	Per township	Per person-month		Per township	Per person-month
1.1.....	58.7	53.4	3,553	1.65	1.50
2.8.....	103.4	36.9	5,314	1.95	0.70
5.3.....	101.8	19.2	5,255	1.94	0.37
7.2.....	148.2	20.6	4,937	3.00	0.42
8.1.....	150.7	18.6	4,036	3.73	0.46
10.1.....	187.3	18.6	5,021	3.73	0.37
20.2.....	779.0	38.6	14,710	5.30	0.26
Average ...	133.6	24.3	4,892	2.73	0.49

^a Per cent of total married women, ages 20 to 44.

Table 4. Acceptors by number of CBG doctors

Item	OBG's per township			
	0	1 to 3	4 or more	Total
Number of townships	92	49	23	164
Total person-months of work.....	427	300	178	905
Total acceptors ^a	8,304	6,592	7,016	21,912
Average acceptors per person-month...	19.4	22.0	39.4	24.2

^a Total acceptors, not only those referred by VHEN's and PPHW's.

13. The analysis also shows that spreading the effort over a whole township is more efficient than concentrating in a single village.

14. *Characteristics of acceptors and sources of referral.* The modal characteristics based on analysis of 36,513 returned coupons are women with four living children (24.6 per cent); women with two living sons (38.1 per cent); women thirty to thirty-four years old (34.6 per cent); and women having elementary education (40.9 per cent). Based on women with one living child as 100, the indices for acceptance rates are as follows: 475 (two children); 867 (three children); 1,075 (four children); 1,100 (five children); and 1,400 (six children and more than six children). Similar indices for education levels are these: elementary schooling (100); no formal education (139); junior high school graduate (106); and senior high school graduate and advanced studies (194).

15. By December, 1964, 3.0 per cent of married women ages twenty to forty-four in the province had accepted the loops. The rates of acceptance by age groups are women ages twenty to twenty-four (0.9 per cent); ages

twenty-five to twenty-nine (3.0 per cent); ages thirty to thirty-four (4.5 per cent); ages thirty-five to thirty-nine (3.9 per cent); and ages forty to forty-four (1.7 per cent).

16. The 120 PPH workers referred 36 per cent of the acceptors, followed by 32 per cent referred by 300 OBG doctors, and 15 per cent referred by some 300 health centres and station staff. The VHEN's, as far as the number of returned coupons shows, have referred only 9 per cent of the total acceptors. A further test based on interview, however, showed their influence to be 85 per cent of that of the PPH's.

17. *Follow-up interview.* Public health nurses of the Population Studies Centre interviewed samples of acceptors on such questions as whether the loop is still *in situ*; if not, and not expelled, why removed; pregnancies; side reactions; who influenced most in the decision to accept the loop; etc.

18. Results of the interview came rather close to the medical studies, suggesting that this is a satisfactory way to evaluate a large-scale action programme. It cost the equivalent of 50 U.S. cents to interview one case (table 5).

Table 5. Results of follow-up interview of acceptors

Item	Follow-up interview	Medical study	
		Sixth month	Twelfth month
Average months of use.....	4.2	6	12
Total months of use.....	4,448	3,978	14,393
Expulsion rate (percentages).....	4.4	8.0	11.3
Removal rate (percentages).....	13.1	20.1	22.2
Re-insertion rate (percentages)....	1.6	3.0	3.5
Continuous users (percentages)....	83.9	75.0	70.0
Pregnancy rate	3.8	3.6	5.3

19. Of 602 acceptors interviewed in the follow-up survey, it was found that PPH workers had issued the most coupons (33.9 per cent), but that most cases (22.6 per cent) had been influenced by satisfied users. Influence of husbands or decisions made by wives themselves accounted for 17.1 per cent, followed by VHEN's (16.2 per cent), OBG's (15.8 per cent), PPHW's (14.3 per cent), health centre staff (7.0 per cent), neighbours not wearing loops (5.8 per cent), and midwives (1.2 per cent).

20. Reasons for not inserting loops were ascertained by interviewing samples of women who had accepted coupons, but had failed to take action. Of these women who did not use the coupon, more than a third (38.4 per cent) did not really mean to use it. Lack of confidence and hesitation (among 27.5 per cent) were the second major reasons given, followed by influence of others (including medical practitioners) (17.4 per cent), inadequate motivation (11.5 per cent), and miscellaneous reasons among the remaining 5.2 per cent.

21. *Field studies for maximum insertions at least cost.* Three field experiments have been undertaken for this purpose. In a "group meeting study", a 4.0 per cent acceptance rate among married women ages twenty to forty-four in the study area was obtained within four months. Of the acceptors, 55 per cent came from "Treatment I" area (meeting in every

neighbourhood), and 45 per cent from "Treatment II" area (meeting in every other neighbourhood), of whom, again, 70 per cent were from areas where meetings were held and 30 per cent were from areas where no meetings were held, indicating a circulation effect.

22. The second study attempted to measure the effect of a distribution of fliers and the impact of an offer of free insertions for a limited period. In four months, 12.1 per cent of the married women ages twenty to forty-four were using the new IUD's, compared with a trivial 0.7 per cent before the study.

23. By the payment of a sum equal to 25 U.S. cents for a referral, the third study procured a 3.3 per cent acceptance rate of the loops in four months. Travelling salesmen (33 per cent), the doctor himself (25 per cent), and satisfied wearers (17 per cent) referred most of these cases.

24. *Cost of procuring one case.* The average cost to recruit a woman for a loop was 412 new Taiwan yuan by the regular FPE programme. It cost NT \$126 by the group meeting study, NT \$76 by the fliers and free insertion study, and NT \$40 by paying for referrals. Caution is necessary, however, in interpreting these results for practical application.

25. *Effect of the programme.* That the action programme implemented in Taichung City with new IUD's has had an effect can be seen in table 6.

Table 6. Percentage decline in fertility rates in Taichung and four other cities, 1964^a compared with 1963^b

Rate	Taichung	Keelung	Taipei	Tainan	Kaohsiung combined	Five
Crude birth rate (in percentages)...	6.9	3.1	0.3	3.6	1.7	2.4
General fertility rate (in percentages)...	7.7	2.6	0.8	3.7	2.5	2.8
Total fertility rate (in percentages)...	7.3	1.5	0.7	4.1	2.8	2.6

^a Covering nine months, January throughout September.

^b Covering nine months, January throughout September.

26. Based upon the age specific-marriage fertility rates of 1963, age distribution of acceptors, and the results of medical follow-up study (including expulsions and removals), it has been estimated that about six insertions are necessary to prevent one live birth per year. The 45,000 loops inserted in Taiwan during 1964, therefore, will probably prevent 7,500 live births in 1965, which is about 1.8 per cent of the total annual live births in the province.

EVALUATION OF THE OVER-ALL FAMILY PLANNING PROGRAMME OF TAIWAN

27. Several surveys indicate that the proportion of married women practising contraception has increased from about 3 per cent in 1952 to about 30 per cent in urban areas and 25 per cent in rural areas in 1964.

28. From 1958 to 1963, the crude birth rate decreased from 41.7 to 36.3 (13 per cent reduction), the general fertility rate from 185 to 170 (8 per cent) and the total fertility rate from 6,079 to 5,351 (12 per cent). How much of the decline is ascribable to the programme is difficult to say.

29. Wider acceptance and practice of birth control may be observed through the pattern of

fertility decline, which occurred, however, mainly among women more than thirty years old. Although the decline was observed in both urban and rural areas, the degree of decline was greater in the former.

30. Having many children, sons in particular, together with longevity and wealth, had been the three major happinesses of the Chinese community. This traditional concept seems to be undergoing radical change. A recent fertility survey conducted on a sample of 2,432 married women ages twenty to thirty-nine in Taichung City shows that 92 per cent of the respondents are in favour of family planning; 30 per cent have used contraceptives at some time; 17 per cent are current satisfied users; and 49 per cent would like to practise in the future. Among 95 per cent of the respondents, the desired number of children was less than four, although currently, an average woman will have 5.4 children.

31. A plan for a province-wide fertility sampling survey to be repeated at intervals is being prepared to evaluate the progress of the action programme in a more systematic manner than in the past.

Family planning and the population problems of Hong Kong

DAPHNE CHUN

1. The need for population control in Hong Kong is more urgent than in any other area of the world. Occupying a land area of 398 square miles, with only sixty-two of them inhabitable,¹ Hong Kong had a population of 3,375,000 in 1964 (see table 1). This density of 9,400 persons per square mile is equivalent to accommodating the population of the whole world in

a circle with a radius of about one hundred miles. Inhabited by less than 600,000 persons just after World War II, the Colony has had a phenomenal increase of more than 3 million people in twenty years. Represented in this increase are nearly 300,000 pre-war residents who returned, more than a million persons who are refugees from China (mainland), and the remaining persons, who are the product of the excess of the number of births over the number of deaths.

¹ *Hong Kong Government annual reports* (1945-1964).

Table 1. Population statistics 1945-1964

Year	Estimated population	Total increase (natural and refugee/immigrant)	Natural increase (live births less deaths)	Increase by refugee influx and immigrants
1945.....	560,000	—	—	—
1946.....	1,600,000	346,861	15,445	331,416
1947.....	1,800,000	200,000	29,242	170,758
1948.....	1,800,000	1,300,000	34,041	95,959
1949.....	1,860,000	60,000	38,487	21,513
1950.....	2,060,000	200,000	42,135	157,865
1951.....	1,985,000	134,535	47,920	86,615
1952.....	2,250,000	265,000	52,517	212,483
1953.....	2,250,000	199,535	57,244	142,291
1954.....	2,300,000	204,069	64,034	140,035
1955.....	2,400,000	100,000	71,431	28,569
1956.....	2,535,000	135,000	77,451	57,549
1957.....	2,677,000	142,000	78,469	63,531
1958.....	2,806,000	129,000	86,070	42,930
1959.....	2,919,000	113,000	84,329	28,671
1960.....	3,014,000	95,000	81,521	13,479
1961.....	3,226,400	212,400	89,990	122,410
1962.....	3,526,500	300,100	91,581	208,519
1963.....	3,642,500	116,000	95,515	20,485
1964.....	3,739,900	97,400	90,406	6,994
		3,179,900	1,227,828	1,952,072

SOURCE: Commissioner of Census and Statistical Planning, *Hong Kong Census*, 1961.

2. The greatest influx of refugees occurred in 1949, at the beginning of the communist régime, and in 1961 and 1962, when there was a shortage of food. Since the 1962 influx, the Hong Kong Government has imposed a restriction on innumigrants. As a result, there were only 6,944 immigrants last year. On the other hand, the natural increase (births over deaths)

rose steadily in recent years, due to the marked decline in the death rate, which was 10.2 per thousand in 1951, but only 4.2 in 1964 (see figure I). The combination of a rapid natural increase and an influx of immigrants has created tremendous problems of housing, education, medical care, health services, etc., in the Colony.

Table 2. Health and education statistics 1953-1964

Year	Estimated population	Doctors		Nurses		Hospital beds		Number of students	Number of teachers
		Number	Ratio	Number	Ratio	Number	Ratio		
1953.....	2,250,000	653	1:3445	1,338	1:1682	4,512	1:499	201,541	8,820
1954.....	2,300,000	700	1:3571	1,411	1:1772	4,695	1:532	250,000	9,166
1955.....	2,400,000	773	1:3105	1,489	1:1612	4,880	1:492	246,833	10,410
1956.....	2,535,000	794	1:3193	1,596	1:1588	5,577	1:455	298,609	12,450
1957.....	2,677,000	899	1:2978	1,721	1:1555	6,970	1:384	308,180	11,428
1958.....	2,806,000	985	1:2849	1,910	1:1469	7,600	1:469	418,540	13,334
1959.....	2,919,000	1,011	1:2887	2,068	1:1411	7,702	1:379	484,986	17,878
1960.....	3,014,000	934	1:3227	1,740	1:1732	8,090	1:373	572,806	19,802
1961.....	3,226,400	1,107	1:2914	1,857	1:1737	9,444	1:342	658,618	21,152
1962.....	3,526,500	1,189	1:2966	2,056	1:1715	10,017	1:352	685,728	20,204
1963.....	3,642,500	1,372	1:2655	2,317	1:1572	11,719	1:311	810,632	27,590
1964.....	3,739,900	1,466	1:2551	2,763	1:1354	11,989	1:312	824,557	24,329

SOURCES: *Hong Kong Education Department Reports, 1953-1964*; *Hong Kong Medical and Health Services Reports, 1953-1964*; *Annual Reports of the Family Planning Association of Hong Kong, 1951-1964*.

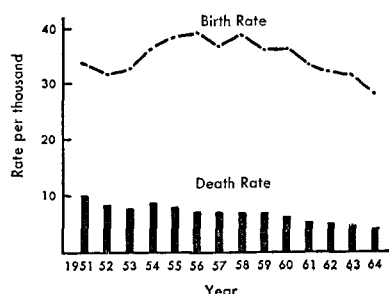


Figure I
Birth and death rates

3. Although numerous resettlement housing estates have been built continuously, supply simply cannot meet the demand; thousands and thousands are still living in squatter huts. Since 1953, the number of medical doctors has doubled, rising from 635 to 1,466 (see table 2), yet the doctor-to-population ratio has improved only from 1:3,445 to 1:2,551. During the same period, hospital beds were increased by 288 per cent from 4,512 to 11,989, but the hospital bed-to-population ratio was narrowed only from 1:499 to 1:312. In the past decade, many new schools were established, with a two and one-half-fold increase in the number of teachers and more than a threefold increase in the number of students (see table 2), yet annually 60,000 children of school age cannot gain admittance to schools.

4. The population problems of Hong Kong are, therefore, clear and alarming. Existing trends give a projection of almost 5 million people by 1971.^{2,3} What is to be done? Because

restrictions of a rapid population growth usually result from an increase in the death rate or a decrease in the birth rate, the only recourse is the control of fertility. To this end, among other aims, the Family Planning Association of Hong Kong was established in 1951, with two clinics. By the end of 1964, there were fifty-two clinics. It is, indeed, gratifying to note the increase in attendance from approximately 3,000 at the commencement to almost 1,200,000 last year (see figure III). In 1964, there were 46,038 patients (21,920 new, 24,118 current) with a total of more than 116,000 visits. Our conservative estimate is that more than 25,000 births have been prevented in the past year (see figure II). This estimate is based on the fact that 80 per cent of the fertile women would have conceived within the year if family planning had not been practised. The estimated number of births prevented every year directly as a result of practising birth control is also shown in figure II, which illustrates that our methods of birth control have become increasingly effective. The average outlay for each case, calculated on our yearly expenditure against the number of patients treated, comes to only 15 Hong Kong dollars (2.6 United States dollars or one British pound). The

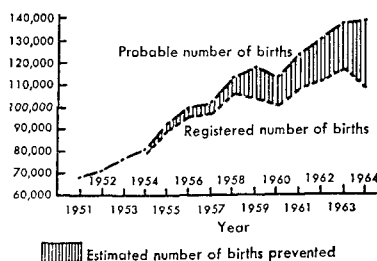


Figure II

² Commissioner of census and Statistical Planning, *Hong Kong life tables, 1961-1968*.

³ Benjamin N. H. Mok, *Population projections for Hong Kong, 1961-1971*.

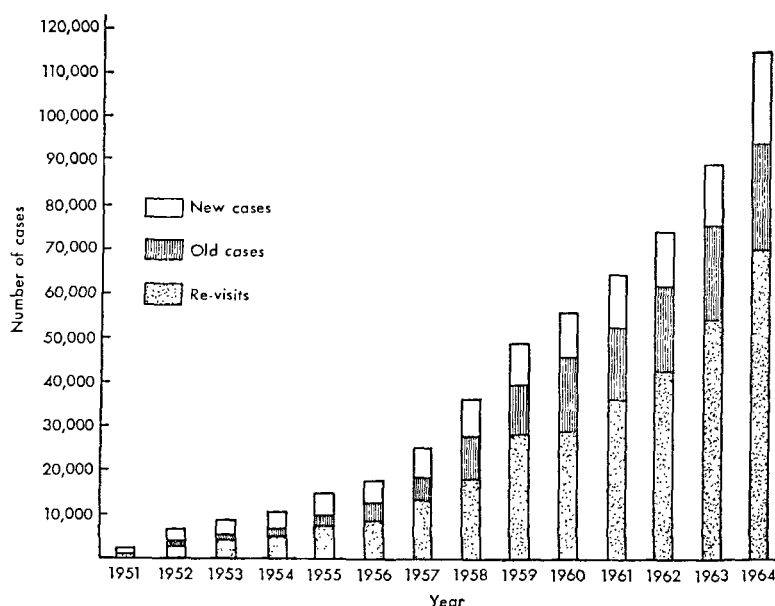


Figure III
Family planning clinic attendance

annual cost to the parents and to the Government for food, clothing, housing, maternity care, public health and welfare for these 25,000 unwanted children can reach more than HK \$800 (U.S. \$130 or British £46 1s. 2d.). This amount will increase in the ensuing years, when the children need education. Ultimately, these children will contribute their offspring, to increase further the population.

5. Figure I shows that the birth rate was very high until 1960, ranging between 34 per thousand in 1951 and 39.7 in 1956, compared with an average of twenty-four for advanced Western countries. The efforts made by the Association finally proved effective when the birth rate dropped to 32 per thousand in 1961. In 1964, the rate was down to 29, the lowest ever recorded for Hong Kong, with 6,744 fewer births than in 1963.

6. Because the majority of our people are poor and housed in quarters shared with others, it was necessary to find a method of birth control which is economical, harmless, effective and convenient. This method appears to be the intra-uterine device (I.U.D.). It was introduced on a trial basis in June 1963. The response was so favourable that by March 1964, we were able to compare the various methods prescribed by the Hong Kong Family Planning Association.

7. Our study was confined to the five most popular contraceptive methods used by 3,000

couples (see table 3), comprising 500 cases each using (a) diaphragm with contraceptive jelly or cream; (b) foam tablets; (c) condoms; (d) oral pills; and (e) 1,000 cases using the intra-uterine device. All cases were taken consecutively. Table 3 shows that I.U.D. patients had the fewest complaints, the lowest accidental pregnancy rate and the highest continuation of use after a minimum observation period of three months. Although mild complications were noted, such results as bleeding, menorrhagia and pelvic infection were conspicuously absent.

Table 3. Comparison of various contraceptive methods

Method	Complaints (per cent)	Accidental pregnancy (per cent)	Continuation of use (per cent)
Diaphragm	4.8	6.4	75
Foam tablets	3.2	13.4	58
Condoms	1.6	5.2	70
Oral pills	4.8	0.6	85
I.U.D.	1.5	0.33	93.9

8. It is not necessary to dwell on the instructions for the use of the I.U.D., because these are packed with the supplies of loops and inserters. I should, however, like to comment on several points:

(a) *Bleeding*. It is important to thread the loop into the inserter just before using, or the

loop may not resume its double "S" shape after insertion. This failure may cause a portion of it to lie in the cervical canal and to give rise to constant irritation or bleeding. Slight bleeding after insertion is to be expected. This may last a few days, due to the slight trauma inflicted by passing the "uterine sound" to find both the direction and the size of the uterus or by inserting the loop. If the bleeding persists for a week or two or if there is severe bleeding or abdominal pain, the loop should be removed. Under such circumstances, removal is preferable. The loop may be reinserted after the next period. Meanwhile, the patient can be advised to use another contraceptive, or condoms;

(b) *Expulsion.* Some uteri are so irritable that they cannot tolerate the presence of the loop. This was found to be the case with 9 per cent of our patients. After the loop was reinserted, there were only 1.4 per cent expulsions. Should expulsion occur after reinsertion, the patient should be taught other contraceptive methods. The use of oral pills is the safest of the temporary methods;

(c) *Accidental pregnancy.* Pregnancy may occur when the patient is not aware that the loop has been expelled, or even when the loop is *in situ*. Fortunately, the number was well under 1 per cent in our cases. After pregnancy has been confirmed, and if the thread of the loop can be seen, grasp it with a pair of forceps to remove it. It also may be left undisturbed. We have followed several pregnant patients with loops *in situ* and have found no malformations of babies at birth. The loops were found incorporated either with the placenta or with the membranes, with no harm to either the mother or to the infant;

(d) *Action to prevent pregnancy.* It has been proved experimentally, by using monkeys,³ that a loop in the uterus increased peristalsis of the fallopian tube, so that the ovum did not remain long enough to be fertilized. Occasionally, this peristalsis fails, which accounts for the accidental pregnancy rate of 0.33 per cent;

(e) *Removal.* The plastic material of the loop is inert and seldom causes infection. The loop can be left in place indefinitely, or until the patient wants another child. We now have followed more than 1,600 patients using the

loops for almost two years and have had no complaints;

(f) *Patients suitable for I.U.D.* We use the loops only for patients who have had at least one child delivered. The cervical canal is somewhat dilated after a delivery, which enables us to insert loops easily. For those who have never had a child, the use of oral pills is recommended as the safest of the contraceptives. The loop can be used for *nullipara*, but the cervical canal may have to be dilated under anaesthesia before the loop is inserted.

Table 4. I.U.D. complications

	Per cent
Complications:	
Slight bleeding.....	4.6
Abdominal pain.....	
Lack of confidence.....	
Expulsion after first insertion.....	9.8
Expulsion after second or third insertion..	1.4

9. With the encouraging results (shown in both the figures and the tables of the text), we started to manufacture the loops and inserters here. The cost of production is equal to U.S. \$0.03 per loop and U.S. \$0.35 for an inserter. We also opened more clinics. In 1964, there were almost 10,000 new cases for the use of the I.U.D. This figure represents 42.65 per cent of all new patients for the year. Aside from being the least expensive of the methods available, the I.U.D. is less tedious to use from the standpoint of the patients and the staff, because re-visits are seldom required, except for re-checking and observation.

10. The appreciable drop in the number of births, in spite of the continuous rise in population, and the great reduction of the birth rate in 1964 might well be attributed to the large-scale use of the I.U.D. and other contraceptive methods. With further expansion of I.U.D. clinics (see figure III) and the consequent increase in users of the method (almost 3,000 new cases in January 1965), a further decrease of at least ten thousand births may be anticipated by the end of this year. We hope Hong Kong eventually will be able to provide adequate educational facilities and health services, as well as housing accommodation for all. These provisions not only will bring happiness to every family in Hong Kong, but also will contribute to the security of the world by helping to balance resources and population.

³ Luigi Mastroianni, "Mechanism of action of the intra-uterine contraceptive device in the primate", *Second International Conference on Intra-uterine Contraception* (New York, Population Council, 1964).

Application of learning theory to a family planning programme in Dacca, East Pakistan

WILLIAM GRIFFITHS, BERYL J. ROBERTS and RAISUNNESSA HUQ

1. In its second Five-Year Plan, the Government of Pakistan included a family planning scheme which led to the development of many activities to meet increasing population pressures. One of the efforts to discover and appraise practical educational approaches which would be valuable in instituting intensive family planning programmes was the Public Health Education Research Project in Family Planning in Dacca, East Pakistan. The project was established by an agreement with the ministries of health, labour and social welfare of Pakistan, the University of Dacca, East Pakistan, and the Population Council of New York. After nine months of educational effort by the project, some preliminary results (which might not be substantiated when the data are more thoroughly analysed over a long period of time) allow for a limited discussion of findings relating to the educational components of learning theory.

2. The research project, first in Dacca as an urban area, and later in rural areas, focused mainly on educational activities relating to clinic and community family planning programmes. The primary objective was to explore effective and appropriate educational methods, motivation, and channels of communication, in order to understand which conditions provided the best possible learning situations for adults. Because public health workers had had some success in applying educational methods toward solving various public health problems, it was important to learn the effectiveness of these established methods in family planning, which is relatively new to public health workers.

3. The theory of learning, when applied to working with adults in a community setting, has, of course, several dimensions. Once the target group has been selected, in any educational programme whose goal is creating new health behaviours or exchanging old health behaviours for new ones, the factors which facilitate or prevent movement toward the desired goal must be identified. These factors become the "core" of the message in working with the target group, regardless of whether

the message is carried through formal information agencies, through small groups, or in a person-to-person educational situation. For example, J. M. Stycos believes that economics are more important than health conditions in motivating people to accept family planning.¹ If one accepts this economic factor, he must give it a central role in the messages developed for family planning programmes.

4. Other forces must also be identified if educational methods are to be effective. Reference individuals and groups play a major role in the processes of decisions by all human beings. Whether a person will change his behaviour or adopt new practices depends on the opinions and attitudes of those individuals and groups important to him. In our urban study area, it was essential to learn and compare the influences in the processes of decisions made by the husband, the wife, members of the extended family, and civic and religious organizations.

5. Learning the appropriate channels to communicate with the target group is often difficult. Direct and indirect measures must be considered, and their relative and eventual potential must be estimated before deciding where the emphasis should be placed. Direct measures through information agencies and personal conferences may have advantages, but the cost and the time required of trained personnel must be considered. Indirect measures of reaching a large target group through secondary sources (for example, working with influential persons or opinion leaders, on the assumption that they are carrying the message to many others) have certain obvious advantages and disadvantages.

6. Many individuals confronted with new ideas will often delay making a decision. This "sleeper" effect phenomenon must be considered in any communication where decision

¹ J. M. Stycos, "A critique of the traditional planned parenthood approach in underdeveloped areas", in C. V. Kiser, ed., *Research in family planning* (Princeton, New Jersey, Princeton University Press, 1962), pp. 477-501.

making or action is an important objective. Certainly, educational programmes in family planning cannot measure the true effectiveness immediately after the educational effort.

7. Workers in action programmes (often referred to as "change agents") have been investigated from several aspects. Sex, age, place of residence, education, experience, and training have been some of the classifications studied in hypothesizing the effective role of change agents in community development, agricultural extension, social welfare, public health, and other community action programmes. Family planning programmes must view with particular care the agent of change in every dimension related to the effectiveness of his role.

8. In the major urban study undertaken, different channels were used: education through only men; education through only women; and no education planned through a control group. In the three experimental housing areas, educational activities of various kinds were conducted. Where the channel of communication was intended for both husbands and wives, separate home visits were made to each and small group meetings, as well as large group meetings, were held. Attempts were also made to identify some of the individuals having influence in the housing colonies. Special educational work was planned for this group in the hope that they would influence others in the colony. Where the channel of communication was for wives only, the educational activities were limited to females; the same procedure applied to channels for husbands only. In each of the three housing areas, personnel were selected and trained to operate family planning clinics, as well as to carry out clinic educational activities. In the clinic areas where only men and only women were the educational target groups, spouses visiting the clinics received no special educational instruction other than what is usually given in any government family planning clinic. In the control area where no educational effort was made, a clinic was established, but no special educational activities were undertaken.

9. The 547 husbands and wives of the target population were government class III workers (clerks and semi-skilled workers) and class IV workers (peons) living in government housing colonies. A survey undertaken by the project staff provided valuable information about this target population. All wives were in the age range to be child producing. The modal age for wives was twenty-eight years, for husbands 38 years. The average number of living children was 3.8. About 80 per cent of the husbands and

27 per cent of the wives were literate in Bengali, and nearly all couples were Moslem. When questioned about their knowledge of temporary family planning methods, 24 per cent of the husbands and 30 per cent of the wives reported they knew of no method. The condom was the most frequently known family planning method. Husbands, more often than wives, knew where to seek advice on family planning. Almost half of the husbands who reported knowing one or more temporary methods had used family planning methods at one time or another. Disapproval of the use of temporary methods by individuals having knowledge of methods was voiced by nearly one third. Approximately half of the couples desired no additional children, and of those couples who wanted more, approximately one third desired some delay before having the next child. Couples having three to five children more frequently expressed a desire for no additional children than couples having six or more children. As might be expected, couples with no male children were the ones most often desiring additional children.

10. Some preliminary results indicate that there was a fair level of expressed receptivity to additional learning about family planning. Those individuals who received the greatest amount of educational exposure were, in general, the ones most receptive to further learning about family planning. In contrast to individuals who had only minimal educational exposure or no exposure, those with the greatest educational exposure were the most likely to have used family planning methods previously. The group with the greatest participation in educational activities might be characterized as follows: men and women who had been married approximately fifteen years, thirty-five years of age, having four children, literate, eager to receive contraceptive supplies, and expressing some degree of dissatisfaction with the traditional methods of contraception. These individuals also were more likely to become continual contraceptive users; those who had received no education were the least likely to become continual users, and those with a minimal amount of educational exposure were between these two groups.

11. The housing colony in which both husbands and wives received the educational effort had the largest percentage of users. In the two channels of communication directed at only one of the sexes, the percentage of users did not differ significantly.

12. In the control area in which no planned education took place, individuals without the educational activities were users about as fre-

quently as those individuals in the channels of communication aimed at one sex. J. M. Stycos,² in his Puerto Rico study, and Judith Blake,³ in her Jamaica study, found a lack of communication between husbands and wives about contraceptive methods. Possibly this lack of communication significantly affects the adoption of family planning practices. We suspect that inter-spouse communication occurred more frequently in the husband-and-wife channels of communication than in the one-sex channels of communication. We also plan to check further the influence that continual home visits might have had on individuals.

13. During the first few months of the action programme, a higher percentage of individuals came to the clinics seeking supplies in the experimental areas than in the control area. The picture changed at the end of a nine month period; after that time, the highest percentage of individuals seeking supplies was from the area in which both husbands and wives had received the educational effort. The next highest percentage of individuals seeking supplies was from the control area. In the areas where only husbands and only wives received education, the percentages of those seeking supplies were the lowest of all the areas, and in the groups for husbands only and for wives only, the percentages were approximately the same. It will be interesting to learn whether other changes occur in the future. Again, it may be that continual home visits only to husbands or only to wives are the key factors. Pressures to adopt family planning practices directed toward only one spouse may still be too strong and may have disadvantageous effects on an area as highly personal as family planning.

14. Asking individuals whether they would be interested in learning more about family planning is not always a reliable measure. A number who indicated that they did not desire to learn more about family planning methods later used the opportunities for instruction.

15. In the rural study, a *thana* (population 125,000; approximately 146 villages) was selected for instituting family planning programmes. Before work began in the *thana*, several villages outside of the *thana* were selected in order to pre-test a variety of educational approaches. Activities that proved to be successful, especially those which the government was able to adopt as part of a national programme, i. e., activities involving minimal

cost and a minimal number of professional personnel, were then undertaken in the *thana*.

16. Exploration in the laboratory villages is a continuous process and transfer of learning is constantly being made to the *thana*. The *thana* being used consists of seven unions, governmental sub-divisions, with populations ranging from 14,723 to 20,761. In each union, varied educational approaches are being tried. No attempt will be made to describe in detail all the educational activities undertaken.

17. In a union, a well trained professional field staff can conduct the fact finding essential for carrying out educational programmes in a rather short time. We have also found that a professional staff can train workers who have only secondary education to conduct important fact finding. Transportation problems can be noted, facilities for meetings found, community officials and some other community leaders can be identified (with an appraisal made of their interest and attitudes), and sanction obtained for an educational programme. With this preliminary information, educational programmes can then be carried out in rural areas by carefully selected and well trained non-professional personnel having only secondary education. Rather close supervision is essential at first. Non-professionals can become effective as leaders of small discussion groups and in explaining family planning methods in home visits.

18. Villagers have been used successfully as volunteers to distribute contraceptives and to maintain records. As reported by Celestina Zalduondo on the findings in Puerto Rico,⁴ it is important to remain in frequent touch with the volunteers, not only to assist in the maintenance of records and to supply contraceptives, but also to give recognition and support to their work. Holding group meetings with volunteers and giving them an opportunity to express their ideas and to ask questions, has been a valuable procedure. Only the opportunity to meet socially provides an important incentive to attend group meetings. In general, our best women volunteers are the ones who have a high interest in family planning and who have the support of their husbands in serving as volunteers. They are also women who are usually at home most of the day, so that they are available to dispense supplies. The best men volunteers also have a high degree of interest in family planning. They

² J. M. Stycos, *Family and fertility in Puerto Rico* (New York, Columbia University Press, 1955).

³ Judith Blake, *Family structure in Jamaica* (New York, The Free Press of Glencoe, 1961).

⁴ Celestina Zalduondo, *Extensive use of the volunteer in a family planning programme* (presented at the third regional conference of the International Planned Parenthood Federation, Western Hemisphere Region, Barbados, West Indies, 20 April 1961).

are usually a socially mobile group who are in their middle ages.

19. Efforts are also being made to discover the effectiveness of having shop-keepers in important bazaars serve as dispensers of contraceptives. These sources for supplies seem to be successful, but we have still many things to learn before we can generalize about the best locations and shops to use.

20. In both urban and rural areas, the project staff found little or no opposition to family planning. A few individuals expressed concern that family planning practices could destroy lives, but their apprehensions were dispelled in discussions with staff members. Religious objections were practically non-existent

in the rural areas and infrequent in the urban areas.

21. The effectiveness of a professional staff's working with urban and rural people did not seem to be related to age, marital status or prior work experience. The sex of the worker in East Pakistan is, of course, an important factor for field and clinic work in family planning. Family planning activities with men and with women must be done, at least at the present time, by workers of the same sex. The most important characteristics of professional field workers were acceptance of family planning as an important national programme that would be helpful to the people of Pakistan and an enthusiasm for undertaking educational activities with individuals and groups.

Evaluation of programme objectives in family planning

JOHN F. KANTNER and FREDERICK F. STEPHAN

1. The title of this paper may be read with stress either on "evaluation" or on "objectives". The two words are, of course, intimately related. We shall discuss aspects of both: first, the problem of setting objectives; and second, the problem of evaluating the results of the efforts put forth to achieve these objectives.

2. In family planning, as in other programmes, setting specific goals and objectives is one way of making broadly conceived purposes effective as a guide to action. The function of these goals is, first of all, to define what is to be done. Thereafter, they have a second function of providing landmarks for mapping out the details of the programme and making the many particular decisions that must be made in the course of conducting the activities, day by day and month by month, through which the programme is actually realized. Finally, their third function is to permit the measurement of progress and the evaluation of the results of these activities.

3. Clearly, family planning programmes should themselves be well planned. Their accomplishments may be affected greatly by how well their objectives are determined, as well as how consistently they are sought in subsequent efforts to carry out the programme.

4. Objectives may be set too low or limited unduly. They then tend to restrict the programme, while at the same time they make its (limited) success easier and more likely. A sound evaluation of a programme with low objectives should take account of the fact that too little was attempted.

5. Conversely, objectives may be set too high or made too comprehensive. They then tend to scatter the effort, waste resources in attempts to reach impractical or unattainable goals, and discourage participation in the programme, as well as support for it. By overly ambitious objectives, it may be possible to arouse larger support and exertion, but there is danger of failure to accomplish what could be done by a programme directed to reasonably feasible objectives. A sound evaluation should take account of the fact that too much was attempted.

6. In family planning, we have seen sharply limited objectives that were appropriate in the small-scale experiments and demonstrations to which they applied, but would be quite inadequate to a fully-developed national programme intended to cope with the severe problems of rapid population growth and economic development. We have also seen major goals for the control of population growth set forth as objectives of programmes that seem, on realistic examination, to be quite inadequate to accomplish them. To avoid the crises that inevitably arise when the course of events forces a realistic evaluation, objectives and expectations should be appropriate to the circumstances, national and local, under which the programme will be conducted; competently developed in relation to both the urgency of the problem and the practical limitations that set the bounds of feasibility for various programme possibilities; and well calculated to make the most of resources and opportunities. But this statement is also true of the objectives of other major programmes; indeed, the objectives of family planning programmes will ordinarily be established within the larger context of health and public welfare programmes and the national economic planning activity, or its equivalent. Thus, the evaluation of such programmes cannot be done adequately without due consideration of the more relevant aspects of other national plans and programmes.

7. In an essential respect, the objectives of family planning programmes must be quantitative. No one would seriously consider confining the choice to one between a moratorium on all births for five or ten years, and letting the rate of natural increase continue at its present high level. The objective will ordinarily be a schedule of progressive reductions in the rate of natural increase or in the birth rate. To draw up such a schedule, one must ask, "How rapidly can these reductions be accomplished?" and "How much must the growth rate be reduced to be tolerable?" At first, it may be possible only to guess at the answers to these questions, but as evidence accumulates from surveys and the actual operation of the family planning programme and as firmer de-

terminations of the rate of economic growth are made, the answers can be improved and made more dependable.

8. Several countries have set objectives in terms of the reduction of the growth rate and the birth rate, then revised these objectives in the light of further experience. Clearly, a current evaluation of the progress achieved should not be based rigidly on the original schedule of objectives. Neither should it merely substitute the new schedule. It should consider the extent to which the changes are a consequence of improved information on what is feasible; adjustment necessitated by failure to meet objectives (or greater success than anticipated) during the early stages of the programme; and reflections of changes in the support of the programme, possibly due to competing claims on national resources.

9. In an essential respect, the objectives of family planning programmes are qualitative, especially as they relate to the means of achieving them. Some reduction in the growth rate could be accomplished by slowing down or suspending other public health programmes and services, but this is not acceptable. It should be acceptable, though, to allocate to family planning some amount of resources that alternatively could be devoted to accelerating other public health activities. Similarly, the means for accomplishing family planning objectives must be compatible with various legal, social, medical and political norms. For example, reduction in birth rates has sometimes been achieved through increased use of contraception combined with more frequent recourse to abortion, especially in cases of contraceptive failure. Abortion is one means to lower fertility levels, but it may not be sanctioned as a means for achieving a reduction in fertility. Such absolute and, at times, relative restrictions must be recognized not only in working out details of the programme, but also in evaluating its effectiveness.

10. Not only are there alternative means to be considered, but also a multiplicity of ends. Family planning is often seen as a way to improve the health of mothers and children; as a substitute for abortion; as a way to forestall future unemployment problems; as a measure to reduce the magnitude of private and public welfare obligations; as a means to increase the efficiency of the female labour force, and so on. These various aims are generally concordant with that of securing wider use of contraception, but they may involve modification of both programme strategies and evaluation protocols. In the remainder of this paper, we shall be concerned with evalua-

tion as it relates to the broad aim of more extensive adoption of family planning and the ultimate reduction of fertility rates.

11. A system for evaluation will be shaped by the character of the organization that is created to promote family planning, and by the schedules of activity and targets which are set for various phases of the programme. The methods to be promoted themselves imply certain kinds of service networks and determine the opportunities for collecting data relating to participants in the family planning programme. The programme records used in this connexion are the forms on which is recorded information obtained at the time a participant visits a clinic or is contacted by a field worker. These records should be confined to basic information having to do with:

- (a) Identification of the couple;
- (b) Type of method used;
- (c) Source of information about the programme;
- (d) Results of medical examination.

The identification information should be detailed and would include, in addition to name, age, and parity of wife, a complete address for the couple, supplemented by the name and address of a person who could assist in locating the couple for follow-up visits. Separate record forms for initial and subsequent visits are desirable. The address information recorded on the initial form should be confirmed at each visit.

12. The analysis of records from initial and subsequent visits and contacts should provide minimum monthly tabulations for each unit as follows:

- (a) Total contacts by age, sex and parity of persons contacted (a contact is any visit, inquiry, or other communication between a programme employee and an actual or potential client);
- (b) Cumulative and new adoptions of methods;
- (c) Initial visits by source of information about programme;
- (d) Initial visits by residential distance zones (coded from participant's address);
- (e) Adopters of methods other than intra-uterine devices (IUD's) classified as: medical contra-indications; preference for other methods;
- (f) Visits by users of conventional methods by interval since last visit;
- (g) Non-adoptions of family planning methods, due to existing pregnancy. This sug-

gested list could be expanded and, if tabulation facilities permit, elaborated through cross tabulation. Even in this rudimentary form, however, these tabulations reveal the volume and nature of business, the consumer appeal of various methods, the relative effectiveness of channels of information, the reach of various centres into their "market areas", an indication of possible variation in medical screening of cases, and some indication of continuity in the use of conventional methods, and of the group which the programme could not assist, despite evidence of positive motivation (pregnant at time of visit).

13. Sample follow-up studies are the heart of the evaluation programme as it relates to participants. Information obtained from all participants should be restricted to those items which will afford some idea of the volume of business, choice of methods, and very general information about how the programme is reaching its market. To do more creates a psychological hazard for some participants, and complicates the administrative tasks of programme personnel. Basically, however, the follow-up is essential, because it is only over a period of time that successful use of family planning can be evaluated. A basic defect in much of the evaluation work to date has been the failure to conduct follow-up studies on a regular and systematic basis. Failure is often due to the insufficiency of address information; thus, the stress given to this item on the initial record.

14. Follow-up studies should provide information on the consistency and effectiveness of use, medical and psychological *sequelae* among continuous users and, for those who have discontinued use, the reasons for stopping, including intentional pregnancy. Periods of exposure-to-risk should be described in sufficient detail to permit the calculation of pregnancy rates. Sampling of cases could be carried out separately for each major method, with sampling ratios proportional to clinic case loads. Stratification by urban-rural residence might be desirable in some situations. Sample size would depend upon length of the follow-up interval, and it should be large enough to afford at least 1,200 months of use for each method for which pregnancy rates are desired. To allow for various forms of attrition in the case load for discontinuation of use, and to permit a minimum amount of sub-classification in the analysis, it is perhaps necessary to have subsamples of at least 500 cases for each method. It would seem adequate to consider a four-fold classification of methods: intra-uterine devices (IUD's), orals, condoms and all others.

15. The list of characteristics for which data are collected should be expanded in the follow-up investigation, so that an analysis of the dynamics of successful adoption can be carried out. In addition to confirming data on age, parity and method, the follow-up inquiry should collect data that would help to distinguish adopters of methods from non-adopters. One of the critical research areas in family planning is the understanding of barriers that prevent couples who express an interest in family planning from becoming adopters of methods. A basic list of characteristics would include education, occupation, economic status, degree of participation in the modernizing sector of society, relative isolation from formal and informal channels of communication, and previous experience with contraception.

16. Possible tabulations of these data are many. A minimum set might include:

(a) Pregnancy rates and mean length of use by method;

(b) Reasons for stopping use by parity and method;

(c) Comparison of successful and unsuccessful users by education, occupation, economic status, degree of participation in modern sector, exposure to communication, and length of experience with contraception.

17. In dealing with methods requiring repeated action, the distinction between method failure and use failure is difficult to resolve. Retrospective reports are an unsatisfactory basis for dealing with this problem. It is suggested, therefore, that the distinction be dropped if women who were pregnant at the time of method adoption are eliminated from the analysis. Operationally, this would take the form of excluding all women who gave birth in less than nine months after initial adoption.

18. Analyses based on programme records and sample follow-up studies will indicate how many couples are adopting family planning through the service network established by the programme, and how successful these adopters are at family planning. These analyses will also provide clues as to reasons for failure. They cannot tell us to what extent knowledge, attitudes and practices are changing in the general population. For this knowledge, periodic sample surveys are generally recommended. Such surveys are ordinarily confined to married couples and afford an opportunity to relate adoptions of methods to the universe of eligible couples. If they are carried out at the end of a programme period, surveys can supply an answer to the basic question: how well did the programme succeed in reaching its goal of

introducing contraception among couples who want it?

19. Family planning programmes, of course, aim to make family planning adopters out of a high proportion of "eligible" couples. We do not yet know, however, what to call a "high" proportion, nor do we know how long to allow for the process of adoption. Under a variety of conditions, and with both "hard" and "easy" methods, some experimental programmes have secured 50 per cent or more of the eligible women as initial adopters in one to three years of effort, with defections ranging from moderate to severe, depending on method and programme. Eligibility, in this context, is defined on the dual basis of the desire to regulate family size and exposure-to-risk. It is thus a refinement of the category of married couples in which the wife is of child-bearing age, to allow for current exposure-to-risk of pregnancy and expressed desire for either the delay or termination of pregnancy. Data from knowledge, attitude and practice (KAP) surveys would permit an empirical approximation of the number of "eligibles" and the number of adopters, which, in turn, would provide the experimental base for realistic setting of goals.

20. Since adoptions of methods vary greatly in effectiveness, and since the group of eligibles is reduced through adoptions, a simple ratio of adopters to eligibles is a relatively weak statistic. A possible refinement would be to weight adoptions, according to the effectiveness of the method adopted. Thus, for example, adoption of the most effective method would count as a full adoption, adoption of a method with a 25 per cent failure rate as three-quarters of an adoption, and so on. An adoption ratio which puts the weighted sum of adopters in the numerator and the eligible non-adopters in the denominator, would be an appropriate summary statistic. The number of eligibles may increase in the course of the programmes as some diffusion of small family norms occurs. The weighted adoption ratio at the end of the plan period would be the critical statistic.

21. The task of measuring changes in each of the components of family planning (knowledge, attitude and practice) and relating these to the programme is more hazardous than merely measuring the level of adoptions. As a minimum condition, this requires a before-after set of surveys and a larger sample than is

necessary in a single KAP survey for the same amount of precision. Further, as attitudes, knowledge and practices change, differences in the size and nature of non-sampling errors are to be expected. The need for this type of information and analysis is greatest when adoption ratios are low.

22. Evidence of use of various methods, as revealed in a KAP survey, should be roughly consistent with data relating to manufacture, import, distribution and sales of contraceptive supplies. Such information, if assembled on a continuous basis, affords, as does the KAP survey, an indication of use beyond those indications reflected directly in programme records. Trend analysis based on these data is complicated, however, by variation over a period of time in inventory positions at various points in the distribution chain. The feasibility of collecting "point-of-sale" information on a sample basis from retailers and from medical dispensaries should be explored.

23. In discussing various approaches to evaluation, we have not, thus far, made any reference to the analysis of births statistics. As is well known, such data, as routinely gathered, are frequently of poor quality. This is not an easy situation to rectify. It takes a number of years to install and improve a vital statistics system, even on a sample basis. A variety of substitute methods involving special manipulation of retrospective data on current and life-time births are being experimented with, as are various types of follow-up surveys, schemes for matching sample registration and sample enumeration data, and programmes for continuous sample enumeration. At this juncture, all of these methods require further trial.

24. Similarly, much useful research is under way regarding the types of data which might be useful as sensitive indicators of short-term changes in fertility. Encouraging results have been obtained from studies of birth intervals, especially the last, or "open", interval. Other investigators have suggested that measurement of change in the prevalence of pregnancy might be feasible, and might yield early indications of change. These and other approaches should be pursued vigorously, for it is clear that, regardless of what programme records or adoption ratios may show, the desire to know what is happening to fertility rates is insistent.

Application of a theory of rural development to family planning in East Pakistan

AKHTER HAMEED KHAN and HARVEY M. CHOLDIN

1. Through experimentation, research and observation in a limited area in East Pakistan, a working model for a set of institutions for rural development has been established. Training of government officers, social research and pilot projects have been concentrated upon a rural laboratory area since 1959. This paper includes a description of the general approach, with special attention to the pilot project in family planning.

I. COMILLA PROJECTS

2. The Comilla projects consist of a training and research academy and the development projects which have grown from it: a co-operative federation, an administration development centre and three pilot projects in women's education, family planning and village schools.¹

3. The projects were built in a demonstration experimental area of one *thana* (107 square miles, 1961 population 217,000, including one town and 246 villages). A *thana* is an administrative area of East Pakistan. In 1963, the projects were reproduced in three other *thanas* of similar size, scattered in East Pakistan. They are supervised and co-ordinated by Comilla.

4. The demonstration areas are in great social and economic distress. One hundred years of population growth have brought extreme pressure upon a once adequate agricultural base. Population density for all of East Pakistan is 922 per square mile (1961), while in the rural part of the demonstration area, the density is approximately 1,600. The major social disruption caused by the partition of India and Pakistan has brought other problems to the villages.

5. The action-research in the experimental area has emphasized empiricism and first-hand meetings with the rural people, and the approach has been pragmatic and flexible. Ideas have been tried in the field; if they were successful, they continued; if they were failures, they were quickly dropped or modified.

6. The two largest projects, co-operatives and local administration, work closely together, and other projects work partially through them. In the co-operative project, a system of village societies has been built and united in a central federation. The system combines economic and educational functions.

7. The co-operative project was started in 1960 in twenty villages. At the end of 1964, 142 societies had been organized in villages and another thirty-one in the town. Members of the village co-operatives meet weekly, make savings deposits, discuss local problems, and do joint planning for production, savings, and marketing. They also pool their credit to borrow from the central co-operative for productive purposes, and purchase jointly some services from the central co-operative.

8. A new kind of agricultural extension system has been built, connecting the central co-operative, local government officers, and the village co-operative members. Each village group selects a farmer to receive agricultural training, who comes weekly to the development centre for practical training by the staff of the central co-operative and the local government officers. After his training, he teaches what he has learned to other members in the village.

9. An administrative team and a *thana* development centre have been built in the administration experiment, along with a public works programme. The project has brought all *thana*-level officers of the "nation-building" departments together with adjacent offices at a new development centre and has introduced co-ordination in a common weekly meeting. It has brought the officers into contact with the villagers through the co-operative system, which has its headquarters at the *thana* development centre. Family planning, women's education and school improvement programmes which operate through the co-operative system and the administrative experiment, have their headquarters at the centre. The pilot projects work within the regular government departments. The departments may evaluate the pilot projects and expand them as working pro-

¹ The activities of all parts of the projects have been recorded in various reports. See *Annual reports* (Comilla, Pakistan Academy for Rural Development).

grammes, as they have done with some programmes, which have been expanded for all East Pakistan.

10. The principles outlined have been derived through observation of previous programmes and attempts at Comilla, including successes and failures. The projects proceeded by trial and error, adapting to the actual setting with its individual characteristics. Programmes were modified and changed as they progressed. Whenever possible, we have tried to work within established custom and leadership, introducing modifications of the existing system when they would yield added benefits.

11. The local leaders are able to communicate with their peers and teach them in ways in which the outsider cannot. The project has found ways to recruit local leaders, to teach them, and to help them teach the villagers. The village people select their own leaders and teachers.

12. Observations of a previous community development agricultural extension project led us to believe that change must come from within the village, with help from outside; however, the traditional order of the villages was in transition, and no established community organization was available. For this reason, we began to build a co-operative system, a new organization, within the villages. The co-operative organization in each village allows change to be accepted or rejected in a group, and it provides a forum in which new ideas can be introduced; it gives the villagers a mechanism for choosing their own leaders and teachers.

13. A teaching and demonstration centre is necessary outside the village. The local leaders in the Comilla projects have been trained outside the village by experts. They have been taken out of the group where the old ways are anchored, and they have been exposed to new people, new places and new ideas. The non-village expert, the trained worker, can be more effective as a teacher at the centre than in the village. With what a villager hears at the centre, he becomes a teacher at home. We have tried to induce the officers of the specialized departments (the experts) to become teachers of the villagers, because the purpose of the departments is to promote change and development.

14. The centre must be stable and dependable. Because villagers have seen many improvement campaigns come and go over the years. They expect any new programme to be short-lived. The centre must prove its dependability over a period of years. The approach must be comprehensive. The Comilla projects

have emphasized several fields of development simultaneously, starting with agriculture and administration, which led to work in family planning, education, and women's education. Co-ordination and rigorous supervision are necessary. The multi-purpose programme means that various departments must work closely together. The emphasis on teaching by officers has made tight supervision necessary, because the officers must be induced to go into the field to perform new tasks. Training must be continuous and lessons must be repeated and repeated. In the pilot project, farmers receive training one day each week, year after year. The old ways change slowly.

15. The style of work has been pragmatic and flexible, with failing projects dropped and with small-scale field work preceding planning. Before making a plan or a manual of procedures, the staff works for six months or a year to establish a working model. This exposition is the rationale for what has been done. The principles will be tested and modified as the project expands into other areas of East Pakistan.

II. PROBLEMS OF FAMILY PLANNING

16. The family planning pilot project incorporates most of the principles and methods outlined above. The project "started small" and expanded as soon as possible. The project has worked within the context of the comprehensive development project, in close connexion with the co-operative and women's education projects. At first, when the approach was more tentative, family planning was introduced only in villagers having co-operative societies, and only through the societies. After the villagers showed an interest in family planning, with no resistance to efforts to promote it, the project expanded to other villages. Mindful that the co-operatives and women's programmes were not available in many places in the province, the staff devised a system to work without them. Ten villages were studied, then thirty-five villages were added to the project. The project was expanded to include all 246 villages of the area and three additional areas of equal size. The method of promotion changed from an intensive to an extensive approach. In both approaches, villagers and officers are teachers, the centre is utilized, and teaching is repetitive and continuous.

17. In the first ten villages, the members of the co-operatives decided whether or not the village should join the project. Each village group selected a woman to be the organizer for family planning, teacher and supply distributor.

The woman chosen came weekly thereafter to the centre for classes on family planning, discussions of problems in the work, reporting sales for the week, and gathering fresh supplies of contraceptives. Later, this system was expanded to include twenty-five additional villages with some male organizers (village homeopathic and untrained doctors), other housewives and some untrained midwives.² In this system, all organizers were paid small monthly salaries. The teaching in the villages was continuous, with repeated visits to the village women by the organizers.

18. In February 1964, a new approach was added: the distribution of contraceptives through shops. The goal was to open a large number of channels to the villagers for easy, private distribution of supplies. The training of the agents was done by the staff of the family planning project with monthly field visits to refill supplies. The contraceptives are subsidized by the government and the sellers offer them at a fixed price, which allows the merchants a profit margin. This commercial system was established with female agents and was duplicated in three other areas in East Pakistan.

19. A publicity system using indigenous methods was built by hiring local singers to write songs and jingles about family planning in traditional song styles, and to perform them in market-places and villages. This method of publicity proved more feasible than outdoor film showings.

III. RESULTS IN FAMILY PLANNING

20. At this point, data are available on the project in the first ten villages. The general indications of the data are as follows: (a) the village people have shown themselves to be interested in family planning by adopting or trying the practices; (b) they are capable of using traditional non-medical contraceptive devices (condoms and foam tablets) effectively; (c) it is possible to organize a non-medical educational and distributional programme through local people of low educational level by using the support of community development-type workers.

21. The ten female village organizers recruited a total of 452 couples to try family planning during thirty-six months of work in the first five villages and twenty-four months in the second five villages. The target population, fertile married couples with the wife in the child-bearing ages, was 880. Of these, 365

couples, or 41 per cent of the eligible couples inside the villages, tried family planning (that is, they purchased some contraceptives). Eighty-seven couples living outside the ten villages also purchased supplies. Primarily the wives purchased the contraceptives, but a few males began to purchase supplies after the programme had run more than one year. (Eight of the villages are Moslem, two are Hindu.)

22. Of the 452 couples who made an initial purchase, 242 of them continued to purchase supplies (they never went three consecutive months without a purchase). Another 210, or 46 per cent, dropped out by going three months or more without a purchase. Forty of the drop-outs came to purchase supplies again, and 170 were permanent drop-outs.

23. Of the 452 wives who joined, thirty were found to have been pregnant at the time of first purchase of supplies. Another twenty-eight stopped using contraceptives seven months or more after first purchasing contraceptives, giving pregnancy as the reason. Of these fifty-eight women who were pregnant when they joined or became pregnant, twenty-eight tried family planning again after their children were born. Twelve of the fifty-eight were pregnant or had recently given birth at the time of the review, so it could not be determined whether they would try family planning again.

24. A follow-up study of all the women who left the programme permanently showed that thirty of them were pregnant between the time of leaving and the time of the survey. Of these thirty, fifteen of the pregnancies terminated within eight months of the date of last purchase, and five more either delivered nine to ten months after dropping out, or conceived within two months of dropping out. Since counting by months among the village women is approximate, we count all these as use-failures, whether or not the woman said she wanted to become pregnant at the time of quitting.

25. The forty-eight pregnancies occurred in 5,597.5 woman-months of use, giving a pregnancy rate of 10.3 per 100 woman-years of use. These figures do not take into account the pregnancies or the woman-months of use of those pregnant when they joined. It is possible that another sixteen women were pregnant at the time of stopping the programme, in which case sixty-four pregnancies have occurred, and the pregnancy rate is 13.7.

IV. CONCLUSION

26. In literacy and landholding, the distribution of those adopting family planning is

² A. Majeed Khan, *Pilot project in family planning* (Comilla, Pakistan Academy for Rural Development, 1964).

not different from the village distributions as a whole. The landless and illiterate are no less likely to try to continue using family planning than landholders and literate persons in the villages.

27. Similar data are not yet collected for the commercial system using shops as distributors, although first observations are that the system will reach a lower percentage of the eligible couples, but a greater number of villages than the direct distribution plan.

28. The initial ten villages indicate that even under conditions of extreme poverty, low literacy, high religiosity, and high population density, family planning can be promoted and accepted. Non-medical village and staff personnel have worked within a system following principles used in the rural development projects at Comilla.

29. Though the data here are from a small pilot project, the system will be tested in 1966 in a district with a population of more than 4.5 million persons.

Review of the family planning action programme in the Republic of Korea

TAEK IL KIM, M.D.

1. Because the family planning action programme in the Republic of Korea is only three years old, valid evidence indicating a downward trend in the birth rate is not available at this time. Also, as world wide experience in the organization and operation of government sponsored programmes is limited, little information is available with which to compare or measure our rate of progress in providing contraceptive information, supplies, and services to couples wishing to limit the number or the spacing of their children. For these reasons, this paper is essentially a factual review of the methods employed in the initiation and development of the programme, the strategy used, the service and supplies provided, the staffing and training, the results achieved to date, and the cost of providing the service. It is evaluative only in the sense that an effort has been made to point out what are considered key factors in development of the programme. Hopefully, this information will be of some interest and value as a reference to other developing nations in the process of initiating family planning action programmes.

I. NEED FOR A FAMILY PLANNING ACTION PROGRAMME

2. The Republic of Korea, comprising about 42 per cent of the Korean peninsula, has a population of approximately 28 million, which is increasing yearly at the rate of about 2.9 per cent. Birth rates are estimated at forty per 1,000 persons. Population distribution by age groups is approximately as follows: birth to nineteen years, 54 per cent; ages twenty to forty-four, 31 per cent; and more than forty-five years old, 15 per cent.

3. Korea's high rate of natural increase needs to be seen in relation to the country's limited agricultural resources. Less than 22 per cent of its land is arable; therefore, food shortages, high unemployment level, low per capita income and poor living standards would appear inevitable unless something is done to reduce the rate of population increase.

4. The need to initiate the practice of family planning in Korea was already critical in 1960,

when the economic growth rate of 2.5 per cent was exceeded by the concurrent 2.9 per cent natural population increase, indicating the urgency of such action.

II. A FIRM FOUNDATION FOR ACTION ESTABLISHED

5. The key factor in expediting recognition and initiation of a programme to achieve an improved reproduction-production balance in the Republic of Korea was the military revolution of May, 1961. This event elevated to authority a group of modern-thinking leaders, who are determined to eliminate or modify all problems limiting economic gains or improved living standards. These leaders established the Supreme Council for National Reconstruction, whose members carefully considered all economic and social improvement plans submitted by an advisory board of experts from all fields.

6. The Council reviewed and approved a plan developed by the Ministry of Health and Social Affairs to provide nation-wide family planning services. The body announced the plan as a policy, allocated development funds from the investment budget and adopted its targets as one of the priority goals of the five-year economic development plan. In the same period, the Council repealed a law prohibiting the importation of medicines or instruments to be used in contraception.

7. Reduction in the natural increase rate of population growth to approximately two per cent by the end of 1971 is the over-all objective of the family planning action programme. To achieve this goal, it will be necessary to obtain 1,500,000 participants in the programme (approximately one-third of the eligible couples in the group twenty to forty-four years old). Specific targets have been tentatively established as follows: 300,000 regular users of traditional contraceptives; 200,000 vasectomies; and 1,000,000 intra-uterine device (IUD) insertions.

III. INITIATION AND DEVELOPMENT

8. Within three months of its initiation in March, 1962, the family planning action pro-

gramme was providing nation-wide services by training and assigning one nurse-midwife to each of the nation's rural and urban health centres. In the Republic of Korea, there is one health centre in each of the 139 counties, which serves populations of approximately 150,000 each; a total of fifty in the cities, which serve populations ranging from 50,000 to 300,000. In 1962, the equivalent of 328,357 United States dollars was allocated for organization and programme operations: staffing, purchase of contraceptives, public information programmes and vasectomy subsidies. Records for the first year indicate that 328,514 couples registered for services and that 3,400 husbands participated in the vasectomy clinic programme.

9. Major developments contributing to programme growth during the year were the establishment of a family planning (FP) advisory committee to the Ministry, the designation of training responsibilities to the Planned Parenthood Federation of Korea, the visit of a consultative group from the Population Council of New York, and the initiation of a rural area research project by the Medical School of Yonsei University to determine the acceptability and effectiveness of traditional contraceptives.

10. Progress in expansion of services in 1963 is reflected in the 1,005,511 couples who registered for services, and in the 19,559 vasectomies that were performed with an operational budget equivalent to \$593,337. Major developments contributing to programme growth were the increase of FP workers from one to two in each health centre; the establishment of an FP section in the Ministry and co-ordination of activities with the maternal and child health programme; the instructions issued by the Prime Minister, outlining specific ways in which related and essential government agencies could assist in the programme; and the establishment of twenty-four research clinics on a nation-wide basis to determine the acceptability and effectiveness of intra-uterine devices (IUD's).

11. The operational budget was equal to \$1,357,900 in 1964. Records on October 31 indicate that 220,000 couples monthly were receiving traditional contraceptives. The records also show that 67,635 wives had participated in the IUD programme and that 18,229 husbands had received vasectomy operations. Major developments contributing to programme growth were these: establishment of FP subsections in all eleven state and special city health section offices; increase of field staff to a total of 2,070 workers; assignment of workers

on a local level by utilizing township offices as service centres; establishment of 842 IUD clinics and increase of vasectomy clinics to 683; designation of the month of May as "National Family Planning Month"; initiation of an urban project (under the auspices of the Seoul National University Medical College) to determine the effectiveness of various methods of communication in getting programme participants; execution of a sample FP attitude survey; and receipt of financial, logistical and technical support from the Population Council.

12. All progress outlined in the foregoing paragraph was made possible by assigning top priority to the project, by allocating adequate yearly budget increases, by getting full co-operation from essential official and voluntary agency groups, by receiving generous assistance from abroad, and by utilizing established public health and local administrative facilities as service centres. This utilization has proved to be of major importance in the low cost initiation of the programme, as well as in its steady development.

13. General awareness by the inhabitants of the locations and services of health centres and attendance at these centres by persons considered "sensitized eligibles", because they participate in maternal and child health activities, has simplified community introduction of the programme. These factors also have expedited development of acceptor rosters and have indicated the value of family planning services and the ease with which they can be integrated into the maternal and child health programme.

IV. IN-SERVICE TRAINING

14. In the Republic of Korea, the in-service training given to all field workers is both academic and practical, covering all subjects in FP and related public health topics. This training is considered essential and is regarded as particularly helpful in obtaining programme participants and in increasing the workers' ability to meet the public. Health workers are taught how to provide simple health information and referral services during home visits and group meetings.

15. Teaching methods employed are lectures, workshops and demonstrations. Emphasis is on what to do and how to do it. Through simulated field situations, the knowledge that has been acquired is applied, and the various programme aids that have been provided are demonstrated. Training courses vary in length from two to four weeks, according to background and experience of the participants.

V. EMPHASIS AND CONTENT OF SERVICES OFFERED

16. The basic aim of family planning workers in the Republic of Korea is to reach all eligible couples wishing to practise family planning and to make as available to them as possible, contraceptive information, supplies and clinic services (IUD and vasectomy). All services are provided free of charge to couples judged unable to pay for expendable items on a continuing basis or for the clinic fees, which cost approximately \$1.20 per IUD insertion and \$2 for vasectomy. Three traditional contraceptives, condom, foam tablet and spermicidal jelly, are provided. Studies indicate that 75 per cent have preferred condoms, 20 per cent have preferred foam tablets, and 5 per cent have preferred jelly. Since introduction of the plastic loop, however, studies indicate that about half of the regular users will switch to this method and about half of the new users will select it as their initial method.

17. In 1963, health centre FP workers averaged ninety-three clinic consultations, 104 home visits, and ten group meetings per month. Effort is concentrated on reaching high parity couples. In general, workers try to diffuse FP information by random communication with one in ten of all eligible couples in their area. At present, there is one FP worker for approximately 10,000 population in the rural areas, and one for approximately 50,000 in the cities. All health centre workers are qualified nurse-midwives, and all township assistants are females with at least a high school education. Supervision of assistant workers is provided by senior health centre nurse-midwives, who, in turn, are supervised by a qualified worker from the state level.

VI. PRODUCTION AND DISTRIBUTION OF SUPPLIES

18. All four contraceptives required to carry out family planning services are now being produced in the Republic of Korea. This is a major step forward in assuring steady growth of the family planning movement. It has expedited supply procurement, reduced foreign exchange requirements, and, most important, increased the availability of contraceptives, particularly condoms, for commercial purchase. Production is currently at a level sufficient to meet action programme needs.

19. Traditional contraceptives are issued to users in quantities judged adequate for one month: one vial containing sixteen foam tablets, one dozen condoms, and one thirty-gram tube of jelly. Loops are distributed to "free" clinics

(subsidized) through local health centres, and to "charge" clinics (paid by customers) directly.

20. The wholesale cost of locally made traditional contraceptives, in United States currency, is approximately eight cents per dozen for condoms, 8.6 cents per vial for foam tablets, and 17.6 cents per tube of jelly. Loop materials and processing cost about two cents per loop. Inserters cost about one dollar each, and those produced locally cost about fifty cents each.

VII. PUBLIC INFORMATION AS A PROGRAMME AID

21. Every effort has been made in the Republic of Korea to develop and provide FP workers with simple, practical programme aids to reinforce their primary tasks of informing eligible couples about the family planning programme and demonstrating contraceptive methods and materials. Emphasis is placed on how and where to get services.

22. The emphasis of the public information programme is on information, rather than on persuasion. Aside from providing the press with articles and conducting radio and television programmes, the information service has produced three movies, held exhibits and carried out mass enlightenment activities during May, which has been proclaimed officially as family planning month. A potent force in supplementing this effort has been the wholehearted co-operation and support provided by the Planned Parenthood Federation of Korea (PPFK), the Office of Public Information and the publishers of numerous magazines and professional journals.

VIII. RESEARCH AND SURVEYS

23. Continuous effort is made by official and voluntary agency groups to improve services by using information gathered in sample surveys and in research projects, including field studies. For example, prior to introduction of the loop on a nation-wide basis, a clinical research study was carried out by the medical committee of the PPFK and two obstetrical and gynaecological clinics of the medical schools to determine the device Korean women found most effective, acceptable and comfortable. Following selection of the Lippes loop, research was expanded to twenty-two IUD clinics on a nation-wide basis. Finally, to introduce the loop in a manner assuring quality service, which is essential to establishing favourable community reaction, 120 obstetrical-gynaecological clinics were designated as locations where loops would be inserted on a pay basis for couples desiring to try this new method. Results were so en-

couraging, following one month's trial, that the loop was added to the action programme on a free basis. The popularity of this device is shown by the fact that 12,998 insertions were made in the first month it was added to the programme. Effectiveness of the loop, as reported from follow-up studies, indicates a 2.3/hundred woman-years pregnancy rate for wearers of the number four loop and 6.2 for the number one.

24. In contrast to the low pregnancy rate among IUD users, research indicates traditional contraceptives to be less effective, with a rate of approximately 17/hundred woman-years among users of condoms and approximately 38/hundred woman-years among users of foam tablets. In the majority of cases, however, failure of traditional methods was attributed to irregular or incorrect use, rather than to defective supplies. Continued use of traditional contraceptives is necessary for women who cannot tolerate the loop. This group is estimated at 20 per cent. The traditional methods also have their value as a bridge to eventual participation in the IUD programme.

25. A nation-wide sample survey conducted by the Bureau of Statistics in April provided a larger amount of useful information, indicating the developmental level of the programme and giving guide lines for improvement. For example, approximately 30 per cent of the eligible couples still have not heard about family planning; 50 per cent have heard about it, but know none of the methods; and 12 per cent of the total eligibles are now practising some form of birth control. Among the urban eligibles, 19 per cent were practising; 6 per cent among the rural eligibles were practising.

26. In rural areas, health centres rank highest as a source of information about family planning, and in urban areas, acquaintances rank highest as the origin of information. "Eco-

nomic reasons" is the motivation given most often by acceptors of family planning methods, and "want more children" is the reason given most often by those who do not accept the family planning methods. The main reason for accepting birth control measures in the Republic of Korea at present appears to be to "close" the family, rather than to space the children.

IX. ACTION PROGRAMME COSTS

27. The total cost of carrying out the action programme in the Republic of Korea for three years has been \$2,279,593, or an average of \$0.031 per capita. Development of the programme is reflected by yearly per capita costs of \$0.012 in 1962, \$0.022 in 1963, and \$0.048 in 1964. What future annual per capita costs will be, of course, cannot be predicted with certainty. At the present operational costs, however, it is estimated that future yearly programme goals can be achieved at an annual per capita expenditure of approximately \$0.05. This means that within the next seven years, a total investment of approximately 10 million dollars will have been used to attain the ten-year goal of 1,500,000 participants.

28. While the savings from achieving this ten-year goal can be measured in terms of the gross national population and can be reflected in improved living standards, it is difficult to express the results in a monetary sense. Some idea of the dollar savings can be projected if the present estimated yearly cost, equalling thirty dollars, to rear a child continues during this entire period. For example, in ten years, accumulated prevention of births will total around 5 million, which, expressed in terms of "buying power", represents a sum equal to 150 million dollars. This figure amply justifies the estimated investment of 10 million dollars in equivalent United States currency.

Family planning in the context of community health services in rural Ceylon

ARNE KINCH, M.D.

1. The activities of the Sweden-Ceylon Family Planning Pilot Project in Ceylon—a country with one of the best public health services in the region of the United Nations Economic Commission for Asia and the Far East (ECAFE)—are based on a bi-lateral agreement (Treaty Series 10/58) between the Royal Government of Sweden and the Government of Ceylon.

2. The aim of the Project is to give the Government of Ceylon recommendations on running and administering a governmental programme on family planning. Consequently, such advice must be based on some years of experience from selected pilot areas. The activities of the Project are run through the channels of the public health services. This is a report on some of the experiences gained.

3. The main principle of the Project is "action-with-research". The activity started in the middle of the year 1958 in two rural areas. During 1962 and 1963, the Project extended its activity to include three new pilot areas. In all three, there is mainly "action" and very little "research", because these areas serve the purpose of further testing the experiences gained from one of the two original areas of "action-with-research" (here called the "sub-division" area).

I. THE PRODUCTIVE FAMILIES

4. When dealing with family planning, it is first necessary to consider which group of a community's population really needs to know how to space, or limit, the birth of children. Quite clearly, that group consists of families where a husband and fertile wife live together, and are, consequently, subject to the risk, or chance, of the wife's becoming pregnant. This group I call the "productive family group" (PFG). Excluded are unmarried males and females, widows, widowers, separated couples, and families where the wife is above the reproductive age. The Project has found the number of families in the PFG to be about 10 to 12 per cent of the entire population in the area concerned. There are reasons to believe that nearly one third of the wives in the PFG

becomes pregnant each year; consequently, only a small portion of the population needs instruction in family planning during a year. But how to reach the PFG and how to get their confidence? Confidence may form the background for the future work.

II. PUBLIC HEALTH SERVICES

5. It is reasonable to presume that in the PFG, a fertile wife is probably pregnant and may need ante-natal care, or that she is the mother of one or more pre-school age children, and should attend classes in child welfare care. These two activities, usually called "maternal and child health" (MCH), constitute essential parts of the public health services. Because it is likely that a well-conducted MCH service will be met with confidence by the families in the area, the MCH can be used to approach the members of the PFG.

6. The public health services in Ceylon consist of fifteen S. H. S. (Superintendent of Health Services) districts. Each of these is divided into a related number of M.O.H. (Medical Officer of Health) districts. The M.O.H. districts are divided into so called "sub-divisions", holding about eight to ten thousand inhabitants. In a sub-division, the public health staff usually is one public health inspector (P.H.I.), who is male, and one or two public health midwives (P.H.M.'s), who are female. There is also a public health nurse (P.H.N.), who may be appointed only for the sub-division, but more often she is in charge of some neighbouring sub-divisions. Once a week or once a fortnight, an ante-natal clinic and a child welfare clinic are conducted under the supervision and guidance of the M.O.H. of the area. The clinics are attended by the P.H.M. and the P.H.N. (if any).

III. ACTION TAKEN

7. During 1958, the Swedish Project commenced its action in a sub-division serving a population of 6,878 (7,780 during 1963). In 1959, the Project started a family welfare centre, which covered the ordinary ante-natal clinic and the ordinary child welfare clinic of

the sub-division. A post-natal clinic (P.N.C.), the main source for offering advice in family planning, was added as an extra service. Staffed by the local public health personnel, this centre, since 1959, has been administered by the Project, and is the original pilot area for gaining experience.

8. At the beginning, the P.N.C. was conducted on a particular afternoon of the week, but the arrangement proved unsuitable, and since 1960, the P.N.C. has been run in close connexion with the child welfare clinic. When the mother comes to the child welfare clinic to have her child examined, to get milk powder or treatment for the child, the Project staff finds it proper on the same occasion to discuss child spacing, and to offer to supply necessary equipment if she requests it. In this way, the P.N.C. becomes an integrated part of the child welfare clinic. As no separate family planning clinic is operated and no particular time is devoted to such activity, the wife is not shy about attending a family welfare centre, where different services are provided.

9. For a long time, it has been the duty of the local public health staff of a sub-division to pay regular home visits to pregnant women or to mothers who have borne children recently. The Project found it suitable to use these home visits as follow-up visits. The P.H.M. was instructed to visit families where the last child is younger than three years every tenth or twelfth week. In connexion with the follow-up visit, a supply of birth control methods is given. The wife is told she need not attend the family welfare centre for new supplies, as they can be given to her by the public health midwives. Clinic visits are compulsory if the wife requests the use of the intra-uterine contraceptive device (IUD).

10. The Project first reaches the wife when the P.H.M. visits pregnant mothers, either to give a check-up or to remind them to attend the ante-natal clinic. Later, when the wife, together with other mothers-to-be, sits in the waiting room, expecting the clinic to start, a simple lecture regarding the physiology of reproduction is delivered by the P.H.M. or the doctor. Avoiding medical terms, the lecturer tells how the pregnancy started. The wife is also told that she should avoid another pregnancy for several years, and that after the child-birth, suitable birth control methods are available if her family wishes.

11. She is given a stencilled letter, addressed to her husband, informing him of his wife's pregnancy. The letter further advises him that after the birth, he will be visited by a male

co-worker, the public health inspector. A one-page leaflet mentioning varied birth control methods is attached to the letter.

12. When the child is born (more than fifty per cent of the deliveries in Ceylon take place in institutions), the P.H.M. informs the P.H.I. of the name of the husband and where the family lives. Within a period of four weeks, the P.H.I. will visit the husband to instruct him on the physiology of reproduction, family planning and available birth control methods. The P.H.I. has samples to show during the discussions, which will take about twenty to forty minutes. This man-to-man talk gives personal contact and offers possibilities of an individual approach, in which many problems can be discussed openly. Within a week after the visit, the P.H.I. informs the P.H.M. whether the husband is in favour of family planning. Sometimes it is impossible for the P.H.I. to meet the husband, or the P.H.I. may often have to make four or five visits before meeting him.

13. During the post-natal visits, either by the P.H.M. at home or by the wife at the P.N.C., the wife gets instructions about family planning. The P.H.M. supplies necessary birth control methods if they are requested, and informs the wife that she will be visited within ten to twelve weeks for further discussions. The wife will be instructed to visit the child welfare clinic to have the child examined. During this visit, she also can receive another supply of birth control methods. As pointed out earlier, if the wife does not like to attend the P.N.C. or the child welfare clinic, she will receive her supply of birth control methods during a home visit by the P.H.M. The wives seem to prefer to receive the supplies during home visits.

IV. POSSIBILITIES OF THE PROGRAMME

14. One may ask if it is possible to use only the available public health staff for implementing such a programme. Will the work-load not be too heavy? Let us examine the situation. A sub-division has ten thousand inhabitants, and consequently, the PFG should be 1,000 to 1,200, or ten to twelve per cent of the population. Presumably, one third of the wives in the PFG may become pregnant each year, which gives about 300 to 400 pregnancies. Some of these end in miscarriages and stillbirths, leaving approximately 325 to 360 children born per year—or about one child per day.

15. Therefore, one P.H.I. and one or two P.H.M.'s must visit and instruct one family per day, disregarding follow-up visits. That

work-load should not be regarded as heavy. The Project has found no difficulties for either the P.H.I. or the P.H.M. to perform their assigned duties along with the family planning programme.

16. The programme discloses that no particular staff need be employed, only the productive families are approached, and a large share of time can be spent in an individual approach in which private problems can be discussed.

17. To summarize, the Project runs its activities in the sub-division area by using the public health staff and the public health facilities. The Project meets only the PFG of the area and disseminates no family planning information outside the PFG. The words "family planning" are not used. "Family welfare" is the term used. It is appropriate and is received with more understanding by the population.

18. The sub-division (with 8,000 to 10,000 inhabitants) is but a small part of a M.O.H. area, which may hold between 100,000 and 200,000 inhabitants. The M.O.H. area, in turn, is a part of a S.H.S. district (300,000 to 600,000 inhabitants). Consequently, it is necessary to discover if the programme in a sub-division can be operated in bigger administrative units. The Project, in 1962, started its activities in a M.O.H. area of 95,000 inhabitants with thirteen public health midwives and nine public health inspectors. During June, 1964, another M.O.H. area of 185,000 inhabitants, with thirty-three public health midwives and thirteen public health inspectors, was included in the Project. In both these areas, family planning was made an integrated part of the service. The experience gained thus far seems to indicate such a plan is promising. During the middle of 1963, the same integrated service was started in a S.H.S. district of 305,000 inhabitants, in which sub-divisions were selected for intensive work, to be spread later into neighbouring areas. In an administrative unit of the size of the S.H.S., certain problems arise regarding supervision and sup-

ply. At present, the Swedish Project is trying in various ways to solve these questions.

19. In the tables and figure to follow, the crude birth rate represents the number of live births per year per one thousand population. In the sub-division area, there has been a declining trend for this rate since 1959. The birth rate given for 1958 is somewhat underestimated because of the under-registration of births during that year (see figure I, as well as tables 1 and 3). The number of live births per



Figure I

Crude birth rate in sub-division area in 1958-1964

year per one thousand population in the female group shows the age-specific birth rate. This rate has been calculated in the sub-division area since 1959. It is difficult to state trends in the age-specific fertility level during such few years. There may be a downward movement in the birth rate for the ages between twenty and thirty. If this is true, it is very encouraging for the Project, as these age groups contribute approximately 40 per cent of all births in the area (see table 2). In table 1, the prospective figures for 1964 are within parentheses.

Table 1. Population, births and crude birth rates in the sub-division area in the years 1958-1964

<i>Year</i>	<i>Population</i>	<i>Births</i>	<i>Crude birth rate (per thousand)</i>
1958.....	6,878	178	25.9
1959.....	6,981	200	28.2
1960.....	7,245	183	25.3
1961.....	7,491	194	25.9
1962.....	7,615	183	24.0
1963.....	7,718	174	22.5
1964.....	(7,888)	(161)	(20.5)

Table 2. Number of females and age-specific birth rates in different groups in the sub-division area 1959-1963

<i>Age group</i>	<i>1959</i>		<i>1960</i>		<i>1961</i>		<i>1962</i>		<i>1963</i>	
	<i>Num-ber</i>	<i>Birth rate</i>	<i>Num-ber</i>	<i>Birth rate</i>	<i>Num-ber</i>	<i>Birth rate</i>	<i>Num-ber</i>	<i>Birth rate</i>	<i>Num-ber</i>	<i>Birth rate</i>
0-14	1,302	—	1,323	—	1,342	0.7	1,342	—	1,351	—
15-19	334	15	329	12.2	337	17.8	358	16.8	370	16.2
20-24	269	145.0	290	120.7	307	94.5	310	122.6	319	81.5
25-29	256	203.1	255	168.6	268	242.5	273	172.2	262	141.2
30-34	208	254.8	233	193.1	258	189.9	268	175.4	275	207.3
35-39	247	141.7	242	165.3	240	150.0	237	139.2	228	140.4
40-44	204	78.4	204	68.6	201	34.8	202	54.5	215	74.4
45 and above...	692	—	716	2.8	754	1.3	780	1.3	803	—

Table 3. Age distribution for female population in sub-division area 1959-1963

<i>Age group</i>	<i>1959</i>		<i>1960</i>		<i>1961</i>		<i>1962</i>		<i>1963</i>	
	<i>Num-ber</i>	<i>Per cent</i>	<i>Num-ber</i>	<i>Per cent</i>	<i>Num-ber</i>	<i>Per cent</i>	<i>Num-ber</i>	<i>Per cent</i>	<i>Num-ber</i>	<i>Per cent</i>
0-14	1,342	37.1	1,343	36.6	1,340	35.8	1,344	35.4	1,357	35.3
15-19	334	9.5	323	8.8	350	9.4	365	9.6	375	9.7
20-24	269	7.7	311	8.5	302	8.1	317	8.4	320	8.3
25-29	256	7.3	254	6.9	282	7.5	263	6.9	261	6.8
30-34	208	5.9	257	7.0	258	6.9	277	7.3	272	7.1
35-39	247	7.0	237	6.5	242	6.5	231	6.1	225	5.8
40-44	204	5.8	204	5.6	197	5.3	206	5.4	224	5.8
45 and above.....	692	19.7	737	20.1	768	20.5	791	20.8	814	21.2
TOTAL	3,512		3,668		3,739		3,794		3,848	

A statistical analysis of the time of conception in relation to the rise of temperature in 5,013 cycles

JOHN MARSHALL

1. Knowledge more nearly accurate than now available of the exact time of ovulation would contribute greatly to fertility control by enabling coitus to be timed so as to enhance or diminish the chances of conception, according to need. A number of indices of ovulation of varying reliability and complexity are available; among these, the recording of the basal body temperature (B.B.T.) is the method which is most readily applicable to large numbers of the population at the present time. The B.B.T., which follows a low level during the early part of the menstrual cycle, rises to a higher level around the time of ovulation, and is then maintained at that level until the onset of the next menstrual period, as shown in figure I, entitled "Basal temperature in normal ovulatory cycles". The apparatus required, namely, a clinical thermometer and chart, is inexpensive; the recognition of the rise in basal body temper-

ature which follows ovulation can be facilitated for the inexperienced by the use of a simple graphic device, a "window", devised by J. G. H. Holt.¹ The experiences of W. M. O. Moore in Mauritius,² and of Dr. and Mme. Rendu on the island of Reunion, have shown that the method can be taught to illiterate people.

2. Despite the ready applicability of the method and its currently widespread use, there are many scientific problems in relation to B.B.T. which have not been studied. Prominent among these is the exact time at which conception can occur in relation to the rise in B.B.T. This study presents evidence upon this point.

¹ J. G. H. Holt, *Marriage and periodic abstinence*, 2nd ed. (London, Longmans, Green and Co. Ltd., 1960).

² W. M. O. Moore, "Limiting families in Mauritius, *New Society* (30 July 1964), pp. 16-17.

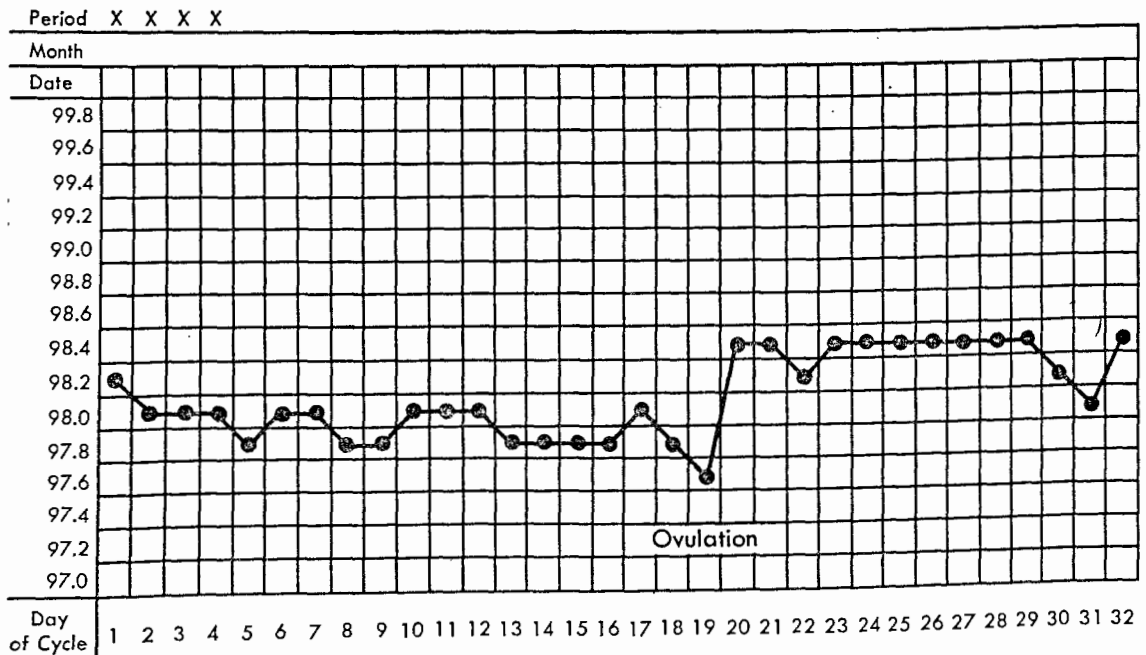


Figure I
Basal temperature in normal ovulatory cycle

I. RESULTS

3. The study is based upon 5,013 consecutive cycles, in which 618 healthy fertile women recorded their B.B.T. During this study, there were fifty pregnancies. The majority of these were deliberate; some were unwanted. As this was not, however, a study of user-effectiveness, but of the timing of conception in relation to the rise in B.B.T., all were included in the analysis.

4. In two instances, the couple had not recorded the B.B.T. in the cycle in which conception occurred. In three instances, although the B.B.T. had been recorded, there was no record of the dates on which coitus took place. In one instance, a series of oscillations of the temperature level prevented interpretation of the chart. There remained, therefore, forty-four cases in which the temperature chart was satisfactory and the time of coitus was recorded.

5. In three of the forty-four cases, there had been no coitus before the rise in temperature took place. In two of these cases, coitus had taken place on the first day on which the

temperature was at the higher level, and in one case, on the second day. Thus, in all three instances, coitus occurred during the period covered by the first three temperature readings at the higher level. In the series of 5,013 cycles, there was not a single instance of conception occurring when the couple refrained from coitus from the first day of the menstrual period until they had recorded three temperature readings at the higher level.

6. In twelve instances, there was no coitus after the temperature had risen to the higher level; coitus was confined to the time between the first day of the menses and the rise of the temperature. The exact time of coitus in relation to the rise of temperature is given in the table below. These twelve instances are of great importance, because the absence of coitus after the rise of temperature enables us to assess with accuracy the exact time relationship between conception and the day of the temperature rise. As shown in the table, coitus as long as ten days before the rise of temperature may be followed by conception on rare occasions.

Table 1. Day of coitus in relation to rise of temperature in cycle in which conception occurred

	Number of days before rise of temperature on which coitus occurred										Total
	10	9	8	7	6	5	4	3	2	1	
Couples who had no coitus after rise of temperature	1	-	-	-	1	3	1	-	3	3	12
Couples who had coitus after rise of temperature, but not during first 3 temperatures at the higher level	1	3	3	2	1	2	4	1	-	1	18
TOTAL	2	3	3	2	2	5	5	1	3	4	30

7. In eighteen instances, coitus occurred both before and after the rise in temperature, but not during the period covered by the first three temperature readings at the higher level. As there was no instance of conception occurring when coitus had been confined to the period after three temperature readings at the higher level, it is reasonable to assume that the coitus prior to the rise of temperature led to conception. The days on which coitus occurred in relation to the rise of temperature are given in the table above. This data confirms that, in rare instances, coitus several days prior to the rise in temperature may be followed by conception.

8. In the remaining eleven cases, coitus occurred both before the rise of temperature

and during the period covered by the first three temperature readings at the higher level; hence the significance of these cycles for the time of conception could not be ascertained.

9. It was important to discover whether conception following coitus several days before the temperature rise was an unusual occurrence, because there had been coitus regularly at that time in the past. Because the sperms are generally believed to survive as long as three days following coitus and ovulation is believed to occur just before the rise of temperature, those cases in which coitus had occurred more than four days before the rise of temperature were analysed. Of the seventeen cases shown in the table, twelve had not had coitus prior to the rise of temperature in previous cycles.

Conception, therefore, occurred in the first cycle in which they had coitus at this time. Five couples had previously had coitus at this time during a total of forty cycles.

II. DISCUSSION

10. It should be made clear at the outset that this was not a study of the "user-effectiveness" of the B.B.T. as a means of avoiding conception; hence the over-all pregnancy rate of 11.9 per 100 woman-years, which can be calculated from this data, is a meaningless figure. The aim was to study the relationship between the time of conception and the rise in B.B.T. Advantage was taken of the fact that a large number of fertile couples were recording their B.B.T. All had undertaken this initially as a means of regulating births. Although many no longer wished to avoid conception, they agreed to continue to record the B.B.T. in order to provide data.

11. The data indicate that when coitus is confined to the part of the cycle after three temperature readings at the higher level have been recorded, conception rarely, if ever, follows. There was no example of such a conception in the present series of 5,013 cycles. This finding accords with the experience of R. Palmer,³ who found that the incidence of pregnancy in these circumstances was less than one per 100 women-years.

12. Coitus during that part of the cycle which precedes the rise of temperature may be followed by conception. On rare occasions, this may be even when the coitus occurred several days before the rise of temperature. The biological basis for this is not apparent from the present study, but there are two possibilities:

³ R. Palmer, *La contraception* (Paris, Masson, 1963).

the first of these is that in some instances, ovulation precedes the rise of temperature by a considerable length of time, and the second is that the sperms may retain their power to fertilize for several days after their introduction into the female reproductive tract. A. R. Abarbanel observed the ovaries by pelvoscopy in 340 women and concluded that ovulation may occur as long as three days before the temperature rises,⁴ but because all his subjects were complaining of infertility, these findings may not be applicable to the population at large. S. J. Kleegan reported a conception following an artificial insemination carried out eight days before the rise of temperature,⁵ but whether this unusual success was due to prolonged survival of the sperms or to ovulation long preceding the rise of temperature, cannot be determined.

13. From the point of view of fertility control, it is essential to know what the chances are of conception following coitus on each day prior to rise of temperature. The present data shows that conception is uncommon when coitus takes place more than four days prior to the rise of temperature, as it occurred on only seventeen occasions in 5,013 cycles. Without knowing how often coitus occurred on each day in all cycles, irrespective of whether conception followed or not, it is not possible to calculate a probability factor for each day. A study designed to provide data on this point is now being undertaken as a joint project with Dr. and Mme. Rendu of le Centre de liaison d'équipes de recherche (C.L.E.R.), and the results of the study will be reported in due course.

⁴ A. R. Abarbanel, ed., *Proceedings of the Second World Congress of Fertility and Sterility*, vol. 1 (1956), pp. 1140-1159.

⁵ S. J. Kleegan, *Fertility and sterility*, vol. V (1954), pp. 7-31.

Hypotheses for family planning among the urban disadvantaged: United States*

JAMES A. PALMORE, JR.

1. To date, little evaluative work in family planning has been carried out in the United States. Major studies have devoted some attention to the family planning knowledge, attitudes, and behaviour of large segments of the populace, but less concern has been given to the evaluation of family planning propaganda. In particular, little effort has gone into family planning studies of the segments of the population who are poor. One might well expect disadvantaged families to have reactions to family planning propaganda that are different from those of other families.

2. To investigate this area, the Community and Family Study Center started several exploratory studies in 1962. The study reported in this paper was designed to use one particular technique and to assess in detail its effects and the communication patterns it stimulated. In August 1962, letters were mailed to 4,005 persons living on the south side of Chicago, Illinois. These people were selected as a random sample from two sampling frames: (a) public assistance roles (women in the Federal Aid to Dependent Children programme); and (b) precinct voting lists. The sample was taken from predominantly negro areas of high unemployment, with an estimated crude birth rate of thirty-seven at the time of sampling. Obviously, the mailing was designed to reach a high proportion of those who are economically unfortunate. It was expected that the mailing would reach a larger number of persons who had not begun using family planning methods efficiently.

3. The letter mailed to this sample enclosed a post card to be returned. When a reply was received, the respondent was sent a copy of a 56-page booklet, *Successful family planning made easy and inexpensive*,¹ and other materials, including two more post cards with instructions to give the cards to friends who also needed the booklets. If one (or both) of these two post cards were returned, the same

materials were sent again, with the same instructions and two post cards. Thus, chains of post cards could begin from one initial response in a "snowballing" process.

4. Nine months after the original mailings began, a sample of women's names was drawn from the returned post cards, and the women were interviewed to determine their knowledge, attitudes, and behaviour in regard to family planning. The effectiveness of the propaganda materials also was probed.

I. INFORMAL COMMUNICATION AND FAMILY PLANNING

5. Reactions to family planning propaganda can take many forms.² The propaganda can stimulate awareness, provide information, lead to trial use of a contraceptive method, instigate improved regularity in use of contraceptives, or lead to use of improved contraceptive methods. Personal communications may play an important role, as an intervening variable, in all of these possible effects.³ Disregarding the content of the communications, we find that persons from low income groups report discussing birth control with more people than those with higher incomes.⁴ They also show a tendency to talk with a variety of persons. Table 1 reports this finding.

6. The fact that poor persons talk about birth control more often than others (at least, when stimulated with propaganda) is relatively unimportant until one considers the possible effects of this talk. Family planning is an area in which moral connotations are important,

² Because we are interested in reactions to propaganda, the tables in this report do not include those respondents who were using effective birth control methods regularly before they received the booklets. Our criteria for efficacy and regularity of use were sufficiently loose that those who remain in the tables had room for improvement.

³ R. Hill, J. M. Stycos and K. W. Back, *The family and population control* (Chapel Hill, University of North Carolina Press, 1959); J. M. Stycos and K. W. Back, *The control of human fertility in Jamaica* (Ithaca, New York, Cornell University Press, 1964).

⁴ For purposes of operation, we defined the disadvantaged (persons with low income) as those with incomes less than 3,900 United States dollars per annum.

* The study was made possible by a grant from the Population Council.

¹ D. J. Bogue, R. Frank and C. Tietze, *Successful family planning made easy and inexpensive* (Chicago, Illinois, Community and Family Study Center, 1963).

Table 1. Personal communication reported by respondents who had received *Successful family planning made easy and inexpensive in the mail* (by income status of respondents)

<i>Personal communication</i>	<i>Income status</i>		
	<i>Total, all incomes: 154^b</i>	<i>High and middle: 75^b</i>	<i>Low: 79^b</i>
Discussions with individuals:			
Mean number of discussions.....	7.23	6.81	7.63
Per cent held with neighbours.....	22.6	20.5	24.4
Per cent held with relatives.....	23.9	28.8	19.7
Per cent held with friends.....	53.5	50.7	55.9
Discussions in groups:			
Mean number of discussions.....	1.90	1.41	2.37
Per cent held with neighbours.....	40.5	48.3	35.6
Per cent held with relatives.....	13.5	10.3	15.6
Per cent held with friends.....	35.1	20.7	44.4
Per cent held with others.....	10.8	20.7	4.4
Per cent who did not discuss.....	51.9	61.3	43.0
Lending booklets: ^a			
Mean number to whom lent.....	1.43	1.13	1.70
Per cent who lent.....	48.3	39.7	55.8
Per cent who did not lend.....	51.7	60.3	44.2

^a Excluding two persons of low income and seven persons of high and medium income for whom no information on booklet lending is available.

^b Number of respondents.

continual social support is necessary to insure regular use, and privacy is paramount. If one assumes that a high level of communication is likely to bring the needed moral and social support, one would expect changes in family planning to be greater among those who talk to many people. This is true, as table 2 shows. Table 2 also reports that the people who talk

about birth control claim that it had some influence on their practice of contraception. It may be, then, that the birth control discussions provide both information on acceptability from known users (not an impersonal booklet's view) and support for the notion of using any type of contraception.

Table 2. Improvement in birth control practices (by income status of respondent)

<i>Birth control discussions with other individuals</i>	<i>Income status</i>		
	<i>Total, all incomes: 154^a</i>	<i>High and middle: 75^a</i>	<i>Low: 79^a</i>
Per cent who improved practice by number of birth control discussions with other individuals:			
Discussed birth control with 0-3 persons....	20.4	17.2	24.0
Discussed birth control with 4-6 persons....	26.2	25.0	27.3
Discussed birth control with 7 or more persons	34.5	26.9	40.6
TOTAL, all respondents	27.3	22.7	31.6
Per cent of respondents who claimed that their discussions:			
Had no effect	66.4	72.5	60.6
Had effect, but they had not acted yet.....	18.6	18.8	18.3
Improved practice	15.0	8.7	21.1

^a Number of respondents.

7. In the light of the data we have presented, it seems that the role of informal discussion of birth control is worth further study. Particular emphasis should be placed on determining the causes of the communication, since the discussions may arise from (a) anxiety about the use of birth control; (b) interest in the use in general; (c) dissatisfaction with presently used methods; (d) ignorance about birth control before receiving propaganda; or (e) other causes. If we assume (as the data lead us to do) that the number of discussions of family planning is positively related to the amount of change in family planning practice, we must consider possible explanations for differences in the amount of communication by the different groups in our sample.

8. There are several alternative hypotheses one might suggest as explanations for the fact that the propaganda stimulated a greater amount of communication among the poor persons in our sample than among persons of high or middle income groups. One might claim, for example, that the differences simply reflect differences in permissiveness in talking about sexual matters of any kind. However, when they were asked: "Do you think birth control is something most people are too shy to talk about, or do you think that most people talk about it rather freely with friends or neighbours they know and like?", more than 70 per cent of two groups responded that people talked about it freely (74.6 per cent for the lower income group, 76.2 per cent for the higher income group).

9. A possibility more important than the one of permissiveness is that the general patterns of social relations differ for economically advantaged and disadvantaged persons. It has been claimed that people with low incomes tend to have personal communications more often with peers that are the same sex, and that they would find more opportunities to discuss family planning matters than would persons with high incomes, who often carry out their personal communications as husband-and-wife units.⁵ One might offer the conjecture that intimate personal relations are more important to the poverty stricken, since these persons have failed by such objective criteria as education, income, and occupation. The status system of a society provides both pecuniary and extra-pecuniary rewards (such as prestige and responsibility) to those who succeed, while per-

sons of low income, isolated from the rewards of that system, may find themselves placing more emphasis on the rewards of close friendship and kinship.

10. There are several other possibilities. One might claim that attempts to influence persons with low incomes have been less frequent than attempts to influence other people; the higher level of communication, then, would be viewed as no more than a reaction to the novelty of the propaganda. One could speculate that high spatial mobility among people with high incomes would hinder formation of intimate personal relations. Whether women are employed or not may affect their leisure time for talking about anything with friends. Finally, the relationships of education, parity, religion, and other such variables on the amount and kind of communication may be important.

II. PREPAREDNESS AND FAMILY PLANNING

11. In fact, there has been some recent discussion of the idea that a small segment of a population is always "on the verge" of using birth control, and needs but small incentive to become family planners.⁶ Freedman, Takeshita and Sun speak of the "low fertility complex" as being related to modernization,⁷ and demographic literature makes frequent reference to rural-urban differentials in fertility and, by implication, fertility control. The common theme in these analyses is that some persons are more prepared than others to start family planning. Formal education, a large number of children, acceptance of the urban norm of small family size, or other such factors may affect preparedness.

12. The "preparedness" hypothesis, as it might be called, has been found useful in explaining the use of birth control in the underdeveloped areas of the world. There is some question how useful this supposition would be in discriminating among persons responding to propaganda in a modern nation. Table 3, controlling by the level of communication, presents some data relevant to the "preparedness" idea.

13. Table 3 presents a complex picture. Although it is clear that the preparedness indices have effects, they are not always those that might be expected. For the total sample, the effects of the preparedness indices are in line with what one would expect; however, the

⁶ R. Hill, J. M. Stycos and K. W. Back, op. cit., p. 290 ff.

⁷ R. Freedman, J. Y. Takeshita and T. H. Sun, "Fertility and family planning in Taiwan: a case study of the demographic transition", *American Journal of Sociology*, vol. LXX (1964), pp. 1627; B. Berelson, "On family planning communication", *Demography*, vol. I (1964), pp. 94-105.

⁵ Elizabeth Bott, "Conjugal roles and social networks", in R. L. Coser, ed., *The family: its structure and functions* (New York, St. Martin's Press, 1964); Herbert J. Gans, *The urban villagers* (Glencoe, New York, The Free Press, 1962).

Table 3. Respondents who improved birth control practice (by income status, birth control discussions, and selected preparedness indices)

Preparedness indices	Number of respondents: 154 ^b	Number of birth control discussions with other individuals and income status				
		Total, all incomes and discussion levels: 27.3 per cent	0-5 discussions		6 or more discussions	
			High or middle income: 45 ^b	Low income: 41 ^b	High or middle income: 30 ^b	Low income: 38 ^b
		Per cent	Per cent	Per cent	Per cent	Per cent
Education:						
3 years high school or less.....	77	26.0	26.3	15.4	18.2	42.9
High school graduates or more....	77	28.6	19.2	40.0	26.3	35.3
Parity:						
3 (or less) living children.....	92	26.1	11.5	28.6	21.7	45.5
4 (or more) living children.....	62	29.0	36.8	20.0	28.6	31.2
Importance of having no more children:						
Very important	105	30.5	26.7	23.1	35.0	37.9
Not so important.....	46	21.7	13.3	28.6	0.0	50.0
Husband's approval of birth control:						
Approves	102	33.3	27.3	35.0	31.8	40.7
Doesn't care or disapproves.....	37	18.9	12.5	21.4	0.0	37.5
Religion:						
Not a member of any.....	47	31.9	16.7	30.8	27.3	54.5
Protestant or Catholic ^a	106	25.5	24.2	22.2	21.1	33.3

^a The sample contains only eleven Catholics.^b Number of respondents.

poverty stricken do not always act according to a rational model. Those who think it is not terribly important if they have another child improve their practice more readily than those who think it is very important to avoid having another child. Similarly, the poor with high parity improve their practice less than others. The effect of education is not clear cut for either the high income or the low income group. Only the figures for husband's approval of birth control and for religion of the respondent conform closely to what would be expected.

14. Given this complex picture, it is important to notice that the level of communication is related fairly consistently to improvement in practice of birth control methods, even when the various preparedness indices are controlled. This finding further documents the importance

of the informal talk in explaining reactions to family planning propaganda.

15. We have presented suggestive data from an exploratory study, looking at the reactions to family planning propaganda by persons with low income. Although we find that preparedness does discriminate between the improvers and the non-improvers in the total sample, its relation to changes in practice among the income sub-groups is not clear. The relation of communications levels, however, was found to be more consistent—even controlling for the preparedness indices. We suggest, therefore, that the communication patterns are worth further study. We are currently undertaking additional research in the use of propaganda in family planning programmes.

Application of life table techniques to measurement of contraceptive effectiveness *

ROBERT G. POTTER, JR.

1. Effectiveness of contraception conventionally has been measured by the Pearl pregnancy rate. To find this rate, total accidental pregnancies are divided by total months of contraceptive exposure and multiplied by 1,200 for the number of pregnancies per one hundred years of contraceptive exposure. Ideally, contraceptive exposure measures the duration of regular or irregular contraceptive usage during which a possibility of conception existed. With research of the last few years showing the inadequacies of the Pearl pregnancy rate,¹ attention has turned recently to an alternative measure, the "cumulative failure rate" based on a life table approach.²

2. The objectives of this paper are three: first, the inadequacies of the Pearl pregnancy rate and the corresponding advantages of the cumulative failure rate are discussed briefly; second, a special set of conditions that permits one to estimate either measure from the other is described; finally, an illustrative set of failure rates, based on data from the Princeton Fertility Study, is presented.

* This research was conducted under grant funds from the Ford Foundation and the National Science Foundation (NSF G-22677).

¹ L. Lasagna, "The qualification of desired and undesired effects of reproductive controls: some principles and problems", in M. C. Sheps and J. C. Ridley, eds., *Public health and population change: current research issues* (Cambridge, Schenkman Publishing Co., 1965); R. G. Potter, "Contraceptive practice and birth intervals among two-child white couples in metropolitan America", *Thirty years of research in fertility: retrospect and prospect* (New York, Milbank Memorial Fund, 1958), pp. 74-92; M. Seklani, "Efficacité de la contraception: méthodes et résultats", *Population* No. 2 (1963); C. Tietze, "The use-effectiveness of contraceptive methods", in C. V. Kiser, ed., *Research in family planning* (Princeton, Princeton University Press, 1962), pp. 357-369; "Differential fecundity and effectiveness of contraception", *The Eugenics Review*, vol. L, No. 4 (1959), pp. 231-237.

² R. G. Potter, "Additional measures of use-effectiveness of contraception", *Milbank Memorial Fund Quarterly*, vol. XLI (1963), pp. 400-418; C. Tietze and S. Lewit, "Recommended procedures for the study of use-effectiveness of contraceptive methods", *International Planned Parenthood Federation Medical Handbook*, part I (London, undated), pp. 59-69; *ibid.*, part I, second edition (1964), pp. 58-61.

I. CONTRACEPTION AS A PROCESS

3. If each group of contraceptive users shared a common monthly probability of accidental pregnancy and if that probability remained fixed in time, the classical methodology for measuring contraceptive effectiveness would prove adequate. The Pearl pregnancy rate (without its multiplier of 1,200) would estimate efficiently the group's common monthly chance of conception. By raising the complement of this probability to any positive integral power, k , one could estimate the proportion of couples expected to remain protected during k months of exposure.

4. Unfortunately, members of most groups of contraceptive users have a wide range in their pregnancy risks. Even in the absence of contraception, couples differ with respect to their monthly conception risk, or "fecundability". Methods of contraception vary in their intrinsic effectiveness. Perhaps the largest source of variation is the unequal regularity with which contraception is practised. In the same sample, an intermittent practice of contraception by some couples may mean monthly risks of conception many times higher than those of other couples who are wholly regular in their precautions.

5. Naturally, high-risk women conceive more rapidly than low-risk women. As a consequence, during a given pregnancy interval, the composition of the sample is changing continually, in terms of who remains at risk. For this reason, the experience of a group of contraceptive users is viewed advantageously as a process changing throughout exposure time. As successive months of exposure elapse, the accident-prone are selectively removed by pregnancy, leaving a low-risk remainder that is increasingly homogeneous. If the interval commences with a childbirth, the process is more complicated. Following childbirth, the risk of conception is zero for a variable number of months, owing to *post-partum* amenorrhoea and anovulatory cycles. If *post-partum* amenorrhoea is not excluded from exposure time,

the monthly incidence of conception typically starts at a low level, rises to a maximum after several months, then starts its long decline. Only when the interval of exposure is from marriage to first pregnancy, or when *post-partum* amenorrhœa is excluded rigorously from exposure time, is the trend usually unilinear, with a progressively declining conception rate reflecting the transition from a heterogeneous sample to a low-risk one that is homogeneous in an increasing degree. Moreover, in a clinic trial, this progressive decline in conception rate may be accentuated if many women with less motivation remove themselves from exposure by abandoning the prescribed method or stopping contraceptive practices altogether.

II. PEARL PREGNANCY RATE

6. The shifting composition of conception risks renders the Pearl pregnancy rate inadequate. The longer a group of contraceptors is followed, the lower will be their Pearl pregnancy rate, because the successful contraceptive users among them will be able to contribute longer experiences and, therefore, more months of pregnancy-free exposure, which dilute the high pregnancy rates of the initial exposure months. Indeed, by allowing the successful contraceptive users to contribute sufficiently long histories, a respectable Pearl pregnancy rate can be wrested from almost any sample.³ For the reasons outlined, the Pearl rate is not a pure measure of contraceptive effectiveness. It also is sensitive to the extraneous factor of observation length.

7. To reduce sensitivity to the observation length, the Pearl pregnancy rate may be calculated using only the initial twelve months of exposure. Even within this restriction, the rate will be higher or lower, depending on what proportion of the sample couples desist from recorded contraception earlier than twelve months for reasons such as shifting to another method, abandoning contraception, or planning a baby. The dilemma arising from the Pearl pregnancy rate is that the exposure lengths contributed by couples cannot be controlled wholly; nevertheless, these exposure lengths partly determine the Pearl pregnancy rate.

III. CUMULATIVE FAILURE RATE

8. A way out of this dilemma is afforded by a life table approach, which, it is hoped, will eventually replace the older methodology. Each couple is first classified according to number of

exposure months and terminal status, separately for each pregnancy interval. One classification system of terminal status that has facilitated analysis of clinic experiences uses the phrases "active user", "accidentally pregnant", "planning a baby", "contraception not needed", "change of method", "contraception abandoned", "moved away", and "not contacted".⁴ Ordinarily, all categories of couples—except possibly those not contacted—are counted as contributing exposure, while couples whose terminal status is "accidentally pregnant" define the number of failures. Next, for each successive exposure-month i , the number of exposed couples n_i and the number of accidental pregnancies a_i are determined. A couple coded as exposed for m months would contribute one month of experience to the first exposure-month, the second exposure-month, and so on through the m^{th} exposure-month. As a third step, again for each exposure-month i , a conception rate $\bar{p}_i = a_i/n_i$ is calculated. The complement $\bar{p}_i$ defines the proportion of couples who passed that month without conceiving. The cumulative product of these survival probabilities, that is, $\bar{p}_1 \times \bar{p}_2 \times \dots \times \bar{p}_k = P(k)$, gives the proportion still not pregnant at the end of k months. Finally, the complement $1 - P(k)$ yields the cumulative k -month failure rate. This rate has a specific interpretation: the proportion of couples who would be expected to conceive within k months if a large population of couples were exposed to the monthly conception rates observed in the sample and if none of these hypothetical couples interrupted contraception until after the k^{th} month, except for pregnancy.⁵

9. An approximate standard error of $P(k)$ is given by $P(k) [\sum q_i/n_i \bar{p}_i]^{1/2}$ when $q_i = 1 - \bar{p}_i$ and n_i is the number of couples exposed during the i^{th} exposure-month. The performance of this approximation improves as sample size increases. A series of unpublished sampling experiments, being conducted in collaboration with Philip Sagi, indicate that quite large samples are necessary before confidence intervals based on $P(k)$ and the foregoing standard error can bracket the true failure rate with frequencies near those predicted by normal theory.

⁴ C. Tietze and S. Lewit, "Recommended procedures for the study of use-effectiveness of contraceptive methods", *International Planned Parenthood Federation Medical Handbook*, part I (London, undated), pp. 63-64.

⁵ More extensive discussion of procedures and related algebra is given in R. G. Potter, "Additional measures of use-effectiveness of contraception", *Milbank Memorial Fund Quarterly*, vol. XLI (1963), pp. 400-418.

³ R. G. Potter, "Length of the observation period as a factor affecting the contraceptive failure rate", *Milbank Memorial Fund Quarterly*, vol. XXXVIII (1960), pp. 140-152.

10. For comparative purposes, a useful summary measure is the cumulative one-year failure rate, or $1 - P(12)$. This is the proportion of women who would be expected to conceive during the first year of exposure if they were subject to the monthly conception rates observed in a sample and if they were to leave only because of accidental pregnancy during that year.

11. A danger in clinical trials is that spuriously low cumulative failure rates may be generated if many weakly motivated patients stop the prescribed method before an accidental pregnancy can be recorded against them. To avoid this danger, one might wish to compute, in addition to cumulative failure rates, cumulative rates of "relevant discontinuation". This concept was used by Tietze to embrace discontinuation for any reason reflecting against the method's acceptability or effectiveness. This supplement is achieved readily by computing the monthly rates to include in the numerators relevant abandonments of the method, as well as accidental pregnancies, while leaving the denominators of exposure time unchanged, and proceeding to derive cumulative rates from the series of monthly rates. One might be interested in the incidence of accidental pregnancy when sufficient exposure time has elapsed to reduce the original sample to a selected sub-sample of motivated couples who find the method acceptable. Specifically, the probability of remaining protected a second year, if successful during the first year, is estimated by $(1 - P(24)) / (1 - P(12))$. Obviously, the life table approach allows many different measures to be chosen according to the interests of the particular analysis. A good illustration of the flexibility of the approach is furnished by one of Dr. Christopher Tietze's reports relating to the intra-uterine contraceptive device (IUCD).⁶ Not only rates of unintended pregnancy are derived from the life table approach, but also rates of spontaneous expulsion, "relevant removals", episodes of pelvic inflammatory disease and an inclusive discontinuation rate that combines the first three categories of reasons for interrupting the use of the IUCD.

IV. NEAR EQUIVALENCE

12. From knowledge of the Pearl pregnancy rate, one ordinarily cannot estimate a cumulative one-year failure rate, because it requires detailed information for its computation. The

exception, which rarely arises in practice, is a computation in which the Pearl pregnancy rate has been calculated using only the initial twelve months of exposure and in which the incidence of pregnancy is low, with few couples quitting before twelve months. Under these highly specialized conditions, the Pearl pregnancy rate, divided by 100, furnishes a useful upper bound estimate of the one-year cumulative failure rate. The reason for this relationship is made clear by the following argument: let $1,200 \cdot R(12)$ designate the Pearl pregnancy rate calculated using only the initial twelve months of exposure; $P(12)$ the proportion of couples conceiving during this first year; and $E(12)$ the average number of exposure months per couple during the same period; in which definition, $R(12)$ equals pregnancies divided by exposure months; dividing numerator and denominator by the number of couples yields $P(12)/E(12)$, and one is led to the identities, $R(12) = P(12)/E(12)$, or $P(12) = E(12) \cdot R(12)$. If there is no couple stopping during the twelve months of exposure, then $P(12)$ meets the definition of the cumulative one-year failure rate. If, in addition to no persons quitting, the pregnancy rate $R(12)$ is low, then $E(12)$ is near 12, and one has $P(12) = 12 \cdot R(12)$, or $P(12) = 1,200R(12)/100$.

13. These relationships are illustrated by the rates of the second and third columns of the table, based on data from the Princeton Fertility Study. One can see that the cumulative one-year failure rate is barely less than the Pearl pregnancy rate divided by 100 when the latter is small in value, but the gap widens as the incidence of pregnancy increases.

V. AN EXAMPLE

14. The advantages of the life table approach to analyse the contraceptive effectiveness of a clinic group have been touched upon. Attention now turns to a general sample of contraceptive users who reported their experiences retrospectively. After a deliberate interruption in contraceptive practices, United States wives conceive rapidly—more than 50 per cent within three months, 75 to 80 per cent within six months and 90 per cent within a year. Partly for this reason, nearly half of the couples in the United States seek to delay their first pregnancy, and most couples seek to space subsequent pregnancies. The proportions which actually succeed in postponing pregnancy ($k, k + 1, k + 2, \dots$ months) cannot be computed directly, because many wives, seeking short postponements, deliberately interrupt contraception after short durations. Cumulative failure rates may be used to estimate these proportions if one assumes,

⁶ C. Tietze, "History and statistical evaluation of intra-uterine contraceptive devices", in M. C. Sheps and J. C. Ridley, eds., *Public health and population change: current research issues* (Cambridge, Mass, Schenkman Publishing Co., 1965).

as seems reasonable, that wives who deliberately interrupt contraception to plan a baby have nearly the same composition of monthly conception risks as wives seeking to postpone pregnancy at least one month longer.

15. In the table, cumulative failure rates for one-year, two-year, and 3.5-year periods are calculated together with standard errors for couples from the Princeton Fertility Study. These respondents, who represent a probability sample of native, white, once-married couples from seven of the largest metropolitan areas of the United States, first were interviewed six months after a second birth and were interviewed three years later.⁷ Accordingly, contraceptive data are available for the interval from marriage to first pregnancy, the intervals from first pregnancy to second birth, and the interval following second birth, up to forty-two months.

16. The frequency of pregnancy varies among these wives according to the method they used, according to religious affiliation, and, most importantly, according to family stage. As long as contraception is practised for spacing purposes, its effectiveness is low, presumably because a substantial minority of couples are taking chances.⁸ Roughly a quarter of the wives

become pregnant accidentally within a year and nearly half within 3.5 years. The relatively higher failure rates characterizing the interval from marriage to first pregnancy reflect partly the absence of *post-partum* amenorrhœa and partly the presence of pre-marital pregnancies, which were not completely removed in the present analysis.

17. Much lower failure rates are found after the second birth in a family among couples who reported wanting only two children at first interview and were practising contraception to limit family size. Only 10 per cent of these 190 wives accidentally conceive during the two years following second birth, and less than a fifth of them conceive within 3.5 years. These failure rates, while impressively low for classical methods of contraception, are not low enough to provide a satisfactory level of protection for a large group of mothers who want to end child-bearing by age thirty, and to continue their reproductive periods (of ten or fifteen years) without pregnancies. This point is almost obscured by a Pearl rate of 5.9 pregnancies per one hundred years of exposure, but it is plain enough by the figure of 18 per cent expected to conceive within 3.5 years.

⁷ C. F. Westoff, R. G. Potter and P. C. Sagi, *The third child* (Princeton, University Press, 1963), chaps. IV-V.

⁸ R. G. Potter, P. C. Sagi and C. F. Westoff, "Improvement of contraception during the course of mar-

riage", *Population Studies*, vol. 16 (London, 1962), pp. 160-174; P. C. Sagi, R. G. Potter and C. F. Westoff, "Contraceptive effectiveness as a function of desired family size", *Population Studies*, vol. 15 (London, 1962), pp. 291-296.

Pearl pregnancy rate^a and cumulative failure rates by stage of family building:
Princeton fertility study

Family stage	Number of couples exposed	Pearl pregnancy rate 1,200 · R(12)	Cumulative failure rate		
			1 year	2 years	3.5 years
Before first pregnancy	495	38.8	.317 ± .023	.419 ± .027	.498 ± .033
Before second and third pregnancy...	805	25.9	.231 ± .016	.340 ± .019	.445 ± .025
After second birth:					
Spacers	495	22.2	.208 ± .018	.359 ± .023	.489 ± .025
Limiters	190	5.9	.058 ± .017	.106 ± .022	.183 ± .028

^a Based on twelve months of exposure.

Effectiveness, acceptability and safety of modern contraceptive methods

CHRISTOPHER TIETZE, M.D.

1. A decade ago, a discussion of modern contraceptive methods would have been concerned primarily with the vaginal diaphragm, with chemical contraception, such as jellies, creams and foam tablets, and perhaps with periodic continence. It might even have included the condom, which came into general use only after mass production had become possible in the nineteenth century. Symbolic of the speed of change in the field of fertility control is that these methods are now referred to as "traditional", while the designation "modern" has been transferred to oral and intra-uterine contraceptives.

2. The oral contraceptives discussed in this report are combinations of synthetic hormones, similar in structure to natural hormones of the human body. Each tablet contains a few milligrammes of a progestin and a smaller amount of estrogen. Taken daily from the fifth to the twenty-fourth day of the menstrual cycle, this combination suppresses ovulation. Two additional factors may contribute to the contraceptive effect: the consistency of the cervical mucous is maintained in its non-ovulatory impenetrable state, and the endometrium is made unsuitable for implantation, since the full secretory pattern is not reached.

I. EFFECTIVENESS OF ORAL CONTRACEPTIVES

3. Regardless of their precise mode of action, the oral contraceptives are highly effective. Reports published through the year 1964 cover an aggregate of about 165,000 cycles of medication, accumulated by more than 12,000 women. During this period of exposure, only twelve pregnancies occurred which were not associated with the omission of one or more tablets, according to the statements of the users. The corresponding pregnancy rate is less than 0.1 per hundred woman-years.

4. Computation of pregnancy rates comparable to those available for other contraceptive methods is not always possible, since it requires the inclusion of so-called patient failures, and some clinical reports state only that no pregnancies occurred when the tablets were taken according to instruction. With

apparently complete data and 131,500 cycles of medication, a total of seventy-one pregnancies in twenty studies was reported, corresponding to a pregnancy rate of 0.7 per one hundred woman-years of use. The low rates of 0.3 to 1.2 pregnancies reported from Puerto Rico are in striking contrast to the higher rates of twenty-eight to forty-two pregnancies associated with the use of six traditional contraceptives by Puerto Rican populations of similar socio-economic status. The six traditional methods included diaphragm and condom.

5. It should be noted, however, that with oral contraceptives, distinguishing current users from non-users is easier than with traditional contraceptives, because the number of tablets to be taken during each cycle is fixed. Irregularities of medication ordinarily can be detected, either because tablets remain after a cycle or because the omission of several tablets is followed by withdrawal bleeding. As a result, periods of exposure with use of oral contraceptives include fewer serious irregularities of use than periods during which traditional contraceptives are used. This situation undoubtedly contributes to the observed differences in pregnancy rates. Minor irregularities of medication are comparatively unimportant. According to observations in Puerto Rico, omission of one to five tablets per cycle increases the pregnancy rate to about two per hundred woman-years. Failure to use traditional contraceptives with perfect regularity has much more serious consequences, since a single unprotected coitus, randomly timed within a cycle, will result in a pregnancy rate of about forty per 100 woman-years.

II. ACCEPTABILITY OF ORAL CONTRACEPTION

6. The high acceptability of oral contraception in the United States is attested by the fact that within four years after the first product was approved by the Food and Drug Administration and made available for general distribution, the number of current users has reached an estimated 3.5 million. This figure accounts for about one-quarter of all contraceptive practice in the United States.

7. There is a general consensus among clinicians in the United States that almost all women, including those with limited education, can be taught to take oral contraceptive tablets with reasonable consistency, and that this method of birth control has proved acceptable to many couples who had been unwilling to try the traditional methods or who had been unable to use them successfully.

8. Persistence in the use of oral contraception among a group of women with a low average family income has recently been studied in Chicago. This investigation was based on the experience of 14,400 women, for whom Enovid (an oral contraceptive) had been prescribed at Planned Parenthood Centres over a period of three years as a routine service procedure, and not as a research project with special efforts to ensure maximum continuity. A life table technique showed that at least 70 per cent, and perhaps as many as 83 per cent of the women, were still on medication after thirty months. These figures are substantially higher than those reported for clinic patients using traditional methods.

9. While enthusiastic reports on the high acceptability of oral contraceptives have also come from investigators in Birmingham, England, Puerto Rico, Mexico City, Hong Kong, Singapore and Colombo, Ceylon, the percentages of continuing users appear to be lower in most of these places than in Chicago. Moreover, it is known that in some instances, the follow-up was much more energetic than is feasible under a general clinic programme. One must expect lower percentages of continuing users and, therefore, many unintended pregnancies, if patients must return to the clinic at their own initiative and expense than if supplies are taken to their homes by field workers.

III. SAFETY OF ORAL CONTRACEPTION

10. The first use of oral contraception is frequently associated with symptoms similar to those occurring during early pregnancy, such as nausea, vomiting, breast engorgement or irregular bleeding. These symptoms tend to disappear within a few months. No serious or permanent side effects have been reported in any of the published investigations of oral contraceptives. Laboratory studies, in some instances, have revealed deviations from normal values. The significance of these changes cannot yet be evaluated.

11. In spite of the encouraging results of clinical trials, the use of oral contraceptives has produced anxieties in many persons, including physicians. To a considerable extent, these

anxieties relate to the possible effects of prolonged use, and they will probably continue until a substantial number of women have used oral contraceptives for long periods without dire consequences. This will take some time, since no woman has been on medication for as long as ten years and comparatively few have been on medication for as long as five years.

12. As of this moment, there is no evidence that prolonged suppression of ovulation will cause permanent damage to the ovary or to the pituitary gland. The cycle of ovulation and menstruation is immediately restored when the drug is discontinued and, with the cycle, the capacity to conceive and bear is restored. As a matter of fact, "fecundability" appears to be higher than normal. There is no sound reason to expect menopause to occur either earlier or later than it would otherwise. No evidence has been offered that any oral contraceptives are cancerogenic in the human.

13. No increased prevalence of malformations has been noted among the children of women taking oral contraceptives. This statement applies not only to children conceived after medication was discontinued, but also to children born after pregnancies resulting from the omission of one or more tablets during treatment. Specifically, no case of masculinization of a female child has been reported which could be attributed to progestin taken by the mother in an oral contraceptive.

14. In 1961 and 1962, after the pill had been used for a number of months by hundreds of thousands of women in the United States, a number of cases of thrombophlebitis and pulmonary embolism, and several deaths from these illnesses, was reported among women who had taken oral contraceptives. Coinciding with the thalidomide disaster, these reports attracted wide public attention and led to the appointment of an *ad hoc* committee of experts by the Food and Drug Administration. After careful study of all available data, the committee concluded that the incidence of fatal thromboembolism was not significantly higher among users of oral contraceptives than among non-pregnant women of reproductive age. The committee recommended, however, that large-scale studies be continued, and this recommendation is being carried out. At this point in the studies, no unfavourable findings have been reported.

IV. INTRA-UTERINE CONTRACEPTIVES

15. Intra-uterine contraceptive devices (IUCD's) offer the only fully reversible method of birth control now available which requires a single decision to have them inserted, rather

than sustained motivation and positive actions on the part of the users. The insidious disposition of user interest, which has played so frustrating a role in all other methods of contraception, is of little importance with the IUCD. Regardless of apathy or fatigue or passion between the sexes, the contraceptive device is in place, and nothing else need be done by either the man or the woman.

16. Intra-uterine devices are small, variously shaped objects, such as rings, spirals, loops, etc., which are inserted into the uterus by a physician. The procedure takes only a few minutes and requires no anaesthesia and usually no dilation of the cervix. The devices are made of inert materials, such as polyethylene or stainless steel, and may remain in the uterus for an indefinite period. Some kinds of IUCD have an appendage or "tail", which extends through the cervical canal into the vagina. This appendage permits easy verification of the continued presence of the device and facilitates removal by para-medical personnel or even by the wearer. Other kinds of IUCD's are completely intra-uterine, without an appendage, and must be removed with a hook-like instrument.

17. The precise mode of action of the IUCD remains unexplained, in spite of much laboratory and clinical research during the past few years. Possible modes of action are interference with the fertilization of the ovum, or with its transportation through the fallopian tube, or with its implantation in the uterus.

V. EFFECTIVENESS OF INTRA-UTERINE CONTRACEPTIVES

18. Clinical and field studies of intra-uterine contraception are under way in a number of countries. The National Committee on Maternal Health in the United States has assembled data on 16,700 cases from thirty-eight institutions and investigators in private practice, and has reported on 132,500 woman-months of use. This is the largest body of clinical data ever analysed according to uniform procedures in the entire history of research in contraception. Independent investigations are being conducted in Chile, China (Taiwan), the Republic of Korea, India, Pakistan, and elsewhere.

19. These clinical studies show pregnancy rates with the most effective IUCD on the order of one to two per 100 woman-years. Somewhat higher rates must be expected under the conditions of private practice or of a public health programme than in clinical studies, since the devices are subject to expulsion, which may not be noticed by the wearer. The frequent check-ups, customary in clinical studies, in-

crease the chance of discovering an unnoticed expulsion before pregnancy occurs.

20. The contraceptive effectiveness of the IUCD is largely independent of the patient's psychology and social background. Intelligence and motivation are of importance only to the extent that they may increase the likelihood of discovering an expulsion. Well educated and emotionally well adjusted couples cannot expect a higher level of protection from the IUCD than from the consistent use of traditional methods, such as the diaphragm or the condom. Certainly they can achieve lower pregnancy rates with oral contraceptives than with the IUCD. The situation is entirely different in populations not accustomed to the consistent practice of contraception, where typical pregnancy rates with traditional methods are on the order of twenty to forty per 100 woman-years or in situations where emotional difficulties interfere with the effective practice of birth control. It is in these situations that the advantages of the IUCD are most apparent.

VI. ACCEPTABILITY OF INTRA-UTERINE CONTRACEPTIVES

21. The modern IUCD's are too new to represent more than a small fraction of current contraceptive practice in any country. There seems to be no question, however, about the high acceptability of this method among potential users. In Buffalo, New York, United States, where the Planned Parenthood Centre has been studying IUCD's since 1960 and offers these devices on the same terms as other methods, they were chosen by 48 per cent of the new clients in 1964; while in the same year 34 per cent chose oral contraceptives, and the remainder chose the traditional methods, including the diaphragm. In Taichung, China (Taiwan), where an intensive educational campaign was conducted in 1963, a survey taken at the end of the year revealed that about half the couples using any form of contraception were using the IUCD.

22. Continued use of the IUCD is determined primarily by physical factors, that is, by the incidence of expulsions and of side effects which may necessitate removal of the device. The incidence of expulsion varies markedly among the various IUCD's. An average of about 10 per cent during the first year after insertion is now considered satisfactory for the major types. Most expulsions occur during the early months after insertion, usually, but not always, during the menstrual flow. Expulsion after the first year is uncommon. The risk of repeated expulsion after reinsertion is much

higher than the risk of primary expulsion. A small proportion of women is apparently unable to retain an IUCD for any protracted period.

23. The incidence of removals for medical reasons or for relevant personal reasons, such as lack of confidence or fear of injury, has been on the same order as the incidence of expulsion, averaging about 10 per cent for the more successful devices. Given a conservative policy of reinsertion, about 80 per cent of IUCD's may be expected to be *in situ* one year after the original insertion. A study in Taichung found a somewhat lower proportion (70 per cent) *in situ* for an early model of the polyethylene loop, now known to be too small for parous women.

VII. SAFETY OF INTRA-UTERINE CONTRACEPTIVES

24. By far the most common complaints among IUCD users are bleeding, including persistent spotting, and pain, including cramps, backache, and other discomforts. These symptoms occur most often immediately after insertion and tend to disappear within a few months. In some cases, the bleeding or pain is sufficiently severe to demand removal of the device.

25. A complication more serious than those mentioned above is pelvic inflammatory disease (PID), which has been reported for 2 to 3 per cent of clinic patients in the United States during the first year after insertion. Comparable data on the incidence of this condition in the general population are not available. However, since the incidence of PID is significantly higher in the same clinics with some IUCD's than with others, and since it is unlikely that any device offers protection against inflammatory processes, it would appear that at least some IUCD's are associated with an increased

incidence of PID. To a considerable extent, if not entirely, this increased incidence represents flare-ups of pre-existing chronic or sub-chronic conditions brought about by the insertion procedure, rather than new infections. The majority of cases of PID among women wearing IUCD's are relatively mild and can be treated successfully with antibiotics, without removal of the device. Furthermore, to the extent that the IUCD's prevent unwanted pregnancies and, thereby, illegal abortions, with frequently accompanying septic complications, the net balance of PID seems to favour the wearers of the IUCD by a wide margin. It was estimated in a report from Chile, presented at the recent Second International Conference on Intra-Uterine Contraception, that of one hundred thousand women fitted with IUCD's, 230 would require hospital treatment for PID during the first year; if these one hundred thousand Chilean women used no contraception, however, the number needing hospital treatment for abortion might be about 5,000.

26. Stainless steel and plastics are used extensively in modern surgery and have been implanted in various organs for long periods without apparent ill effects. No evidence has been produced that the IUCD's are likely to cause cancer of the uterus or of the cervix. "Fecundability" after removal is within normal limits. No case of injury to a child, conceived or gestated while the mother had a device in the uterus, has been reported.

27. The systematic evaluation of intra-uterine contraception will, doubtless, continue for a number of years. At this moment, it appears that the method is highly effective, highly acceptable, safe enough to prevent far more damage than it might cause, and that it has the highest demographic significance.

Fertility and family planning in rural Korea

JAE MO YANG

1. The Republic of Korea is a country with a population of 28 million and a density of approximately 280 persons per square kilometre. Recent analysis of the census figures indicates the birth rate to be more than forty per 1,000 population. This level probably has been maintained to the present time. The mortality rate in Korea has dropped markedly since 1963. Recently it has been estimated at eleven persons per thousand. If these rates remain at the present level, Korea's population will double every twenty-four years.

2. To provide adequate knowledge and experience for preparing efficient programmes of family planning services, an action-research programme has been under way in a rural area of Koyang, the Republic of Korea, since 1962, under the auspices of the Yonsei University College of Medicine. A generous grant from the Population Council, New York, United States, made the programme possible. The over-all objectives of the Koyang project are to demonstrate the possibility of reducing the birth rate through family education and services, and to assess this possibility.

I. EXPERIMENTAL AND CONTROL AREAS

3. The main reason for the choice of Wondang Myun (township), Koyang Gun (county), as the site for the family planning experiment was convenience. Located thirteen miles north of Seoul, the rural health centre at Koyang has been, for several years, a demonstration and training ground for Yonsei University's medical students and for members of the National Institute of Public Health Training. In 1964, the township had approximately ten thousand inhabitants in seven villages, which are located within a radius of four miles from the health centre. The typical village contains 200-250 households, whose average size is 5.9 persons. Most villagers (83 per cent) are farmers, who earn their living largely by growing rice and vegetables. The others are sales workers, craftsmen, or village service workers.

4. The level of education is average for rural Korea. Three-fourths of the adults understand the Korean alphabet, and 40 per cent have had

primary school education. Most people profess no religion; 5 per cent are Buddhists, and another 5 per cent are Christians. The dwellings are usually built with mud walls and straw-thatched roofs, and nearly one house in ten has electricity. For most houses, there are sheltered bathing areas on the premises. Conditions are changing slowly in all the villages, especially in the one near the rural health centre, where the county office was established after the study began. A suburban train from Seoul now makes brief stops at this village, increasing the natives' exposure to urban influence.

5. An area, Kimpo Myun, having a population of size and characteristics similar to Wondang, was selected as a control on the basis of the 1960 census data. In 1964, this township had a population of some 13,600 persons living in seven villages. It is located twenty miles west of Seoul, and is separated from the study area by the Han River. One of the villages which has had a government office, it is relatively urbanized, with theatres, schools, churches, etc. Hence, the average level of literacy and education is somewhat higher than in Wondang. The proportion of non-farmers is about twice that in Wondang; persons professing no religion are somewhat fewer than in Wondang.

6. Like the experimental area, the control area is served by an active health centre, with the normal complement of three family planning workers and one Myun level worker, who are carrying on educational and clinical services as part of the national programme of population control. The area is thus exposed to a family planning effort similar to that in Wondang, but one that is less intensive.

II. RESEARCH SCHEDULE

7. The study began in September, 1962, with a base line survey of information, attitude and practices related to family planning in both the experimental and the control areas. From the 1,412 eligible couples with the wife under fifty years of age in the experimental area, and the 1,739 couples in the control area, a sample of 500 couples was selected randomly in each

area to give a 95 per cent confidence interval of 5 per cent for estimating the universe proportions. Field work was carried out from 31 August to 29 September 1962.

8. To observe the changes, if any, in fertility rate and in the practice of contraception during the first year of the programme, a brief re-interview of the same respondents (only the wives) contacted in the base line survey was conducted in both areas during the winter of 1963. For further assurance of a valid evaluation of the action programme after two years (September, 1962 to August, 1964), another follow-up survey was conducted in the fall of 1964. The population (i.e., eligible couples to the age of forty-nine on 31 December, 1963) was divided into two sub-universes for this follow-up survey. Sub-universe one contains eligible couples previously interviewed in the first survey, and sub-universe two contains all other eligible couples.

9. Sample size was determined as follows: from sub-universe one, all eligible couples were selected with a probability of one; from sub-universe two, 202 in the experimental area and 219 in the control area were selected randomly, with the expectation that in estimating the parameter, the 95 per cent confidence interval could not exceed 5 per cent. Combining all these, the sample sizes were 637 in Wondang and 635 in Kimpo.

III. SURVEY RESULTS

10. For the twelve months preceding the survey in September 1962, the birth rate per one thousand population was found to be 41.8 in the experimental area of Wondang and 40.8 in Kimpo. It declined to 32.1 in Wondang and 34.0 in Kimpo in 1963. It declined further in 1964, to 28.6 in Wondang and 29.8 in Kimpo.

11. According to the results of the follow-up survey, most people in Wondang (96.0 per cent) and Kimpo (93.2 per cent) agree with the idea of contraception as a means to "avoid being pregnant when a married couple have too many children or too frequent pregnancies", but fewer people have actually heard of contraceptive methods—76 per cent of eligible couples in Wondang and 75 per cent in Kimpo. The actual practice of contraception increased in both areas, with the increase in Wondang higher than that in Kimpo. The figures are shown in table 1.

12. The age distribution of the current users of contraceptive methods has its mode in the ages thirty to thirty-four in both areas, but in the ages twenty to twenty-four and forty to forty-four, Wondang has higher proportions

than Kimpo. That is to say, Wondang has a flat uni-modal distribution, while Kimpo has a rather concentrated leptokurtic curve.

Table 1. Proportion of eligible women who have practised or are practising contraception to total number of eligible women, by year

<i>Year</i>	<i>Wondang (per cent)</i>	<i>Kimpo (per cent)</i>
1962.....	7.9	11.7
1963.....	36.8	21.9
1964.....	45.0	29.1

13. Stillbirths and abortions, whether spontaneous or induced, accounted for about 6 per cent of the total pregnancies reported in the first survey in both Wondang and Kimpo. But in the year 1961 to 1962, pregnancy wastage in Wondang amounted to 12.3 per cent, and in Kimpo to 14.7 per cent. In the follow-up survey, the rate of induced abortions to total pregnancies during the two years of the action programme was found to be 16.8 per cent in Wondang and 18.6 per cent in Kimpo. It has been revealed that 40 per cent of the accidental pregnancies in Wondang were terminated by induced abortion. In fact, the induced abortions carried out in the past two years constitute 54.5 per cent of all the induced abortions reported by the eligible women presently residing in Wondang. Unlike Wondang, in Kimpo the number of induced abortions in the past two years represents only 38.3 per cent of all induced abortions reported by eligible women in that area.

14. At the time of the follow-up survey, a new method of contraception, the intra-uterine device, was being introduced rapidly in the Republic of Korea, which made it necessary to discover the general attitude toward the new method. After informing the people of the advantages and disadvantages of the intra-uterine devices, we found that in Wondang, 41.6 per cent were in favour of the method and in Kimpo, 34.1 per cent approved it.

15. For those who had never used contraceptives, an inquiry was made whether or not they wanted to use one of the methods in the future. In Wondang, 45 per cent expressed their interest in future use and in Kimpo, 37 per cent showed an interest. These findings give us reason to believe that the birth rate in Korea can be lowered by continued effort to provide services to those who are favourably inclined towards contraception.

IV. RESULT OF CLINICAL AND EDUCATIONAL SERVICES

16. Before the educational and clinical services were launched, the programme was introduced to the experimental population in three stages: (a) the programme was explained to the Myun and village chiefs to obtain their confidence and co-operation; (b) the village chiefs then invited the opinion leaders of each village to a conference, where the field supervisor explained the programme and introduced personnel; (c) public meetings were held in the villages, usually at night, when the villagers were free from work. Films, lectures, slides and leaflets on family planning methods were presented to an audience of both men and women, and the field worker assigned to the village was introduced.

17. Contraceptive services were initiated in the study area in October 1962. Four family planning nurses, including one trained public health nurse, were added to the staff of the health centre. To increase the staff's mobility, thereby broadening its range of activity, a driver and a vehicle were provided.

18. Teaching sessions and meetings for groups of ten to fifteen women were arranged by the village leaders in co-operation with the family planning workers assigned to the villages. At these meetings, emphasis was on the need for family planning. A set of flannel boards was used to depict the story of a planned family, small and happy, compared with an unplanned one, large and ragged. An explanation of reproductive physiology and contraceptive methods was given through the use of visual aids, such as flip charts and flash cards. Samples of contraceptive devices were shown and their use was explained. A pamphlet, written in simple Korean, on the need for family planning, and leaflets of instructions on the use of contraceptive devices, were distributed without cost to the women. Cards for recording menstrual periods also were distributed, along with instructions for their use.

19. After the group teaching sessions, individual consultations were given at the clinic or at home, if persons requested them. All women who sought advice were registered. Home visits were made monthly to the users of contraceptives to distribute supplies and to discuss any problems that arose. By August 1964, the number of registered women came to 743 (including those who left the programme and were re-admitted).

20. Field workers carried out an average of 100 to 150 home visits monthly. By August 1964, the number of home visits had reached

approximately 7,000. At the request of the field workers or of the village people, teaching sessions for men also were conducted from time to time by field supervisors.

21. Because the study was intended to introduce and encourage the use of simple methods widely accepted in other places and to assess the effectiveness of these methods in reducing the birth rate, the staff recommended the foam tablet and the condom as first choices for trial use. However, five methods (foam tablets, condoms, safe period, diaphragm and jelly, and coitus interruptus) were explained fully, and supplies for these methods were provided without cost to the users.

22. From the onset of the action programme in September 1962, to August 1964, a total of 769 women in Wondang registered as participants. This figure represents 49.5 per cent of 1,555 women, ages fifteen to forty-nine, who were living with their husbands in the experimental area on 31 December 1963. Approximately 70 per cent of the acceptors were in the age range of twenty-five to thirty-nine years, as compared to approximately 52 per cent of all eligible women.

23. Of the 769 participants, 535 (69.6 per cent) were classified as active users in August 1964. Those who discontinued contraceptive measures gave the following reasons: wanted a child (7.7 per cent), accidental pregnancy (7.3 per cent), pregnancy no longer a risk because of menopause, death of spouse, divorce or illness (3.1 per cent), moved out of the area (6.4 per cent), could not be contacted (0.7 per cent), pregnancy before registration (0.9 per cent).

24. According to the follow-up survey, the condom was preferred widely. In August 1964, 82.8 per cent of the active users were trying this method. This fact suggests that the practice of contraception may depend on the husbands' initiative, even though the contraceptive supplies were first introduced into the home by the wives, through female family planning workers.

25. Pregnancy rates give an indication of the effect of the programme over a short term. Table 2 shows the number of accidental pregnancies and pregnancy rates of the 769 participating women.

26. Table 3 indicates the use-effectiveness of the various methods used by the 769 participants in the programme in the experimental area from September 1962 to August 1964. The pregnancy rate with the use of the condom was lower than with other methods, but the high level of accidental pregnancies in general sug-

Table 2. Accidental pregnancies and pregnancy rates per 100 years of exposure by duration of marriage (all methods of birth control, September 1962-August 1964)

<i>Duration of marriage</i>	<i>Month of exposure^a</i>	<i>Accidental pregnancies</i>	<i>Pregnancy rate</i>
0-4.....	788	23	35.0
5-9.....	1,200	28	28.0
10-14.....	1,465	44	36.0
15-19.....	1,215	30	29.6
20-24.....	1,389	29	25.1
25 and over.....	630	3	5.7
TOTAL	6,687	157	28.2

^a Excluding *post-partum* amenorrhœa.

Table 3. Accidental pregnancies and pregnancy rates per 100 years of exposure by contraceptive method used, September 1962-August 1964

<i>Method</i>	<i>Months of exposure</i>	<i>Accidental pregnancies</i>	<i>Pregnancy rate</i>
<i>Including post-partum amenorrhœa:</i>			
Condom.....	5,838	79	16.2
Foam tablet.....	1,386	34	29.4
Either condom or foam tablet....	1,094	26	28.5
Rhythm and others.....	316	18	68.4
TOTAL	8,634	157	21.8
<i>Excluding post-partum amenorrhœa:</i>			
Condom.....	4,446	79	21.3
Foam tablet.....	1,137	34	35.9
Either condom or foam tablet....	803	26	38.9
Rhythm and others.....	301	18	71.8
TOTAL	6,587	157	28.2

gests that the methods offered were used irregularly, or not according to instructions.

V. SUMMARY AND FINDINGS

27. After twenty-four months of pursuing an action programme in Koyang Gun aimed at determining the acceptance and effectiveness of traditional contraceptive methods, our findings are summarized in the paragraphs to follow. Of the 1,555 eligible women, 769, or 49.5 per cent, participated in the contraceptive programme. Of the 769, 70 per cent were active users at the time of evaluation. Acceptance was highest (72 per cent) among the twenty-five to thirty-nine women's age group. Acceptance was also high (71 per cent) among women who had three or more children. Acceptance increased more than fivefold (from 8 per cent to 45 per cent) as a result of the programme. One-third of the par-

ticipating women registered at the health centre gave "spacing" as their reason for practising family planning methods; one-fourth gave "no more children"; another third gave "economic problems". The condom was the method chosen most often (82.8 per cent), suggesting that husbands may be taking the initiative in contraceptive practice.

28. The crude birth index declined by 12 per thousand in the experimental area and by 11 per thousand in the control area. The decline is seemingly greatly influenced by the number of abortions, but the decline does reflect a growing wish for effective methods to limit families. The rate of pregnancies among participants in the experimental area declined from 62 to 28. However, the generally high level of pregnancy rates (ranging from 16.2 to 68.4, according to method used) indicates irregular or incorrect usage.

SUMMARIES OF PAPERS

Population problems in Chile and the role of the School of Public Health

G. ADRIASOLA, R. ARMIJO, H. BEHM
and S. PLAZA

The Chilean School of Public Health will consider itself responsible for investigation of the country's population problems: cultural and ethnological integration, internal migration, population explosion, family planning and motivations, in relation with health, human reproduction, child growth and development.

The Department of Epidemiology put forward a survey of a random sample of women of child-bearing age. Different South American groups have adopted the same technique. Valuable discoveries came from the interviews: higher proportion of abortion in the prosperous class, approximately one abortion for every two births, influence of the economic factor, sparing use of contraceptives and scanty opposition to contraception. A longitudinal study of a closed population, which is under way, will provide further knowledge.

The study made by the Maternal and Child Health Department in hospitals of the National Health Service show that 8.1 per cent of the admissions were due to abortion, with a 1.7 per cent occupation of the bed-days available and a consumption of 26.7 per cent of the blood-banks stock. For each 100 births there were thirty-one abortions. The Committee for the Protection of the Family backed its plan of a co-operative investigation attempting to evaluate the acceptance, efficiency, and influence on the abortion rate of diverse contraceptive devices.

The Department of Biostatistics has improved demographic knowledge in support of the National Health Plan. It has provided analysis of reliability in certification and codification of the causes of death, life tables, population projections with their components, mortality and their relation with the standard of living. The great quota of infant mortality is shown by post-natal mortality, especially in the working class among those who have not received medical attention.

These discoveries made it possible to put into action plans for investigation into population problems, already favourably received in

Chile, and by international agencies and the initiation of a Department of Research which, in 1966, may extend itself through Latin-America, by means of systematic courses in medical demography.

A contraceptive programme in a Latin American urban community: policy, objectives and facts

ONOFRE AVENDAÑO and ANIBAL
FAUNDES-LATHAM

Chile, with an average density of 11.6 inhabitants per square kilometre, is not an over-populated country; however, because of the shape of its territory, the population is unevenly distributed.

Likewise, there is an uneven family size according to the socio-economic status. The affluent and well educated groups deliberately control their fertility, whereas the less privileged and less educated usually have large families.

Chilean women make use of illegal (criminal) abortion as the most effective means to limit their fertility. As a corollary, there is an increasing frequency of abortions in the country, and at present a fair estimate would be one abortion for every two live births. Out of every three abortions, two are illegal. Two out of five maternal deaths in the recent years were due to abortion. The consequences are disastrous for the individual's health, for the family economy and for the budget of the National Health Service.

The Comité Chileno de Protección de la Familia, affiliated to the International Planned Parenthood Federation/Western Hemisphere Region, was created as a voluntary agency. It aims to stimulate research on abortion problems and to prevent criminal abortion by means of extensive use of contraception. During the past three years, the Comité has been operating with the close cooperation of the National Health Service and the University of Chile.

The San Gregorio Project, sponsored by the Population Council, is a typical programme for the investigation of the problems of abortion, contraception and some demographic

implications in an urban community in Latin America. Through the experimental use of extensive contraception, we plan to study its effects upon the incidence of abortion and birth rates, and to evaluate the acceptability, the use-effectiveness, and other clinical aspects of intra-uterine contraception.

Population planning. Some suggestions for emphasis in future research

GEORGE W. CADBURY

This paper is designed to explore some of the problems of population planning which are becoming the urgent concern of governments that have recognized that they have a quantitative as well as a health problem arising from too many births. It does so by suggesting a dozen areas in which new or increased emphasis might be placed in our research programmes.

In particular it suggests that there are qualitative considerations that will govern the optimum size and composition of a national population. It recognizes the sensitive nature of the problem and notes that there will be differing solutions by different communities just as there will be by different families. Outside interference is not advocated. It clings to the belief that there is yet time to solve the population problem by voluntary means.

Practical policies discussed are divided between those relevant to a situation where a simple reduction of the birth rate is the immediate goal and those in which more complex considerations are involved. In both cases influence of social and economic conditions is recognized, together with the effects of educational and moral conditioning. In the more complex cases more direct inducements are suggested as necessary to produce a population pattern that conforms to a community's needs and desires.

The paper concludes with twelve suggestions for new emphasis in research.

Experiences in Czechoslovakia with the effects and consequences of legalized artificial termination of pregnancy

ANTONIN ČERNOCH

Gynaecological investigations of the health of women who were officially permitted termination of the pregnancy in the years 1958 to 1964 have revealed a 75 to 90 per cent decline in criminal abortions and subsequent gynaecological inflammations. The analysis of *sequelæ* of

491,000 pregnancy interruptions performed in that period shows that improvement has been achieved so there occurs one death per 82,000 interruptions, only 0.06 per cent of injuries, and 3 to 4 per cent of gynaecological inflammations. A large contribution to the improved results has been made by the determination of contraindications of interruptions in pregnancies exceeding twelve weeks and in women who had never been delivered of a child. The decisions in individual cases is left to the discretion of the committees permitting terminations of pregnancies. The regulations governing the decision of the committees can be modified to prevent adverse effects and to maintain a satisfactory population increase. In spite of the considerable improvements there remain some unfavourable consequences, for example, parametritis, insufficiency of the uterine cervix, and disturbances and complications in subsequent pregnancies, so that existing practice cannot be considered entirely satisfactory.

Economic programmes to prevent births

STEPHEN ENKE

Many of the less developed countries (LDC's) seem destined to double their populations by 1995. They cannot double their invested capital as soon as that because natural resources ("land") are fixed in supply, and technical productivity is not likely to increase at 2.5 per cent yearly. As a result gross national product divided by population may barely rise in these countries.

If national economic resources were devoted to retarding population growth rather than accelerating production growth, these resources could be 100 times more effective in raising some LDC's output per person. The economic worth of preventing a birth in a seriously overpopulated LDC is usually from one to two times the annual per capita income of that country.

The resource cost of preventing a birth varies according to method used, but is roughly from five US dollars to seven and one half US dollars over five years. With recent devices such as the intrauterine coil it is perhaps as low as two US dollars. Cost per couple participating in a reasonably mixed method programme to reduce births is roughly one US dollar per year.

A typical LDC must cut its crude birth rate by one third if it wishes to halve its natural increase rate. This means that from eight to twelve adults per 100 population would need to be practising contraception in a rather effective form. The cost of such a national programme

would be about 10 U.S. cents annually per head of population. The resultant budget would constitute, for most LDC's, about 1 per cent of the cost of their present overall development programmes. This 1 per cent of total development budgets, spent reducing births, could be as effective in raising output per person as the other 99 per cent altogether.

Midwife as a local functionary and her role in family planning: some research findings

HASSAN NAWAZ GARDEZI

Traditionally, midwives have occupied an important place in Pakistani communities as maternity specialists and they continue to be indispensable for large masses of people. Research indicates that midwifery in a large Pakistani city is not a hereditary profession, but women are driven to adopt the work by economic stress. Typically a midwife is illiterate and possesses meagre knowledge concerning deliberate fertility control. At the same time, she reacts favourably to the extension of her roles to include family planning work. There is evidence that some midwives already have started giving family planning advice and guidance to their clients. This is in spite of the fact that they have been left out of the mainstream of the family planning movement in Pakistan. When exposed to a motivation course, a positive improvement was registered in midwives' knowledge of matters related to deliberate fertility control. Their attitude towards family planning also became more favourable.

The conclusion is that a scheme of economic incentives is needed to strengthen the status of midwives as local functionaries. Furthermore, positive gains are expected in the promotion of deliberate fertility control if their unique position is utilised in mediating between the communication media and the general public. Regular short interval motivation courses arranged for midwives can serve as effective means of increasing their resourcefulness as change agents in the area of family planning.

Attitude studies relating to family planning in India

R. P. GOYAL

The family planning problem in India is one of bringing about a change in people's attitude, their norms and values in favour of small family size. A brief review of the attitude studies in India brings out that a large proportion of

females are willing to learn family planning, but much reliance cannot be given these figures. There is need, therefore, to launch an extensive education programme. This should be done under the supervision of social scientists, consisting of sociologists, social anthropologists, social psychologists, demographers, economists and teachers.

In India significant fertility differentials are found by age at marriage and educational level. It will, thus, be advisable to spend funds on increasing educational facilities in the country.

The attitude studies point out that women above the age of thirty-five and with more than four living children are more receptive to family planning than other women. It is, therefore, preferable to concentrate on this group in the initial stages rather than to waste energies on a larger group.

The attitude of the Indian masses towards abortion and sterilization as family planning methods is not favourable. Sterilization, too, may not help in bringing about the reduction in birth rate. These methods thus have minor significance.

The family planning studies on which this paper is based are few in number and have a limited scope. The results, therefore, need not be taken as firmly established. The need, therefore, is for more comprehensive studies and researches in family planning to improve knowledge before taking appropriate policy decisions.

An action-research project on family planning in "poverty" neighbourhoods of New York City

ALAN F. GUTTMACHER and STEVEN POLGAR

Introduction of oral methods of birth control and the new intra-uterine devices has brought contraceptive clinics unusual success in attracting clients, in encouraging continued use of birth control methods and in maintaining a high rate of effective use among those who adopted one of the methods. Reports from the United States and from other countries indicate the need for a study of the impact of the new methods.

One such study is underway in New York City where the Planned Parenthood Federation of America, Inc., has started an extensive action project. The New York Mobile Unit is sending equipment and staff to six locations in twelve areas of three boroughs for a half a day each week. An intensive educational campaign will be carried out. Clinic services will

be offered free to those unable to pay and a sliding scale will be set for others. Women ineligible for care will be referred to cooperating private physicians.

Sites were selected on the basis of their designation as a "poverty" or low-income area, provision of housing by a neighbourhood agency, and absence of any contraceptive clinic in the area. The twelve areas (including about 70,000 persons in each) were divided into six pairs, mated for similarity in socio-economic and ethnic composition. One of the pair will provide birth control services; the other will serve as a control area.

In three neighbourhoods a total of 750 respondents will be interviewed on such subjects as pregnancy, socio-economic status, ethnic origin, education, work-record, family planning behaviour and past experiences with contraceptives. After two years, the respondents will be interviewed again. Other investigations will include a study of births from 1960 through 1967, measurements of changes in the volume of contraceptive sales, interviews with doctors on changes in the volume of requests for birth control advice and contraceptives, comparison of routine records of patients served by the mobile unit with those served by centres previously existing.

This data will aid evaluation of changes in the practice of contraception, in birth rates, and in the attitudes of individuals toward family planning.

Inter-generational mobility and family planning in urban Brazil

SUGIYAMA IUTAKA

Based on data collected during the Fertility Survey in Rio de Janeiro, the author analyses the effect of social mobility on the differential use of contraceptive devices. Birth control is widely spread, more than half of the informants used some kind of contraceptive device. There is an association between the use of birth control methods and social status: the higher the social position of the respondent, the more likely she is to use contraceptive methods. When the factor of mobility is taken into account, the general pattern is that socially mobile individuals are more likely to be family planners, and this is decisive because the mobile people in Rio de Janeiro constitute more than 60 per cent of the total population. The distance traversed in the process of social mobility is crucial in understanding the differential behaviour. Among those who climb socially, the

more intense the mobility, the more likely the women are to use birth control methods; while the reverse is true for those that descend socially. The methods used by the mobile people tend to be different from those who are immobile. The downwardly mobile tend to use more effective methods than the other two groups. The upwardly mobile have a greater tendency to use methods that are socially "acceptable"; however, when we consider the question of acceptance of the innovation of birth control pills, the consistency is only partially maintained. The upwardly mobile people still are the most resistant, but the immobile tend to accept this specific innovation more readily than the downwardly mobile.

The planning of the family size in the different social classes according to the results of investigations in Schleswig-Holstein, Federal Republic of Germany

HANS W. JÜRGENS

Social investigations among families in the Federal Republic of Germany have shown that the number of children as well as the differences in their ages is rationally planned. The reasons are the desire to maintain a high living standard as well as to assure a fair standard of education for the children. For the first time in 1950 peoples of the Federal Republic of Germany were subjected to an investigation in the form of a random test to find the number of children wanted by persons of different social classes. This inquiry showed marked differences in wishes regarding family size. At intervals of six years and of twelve years after this inquiry we determined the number of children in the different social classes of Schleswig-Holstein, a part of the Federal Republic of Germany. The plans for the number of children expressed in 1950 had been kept to a large extent. The second investigation which took place after twelve years showed a somewhat higher number of children than the number families had wanted in 1950. Social differences were kept the same as those in 1950. These findings demonstrate that judgements for planning family sizes are to be based not only on absolute average figures but mainly upon the social relations within the population. These last are less influenced externally than the average figures.

Some essential factors for fertility control in Japan

YOSHIO KOYA

Strongly motivated by hardships following World War II, the Japanese people took the

initiative in family planning before the government began official action. Induced abortion, already widely used as a method of birth control, was encouraged by the establishment of Eugenic Protection Law in 1947. A provision of this law was to legalize abortion for women whose health may be affected by delivery, either from the physical or economic viewpoint. A Cabinet decision of 1951 sought to replace the method of induced abortion by encouraging the use of contraceptives.

The author suggests that once people become accustomed to induced abortion guiding them to the use of other birth control methods is difficult. As an example he shows in tabular form the results of a project of instruction in three villages and at three coal mines. A five-year guidance period achieved a decline in birth and pregnancy rates with a notable decline in induced abortions, but a full five years was necessary before the decrease in abortion showed a significant level. Although the programme brought a decline in abortions, it produced no decrease in the number of abortions once pregnancies had occurred. The author cautions persons concerned with laws on induced abortions to note this fact and to teach family planning methods rather than to seek to prohibit or limit abortions.

A second table shows results of a survey that indicates family planning education can be passed from one generation to the next. The proportion of people practising contraception was much larger in three villages that had received guidance seven years ago than that in other agricultural areas where no instruction had been given.

A third table shows where the younger generation obtains its knowledge of contraception. Publications are the most frequent source with midwives a second large source. Younger wives generally do not learn from their parents or family members but from discussions with friends. Old villages of the feudal style seem to offer less opportunities for discussion than modern villages where many women work and see other persons freely.

On technical assistance in the field of family planning

ULLA LINDSTRÖM

The aim for family planning assistance must be to start pilot projects, to "promote promotion". Sweden has two programmes under way, one has been in progress in Pakistan since 1960 and the other in Ceylon, where an "action

with research" project has been carried on since 1958.

According to Swedish experience, the export teams should consist of medical personnel as well as experts on teaching and information techniques. Recruiting for the Swedish projects is done in other countries and the employment made attractive from a salary and career point of view.

The field work includes research in order to obtain knowledge of:

- (a) What information to give to people in need of contraception;
- (b) How to give that information;
- (c) What types of services should be available; and
- (d) How to measure the results of the programme.

The contraceptive methods must fit the medical, social, cultural and religious circumstances. At present an intra-uterine device appears to be an acceptable contraceptive. The "oral pills" are still too expensive for mass distribution.

For the organization of family planning assistance the medical infrastructure of the receiving country should be used. If this structure is inadequate, a network of information centres might be established to promote the family welfare concept of which family planning is one side. The government of the receiving country must provide the administrative means in the field of family planning and make available qualified civil servants and sufficient funds.

The impact of the family planning movement on the Indian population

K. K. MATHEN

After reviewing the recent growth of Indian population brought about by the phenomenal reduction in mortality, the paper considers the prospects for a similar decline in fertility. Comparing conditions in western nations which brought about a decline in fertility, one observes that in India, the situation is not similar. Expansion of industries, progress in modern technology and education, scope for migration and large scale urbanization, are some of the important factors which influenced human fertility in western countries. In the present stage of development in India, these factors have not begun to exert their influence on the fertility trends of her population. An examination of the course of some of the experiments to popularise family planning in India, shows

that there are five stages in the progress of family planning. In the present stage of development, the community passes through these five stages at a slow pace. The role of urbanization and education in enhancing the speed with which the community reaches the final stage of successful control of fertility is discussed. The inadequacy of present day knowledge and methods of the family planning in so far as the Indian population is concerned is outlined and the need for new approach and new techniques emphasized.

Social and psychological factors affecting fertility in a legalized abortion system

KÁROLY MILTÉNYI

The study analyses the results of two surveys, identical as to tenor and method, the basis of which was the interrogation in 1960 of 26,100 and in 1964 of 27,900 childbearing females. After a methodical introduction, the study investigates the impact of the factors on birth control, by the ratio of childbearing and surgically aborting females.

Birth tendency essentially is influenced by marital status and, in the case of married women, by the number of children. The psychological disposition connected with the acceptance of a child (especially of the first child) scarcely is influenced by age; pregnant, childless, married women in advanced age accept pregnancy in an essentially higher ratio than the married women having one or more children in any of the age-groups. The birth control of gainfully occupied females is more intensive than that of women who are dependants; the difference, however, between the two groups is decreasing. The birth control of families heterogeneous in respect to occupation is more intensive than that of homogeneous ones. Concerning the first child, no connexion is observed between the level of income and birth tendency. As for the acceptance of the second child, a negative correlation is reflected. Independent housing has a significant role in the formation of birth tendency; the impact of housing density, however, is not observed.

The motives regarding the decision to interrupt pregnancy (according to the opinion of the interested persons) in two thirds of the total cases are of a subjective nature; in about half of these cases the number of existing children is considered sufficient. In one third of total cases unfit living conditions (mainly bad housing) are mentioned. Among surgically aborting females 60 per cent regard their fer-

tility as being completed; 40 per cent want to be confined at a later period, but subordinate confinement to certain conditions. Among the surgically aborting females 46 per cent generally do not practise contraception.

Action-research in one-time family planning methods – outline of a plan for West Bengal

K. N. MITRA, M.D.

The problem of population pressure in India, in particular in West Bengal, which ranks as the second most crowded state in the Union, is discussed. The necessity to curb high birth rate at a lower level in the course of next few years is stressed.

Different methods of contraception are compared with regard to their cost, efficacy, and practical utility. Emphasis is on one-time methods for success in curbing birth rates effectively and quickly.

Failure to use a method of birth control consistently is noted. Recommendation is made to overcome this difficulty utilizing the initiative of physicians through monetary incentives of *pro rata* payments according to cases attended.

A non-governmental institute is proposed to organise the field work, maintain continuous check on the data, conduct study, research and generally to overcome inertia and provide momentum for a birth control campaign. The cost, structure and function of such an institute and action centres are outlined briefly.

Estimated reductions in birth rate resulting from different combinations of sterilization and contraception programmes in India

D. V. R. MURTY

An attempt has been made in this paper to estimate the birth rates in India resulting from certain combinations of sterilization and contraception programmes. The calculations show that the current sterilization programme of five per 1,000 population per year supported by a contraception programme with an average effectiveness of 54 per cent for the entire population will reduce the birth rate of 41.7 for the country in 1964 to the level of twenty-five by 1973. If, however, the average contraceptive effectiveness is 10 per cent, the reduced birth rate will be about thirty-five.

Process of birth control

P. P. TALWAR

The accelerating rate of population growth has offset most of the efforts towards economic development. Most of the developing countries are exposed to still rapid growth of population since mortality is declining fast with a relatively high constant level of fertility. India has a heavy base of population; acceleration in its growth rate is impinging hard on its economic development attempted through Five Year plans. The importance of family planning in achieving the economic development has been realised since the First Five Year Plan.

It is essential to understand the process of childbirth before control can be planned. The basic steps in the process of childbirth are (a) union of two sexes; (b) deposition of semen in the vagina with sufficient number of mobile and healthy spermatozoa so that some of them can swim into the cervix and pass on the fallopian tube through uterus; (c) availability of a ripe ovum; (d) spermatozoa should pierce through the outer wall of the ovum and fertilize it; (e) the proper implantation of the zygote in the endometrium; (f) successful development of the fertilized ovum in the uterus.

Despite the needed combination of all these events, the level of births is so high that controls must be imposed on their occurrence. The checks can be grouped into the following three categories: (a) controls imposed by nature, (b) controls imposed by social and cultural institutions; and (c) controls imposed by artificial means. All these categories of checks impose controls at various stages in the process of childbirth. These various stages are (i) prevention of union of two sexes; (ii) if there is union, avoid deposition of spermatozoa inside vagina; (iii) if the ejaculation has occurred inside the vagina, check entry of spermatozoa into cervix; (iv) if spermatozoa enter fallopian tube, ensure the absence of ovum; (v) if pregnancy occurs, avoid its termination into a live birth; and (vi) if every factor of sex life is normal births can still be avoided.

The demographic effectiveness of different methods of family limitation

G. R. VENNING

The three criteria for measuring the efficacy of any method of family limitation are the theoretical, the practical, and the demographic. Theoretical effectiveness assumes correct use of

a method. Practical effectiveness which allows for normal conditions of use is applicable to any group of people using a particular method. Demographic effectiveness is the effectiveness of a method or group of methods judged by their influence upon the birth rate of a community.

Little factual information exists about the relative demographic effectiveness of different methods or combinations of methods of family limitation as judged by their impact upon the birth rate of a community. The explanation that the use of contraceptives was a major factor in the fall of the birth rate in the United States and Europe is rejected for a number of reasons. Evidence of a high incidence of induced abortion in the United States and other countries leads one to conclude that abstinence and induced abortion are the most likely reasons for the fall in the birth rate.

Well-documented information exists about the practical effectiveness of contraceptive methods. In some cases theoretical effectiveness is also known but in others the failure rates may be attributable either to inadequate (theoretical) effectiveness or to faulty use. Induced abortion is virtually 100 per cent effective both in theory and in practice. Failures occur with both male and female sterilisation. Failure rates of local chemical and mechanical methods have been so high that these methods must be assumed to have poor demographic effectiveness.

Oral contraceptive pills and the new plastic intra-uterine devices have an advantage in that they do not involve precautions at the time of intercourse or restrict normal intercourse. The effectiveness of the oral contraceptive method in normal practical use has approached closely the theoretical effectiveness.

Potentially effective methods include delay in age of marriage or regular union, abortion, and sterilisation. Abortion and sterilisation are not always culturally acceptable, and female sterilisation is safe only when hospital facilities are available. Sterilisation as an influence is likely to be disappointing because the method is never justifiably applied to young couples of low parity. Abortion has the drawback of needing to be repeated.

On the evidence available at present all methods of family limitation have some disadvantages from a demographic point of view. The oral contraception and the new intra-uterine devices are potentially the two most useful contraceptive methods with male sterilization and legalized abortion potentially effective methods.

Religious, educational and socio-economic factors associated with different methods of fertility control

J. YERUSHALMY

The contraceptive practices between the termination of the preceding and current pregnancies were ascertained for a cohort of more than 6,000 pregnant women. On this basis the gravidas were classified in three groups: group I—non-users; group II—"planned pregnancies"; and group III—"contraceptive failures." The last group contributed more pregnancies (34 per cent) than the non-users (29 per cent); 37 per cent of the pregnancies were planned.

A larger proportion of Catholics than Protestants did not use contraceptives. The higher the educational and economic level of the gravida, the lower the percentage of non-users. The most common method of contraception was

the diaphragm for Protestants and rhythm for Catholics; however, one third of the Catholics in this study used contraceptive methods other than rhythm. Rhythm, douche, and jelly were less effective than diaphragm, condom, and withdrawal.

Non-users had a shorter interval between pregnancies and the "planned pregnancies" the longest interval, with the interval for the "contraceptive failure" group between the two. The mean interval increased markedly with increasing age of gravida in all three groups. The difference in the interval between users and non-users of contraception was greatest for the older ages. Group II provides means for estimating the desired interval. A comparison of the desired interval with that actually attained shows them to be close for younger gravidas but the actual interval for older gravidas exceeds the desired interval by about ten months.

Meeting A.2

MORTALITY

PAPERS

State measures in the field of public health and their influence on mortality among the population

S. Y. FREIDLIN

[Translated from Russian]

1. The mortality level and its dynamics are rightly considered the fundamental indicators of the well-being and health of the population.

2. Russian *zemstvo* doctors working among peasants in pre-revolutionary Russia had already established a direct relationship between mortality and the amount of property owned: the more prosperous people were, the lower their mortality became.

Table 1. Mortality of peasants according to data from the Voronezh *zemstvo* (a local government organ in pre-revolutionary Russia)

Property owned	Number of deaths per 1,000 population
Landless	34.1
Owning up to 5 <i>desyatinas</i> of land.....	35.0
Owning from 5 to 15 <i>desyatinas</i>	33.2
Owning from 15 to 25 <i>desyatinas</i>	28.6
Owning more than 25 <i>desyatinas</i>	26.2

3. After foreign intervention and the Civil War had come to an end and the country turned to peaceful construction, mortality in the Soviet Union began to decline. By 1926, as the Soviet Union's economy and culture developed and grew stronger, the mortality rate was 30.2 per cent lower than in 1913; by 1940, after the foundations of socialism had been built, mortality was 38.1 per cent lower than in 1913 and had reached the level of 18 per thousand. After the end of the Second World War (1941-1945) and the elimination of its after-effects, the Soviet Union embarked upon the further development of its economy and cultural life and the construction of the material and technical

foundations of communist society. At the same time, the well-being of the workers rose steadily, their level of health increased and the mortality indicators declined. By 1963, mortality rates in the Soviet Union had declined to a quarter of the 1913 figure.

Table 2. Mortality in the Soviet Union

Year	Number of deaths per 1,000 population
1913.....	29.1
1926.....	20.3
1940.....	18.0
1950.....	9.7
1959.....	7.6
1963.....	7.2

4. The average mortality rate in the Soviet Union during the past five years (1959-1963) has been the lowest in the world, amounting to 7.3 deaths per 1,000 population. As a result of the decline in mortality rates, the life expectancy in the period 1960-1961 was 60 per cent greater than in the years 1926-1927 and more than twice as great as it was before the Revolution.

5. The life expectancy of the entire population of the Soviet Union was 70 years in the period 1960-1961, 44 years in the period 1926-1927 and 32 years before the Revolution.

6. What were the decisive factors in this sharp decline in mortality rates and increase in life expectancy in the Soviet Union?

7. Social and economic factors are of prime significance in improving the health and

increasing the life expectancy of the Soviet population. We should first mention the most important of these factors: the rise in the Soviet Union's national income, which in 1963 was more than five times as high as in 1940, and the rise of 590 per cent in the real wages of Soviet workers in comparison with the pre-revolutionary period. In addition to their individual wages, workers in the Soviet Union receive considerable sums from public funds in the form of social insurance payments, various allowances, pensions and students' grants, holiday pay, free education, free medical services and so forth. In 1960, manual and non-manual workers changed over to a shorter seven- and six-hour working day. Over the last ten years (1954-1963), a total of 632 million m² of housing, or more than 17 million dwellings, has been built in towns and workers' settlements, while in rural areas some 6 million houses have been built. One hundred and eight million people, representing almost half the total population of the Soviet Union, have moved into the new housing and thereby improved their living conditions.

8. Extensive public health measures have also been of considerable importance in improving the health of the population and reducing mortality. In the Soviet Union, health services are provided by the State and are one of its most important functions. The first Chairman of the Presidium of the Supreme Soviet of the Union of Soviet Socialist Republics, N. I. Kalinin, said: "In our socialist country, the health of the workers and peasants is a fundamental concern of the State."

9. The State character of Soviet health services is reflected in the Constitution of the Union of Soviet Socialist Republics, one of the articles of which states: "Citizens of the Union of Soviet Socialist Republics have the right to maintenance in old age and also in case of sickness or disability. This right is ensured by the extensive development of social insurance of manual and non-manual workers at State expense, free medical service for the working people and the provision of a wide network of health resorts for the use of the working people."

10. The Soviet State is vitally interested in ensuring the health, long life, reduced mortality and prosperity of its citizens. The Programme of the Communist Party of the Soviet Union declares: "The Socialist State is the only State which assumes responsibility for protecting and constantly improving the health of the whole population." To that end, an extensive programme has been worked out with a view to

preventing and sharply reducing sickness, eliminating wide-spread infectious diseases and fully supplying the people's needs for all kinds of highly skilled medical services.

11. The most important factor in carrying out this programme is the availability of doctors, for it has long been known that there is a direct relationship between the provision of medical assistance and the health of the population: the more assistance is provided, the lower is the mortality rate.

Table 3. Medical care and mortality for different provinces of European Russia in 1913

<i>Number of inhabitants (in thousands) per doctor in the province</i>	<i>Number of deaths per 1,000 population</i>
19.9.....	33.1
10.0.....	27.1
7.4.....	25.9
4.1.....	22.1

12. From the first days of their existence, the Soviet health services have devoted particular attention to the training of doctors. In the Soviet Union in 1963 there were 17.9 times as many doctors as in Russia in 1913, and the number of doctors in relation to the population was 12.3 times as great.

Table 4. Number of doctors and ratio of doctors to population in the Soviet Union

<i>Year</i>	<i>Number of doctors (excluding military doctors)</i>	
	<i>Thousands</i>	<i>Per 1,000 population</i>
1913.....	28	1.8
1917.....	—	—
1940.....	155	7.9
1953.....	301	15.7
1964.....	501	22.1

13. The Soviet Union has one fourth of all the doctors in the world and nearly half of the total for Europe. This high level of medical care creates the necessary conditions for the provision of high-quality specialized medical and preventive treatment.

14. The trend towards preventive medicine in the Soviet public health system has essentially been an outgrowth of the extensive development of accessible, highly skilled care at dispensaries and general clinics. The dispensaries and general clinics are perhaps the most

important of all medical and preventive institutions. They are of particular significance because, first, they are closest at hand for the great bulk of the population and they serve vast numbers of people. The Soviet Union has a total of almost 40,000 institutions providing clinical treatment. Each year these institutions handle more than 1,000 million clinic visits and carry out more than 100 million visits to sick people at their homes. Secondly, the general clinics and dispensaries play a special part in improving public health and reducing mortality because the work of the doctors attached to these institutions has very great preventive value. The general clinic doctor is the first to discover infectious diseases at their original point of outbreak. He sees not only sick people, but also healthy people who seek a medical consultation. The fate of the sick person is determined at the general clinics, since the patient generally reports when the disease is in the initial stages, and it is a well-known fact that early diagnosis and prompt treatment can ensure complete and rapid recovery in most cases of illness. Early diagnosis is especially important in such diseases as tuberculosis, venereal disease, malignant tumours, and heart and vascular diseases.

15. The treatment of such patients calls for active and systematic medical supervision. The health service must actively seek out sick people instead of waiting passively until people who are ill request medical assistance. This method of providing medical services for the population in the Soviet Union has come to be known as the clinic method and is an outgrowth of the stress on preventive medicine in the Soviet health service. It is a synthesis of curative and preventive medicine in which the healthy person as well as the sick one is the subject of observation and care. The very first years of the Soviet health service witnessed the establishment on a broad scale of special clinics for the treatment of tuberculosis and of skin and venereal diseases.

16. At the present time, such institutions serve all urban centres and rural localities in the Soviet Union. They have played a major role in reducing mortality from tuberculosis and the incidence of syphilis.

	<i>Reduction in mortality from tuberculosis among urban population of the Soviet Union (1950=100)</i>	<i>Incidence of active syphilis (per 100,000 population)</i>
1950.....	100.0	24.7
1955.....	37.6	5.6
1960.....	25.0	—
1961.....	22.8	1.5

17. In view of the successful experience of the work of the anti-tuberculosis and skin and venereal disease clinics, a start was made in setting up cancer clinics and establishing cardiac units at general clinics. The clinic method is gradually spreading to all general clinics and is embracing ever wider sections of the population. The Programme of the Communist Party of the Soviet Union envisages coverage of the entire Soviet population by clinical observation. The mass preventive medical examinations using radiography which are already being carried out are a prerequisite for this. Workers in industrial enterprises, who receive priority medical service in the Soviet Union, are the first persons to undergo medical examinations. More than 1,000 medical and health units have been set up at large enterprises and construction projects, where the clinical method has by now already gained ascendancy.

18. Out-patient institutions are of great importance in reducing mortality from diseases requiring urgent treatment. An extensive network of special first-aid institutions and flying doctor stations has been established throughout the country. The Soviet Union has more than 2,000 special State first-aid stations with a fleet of about 10,000 special ambulances, some of which have recently been further adapted for the treatment of patients suffering from thrombo-embolic conditions and shock. Every year these institutions give first aid in accidents and sudden illness to almost 30 million people. All general clinics have first-aid posts, and there are flying doctor stations attached to all 166 Republic, territorial and regional hospitals. In 1961, as a result, a large proportion of patients requiring urgent surgical treatment arrived at the surgical departments of urban hospitals within six hours of the onset of the disease: 76.7 per cent in the case of perforated gastric or duodenal ulcers; 59.4 per cent for strangulated hernias; 45.1 per cent for extra-uterine pregnancies; and 40.0 per cent for intestinal obstructions. The only sure way of reducing the fatality of these acute diseases is, of course, for the sufferers to be taken to a hospital as quickly as possible. Indeed, in recent years post-operative fatalities in urgent surgical operations at urban hospitals have declined to 0.2 per cent for acute appendicitis, 0.2 per cent for extra-uterine pregnancy and 2.4 per cent for strangulated hernias. This reduction in fatalities is inevitably reflected in a decline in the mortality indicators.

19. The mortality level is still largely dependent on the availability and quality of hospital facilities. During the years of Soviet rule, the number of hospital beds in the Soviet Union

has increased nearly ten times and by 1963 had reached 90 beds per 10,000 population.

Table 5. Number of hospital beds and ratio of hospital beds to population in the Soviet Union

Year	Number of hospital beds (excluding military hospitals)	
	In thousands	Per 10,000 population
1913.....	208	13
1917.....	149	10
1940.....	791	40
1953.....	1,162	61
1964 (beginning of year)	2,044	90

20. In recent years, as medical science has developed and chest surgery, endocrinology, cardiology, traumatology etc. have progressed, hospital treatment has tended towards greater specialization and considerable advances have been made: specialized hospital departments in all specialties, including the newer ones, have been established in all Republic, territorial and regional centres. The hospital fatality rate, which to some extent can be considered a general indicator of the activity of hospitals, has been cut nearly in half in the past twelve years (1950-1961) and for some diseases it has fallen even more sharply.

Table 6. Fatality among adult patients in urban hospitals

Illness	Number of deaths in urban hospitals as a percentage of all patients	
	1950	1961
All diseases	2.4	1.4
Rheumatic heart defects.....	11.0	4.4
Vascular brain lesions	15.0	7.8
Hypertension	5.3	3.4
Croupous pneumonia	2.7	1.5
Gastric and duodenal ulcers...	2.1	0.9

21. These diseases are, of course, among the major causes of death; hence, any reduction in the fatalities resulting from them is bound to bring about a decline in the over-all mortality level.

22. The largest proportion of deaths is caused by cardio-vascular diseases, which, in 1960, accounted for 37 per cent of all deaths. The control of these diseases occupies a central position in Soviet public health. Several special cardiological research institutes have been established in the Soviet Union to study the aetiology, pathogenesis, clinical aspects and

prophylaxis of cardio-vascular diseases. Urban hospitals have special cardiological departments, and general clinics have cardiological consulting units. The clinical treatment of sufferers from such diseases has become the main work of thousands of specialists in therapeutics.

23. Nationwide measures taken in the Soviet Union with a view to improving working and living conditions have been of prime importance in the major advances made in the control of cardio-vascular diseases. Technical progress in the Soviet Union has made work immeasurably easier and many trades which are harmful to the human organism are disappearing. The opportunity to choose a job in accordance with one's personal inclinations and the maintenance of a regular work schedule are of increasing importance in the prevention of hypertension, arteriosclerosis and coronary disease. Of great importance in this regard are physical education and participation in various types of sports, not only by young people but also by people in their middle and advanced years, which is extremely wide-spread in the Soviet Union.

24. Malignant tumours are the second most important cause of death. To combat this disease, a single State cancer organization has been established in the Soviet Union, all of whose units are interconnected, working according to the same plan and by the same methods. By 1962, the network of cancer institutions included nineteen research institutes, 255 cancer clinics, and 2,058 clinical departments and units at hospitals and general clinics. There are more than 30,000 beds for cancer patients. In 1959, because of the great importance attached to the effort to combat malignant tumours, the Council of Ministers of the Soviet Union adopted a special resolution "on intensifying scientific research into cancer", providing for a considerable expansion of cancer research institutes and the development of new institutes and laboratories.

25. A large part in reducing the mortality level in the Soviet Union has been played by the broadly based State system of measures for protecting the health of women and children. In the first months of Soviet rule, the Soviet Government issued the decree of 31 January 1918 on maternal and child welfare, which established the broad pattern of Soviet services in this field. A series of subsequent decrees, orders and resolutions by the Soviet Government completed the construction of a balanced system of maternal and child welfare. Soviet law provides solid protection for the interests of the mother and child. Thus, it is illegal to use female labour for heavy or unhealthy work;

to refuse work to women, discharge them or reduce their wages because they are pregnant or nursing a child; and to put pregnant women and nursing mothers on overtime and night work. Provision is made for compulsory paid leave of 112 days before and after child-birth in the case of normal births.

26. By the end of 1963, the Soviet Union had 227,000 medical and maternity beds for pregnant and recently confined women, 18,500 women's consultation units and general children's clinics. It has 33,000 doctors specializing in midwifery and gynaecology.

27. In 1961, maternal mortality stood at less than one fifteenth of the level during the pre-revolutionary period, when more than 30,000 women died in Russia every year in child-birth. Infant mortality in the Soviet Union in 1963 was little more than one ninth of the figure for 1913.

28. For forty-seven years, maternal and child welfare in the Soviet Union has withstood the test of time and yielded remarkable results, and it is now justly admired throughout the world.

Public health activities as factors in levels and trends of mortality and morbidity in developing countries

GWENDOLYN Z. JOHNSON

1. The historical decline of mortality in the now economically advanced countries was due both to dividends from general economic and social development and to actions undertaken expressly to improve health and reduce mortality.¹ Over the past decade or so, nearly all of the less advanced countries have either initiated or accelerated projects of economic development, and virtually all of the accomplishments have had at least an indirect role in the improvement of health status. Public health activities themselves constitute an important aspect of developmental planning in many of the less developed countries.² This paper will seek, so far as possible, within the limitations of space and data, to show what role health activities have played in reducing mortality and morbidity in these countries.

I. LEVELS AND TRENDS OF MORTALITY

2. *Infant mortality and mortality in early childhood* (ages 1-4 years) have been found to be the most sensitive demographic indicators of community living standards. Infant mortality (annual deaths to children under one year of age per 1,000 live births in the same year) is particularly sensitive both to improvements and to deteriorations in environmental circumstances affecting health. Adequate statistics are available for about twenty-four developing countries at specified periods in the recent past, making it possible to observe both levels and trends of infant mortality in these areas.³ In addition, sample surveys undertaken during the 1950's in a number of countries of Africa south of the Sahara provided estimates

of levels of infant mortality: among ten countries the range was from 130 infants deaths per 1,000 live births in Ruanda-Urundi (1952) to 293 in Mali (1955-1957).⁴ Two countries with higher rates in addition to Mali were Nyasaland and Northern Rhodesia with 242 and 292, respectively. Moderately high rates were noted in recent years for Egypt and parts of the Sudan. The validity of some of these data are questionable, but the figures are likely to understate rather than to exaggerate the levels of infant mortality. Hence, there is ample evidence that the African continent is plagued by a phenomenal waste of life in infancy. Declines have been registered in six areas of Africa (Gambia: Bathurst, Ghana, Rodriguez, Mauritius, and Ceuta and Melilla in Spanish West Africa) for which trends could be appraised, but some of these places are very small and typical of the region.

3. Infant mortality is still comparatively high in countries of Latin America: among eleven of them the range in 1962 was from forty-two infant deaths per 1,000 live births in Puerto Rico to 117 for Chile. Reliable data are lacking for most countries of South America, but if statistics for countries with complete registration—most of which are in Central America—are indicative of levels and trends in the region as a whole, it would appear that Latin America has taken impressive strides in reducing infant mortality well below the high rates that prevailed during the 1930's and 1940's. Asia, too, seems to have experienced important decreases in infant mortality. From 1935-1939 to 1955-1959, declines in five countries ranged from 50 per cent in Federation of Malaya (excluding Singapore) to 76 per cent in China (Taiwan), and among eight countries with reasonably good data for the period 1955-1959, only Brunei and Aden had average rates above

¹ For a more elaborate statement, see United Nations, *Population Bulletin*, No. 6 (United Nations publication, Sales No.: 62.XIII.2).

² "Inquiry among Governments on problems resulting from the interaction of economic development and population changes" (United Nations document, E/3895/Rev.1, Corr.1 and Add.1).

³ United Nations, *Demographic Yearbook*, 1959, 1963 (United Nations publications, Sales Nos.: 59.XIII.1 and 64.XIII.1); World Health Organization, *Annual Epidemiological and Vital Statistics, 1939-1946*, part I (Geneva, 1951).

⁴ G. Z. Johnson, "Health conditions in rural and urban areas of developing countries", *Population Studies*, vol. XVII, no. 3 (March 1964), pp. 298-99; T. E. Smith and J. G. C. Blacker, *Population Characteristics of the Commonwealth Countries of Tropical Africa* (University of London, Commonwealth Papers 9, Bristol, 1963), pp. 41-42.

100. However, as the larger countries (which tend to have less favourable mortality conditions) are not represented, the data and trends shown probably depict an unduly favourable picture of infant mortality conditions and trends in Asia. For example, high rates are currently indicated for rural India and urban Pakistan.⁵

4. In highly developed countries, only a small fraction of the annual number of deaths occurs to children between the ages of one and four years. The 1960-1961 averages for England and Wales, the Netherlands and Sweden were, respectively, 0.5, 1.1 and 0.5 per cent, but in eleven of twenty-one developing countries, 10 per cent or more of all deaths occurred to children in this age group, and in four countries the figures exceeded 20 per cent.⁶ Taking account of probable improvements in the completeness of death registration for all ages, and particularly for children, it can be considered that during the decade of the 1950's, a majority of these twenty-one developing countries probably experienced some declines in the proportion of deaths occurring to young children; noteworthy gains were made in Ceylon, Singapore, Taiwan and a few other countries. However, in view of the lack of data for major countries in each region, conclusions as to general trends in developing countries may be unjustified.

5. The decreases noted in infant and child mortality have been achieved in some countries by the implementation of certain public health measures. In a number of Latin American countries there have been increases in the proportion of expectant mothers receiving prenatal care and in the percentage of infants who receive medical care. Furthermore, as will be noted later, there has been steady progress in the region in the construction of urban water supply systems, and many countries have recently accelerated efforts to supply community water facilities to rural inhabitants. No doubt the campaigns against diphtheria, whooping cough and malaria have also aided infant and child mortality declines in Latin America.⁷ The numerous campaigns against malaria, yellow

fever, smallpox, bilharzia and other diseases that take a toll in infant and child mortality in countries of Africa have reportedly borne fruit, though largely in urban areas.⁸ The anti-malaria campaigns have probably been particularly helpful, as malaria is considered one of the main causes of mortality at all ages in tropical Africa.⁹ The decline of infant mortality in Asia has been attributed to the control of disease and to the implementation of general health measures. Although the gains have been impressive, there is abundant evidence that infant and child mortality in developing countries is still markedly higher than in economically advanced regions, and that there remains much to be accomplished.

6. Statistics of levels and trends of maternal mortality are available for only about fourteen countries in the developing regions. If the data for these countries are representative, it would seem that the 1950's witnessed a decline of maternal mortality in developing countries. Ceylon's rate of 571 deaths per 100,000 live births in 1950-1952—which was highest for all countries having the data—had declined to 303 by 1960, and the figure for Puerto Rico dropped phenomenally, from 206 to 46 during the same period.¹⁰ These trends reflect the increasing tendency for mothers to receive prenatal and post natal care, as well as improved environmental sanitation and also for health authorities in many developing countries to treat mortality from childbirth and related causes as preventable incidents: death rates due to toxæmias of pregnancy and the puerperium, indicative of inadequate prenatal care, decreased between 1950-1952 and 1960 as did death rates for sepsis of pregnancy, childbirth and the puerperium, which suggest increases in proportions of mothers receiving post natal care.¹¹

7. The fruits of the combined efforts to reduce mortality at all ages are reflected by gains in expectation of life at birth. The gap in average life expectancy between developing and economically advanced countries is very great: around 1955-1958 the range for the Soviet Union, Europe, Oceania and Northern America was from sixty-eight to seventy years, whereas for Africa, Asia and Latin America the averages were, respectively, "probably less than forty",

icas, 1957-1960", *Scientific Publication*, No. 64 (Washington, D.C., 1962).

⁸ G. Z. Johnson, op. cit., p. 302.

⁹ T. E. Smith and J. G. C. Blacker, op. cit., pp. 41-44.

¹⁰ World Health Organization, *Epidemiological and Vital Statistics Reports*, vol. 16, No. 11 (1963).

¹¹ World Health Organization, "Maternal mortality, 1950-1960", *WHO Chronicle*, vol. 18, No. 3 (March 1964), pp. 100-102.

⁵ World Health Organization, *Annual Epidemiological and Vital Statistics*, 1959 (Geneva, 1961). Rates for Karachi and Dacca, Pakistan were 77 and 225, respectively. Results of the Indian National Sample Survey, Fourteenth Round, indicated an infant mortality rate of 145.9 for rural India. See India, the National Sample Survey, *Fertility and Mortality Rates in India* (Calcutta, 1963), p. 17.

⁶ United Nations, *Demographic Yearbook*, 1957, 1961, 1963 (United Nations publications, Sales Nos.: 57.XIII.1; 62.XIII.1; and 64.XIII.1).

⁷ Pan American Health Organization, "Summary of four-year reports on health conditions in the Amer-

forty to fifty and fifty to fifty-five.¹² There were spectacular gains in life expectancy at birth in several of the developing countries for which suitable statistics are available. Thus, in Mauritius between 1942-1946 and 1951-1953 the average annual gain in life expectancy amounted to more than two years and in Puerto Rico between 1939-1941 and 1960, the average annual gain was more than one year. Ceylon also registered large gains, averaging more than one and one-half years annually during the period 1944-1945 to 1954. Each of these countries has had the benefit of public health campaigns: in Ceylon and Mauritius, the efforts were geared primarily toward eradication of malaria; in Puerto Rico, environmental sanitation and improved housing conditions were among the main targets.

8. It has been observed that the most important single factor in the reduction of death rates in some developing countries has been the decline of infant mortality, and the pertinent literature readily discloses the preoccupation of many developing countries with the problem of reducing high infant mortality rates. The significant gains in average life expectancy in Puerto Rico (1950-1960) and Ceylon (1946-1952) were associated with very important declines in infant mortality. The table shows that about one quarter of the total gain for females in each of these countries was due to the decrease of infant mortality.¹³ Results for Argentina, 1946-1948 to 1959-1961, are also given in the table.

II. MORTALITY AND MORBIDITY IN URBAN AND RURAL AREAS¹⁴

9. Mortality levels as indicated by expectation of life at birth and infant mortality rates

¹² United Nations, "The situation and recent trends of mortality in the world", *Population Bulletin of the United Nations*, No. 6 (United Nations publication, Sales No.: 62.XIII.2), p. 17.

¹³ The figures were calculated by a simple method of standardization. For example, the total gain in life expectancy for Puerto Rico was derived from abridged life tables for 1950 and 1960. An additional life table was constructed using the infant mortality rate (q_0) from the 1960 life table and taking the 1950 life table mortality rates for all higher ages. The difference between the e_0^0 value obtained from this fictitious life table and that of the 1950 life table represents the gain in expectation of life at birth due to the decrease in the infant mortality rate between 1950 and 1960. Other, more refined methods could perhaps be applied with superior results. See for example, C. Chandra Sekar, "The effect of the change in mortality conditions in an age group on the expectation of life at birth", *Human Biology*, vol. 21, No. 2 (February 1949), pp. 35-46.

¹⁴ The following is a summary of a paper previously prepared by the author. See G. Z. Johnson, "Health conditions in rural and urban areas of devel-

do not vary systematically with rural-urban residence in those developing countries for which data have been examined, although there is a tendency for mortality to be lower in the principal city than elsewhere in Latin American countries. In countries of each of the developing regions medical and health facilities are concentrated in the largest, usually the capital city. Not only do these cities offer higher quality medical service than is available in smaller towns and rural areas, but inhabitants of the principal city usually have access to a greater variety of specialized services than are available elsewhere in the country. It can be inferred that small towns, lacking the facilities of large cities, but having many of their undesirable health characteristics may have higher mortality than either rural communities or cities.

10. Failure to find systematic differences may be due in part to the quality of available data but, as mortality is generally very high and health facilities are inadequate even in the main cities, differences in availability of health services and facilities are probably not of sufficient importance in many developing countries to constitute the deciding factor in the mortality differential. In the past, health needs in smaller towns and rural areas have generally been neglected, and authorities have tended to concentrate health activities in the main city. However, these activities have been largely of a curative nature: measures to prevent disease have been implemented on a wide scale only during the past two decades, and the results are apparent in the lower mortality and morbidity rates in cities that have had the benefit of such programmes. Preventive and curative health measures are being extended on an increasingly wide scale to rural areas of developing countries. The establishment of maternal and child-care centres and units in rural places; the provision in some countries of general health care by mobile units; and campaigns against such diseases as yaws, malaria, bilharzia and yellow fever have greatly reduced sickness and death rates in rural parts of a number of developing countries. Such differences between developing countries in the health measures that have been implemented in rural and urban localities probably account in large part for the absence of a systematic rural-urban mortality differential.

11. Greater progress seems to have been made in the provision of adequate water supplies for urban than for rural inhabitants in most developing countries. The generally lower

oping countries", *Population Studies*, vol. XVII, No. 3 (March, 1964), pp. 293-309.

mortality of infants in urban than in rural communities of Latin American countries arises from the fact that much larger percentages of population in the larger communities have access to piped water. Although there are one or two outstanding exceptions in Africa, generally a much smaller percentage of rural than of urban inhabitants have a suitable system for disposing of excreta, a situation which, along with consumption of impure drinking water is associated with a wide prevalence of gastro-intestinal disease. On the other hand, high rates of sickness and mortality due to tuberculosis and other communicable diseases often occur in large cities of certain developing countries, because authorities have been unable to cope adequately with the large, congested and filthy areas that develop as a result of inadequate housing and related conditions.

III. SPECIFIC PUBLIC HEALTH MEASURES AFFECTING TRENDS OF MORTALITY AND MORBIDITY

12. *General environmental sanitation:* diseases due to consumption of impure drinking water (typhoid fever, cholera, dysentery, infectious hepatitis and others) account in large part for the differences in mortality and morbidity between developed and developing countries. As late as 1963 about 40 per cent of the urban population and 70 per cent of the total population of seventy-five developing countries had no access to piped water within a reasonable distance.¹⁵ For a group of economically advanced countries, the leading causes of deaths in 1960 were, in the order stated, heart disease, malignant neoplasms, vascular lesions affecting the central nervous system, accidents, and influenza and pneumonia. The first two accounted for 50 per cent of all deaths, and the leading cause of deaths to children aged 1-4 years was accidents. For twelve selected underdeveloped countries in Asia, Africa and Latin America, the leading cause of deaths in 1960 was the group of diseases including gastritis, duodentitis, enteritis and colitis (except diarrhoea of the newborn) followed by influenza and pneumonia, heart disease and malignant neoplasms. One-fifth of deaths to children aged 1-4 years was also caused by the group of diseases that includes gastritis, duodentitis, enteritis and colitis.¹⁶

¹⁵ World Health Organization, "The influence of community water supplies on health and social progress", *WHO Chronicle*, vol. 18, No. 5 (May 1964), p. 180.

¹⁶ World Health Organization, *Epidemiological and Vital Statistics Report*, vol. 16, No. 1 (Geneva, 1963), pp. 30-33, and vol. 17, No. 3 (Geneva, 1964), pp. 118-123.

13. The favourable, if slight changes discernible in developing countries during recent years can be attributed in large measure to improvements in the quality of drinking water, provision of safe disposal of excreta for a larger percentage of people, and other improvements in environmental sanitation.¹⁷ The following examples will illustrate this point. After installation of safe water supplies in thirty rural areas of Japan, cases of communicable intestinal diseases decreased by 72 per cent; the prevalence of trachoma by 64 per cent; and the death rate of infants and young children by 52 per cent. After similar improvements in Uttar Pradesh, India, deaths due to cholera, typhoid fever and diarrhoeal disease declined by 74, 64 and 42 per cent, respectively.¹⁸

14. *Control of specific diseases:*¹⁹ Governments of a number of developing countries consider morbidity and mortality caused by malaria to be their most pressing health problem, and the international effort to eradicate the disease is one of the primary reasons for the decline of death rates in countries where malaria is endemic. The anti-malaria campaign in Ceylon is said to have reduced the annual number of cases from 2,750,000 in 1946 to 422 in 1960. As a result of its campaign, India reported 78 per cent fewer cases of malaria during 1959-1960 than in 1953-1954. A massive international campaign affecting, at various stages, from 75 to 275 million people in developing regions reduced the incidence of active yaws from 25-30 per cent around 1955 to about 2 per cent in 1960. In Nigeria alone, the percentage of population with active yaws declined from 28.4 to 5.6 between 1955 and 1960, as a result of concerted efforts to control the disease. In another example of the effect of health measures on mortality due to specific diseases, the installation of 10,455 privies in Costa Rica is said to have reduced the diarrhoea and enteritis death rate by one-half between 1942 and 1954.²⁰ Virtually every developing country reporting to the World Health Organ-

¹⁷ *Ibid.*; see also, World Health Organization, *Second Report on the World Health Situation, 1957-1960*, reports from 163 states and territories (Geneva, 1963).

¹⁸ D. H. Dieterich and J. M. Henderson, *Urban Water Supply Conditions and Needs in Seventy-Five Developing Countries*, World Health Organization Public Health Papers, No. 23 (Geneva, 1963), p. 20.

¹⁹ Except where indicated, the following paragraph is summarized from World Health Organization, *Second Report on the World Health Situation, 1957-1960* (Geneva, 1963), pp. 21-23, 24, 162, and part II, Country Reviews.

²⁰ D. J. Schleissmann, "Diarrhoeal disease and the environment", *Bulletin of the World Health Organization*, vol. 21, No. 3 (Geneva, 1959), pp. 381-386.

ization indicated that inoculations, residual sprayings or other methods had been employed in order to combat diseases that are considered as major health problems. However, most of

these programmes were begun within the last few years, and for the recent ones, no information was available as to the effectiveness in terms of morbidity and mortality rates.

Estimated gains in expectation of life at birth for females due to declines of infant mortality in selected countries at dates specified

Country and period	Expectation of life at birth		Life table infant mortality rate		Gains in e_0^o due to infant mortality reduction		
	e_0^o	Gain (in years)	q_0	Per cent decrease	Xe_0^o ^a	Number of years	Per cent of total increase
Argentina:							
1946-1948	62.95	5.90	.06712	20.2	63.86	0.91	15.4
1959-1961	68.85		.05356				
Ceylon:							
1946	41.63	13.9	.14913	51.0	45.32	3.69	26.5
1952	55.5		.07304				
Puerto Rico:							
1950	61.49	10.07	.06175	38.9	64.10	2.35	23.3
1960	71.56		.03775				

^a $Xe_0^o = e_0^o$ calculated using values of q at ages 1 and above as in the earlier life table and q_0 as in the later life table. The result shows what e_0^o would have been if only infant mortality had changed.

Some characteristics of mortality in the European region *

E. F. KROHN and A. WEBER

I. INTRODUCTION

1. The purpose of the present paper is to provide a brief review of some of the important patterns and trends of mortality, typical of the European region as a whole, and especially of the technically more developed countries. These features are not limited to this region alone, but are shared by technically developed countries in other parts of the world, like Australia, Canada, Japan, New Zealand and the United States of America. The European region is unique, however, in that the characteristics to be described pertain to a very large percentage of the population and are of immediate importance for planning of public health measures and health statistical activities in the region as a whole.

2. The term "region" in this paper refers to the administrative sub-division employed by the World Health Organization. Some of the data given, however, apply to the geographical sub-division used by the United Nations. Thus, in some of the tables, Morocco and the Asian part of Turkey are not included, and data from the Union of Soviet Socialist Republics have, when available, been given separately.

3. A study of the European region shows that it is comparatively crowded, the central part showing the highest population density in the world, but it is increasing at a considerably lower rate than other populations. The mean annual rate of increase of Europe is the lowest in the world and three times lower than the highest rate, that of Central America. By far, the greatest part of the differences in rate of population growth is explained by the last two columns of the table, showing that the populations of Europe, particularly the north, west and central parts, are characterized by low death rates and, especially, low birth rates, and that the arithmetic difference between these two rates is lower than in other regions.

4. It would be wrong to assume, however, that the European region has homogeneous characteristics. There are large differences in

the birth and death rates between one country and another.

5. Another important demographic characteristic of the European region is the relatively high age of its population. The data show that in the six countries mentioned, the proportion of old people has increased steadily over the last fifty years. The proportion of children under fifteen years of age has decreased since the beginning of the century, but has in most of the countries studied shown an increase over the last two decades. Data have been provided from Brazil, the United Arab Republic and India, each representing a different region of the world, for comparison. It will be seen that the percentage of children is higher in these countries than in those of the European region and, especially, that the percentage of old people is lower and does not show a consistent increase.

II. THE EVOLUTION OF THE DEATH RATES IN EUROPE

6. After an almost universal decline in recent decades, death rates in some countries show a tendency to level-off or even to increase slightly. This phenomenon has also been observed in countries outside Europe and is at present the subject of several studies. The obvious influence of the increasing age of populations is not sufficient to explain the levelling-off, as this appears also in age-adjusted data.

7. In the north of Europe, most of the deaths take place in the older age-groups, while in the south, deaths of young adults and, above all, infants are proportionately more numerous, as is shown in table 1 below.

8. In table 2, we have reproduced the death rates for four selected countries for 1961-1962 by broad age-groups and by sex. In addition, to show the trend in death rates over recent years, death rates for the two years 1961-1962 are given as a percentage of the rates for 1951-1952.

9. In making this selection, we have tried to include countries that are representative of health conditions in different parts of Europe. Our choice has, however, been restricted by the absence of comparable statistics for the begin-

* This paper is partly an adaptation of the one presented to the Regional Committee for Europe at its 13th session in 1963.

Table 1. Number of deaths of children under five and of persons under twenty-five years per 100 deaths at all ages for five countries in the European region

Country	Children less than five years of age	Persons less than twenty-five years of age
Sweden, 1961	2.7	4.3
Czechoslovakia, 1961	4.7	7.1
Italy, 1961	9.4	11.9
Portugal, 1962	23.3	26.5
Turkey (provincial and district centres) 1962	41.7	48.0

SOURCE: United Nations, *Demographic Yearbook*, 1963 (United Nations publication, Sales No.: 64.XIII.1).

ning of the last decade for several countries and in particular for the countries of Eastern Europe. For this reason, we have had to limit our choice to four countries in the north and west of Europe.

10. The death rates are lower in the female population than in the male, for each age-group. The reduction in the death rate over the period in question has also, in general, been larger for the female population. For this reason, the difference in the death rates between the two sexes is becoming more marked, particularly for the age-groups 15-44 and 45-64 years. The greatest death rate reduction has been in children and this applies particularly to France and Italy. Since the death rates in these countries were considerably higher than those in

England and Sweden for children, it can be concluded that the differences in death rates between one country and another are decreasing appreciably in this age-group.

III. INFANT MORTALITY

11. In Europe itself, infant death rates in 1962 lay between 15.3 and 92 per 1,000 live births. The lowest rates were in the Netherlands and Sweden, and the highest were in Albania and Yugoslavia. No precise recent data are available on infant mortality in Algeria, Morocco or Turkey, but infant mortality is thought to be much higher in these countries. Infant mortality, and particularly post-neo-natal mortality, has decreased everywhere over the past ten years.

12. From one country to another, the variations in post-neo-natal mortality are much larger than those in neo-natal mortality. In the countries of northern Europe, edogenous factors of genetic or intra-uterine origin are becoming the most important causes of infantile mortality, and neo-natal mortality represents up to 80 per cent of all infantile mortality, while in the south of Europe, exogenous factors still play a considerable role and are responsible for the high post-neo-natal mortality.

13. A study of infant mortality by different causes for the countries in the region exhibits the divergent trend in mortality from congenital malformations, birth injuries, post-natal asphyxia and atelectasis, which in Sweden already account for more than half of the infant mortality, as against mortality from all other causes.

Table 2. Mean annual death rate in 1961-1962, by sex and age group per 100,000 population and as a percentage of the mean annual rate in 1951-1952 (figures given in brackets) for four countries

Age-group	England and Wales	France	Italy ^a	Sweden
<i>Male</i>				
Under 1 ^b	2,420.6 (75)	2,456.8 (51)	4,568.2 (66)	1,763.6 (76)
1-14	60.2 (72)	68.2 (50)	100.2 (52)	55.6 (65)
15-44	151.6 (81)	212.3 (83)	183.0 (82)	141.6 (82)
45-64	1,387.4 (96)	1,462.7 (100)	1,236.7 (99)	924.5 (95)
65 and above	8,279.8 (98)	7,425.8 (93)	7,160.3 (98)	6,620.4 (99)
<i>Female</i>				
Under 1 ^b	1,875.9 (75)	1,868.0 (48)	3,776.0 (63)	1,342.6 (74)
1-14	43.5 (68)	52.5 (46)	82.3 (47)	42.3 (71)
15-44	99.5 (71)	109.2 (63)	106.7 (64)	81.0 (68)
45-64	741.5 (88)	695.2 (80)	672.8 (82)	591.3 (78)
65 and above	6,044.0 (96)	5,420.9 (90)	5,579.0 (88)	5,539.4 (88)

SOURCES: World Health Organization, *Annual Epidemiological and Vital Statistics* (1951, 1952 and 1961); World Health Organization, *World Health Statistics Annual*, Vol. I, 1962, 1963 (previously: *Annual Epidemiological and Vital Statistics*).

^a For Italy, 1962 only.

^b Rate per 100,000 live births.

IV. MORTALITY FROM 1 TO 14 YEARS

14. It is in this age-group that death rates have decreased the most during the periods studied. Deaths from infective and parasitic diseases (B1-B17)¹ have continued to decrease. In France, the 1961-1962 rates are less than 20 per cent of the 1951-1952 rates, while in Sweden where the rates are the lowest, the decline has been less marked, the rates in 1961-1962 still being 45 per cent of the 1951-1952 rates. Also in this age-group, the deaths from congenital malformations have increased throughout almost the whole period. In France, Sweden and in England, deaths attributed to congenital malformations are in excess of those caused by infective and parasitic diseases. Nevertheless, the most important cause of death in this age-group remains accidents of all sorts. The rate for boys is around 20 per 100,000, twice the rate for girls. In boys, accidents were responsible in 1961-1962 for one death in four in Italy, one in three in France and England, and two in five in Sweden.

V. MORTALITY IN THE POPULATION AGED 15-44 YEARS

15. The principal causes of death in this age-group are accidents, cancer, heart disease, infective and parasitic diseases and suicide, to which must be added, in women, deliveries and complications of pregnancy, delivery and the puerperium.

16. A comparison of mortality during the periods 1951-1952 and 1961-1962 in the European countries shows that mortality from accidents increased between the periods 1951-1952 and 1961-1962. It is easily the most important cause of death for this age-group in the male population where the death rates from accidents are from five to eight times higher than for the female population. In this age-group there was also a large increase in suicide, particularly in women. In Sweden, in 1962, accidents and suicides in the male population represented about two thirds of the deaths between ages 15 and 24, one half between 25 and 34, and one third between 35 and 44, whereas for the female population, the proportions of accidents and suicides were respectively one third, one fourth, and one sixth.

17. In age-group 25-34, suicides represented, in many countries, a very considerable proportion of the deaths as shown in table 3.

18. From 15 to 44 years, mortality from malignant neoplasms, unlike most other causes,

Table 3. Deaths by suicide per 100 deaths from all causes in 1962 in certain countries among persons aged 25 to 34

Country	Males	Females
Denmark	24	18
Hungary	22	10
Sweden	21	18
Finland	20	14
Switzerland	17	11
Austria	17	13

SOURCE: World Health Organization, *World Health Statistics Annual, Vol. I, 1962, 1963* (previously: *Annual Epidemiological and Vital Statistics*).

is higher for women than for men. For the two sexes, there is only a small change in mortality between 1951-1952 and 1961-1962. The death rate for infective and parasitic diseases, and in particular for tuberculosis, which in 1951-1952 represented nearly all of the deaths from infective and parasitic diseases, has declined very sharply during the period under review.

VI. MORTALITY FROM THE AGE OF 45 ONWARDS

19. Between 45 and 64, and perhaps even from 35 onwards, one or more factors have affected the mortality trend in the male population. It has been noticed that between the ages of 45 and 64, the decline in mortality between the periods 1951-1952 and 1961-1962 has been at very different rates for the two sexes—the rate for males having declined much less than for females. For this reason, a more careful study has been made of the mortality trend in persons from 35 to 74, by five-year age-groups.

20. In males, the mortality continued to decline significantly up to 1955-1956; but from 1956 onwards there was, generally speaking, a stabilization of the rates in most countries. This stabilization is, however, much less noticeable in women. It is even non-existent. This retarded decline of the death rate in the male population between 45 and 64 years cannot be explained entirely by variations in the age-composition with this group, since the stabilization applies to each five-year age-group.

21. The principal causes of deaths in the age-group 45-64 are "heart diseases", neoplasms, cerebro-vascular diseases, accidents, suicides, influenza and pneumonia. In France and Italy, infective and parasitic diseases are still responsible for a large number of deaths. It is also noticeable that there are a large number of deaths from cirrhosis of the liver in France and from bronchitis in England and Wales.

¹ World Health Organization, *Annual Epidemiological and Vital Statistics*.

22. Mortality from heart diseases and malignant neoplasms is increasing in males, while mortality from accidents, and cirrhosis of the liver is, generally speaking, increasing for both sexes. However, mortality from these last causes is much lower than that from heart disease and cancer. It would seem, therefore, that the latter diseases lay behind the changes in male mortality in the second half of the last decade.

23. As can be seen from table 4 below

(covering England and Wales and the Netherlands), mortality from cardio-vascular diseases as a whole has, generally speaking, increased in males from 35 to 64 between the periods 1954-1956 and 1958-1960, while mortality in females has continued to decline during the period under review. This increase among the men is mainly due to the increase in mortality from arterio-sclerotic and degenerative heart disease (B26), which represent more than half the mortality for all cardio-vascular diseases in males from 35 to 74.

Table 4. Death rate from cardio-vascular diseases per 100,000 population from 35 to 74 years by sex and age-group for the periods 1954-1956 and 1958-1960 in two countries

Age-group	England and Wales				Netherlands			
	Cardio-vascular diseases ^a		Arterio-sclerotic and degenerative heart diseases (420-422)		Cardio-vascular diseases ^b		Arterio-sclerotic and degenerative heart diseases (420-422)	
	1954-1956	1958-1960	1954-1956	1958-1960	1954-1956	1958-1960	1954-1956	1958-1960
<i>Male</i>								
35-44.....	77.6	82.2	40.3	47.4	39.3	48.0	19.8	28.0
45-54.....	293.6	306.9	182.8	202.0	177.4	176.5	114.1	121.8
55-64.....	964.7	977.6	579.9	621.0	585.4	588.5	366.4	385.9
65-74.....	2,828.2	2,762.7	1,581.8	1,580.0	1,804.4	1,727.6	997.9	980.3
<i>Female</i>								
35-44.....	48.3	43.2	7.2	7.4	26.0	20.4	5.8	4.0
45-54.....	149.2	137.0	37.6	37.3	88.9	74.5	26.2	21.9
55-64.....	501.6	472.5	189.6	189.3	348.7	304.3	143.8	132.7
65-74.....	1,869.7	1,752.7	835.6	791.5	1,572.5	1,367.6	696.9	616.3

SOURCE: World Health Organization, *Epidemiological and Vital Statistics Report*, No. 12 (1959), pp. 335-394 and No. 16 (1963), pp. 95-206.

^{a, b} Numbers 022, 023, 330-334, 400-468, 754 and 782 in the detailed list.

24. Mortality from arterio-sclerotic and degenerative heart diseases is much higher in the males than in the females. The difference decreases, however, with age, the ratio of mortality between the sexes being nearly 7 between the ages of 35 and 44, but falling to less than 2 between 65 and 74. This phenomenon contrasts with an absence of difference between males and females in respect to all the other cardio-vascular diseases.

25. The differences in mortality between countries with regard to arterio-sclerotic and

degenerative heart diseases are just as striking. Mortality from malignant neoplasms shows more complex changes. Death rates from cancer of the trachea, bronchi and lung have continued to increase in males, generally from 55 years, sometimes even from 45 years, while in females the increase has already become evident from 35 years in a number of countries. For these sites, mortality in males is much higher than in females, particularly from 45 years. There are, however, significant differences from one country to another as shown in table 5.

Table 5. Death rate for cancer of trachea, bronchi and lung (A50) per 100,000 population aged 55 to 64 for the year 1961 in four countries

	France	England and Wales	Italy	Sweden
Males	104.2	288.0	121.6	65.9
Females	11.4	32.3	15.2	14.0
Mortality ratio between the sexes.	9.1	8.9	8.0	4.7

SOURCE: World Health Organization, *Epidemiological and Vital Statistics Report*, No. 17 (1964), pp. 235-298.

26. Mortality from leukæmia and aleukæmia has been increasing during the last decade and now constitutes an appreciable proportion of the cancer mortality in persons under 35.

VII. SUMMARY AND CONCLUSIONS

27. Generally speaking, the population of the European region has a high density, a low death-rate, a relatively low birth-rate, a fairly high longevity and a very low rate of increase. Similar characteristics are to be found in certain technically-developed countries in other regions, but these characteristics apply only to a very small minority of the populations and countries of the world.

28. Crude death rate is tending to become

stable or even to increase in certain highly developed countries, after having declined for several decades. As to the decline in infant mortality, this has become relatively slight in those countries where the rate is already low.

29. In contrast to most of the other regions, the most important causes of death are the chronic and non-infectious diseases. Coronary arterio-sclerosis and malignant neoplasms are the most frequent causes of death, and accidents also take a large toll of life, while infectious diseases are much less important. Although infantile mortality rates are low in Europe, an increase is to be noted in the relative importance of death in early infancy, and, particularly, in deaths during the first month after birth (table 6).

Table 6 follows on page 336

Table 6. Mean annual mortality from certain causes, by sex, in persons aged 45 to 64 in 1951-1952 and in 1961-1962 in four European countries

Cause of death	England and Wales			France			Italy			Sweden		
	1951-1952	1961-1962	1961-1962	1951-1952	1961-1962	1961-1962	1951-1952	1961-1962	1961-1962	1951-1952	1961-1962	1961-1962
	rate	rate	rate as	rate	rate	rate as	rate	rate	rate as	rate	rate	rate as
	per	per	per cent of	per	per	per cent of	per	per	per cent of	per	per	per cent of
	100,000	100,000	1951-1952	100,000	100,000	1951-1952	100,000	100,000	1951-1952	100,000	100,000	1951-1952
<i>Male</i>												
All causes	1,441.3	1,387.4	96	1,462.2	1,462.7	100	1,244.8	1,236.7	99	972.2	924.5	95
B24-B28 "heart diseases"	411.3	478.4	116	227.3	243.6	107	252.8 ^a	305.2	121	289.5	332.3	115
B18 malignant neoplasms	347.9	381.1	110	291.2	372.1	128	254.6	313.7	123	213.5	219.3	108
B22 vascular lesions affecting central nervous system	114.1	105.4	92	120.4	111.7	93	124.1	113.0	91	90.5	68.9	76
BE47-BE48 accidents	39.9	42.0	105	100.6	111.1	110	72.3	82.7	114	54.1	61.3	113
B1-B17 infective and parasitic diseases	88.9	24.6	28	154.3	74.7	48	100.8 ^a	70.3	70	48.2	16.5	34
B30-B31 influenza and pneumonia	68.8	49.1	71	38.8	18.2	47	42.0	24.0	57	18.9	13.8	73
B32 bronchitis	122.8	115.3	94	4.5	3.8	84	20.2	42.8	212	2.6	3.7	142
B-37 cirrhosis of liver	5.9	6.3	107	71.8	108.3	151	50.0	65.1	131	7.4	14.4	194
BE49 suicide and self-inflicted injury	24.9	24.1	97	46.4	49.5	107	21.6	15.4	71	48.8	48.7	100
<i>Female</i>												
All causes	843.5	741.5	88	865.4	695.2	80	824.1	672.8	82	760.5	591.3	78
B24-B28 "heart diseases"	192.2	172.4	90	128.1	95.7	75	194.6 ^a	163.6	84	165.9	132.0	80
B18 malignant neoplasms	264.9	268.0	101	227.7	226.0	99	208.6	218.7	105	248.7	232.4	93
B22 vascular lesions affecting central nervous system	120.8	92.4	76	101.5	74.4	73	109.6	84.4	77	110.1	65.9	60
BE47-BE48 accidents	12.4	16.5	132	28.8	29.0	101	13.2	16.8	127	11.9	14.8	124
B1-B17 infective and parasitic diseases	26.1	9.2	35	48.2	19.2	40	36.2 ^a	17.4	48	26.1	7.5	29
B30-B31 influenza and pneumonia	35.4	27.4	77	21.4	8.2	38	28.3	12.2	43	16.6	8.5	51
B32 bronchitis	28.5	22.0	77	1.2	0.7	58	10.0	11.0	110	2.1	2.1	100
B37 cirrhosis of liver	3.9	4.1	118	40.2	43.5	108	17.7	21.2	120	4.9	5.9	120
BE49 suicide and self-inflicted injury	14.0	17.7	126	13.5	13.5	100	5.6	5.5	98	13.6	13.5	99

SOURCES: World Health Organization, *Annual Epidemiological and Vital Statistics*, 1951, 1952 and 1961; World Health Organization, *World Health Statistics Annual*, 1962 (previously: *Annual Epidemiological and Vital Statistics*), vol. I (1965).

^a 1952 only.

Social and economic factors in mortality in developing countries ¹

AKIRA KUSUKAWA

I. INTRODUCTION

1. For those countries whose economic development has been stabilized at a high level for some time, the mortality decline which accompanied their process of industrialization, particularly in the period preceding modern medical and sanitary practices, has been described as incidental to improved economic and social conditions. Early reduction of the toll taken by tuberculosis is one instance of the salutary effect of improved living conditions despite the absence of chemotherapy.

2. On the other hand, the steep decline in mortality which took place in developing countries immediately after the Second World War (e.g. Ceylon and Japan) can be attributed to the introduction of specific medical and public health measures resulting from new discoveries and techniques. In most of these developing countries, a rising level of living was either absent or taking place at too slow a pace to attribute to these factors the drastic drop in mortality which occurred during this brief period.

3. At the present time, with the addition of the benefits of modern sanitation and public health systems to otherwise advanced economic and social conditions, the mechanism for a reduction in mortality in the developed countries has become more complex. The post-war developing countries with rapid progress in mortality reduction have possibly benefited from general conditions favouring the effective implementation of health programmes as well as from intensified activity in the field of preventive medicine. But while the remainder of the developing countries, those with mortality reduction proceeding at a moderate pace, have access to medical and public health measures comparable in scope to those of the preceding category, the existence of unfavourable general conditions is a deterrent to the realization of specific health programmes.

¹ In this paper, the developing countries are defined as those with annual per capita income below US \$350 for 1957-1959, whereas the developed countries are those above US \$350, as estimated by the Statistical Office of the United Nations.

II. CAUSALITY OF MORTALITY

4. In this paper, while examining the chain of cause-and-effect relationship with respect to mortality decline, the major emphasis is placed on social and economic factors² as indirectly linked to, or contributory to immediate causes of, mortality. Expectation of life at birth for both sexes has been used in establishing a basis for comparison, since it is a measure which is "controlled" with respect to sex and age.

5. The working hypothesis may therefore be stated as follows: there are two groups of conditions—one relating to health-services, the other socio-economic—contributing indirectly to the mortality decline in the developing countries. The variation in mortality between countries at a point in time has been considered rather than the trend within countries. This has been necessary because of the unavailability of reliable statistics over a period of time for a significant number of developing countries. It perhaps should also be mentioned that an experimental design of this nature would be impractical for large populations.

III. SELECTION OF INDICATORS *a priori* CONTRIBUTORY TO MORTALITY VARIATION IN DEVELOPING COUNTRIES

6. There is no need to point out the difference between what is considered in abstract terms as factors, on the one hand, and what is measured as indicators, on the other. Also, it is obvious that considerable toleration has to be exercised because of the limitations imposed by the degree of availability of the indicators for the developing countries.

7. For sixty-three countries comprising about three-fifths of the population of the world's developing area as of 1957-1959, e_0 's for both sexes were obtained either from official sources or by estimation. The following health-service, social and economic indicators, assumed *a priori* to be contributory to variation in mortality, have been obtained as far as possible for these countries:

² See paragraphs 6 and 7.

Health-service indicator:³

Hospital facilities: measured as the number of hospital beds per 1,000 population according to data for recent years, mostly 1954-1959, denoted as H.

Social indicators:

Urbanization: measured as the percentage of total population residing in localities of 20,000 or more inhabitants, according to recent census data and other estimates, denoted as S(1).

Literacy: measured as the percentage of females aged fifteen years and over able to read and write, denoted as S(2).

Radio communication: measured as the number of receiving radio sets per 1,000 population in 1959 or the latest year for which data are available, denoted as S(3).

Economic indicators:

Income: measured as the US dollar equivalent of annual per capita income calculated for 1957-1959, denoted as E(1).

Energy consumption: measured as per capita consumption of koligrammes of coal equivalent during 1960, denoted as E(2).

Non-agricultural activities: measured as the percentage of economically active males engaged in activities other than agriculture, forestry and fishing, according to recent census data and other estimates, denoted as E(3).

IV. ANALYSIS OF VARIANCE OF $e\%$ s IN DEVELOPING COUNTRIES

8. The basis of this analysis is that the population of the developing area has been dealt with as though subjected simultaneously to varying degrees of health-services, social and economic conditions, with each country being

³ Other health indicators such as the extent of water treatment, nutrition, clothing and shelters have been discarded because of the less extensive coverage of data available for developing countries.

treated as a unit for a resulting specific phenomenon, i.e., a certain level of mortality. It is assumed that these varying conditions can be defined within the appropriately demarcated levels of each indicator. For the triple classification, with a high and low level for each indicator, a total of sixty-three countries was used with data available for a good representation of countries in every case. Since data for different countries were lacking for all combinations of factors, the number of sub-classes divided as above was the maximum limit that could be attained.

9. Another methodological limitation in this study arises from disproportionate sub-class numbers. It was considered that a further refinement of statistical analysis, such as that dealing with unorthogonal cases, was scarcely applicable to the data at hand partly because of the varying degrees of accuracy of the data used and partly because of the uncertainty of the types of distribution of the indicators, with the exception of $e\%$ s which showed, for the case of developing countries, a distribution close to the t -function. Using an auxiliary simplified method, the variance related to country-to-country differences was estimated separately from the residual variance. Fortunately, in this study, though the former variance was large, the relative importance among indicators as well as their interactions was not affected. Therefore, the calculations were carried out by ignoring the disproportion of sub-class numbers.

10. In spite of the reservations mentioned above, the following findings indicate something beyond what may be obtained by merely describing the social and economic differentials in mortality:

Table 1. Extent of effects of unknown and error factors in variation of $e\%$

Serial number of analysis of variance	Indicators *	Number of countries	Percentage of residual mean variance in total mean variance
1.....	H, S(1), E(1)	52	0.1
2.....	H, S(1), E(2)	54	1.1
3.....	H, S(1), E(3)	39	3.5
4.....	H, S(2), E(1)	54	0.4
5.....	H, S(2), E(2)	59	7.4
6.....	H, S(2), E(3)	43	9.2
7.....	H, S(3), E(1)	57	17.7
8.....	H, S(3), E(2)	61	6.3
9.....	H, S(3), E(3)	43	Satisfactory triple classification unobtainable

Table 1. Extent of effects of unknown and error factors in variation of e_0^0 (continued)

Serial number of analysis of variance	Indicators ^a	Number of countries	Percentage of residual mean variance in total mean variance
10.....	H, S(1), S(2)	51	6.4
11.....	H, S(1), S(3)	53	1.3
12.....	H, S(2), S(3)	58	7.0
13.....	H, E(1), E(2)	58	4.8
14.....	H, E(1), E(3)	42	2.8
15.....	H, E(2), E(3)	46	0.5

^a See paragraph 7.

Out of fifteen combinations of triple classification (one being always the health-service indicator), five cases were found with small proportions of residual mean variance, i.e., less than 1.5 per cent in the total mean variance (as italicized in table 1). The remaining combinations were discarded from further consideration because they appear to show that the variation of e_0^0 was not sufficiently covered by these combinations of indicators, resulting in allocation of a sizable portion of the variation of e_0^0 to unknown and error factors. Besides, all these discarded cases failed to reach an acceptable level of statistical significance for each indicator as well as for their interactions. For instance, in combination no. 9, 43 countries could not be satisfactorily classified because no more

than a single observation of e_0^0 could be allocated for each of the two sub-classes by any permissible shifts of level boundaries of the three indicators concerned.

11. Table 2, listing only the results of those analyses of variance which attain a satisfactory level of statistical significance, purports to indicate the likely percentages of total mean variance, contributed by the selected indicators. The range for the health-service indicator approximates 5 per cent at one extreme to around 50 per cent at the other; for social and economic indicators together with the first order interactions among them, about 39 per cent to 72 per cent; and for first order interactions between the health-service indicator and social and economic indicators, roughly 7 to 24 per cent of the total mean variance of e_0^0 .

Table 2. Extent of contribution of health and social and economic indicators to variation of e_0^0

Serial ^a number of analysis of variance	Indicators ^a	Percentage of total mean variance		
		Health-service indicator	Social and economic indicators plus first order interactions among them	First order interactions between health-service indicator and social and economic indicators
1.....	H,S(1),E(1)	51.0	38.6	10.3
2.....	H,S(1),E(2)	41.7	49.8	7.4
4.....	H,S(2),E(1)	11.9	71.4	16.3
11.....	H,S(1),S(3)	35.0	45.9	17.8
15.....	H,E(2),E(3)	3.5	71.7	24.3

^a See table 1.

12. The implication of the wide range in contributions of the health-service indicator to variation in e_0^0 may be that what is indicated by hospital-beds-per-head has numerous elements which include not only those directed specifically to medical and health activities but those inclined to other activities as well. While the

former elements may be considered contributory to variations in e_0^0 only some of the latter elements may be relevant to the causes of mortality variation. In cases where the social and economic indicators selected for combination with hospital-beds-per-head lack those elements conceived of as strictly socio-economic but are

nevertheless considered to be relevant to mortality, some of the socio-economic elements included in the health-service indicator may account in part for variation in e_0 . On the other hand, the indicators which were *a priori* selected on the basis of their purely social and economic characteristics may also contain elements relevant to health-service activities in which the measure of hospital-beds-per-head is not included. In this case, the contribution by social and economic indicators may have greater weight, suggesting that some of the socio-economic elements in the health-service indicator are of only secondary importance when compared with the health-service elements in social and economic indicators.

13. Some elements of both health-service and social and economic indicators may be irrelevant to mortality, if each indicator acts independently on mortality; but when the two groups of indicators act together, they would become relevant through the secondary process, i.e., interactions. If the interactions are analogous to the so-called "enmeshed" (because practically inseparable) mechanism of mortality, the analysis of variance is somewhat superior, as shown in table 2, to the descriptive approach through observation of mortality differentials in different groups. But, if it is meant that they arise from the difference between indicator and factor, the analysis of variance does not carry so much weight.

14. Table 3 shows the extent of statistical significance in the measure of contribution of each source of variation to the total variation in e_0 . Within the limitations mentioned in the preceding paragraphs, the following summary may be made with reference to tables 1 and 3. If the variation in e_0 for developing countries is

to be explained in terms of hospital facilities, urbanization and income (analysis no. 1), the first two indicators appear to play a highly significant role, followed by interaction between these two. Then, income and its interaction with hospital facilities may contribute in some degree to the variation of mortality. Retaining these first two indicators, an attempt may be made to replace the third indicator so as to decrease not only residual variance but also the probability of a larger value of F corresponding to the new third indicator. First, the economic indicators considered in this study were tried. Neither energy consumption nor non-agricultural activities lead to a better result than that of a combination of hospital facilities, urbanization and income (see analyses nos. 2 and 3). The proportion of residual variance increased by eleven to thirty-five times that of analysis no. 1. In other words, the latter two economic indicators failed to cover some of the elements of the economic "factor" relevant to mortality. Second, the third indicator of analysis no. 1 may be replaced by one of the other two social indicators. The results were much worse, further increasing residual variance (see analyses nos. 10 and 11). The next trial may be to replace urbanization, keeping hospital facilities and income. A result worth mentioning was obtained for a combination of hospital facilities, literacy and income (analysis no. 4). Yet, its residual variance was four times as high as that of a combination of hospital facilities, urbanization and income. However, it is interesting to note that, while some elements of the social indicator "urbanization" relevant to mortality are not represented in the social indicator "literacy", the social indicator "literacy" appears to cover elements which may be relevant to specific health activities but are not represented by the health-service indicator "hospital facilities".

Table 3. Probability^a of a larger value of F by source of variation for selected analyses of variance of e_0

Serial ^b number of analysis of variance	Indicators ^b	Source of variation ^c											
		Single indicators					First order interactions						
		H	S	S	E	E	H π S	H π S	H π E	H π E	S π E	S π S	E π E
1....	H,S(1),E(1)	***	***		*		**		*		—		
2....	H,S(1),E(2)	*	*		*		—		—		—		
4....	H,S(2),E(1)	*	***		*		*		—		—		
11....	H,S(1),S(3)	*	*	—			*	—				—	
15....	H,E(2),S(3)	*			**	**			—	**			—

^a ***: 0.01-0.05; **: 0.05-0.10; *: 0.10-0.20; — : 0.24 +.

^b See table 1.

^c Where both of non-health indicators are either "social" or "economic", the left one is the indicator with smaller number in denotation and the right one that with larger number.

ties". Finally, an attempt may be made with combinations of the health-service indicator and two of the three economic indicators. The extent of residual variance in analyses nos. 13, 14 and 15 in order in table 1 decreased from 4.8 per cent to 0.5 per cent. Together with this finding, the medium level of statistical significance played by energy consumption and non-agricultural activities suggests that the two indicators, particularly non-agricultural activities, may have a certain social inclination when compared with the economic indicator "income" (see analysis no. 15).

15. At this stage, any conclusion as to the extent to which social and economic factors contribute to the variation of mortality in comparison with a health-service indicator could be only of a highly tentative nature. But, keeping in mind the limitations already stated, the possibility is suggested that the combined effect of urbanization, literacy, energy consumption, non-agricultural activities and income in that order, may account for one-half or even more of the variations of $e\%$ in developing countries, while a little less than one-third of the variation may be attributable to health-services alone.

Measures to reduce infant mortality in the Ukrainian Soviet Socialist Republic

R. V. MEDYANIK

[Translated from Russian]

1. Maternal and child welfare in the Ukrainian Soviet Socialist Republic takes the form of action by the State as prescribed by law and of medical services provided by the public health authorities.

2. Soviet labour legislation bars women from the performance of heavy work. Pregnant women may not be made to work overtime, and nursing mothers, for the duration of the nursing period, may not be made to work nights. Also, in addition to the usual break for meals, nursing mothers are given an extra break to feed their babies every three and a half hours; naturally, they retain their full wages.

3. Besides the annual holiday period, every pregnant working woman receives paid leave of 112 days before and after childbirth in the case of normal pregnancies and labour, and 126 days for multiple births and labour with pathological complications.

4. After childbirth, mothers receive a State grant to buy what they need for the newborn baby. Mothers with many children earn the honorary title of "Mother-heroine" and are awarded the order of "Glorious motherhood" and the "Motherhood medal". Mothers with two children receive financial allowances from the State on the birth of a third child and each subsequent child.

5. In addition to the special action by the State in the field of maternal and child welfare, a factor of exceptional importance in improving the general state of health, and the health of women and children in particular, is the consistent broad action by the State for the constant improvement of the material well-being of the people. The basis for the rise in the material well-being of the Soviet people is the steady growth in the national income, which is distributed in full for the benefit of the working people. Per capita national income in the Soviet Union increased nineteen times during the period 1913-1963. As the national income has grown, the position of the working people has changed rapidly. As early as 1930, unemploy-

ment was completely and permanently eliminated. In the period from 1913 to 1963, the real income of industrial and construction workers increased by 5.9 times, and that of peasants by more than seven times. Housing construction is going ahead on a vast scale in the Soviet Union, including the Ukraine. In the period 1960-1963, the average annual expenditure on State housing construction in the Ukrainian Soviet Socialist Republic amounted to some 750 million roubles, which is 1.3 times as much as the appropriation for state housing and construction for the whole of the Soviet Union in 1940.

6. In addition to their wages, all workers receive considerable sums which are paid by the State out of public consumption funds; these sums take the form of various grants, pensions, scholarships, free education and health services, the maintenance of kindergartens and nurseries, pioneer camps, and so forth.

7. The constant improvement in the economic well-being of the Ukrainian Republic, a rise in the cultural, medical and health standards and habits of the broad masses of the population, and extensive State action in the field of maternal and child welfare all ensure a decline in infant mortality from year to year.

8. Infant mortality in the Ukrainian Soviet Socialist Republic has declined rapidly. Over the past decade alone, it has declined by 62 per cent, and since 1959 by 33 per cent; it is 6.7 times lower than it was in 1940.

9. In 1962 the infant mortality rate was twenty five per 1,000 births, and in 1963 it was 24. In the Vinnitsa, Kiev, Chernigov, Cherkassy, and Sumy and various other regions of the Ukraine, it was below 20. Each year there is an increase in the number of districts where the infant mortality rate is below 10, and in the number of villages where there has been no infant mortality for a number of years.

10. In a socialist society where concern for human beings, for mothers and children, is a task of major importance for the State, the

main factor in reducing infant mortality is the provision of high-quality preventive care and medical facilities.

11. During the years of the Soviet régime, a well-balanced system of maternal and child welfare and a network of institutions for the prevention and treatment of women's and children's diseases have been set up in the Ukraine. These institutions are similar in form and operation to those of the unified Soviet public health system. The medical care furnished to the population of the Ukrainian Soviet Socialist Republic, as well as to the population of the other republics of the Soviet Union, is provided free of charge regardless of its nature.

12. Despite the fact that during the Second World War the territory of the Ukrainian Soviet Socialist Republic was occupied for a time by the German fascists, who destroyed towns and villages, the network of children's institutions and maternity homes established during the years of the Soviet régime has not only been re-established but, by comparison with 1940, has been considerably expanded.

13. What are the principal measures taken by the public health authorities of the Ukraine which have brought about the sharp decline in infant mortality?

14. Most important is the provision of pre-natal and post-natal care.

15. Pre-natal care is provided, in urban areas, by gynaecologists, who are available in all the towns and district centres of the Ukraine. In rural areas, it is provided by physicians of the rural medical sectors and by midwives attached to the medical auxiliary and obstetric stations and to the collective-farm maternity homes.

16. In 1963 there were in the Ukrainian Soviet Socialist Republic about 2,100 maternity clinics, more than 18,000 out-patient clinics in charge of auxiliary medical staff and about 5,000 dispensaries in charge of medical or auxiliary medical staff. In large industrial enterprises and at building sites, there were 307 medical health units and 5,647 dispensaries. For the convenience of the population, the maternity clinics operate on a sector basis, the

entire area of a town or settlement being divided into sectors, each comprising a maximum of 4,000 persons.

17. The maternity clinics keep a systematic watch over the health of all pregnant women from the early stages of pregnancy (three months onwards). In the course of a normal pregnancy, a woman makes eight to twelve visits to a maternity clinic, where a series of laboratory tests is systematically carried out—urine and blood analysis, chest X-ray and, when indicated, blood tests for toxoplasmosis, listerellosis, Rh-factor and so on. The method of systematic house visits is widely used by the maternity clinics in so far as pregnant women are concerned.

18. Health education has an important place in the activities of the maternity clinics. So-called schools for mothers are conducted in all these clinics so that women may learn the regimen they must follow in connexion with pregnancy and childbirth and also how to look after their newborn baby. The clinics give particular attention to the care of women working in industrial undertakings and institutions. Together with the medical staff of the dispensaries or medical health units of industrial undertakings, they work out a programme of health, hygiene and sanitary measures and see that they are carried out. Preventive measures such as transferring women to lighter work and ensuring a working position are decided upon by a physician in consultation with the plant manager and the trade union and with extensive assistance from public funds. Enterprises with more than 500 women employees have specially equipped "personal hygiene rooms" staffed by a nurse. Systematic supervision over the health of women enables disease to be prevented and ensures that pregnancy takes its normal course and a healthy child is born.

19. A factor of considerable importance in reducing peri-natal mortality has been the provision of in-patient facilities in hospitals for women in childbirth. The problem of providing such facilities has been solved fully in the Ukraine in rural as well as in urban areas. The following table shows the percentage of hospital births for the years 1956 to 1963:

	1956	1957	1958	1959	1960	1961	1962	1963
Percentage of hospital births.	93.9	95.9	97.1	97.7	99.5	99.2	99.5	99.4

20. A broad programme of action is carried out in the Republic for the prevention of premature births and extends even to girls of puberal and pre-puberal age. As a means of

improving the health of girls of puberal age and beyond, a large network of hygiene and physical development clinics for girls (previously called child gynaecology clinics) has

been set up in the Ukrainian Soviet Socialist Republic. The physicians in charge of these clinics, in addition to their medical work, carry out mass examinations of girls from schools and pre-school institutions in order to discover abnormalities in their development in good time. The close links between these clinics and the ordinary children's clinics, the school physicians and the parents make it possible to prevent the emergence of various impairments of the reproductive system at the adult stage.

21. Only the basic measures carried out in the field of pre-natal medicine have been enumerated here, since it is difficult to describe their wide variety in a short paper of this kind. From our experience we can state that the basic condition for the successful solution of the complex problem of pre-natal preventive medicine is constant clinical supervision of pregnant women and of all future mothers.

22. The action taken in the republic in the field of pre-natal preventive medicine has helped to reduce the number of premature births and stillbirths. In 1963, the stillbirth rate in the republic was only 0.94 per cent.

23. Considerable attention is given to newborn and children, and special sections with a paediatrician in attendance are provided for them in maternity hospitals. Since a large proportion of neo-natal mortality is accounted for by premature births, special measures are taken in the Ukraine for the care of premature children. Special facilities for premature births and the care of premature children have been established in the regional centres and large towns. Pregnant women in danger of giving birth prematurely, or with labour imminent after twenty-four to twenty-eight weeks of pregnancy, are taken to hospitals having such facilities.

24. The experience gained from the operation of these special facilities shows that through proper treatment the pregnancy of the women in question can in many cases be prolonged to a later period more favourable for the preservation of the foetus and the life of the new-born child. Evidence of this can be found in the decline in the proportion of children weighing less than 1,500 grammes at birth. Special methods have been devised for coping with premature births and the care of premature

children in the hospitals having these special facilities. As a result of the measures taken, mortality among premature children has been reduced.

25. After leaving the maternity homes, children come under the care of the children's clinics. In the Ukrainian Soviet Socialist Republic, as in the Soviet Union as a whole, great importance is attached to the development and improvement of these clinics and their equipment in view of their leading role in improving child health and reducing the incidence of disease and mortality.

26. In the Ukraine there are at the present time (as of 1 January 1964) more than 2,000 children's clinics, the increase during the past five years alone being 752. Before the October Revolution there were in the present territory of the Ukrainian Soviet Socialist Republic only three maternal and child health clinics.

27. The children's clinics, like the maternity clinics, operate on a sector basis. Much has been done in the Republic to break up into smaller units the paediatric sectors which constitute the basic unit in the operations of the children's clinics. Over the last five years, the number of these sectors has increased by 1,260, and on 1 January 1964 there were 5,331 of them in urban areas. Each sector comprises, on the average, approximately 1,000 children up to fifteen years of age, of whom seventy to seventy-five are under one year.

28. The children's clinics work closely with the maternity clinics. In the last month of pregnancy the sector paediatrician and visiting nurse call on each woman at home in order to become acquainted with her living conditions and to give any necessary advice. The clinic staff do not wait until the mother brings the child to them but, after being told by the maternity home that the new-born child has been discharged, go to her themselves and make arrangements for keeping the child's health under constant supervision.

29. In 1963, 95.3 per cent of the children in urban areas were visited at home by a physician in the first three days after their discharge from the maternity home.

30. In the Ukraine a systematic watch is kept on the physical, emotional and mental

Table 1. Percentage of children reaching the age of one year who were systematically observed (data from urban children's hospitals)

	1950	1959	1960	1961	1962	1963
By physicians	67.5	93.3	94.7	94.5	95.8	96.6
By nurses	84.3	97.1	98.6	98.0	98.5	98.5

development of children in their first year of life, and measures are taken to ensure that they are correctly fed and are protected against rickets, hypertrophy and other diseases.

31. Serving one particular sector, the pædiatrician, with the visiting nurse as his permanent assistant, has an opportunity not only to get to know the state of health of the children observed by him but also to influence the living conditions of the family, which is a very important element in giving effect to general measures for the improvement of child health.

32. As the result of a constant campaign on behalf of breast feeding, the point has been reached where only 5.5 per cent of the children are artificially fed; about 8 per cent of all children receive an early food supplement (according to data from urban children's hospitals).

33. Particular attention is given to the proper feeding of children. There has been a substantial increase in recent years in the number of infant feeding and food distributing centres. On 1 January 1964 there were 1,133 infant feeding centres and about 500 distributing centres operating in the Ukrainian Soviet Socialist Republic. Work is in progress to establish new infant feeding centres in all settlements and collective farms.

34. Non-liquid infant food products are also produced in the Ukrainian Soviet Socialist Republic on an industrial basis. In many regions, special facilities have been set up in dairies for the production of ionized milk according to a process developed by Ukrainian scientists.

35. Every year, the Government earmarks a large sum for the free feeding of children in their first year, particularly those being artificially fed and receiving supplementary feeding at an early age.

36. The sector pædiatricians and nurses ensure that children receive preventive inoculations at the proper time against smallpox, diphtheria, tuberculosis, whooping-cough, poliomyelitis and measles. In the clinics and health centres, the pædiatricians work with physicians specializing in stomatology, otolaryngology, ophthalmology, dermatology, surgery, X-rays and other subjects; the latter give the children specialized medical assistance of all types and help with preventive measures.

37. Among the various measures for combating infant mortality, a leading role is played by health education. However well the work of the sector physician or visiting nurse is done, their efforts will be successful only if the parents

are instructed in the rudiments of health and hygiene regarding the care and feeding of children and the prevention of children's diseases.

38. Health education takes various forms. Among those which have been widely adopted are consultation facilities for young mothers, training courses for mothers, question and answer evenings, a university of health and so on. All this, coupled with universal education and the large-scale publication of material in the fields of science, popular science and literature, has familiarized the people with matters of health and hygiene and has undoubtedly been reflected in the reduction of children's diseases and infant mortality.

39. The incidence of infectious diseases declines sharply from year to year. Such diseases as diphtheria and poliomyelitis will be completely eliminated in a very short time, and some districts have already been free of them for several years.

40. A child who contracts a disease is treated by the pædiatrician and, according to the nature and duration of the disease, is cared for at home or is placed in a hospital of the appropriate type. In 1963, 71 per cent of the children suffering from pneumonia and 99 per cent of those suffering from toxic dyspepsia were treated in hospitals (according to data from urban children's hospitals).

41. The number of hospital beds reserved for children increases each year. As of 1 January 1964, the total of such beds in the Ukrainian Soviet Socialist Republic was 56,898, their number having risen by 47 per cent over the past five years. Thus, whereas the total increase in hospital beds for the entire population over this period was 26 per cent, the relative increase in the number of beds reserved for children was 34 per cent.

42. Much is being done to improve the efficiency of the children's sections of hospitals and to provide them with up-to-date apparatus, instruments and equipment. Such sections have been established in all the districts of the country, and more than 7,000 children's beds have been provided in rural sector hospitals.

43. The improved efficiency of the children's sections of hospitals has led to a decline in hospital deaths.

44. The rise in the number of institutions for the prevention and treatment of disease has been accompanied by a considerable increase in the number of pædiatricians in the Ukrainian Soviet Socialist Republic.

Table 2. Deaths per 100 children discharged from hospital
(data from urban hospitals)

	1959	1960	1961	1962	1963
Up to fourteen years of age.....	1.51	1.27	1.00	0.94	0.92
Up to one year of age.....	3.91	3.14	2.55	2.45	2.45

45. Great difficulties had to be overcome in the early years of the Soviet régime, since there were very few paediatricians, midwives and gynaecologists. Because of this, general practitioners had to specialize in paediatrics and midwifery. Beginning in 1930, special paediatric departments were established in medical institutes. At the present time there are 13,400 physicians specializing in paediatrics, and 6,400 specializing in midwifery and gynaecology. By comparison with 1940, the number of such specialists has increased by 2.9 times. A large number of physicians and candidates in medical science are working in the eighteen medical schools and institutes for advanced medical training, the various paediatric departments and the four scientific research institutes for maternal and child welfare of the Ukrainian Soviet Socialist Republic.

46. Of exceptionally great importance in reducing infant mortality are the measures for the advanced training of paediatricians, of the physicians in rural medical sectors and of auxiliary medical staff. There are three institutes and two university departments for the advanced training of physicians in the Ukrainian Soviet Socialist Republic which provide specialist courses and advanced training for paediatricians. Advanced medical training is also provided (in the administrative centre of each region, there are large regional hospitals which serve as focal points as regards methods, advice and treatment). Medical training provided in periodic courses, which have been given in all regions over many years, has also proved its worth. The sector physicians are also able to improve their level of competence through their regular work in hospitals.

47. The certification of paediatricians is an important factor in raising qualifications. Systematic measures are carried out by the public health authorities for improving the qualifications of auxiliary medical staff, midwives and visiting nurses. These include monthly meetings (referred to as "midwives' day") in each district for the study of specified topics. Ten-day meetings, seminars and conferences are also held.

48. A new device for improving the qualifications of medical staff is study based on

the experience of the leading institutions for the prevention and treatment of disease; these so-called schools of advanced experience are conducted in each region.

49. One of the methods used for the exchange of practical experience and the improvement of qualifications is the systematic holding of regional, interregional and republic-level scientific conferences of a practical nature and scientific meetings for medical personnel.

50. An important means of checking on the quality of the services for the prevention and treatment of children's diseases is the careful *post-mortem* examination that is made upon the death of every child (carried out within a day or so of the death). Our experience justified the conclusion that the analysis of infant mortality for the purpose of detecting mistakes in the prevention, diagnosis and treatment of disease is a most effective means of reducing infant mortality. Such analysis makes it possible to eliminate organizational defects and raise the qualifications of physicians, visiting nurses and midwives.

51. An extremely important factor in reducing infant mortality in the Ukrainian Soviet Socialist Republic is the close co-operation that exists between the public health authorities in all phases of their activities and the various institutions and agencies. All the institutions for the prevention and treatment of disease and all medical staff, regardless of their specialties and duties, are drawn into the efforts for the betterment of maternal and child health. As a result, the feeling of responsibility of medical workers for the health and life of children has been strengthened.

52. Questions relating to the improvement of facilities for the prevention and treatment of children's diseases are given constant attention by the Ministry of Public Health of the Ukrainian Soviet Socialist Republic.

53. For a number of years, the Ukrainian Ministry of Public Health's plan of basic organizational measures has contained a special section on the improvement of facilities for the prevention and treatment of children's diseases and the reduction of infant mortality. Mortality is analysed monthly. The results of such analysis show that the main causes of infant mortality in

the Ukrainian Soviet Socialist Republic are diseases of the respiratory organs and of new-born children (during the first month of life) and congenital developmental defects.

54. There has been a decline in infant mortality for all diseases, although the rate of decline has varied from disease to disease. From 1956 to 1963, the most outstanding declines were 57 per cent for infectious diseases, 54 per cent for diseases of the digestive tract, 44 per cent for diseases of the new-born and 39 per cent for diseases of the respiratory organs.

55. Not only is the level of infant mortality declining in the Ukrainian Soviet Socialist

Republic, but child health is improving significantly. Beginning in 1960, a health index was introduced in many clinics and health centres, this being the percentage of children up to the age of one year who have not become sick during a calendar year or a full year of their lives. This index has been rising rapidly from year to year; at Kiev in 1963 it was 30 per cent.

56. An analysis of the statistics of infant morbidity and mortality indicates that there are further possibilities for reducing the level of infant mortality in the Ukrainian Republic. A considerable number of the medical staff of the Ukraine is seeking means for taking advantage of these possibilities.

Evaluation of the health aspects of population replacement in the Soviet Union and in several economically developed capitalist countries

A. M. MERKOV

[Translated from Russian]

1. A proper evaluation of the state and progress of public health is indispensable for public health planning and supervision. It is also very helpful in evaluating the effects of the various social systems on public health and in bringing to light the beneficent influence of socialism.

2. Among the indices used to determine the state of public health are: (a) population replacement statistics; (b) morbidity statistics; and (c) physical development statistics. Statistics of the last-mentioned type are particularly important when dealing with the health of the younger generation. The most important general indices of public health are population replacement statistics and morbidity statistics.

3. Despite the great importance of morbidity statistics, the differences in the methods of ana-

lyzing morbidity in different countries are a considerable obstacle to international comparability. It has therefore been necessary in this paper to give the main attention to population replacement statistics, especially mortality statistics. Mortality statistics serve as the basis for compiling a life table showing the expectation of life at various ages. A life table is a good indicator of the progress being made in a nation's health as a result of changes and improvements in general social, sanitary and hygienic conditions.

4. A rough evaluation of the state of a population's health can be made on the basis of the statistics of its natural movement.

5. Such an evaluation can be made at the present time in accordance with the following table:

Evaluation	Approximate rates per 1,000 population		Infant mortality rate per 1,000 live births
	Birth rate	Death rate	
Very low.....	Up to 10	Up to 7	Up to 20
Low	11-15	8	21-30
Below average.....	16-20	9-10	31-34
Average	21-25	11-12	35-49
Above average.....	26-30	13-15	50-60
High	31-40	16-20	61-74
Very high.....	Over 40	Over 20	75 or over

6. A comparison of the actual birth and death rates for a given country with the figures given in this table can give some idea of the state of health of the population of that country. Statistics of the natural movement of population for the USSR and several of the economically developed capitalist countries (United States of America, England and Wales, France, Federal Republic of Germany) are given in the following table:

Country	Year	Per 1,000 population		
		Birth rate	Death rate	Natural increase
Soviet Union	1913	45.5	29.1	16.4
	1959	25.0	7.6	17.4
	1960	24.9	7.1	17.8
	1961	23.8	7.2	16.6
	1962	22.4	7.5	14.9
	1963	21.2	7.2	14.0
United States	1915	25.0	13.2	11.8
	1959	24.1	9.4	14.7
	1960	23.7	9.5	14.2
	1961	23.3	9.3	14.0
	1962	22.4	9.5	12.9
	1963	21.6	9.6	12.0
England and Wales.....	1911-1913	24.3	14.2	10.1
	1959	16.9	11.7	5.2
	1960	17.5	11.5	6.0
	1961	17.9	12.0	5.9
	1962	18.3	11.9	6.4
	1963	18.5	12.2	6.3
Germany	1910-1914	28.2	16.7	7.5
Federal Republic of Germany..	1959	17.7	10.8	6.9
	1960	17.8	11.3	6.5
	1961	18.3	11.0	7.3
	1962	18.2	11.1	7.1
	1963	18.5	11.4	7.1
France	1911-1913	18.1	19.0	0.9
	1959	18.3	11.3	7.0
	1960	17.9	11.4	6.5
	1961	18.2	10.8	7.4
	1962	17.7	11.5	6.2
	1963	17.9	11.7	6.2

7. Particularly worthy of attention is the fact that the crude death rate for the Soviet Union in 1963 was four times lower than in 1913, whereas the corresponding decrease for the other countries over the same period was as follows: United States—1.38 times; England and Wales—1.16 times; Federal Republic of Germany (compared with Germany in 1913)—1.5 times; France—1.6 times.

8. The fact that there has been such a significant decrease in mortality in the Soviet Union over a relatively short period during which the country took part in two world wars and went through a civil war speaks volumes of the beneficial effects of the sharp improvement in living conditions brought about by the successful building of socialism.

9. The birth rates, death rates and rates of natural increase referred to above are crude rates, and although they are widely used, they do not provide an adequate basis for study and analysis, from the point of view of the progress being made in sanitation and hygiene, of the

population replacement indices of a particular country over a fairly long period of time or for inter-country comparisons of such indices. These indices are important for evaluating the numerical increase or decrease in a country's population, but they are inadequate for determining the health characteristics or evaluating the replacement processes of a population, as they vary not only as a result of changes in the state of health of the population but also according to changes in its age and sex structure.

10. More useful for the evaluation of population replacement are general and legitimate fertility rates, age-specific fertility and mortality rates (for quinquennial or decennial age groups), and standardized rates which eliminate the influence of differences in the age and sex structure of a population on its birth and death rates.

11. The best method for carrying out a statistical study of the mortality and mean length of life of a population is the construction

of life tables. The figures in these tables express in the most accurate form the relative force of mortality and the expectation of life at various ages.

12. The crude rates of natural increase are also inadequate for a comparative evaluation of the health aspects of population replacement in groups of differing age and sex structure. For this purpose use must be made of indices which reflect only the character of the replacement and are not dependent on the age and sex structure of the population. Such indices are the gross and net reproduction rates, which make it possible to establish the ratio between the numbers of persons in the new and old generations, i.e., to show to what extent the generation living at a given moment is producing its replacement. The 1959 population census in the Soviet Union made it possible to investigate the present state of health of the population of the Soviet Union by the most accurate methods in the form of population health indices. A study of population replacement in the Soviet Union and an evaluation of the health aspects of such replacement were carried out by these methods, and the results were compared with similar material for several of the most highly developed capitalist countries (United States of America, England and Wales, France, Federal Republic of Germany). The conclusions arrived at were as follows. In 1959, by comparison with the data of the 1926 census, there were in the Soviet Union a higher percentage of elderly persons (over fifty years of age), a smaller percentage of children and adolescents (up to fifteen years of age) and a higher proportion of women in the population as a whole. The reasons for these changes were, on the one hand, the considerable losses of population (particularly men) suffered during the Second World War—during which, from 1941 to 1945, the Soviet Union bore the brunt of the war and the havoc wrought by the armed forces of Nazi Germany—and, on the other hand, the reduction in the death rate and the increase in the expectation of life, together with some reduction in the birth rate. All this is clear from the population pyramid for the Soviet Union reproduced in figure I. This was compiled from the data of the 1926 and 1959 censuses, each of which comprised the population living within the boundaries of the Soviet Union at the respective times.

13. The data given show that the proportion of both males and females up to 20 years of age was lower in 1959 than in 1926, this being the result of the fall in the birth rate during the war and the post-war period. For the ages above 20 years, the percentage of women was

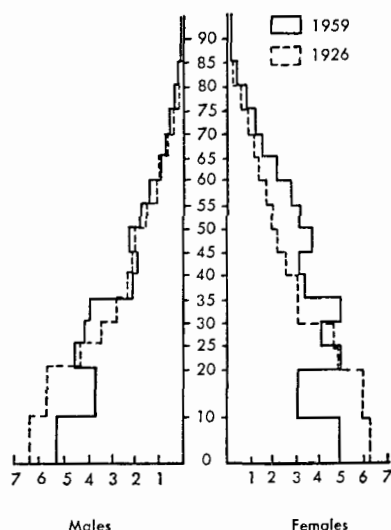


Figure I
Age structure of the population of the Soviet Union

considerably higher in 1959 than in 1926, but in the case of men there were only slight increases, or, in some age groups, none at all because of the loss of male population during the Second World War.

14. In spite of the changes that have occurred, the population of the USSR has a more favourable age structure than the population of the United States, England and Wales, France or the Republic of Germany. This can be seen from figure II, which shows the age structure of the population of the Soviet Union and of the population of several economically developed capitalist countries (United States of America, Federal Republic of Germany, England and Wales, and France). The proportion of population between the ages of 15 and 49

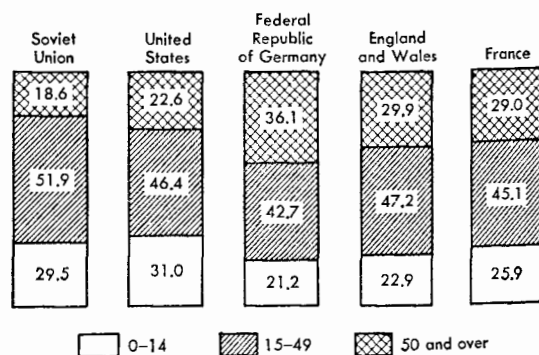


Figure II

Age structure of the population of the Soviet Union and of the population of several capitalist countries

years is higher in the Soviet Union than in any of the other countries.

15. In 1959, the sex structure of the population of the USSR was males, 45 per cent and females, 55 per cent (in 1926 the corresponding percentages were 48 per cent and 52 per cent). This disproportion between the number of males and females is characteristic of the older age-groups. Among that section of the population which was not more than 32 years old in 1959 and consequently had scarcely taken any direct part in the Second World War, the proportions of males and females were almost equal (50.1 per cent and 49.9 per cent respectively). Among these over thirty-two years of age, however, the proportions were 37.4 per cent and 62.6 per cent, while in the 55-59 age group there were only 33.4 per cent men as against 66.6 per cent women. Figures III and IV show that while there is scarcely any male in the Soviet Union over thirty-five years of age who is not married, 48 per cent of all females of child-bearing age (those over sixteen years of age) are unmarried, i.e., more than in the other countries selected for comparison.

16. These percentages must also be considered in relation to the health and demographic situation resulting from the Second World War. Life expectancy in the Soviet Union has, as can be seen in figure V, increased considerably in comparison with the pre-revolutionary period (1896-1897), the first years after the great October socialist revolution (1926-1927) and the years 1938-1939.

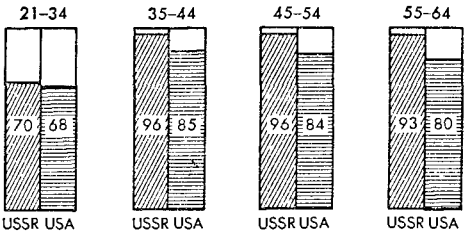


Figure III

Married men as a proportion of the male population in different age groups in the Soviet Union and the United States of America in 1959

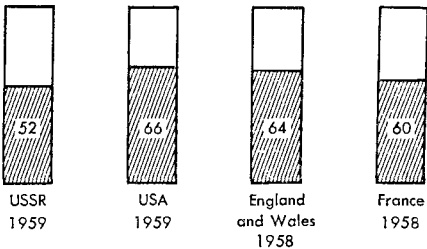


Figure IV

Percentage of married women among females aged 16 years and over

17. The table below compares the expectation of life in the Soviet Union and in several capitalist countries.

Expectation of life (in years)

Age (in years)	Soviet Union (1958-1959)			United States (1961)		England and Wales (1961)		France (1961)	
	M	F	Both sexes	M	F	M	F	M	F
0.....	64	72	69	67	74	68	74	68	75
5.....	63	71	68	64	71	65	70	65	71
10.....	59	66	63	59	66	60	66	60	66
20.....	50	56	54	50	56	51	56	50	57
30.....	41	47	45	41	46	41	46	41	47
40.....	32	38	36	32	37	32	37	32	38
50.....	24	29	27	23	28	23	27	23	29
60.....	17	21	19	16	20	15	19	16	20
70.....	11	13	13	10	13	10	12	10	13

18. As can be seen from the table, the expectation of life at birth is lower in the Soviet Union than in the other countries considered. At ages five to twenty years the life expectancy levels out for the various countries, and at age thirty and over, the expectation of life in the

Soviet Union becomes greater than that in the United States of America, England and Wales, and France. After 1958-1959 the expectation of life in the USSR continued to increase and by 1962-1963 was seventy years at birth (sixty-five years for males and seventy-three years for



Figure V
Expectation of life in the Soviet Union

females), this indicating a continuing rise in the state of health of the population of the Soviet Union.

19. The Soviet Union's achievements in reducing infant mortality can be seen from the following figures:

Infant mortality per 1,000 live births

	1913	1940	1960	1962	1963
Soviet Union (contemporary boundaries).....	269	182	35	32	30.9
United States	99.9 (1915)	47	26	25.3	25.2
England and Wales.....	108	61	23	22	22
France	112	92	27	26	26
Federal Republic of Germany (in 1913 and 1940 all of Germany)	151	64	34	29.1	27

20. None of the countries considered had such a high infant mortality rate as Russia in 1913, and in none of them has there been such a rapid decrease in infant mortality as in the Soviet Union. This success of the Soviet Union was achieved through a sharp improvement in the living conditions and cultural level of the people and also by means of extensive measures for the protection of female labour and medical services for women and children (the establishment of a network of maternal and child welfare clinics, maternity homes, nurseries, infant feeding centres, etc.), which were entirely lacking in pre-revolutionary Russia. Nevertheless, a further reduction in infant mortality is one of the most important tasks facing the Soviet health services.

exception of the United States of America (for females up to 35 years of age). The legitimate fertility rate (the most accurate index of the incidence of health conditions on the level of female reproduction) for females aged 15 to 49 years is lower in the Soviet Union now than it was in 1926; it is, however, higher than in

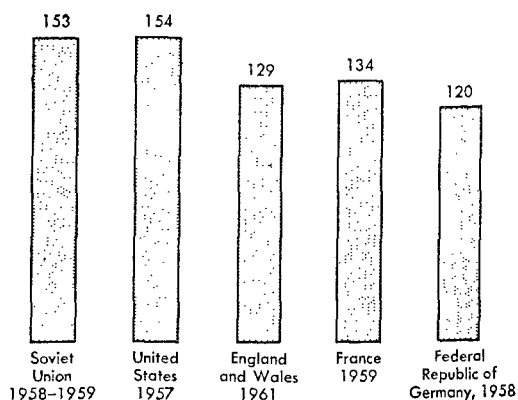


Figure VI
Standardized legitimate fertility rates for females aged 15 to 49 years

21. Owing to the previously mentioned imbalance in the age-sex structure of the population of the Soviet Union which is one of the consequences of the Second World War, the general fertility rate in the Soviet Union as can be seen from figure VI and the following tables, is lower now than it was in 1926, but it is still higher at almost all ages than in the capitalist countries considered here, with the

England and France and is almost identical with the rate for the United States of America, despite the fact that these latter countries did

not suffer as great a loss of their male population during the Second World War as did the Soviet Union.

A. General fertility rates (per 1,000 females by age groups)

<i>Age (in years)</i>	<i>Soviet Union (1926-1927)</i>	<i>Soviet Union (1958-1959)</i>	<i>United States (1957)</i>	<i>England and Wales (1958)</i>	<i>France (1958)</i>
Under 20	38	29	96	31	21
20-24	259	162	261	158	154
25-29	269	165	200	161	174
30-34	225	110	118	94	108
35-39	172	67	61	46	58
40-44	91	24	16	12	18
45-49	23	5	1	0.8	2
TOTAL 15-49	159	89	123	69	81

B. Legitimate fertility rates (per 1,000 females by age groups)

<i>Age (in years)</i>	<i>Soviet Union (1958-1959)</i>	<i>United States (1957)</i>	<i>England and Wales (1961)</i>	<i>France (1959)</i>
20-24	324	356	276	334
25-29	217	226	201	219
30-34	142	129	110	124
35-39	92	67	51	64
40-44	39	18	15	23
45-49	9	—	1	18
TOTAL 15-49	153	161	100	118
Standardized rates for age group 15-49.....	153	154	129	134

22. The most accurate index of the final results of population replacement, viz., the net reproduction rate, is higher for the Soviet Union than for England and the Federal Republic of Germany and is approximately the same as the rate for France. It is adequate to ensure the replacement of the population of the Soviet Union. This rate is as follows for each country: Soviet Union, 1.26; United States of America, 1.7; England and Wales, 1.2; France, 1.3; and Federal Republic of Germany, 1.1. The difference between the rates for the Soviet Union and the United States of America is the result of the difference in the ratio of men to women in the populations of the two countries, which, in turn, is attributable to the efforts demanded of the Soviet Union for the

military defeat of German Nazism during the Second World War.

23. The foregoing data are evidence of the improvement in living conditions and health conditions in the USSR. Despite the losses suffered in the Second World War, the Soviet Union is outstripping the economically more advanced capitalist countries of the world as far as indices of public health are concerned. This is particularly noteworthy in view of the fact that pre-revolutionary Russia and the Soviet Union in its early years were at an extremely low level of economic and cultural development, lagging far behind the corresponding levels in the economically developed capitalist countries, which have been cited in this report for purposes of comparison. In a relatively brief period

the Soviet Union has caught up with the foremost capitalist countries not only economically and culturally but also in so far as the indices of the health of the population, referred to in this report, as replacement rates, are concerned.

24. A significant role has been played in this regard by the achievements of the Soviet health services in providing a very high level of medical care for the people. As evidence of this it is sufficient to point out that in pre-revolutionary Russia in 1913 there were only 1.8 medical practitioners of all categories per 10,000 population, whereas in the Soviet Union the corresponding figures were 21.5 per 10,000 population in 1962 and 22.1 in 1963. In 1962

the corresponding figure for the United States of America was 18.0, for England, 19.6, for France, 14.6 and for the Federal Republic of Germany, 19.6. The increase in the number of physicians has been matched by the expansion of medical facilities. In Russia in 1913, the number of hospital beds per 10,000 population was 13, whereas in the Soviet Union it was 87 in 1962 and 90 in 1963 (a sevenfold increase); the number of beds for pregnant women and women in confinement increased by thirty times (from 7,500 to 227,000); and the number of maternal and child welfare clinics increased by more than 2,000 times (from 9 to 18,500). These achievements of the USSR are the result of the building of socialism.

Infant mortality in certain countries of low mortality

IWAO M. MORIYAMA

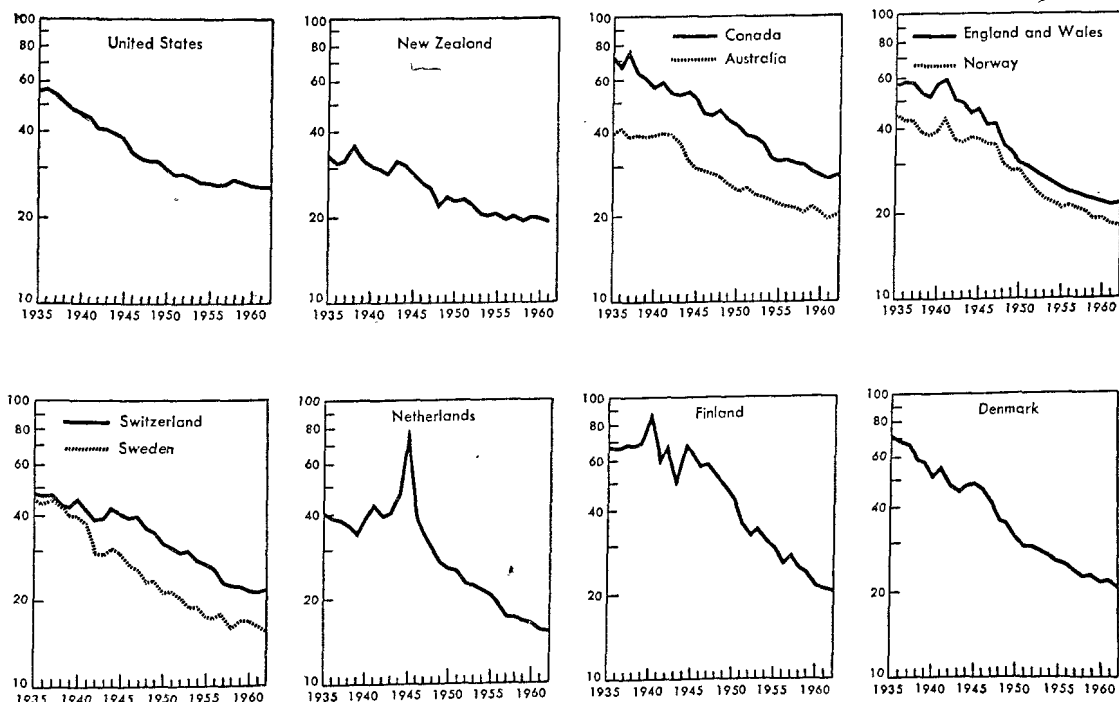
1. It is clear from the infant mortality trends that substantial reductions in rates have occurred over the years in countries of low mortality. (See figure.) Despite the interruptions of World War II in several countries, the rates are now at the lowest level in the history of these countries. In Sweden and the Netherlands, the infant mortality rates are well below 20 per 1,000 live births, and in five countries—Australia, Denmark, Finland, New Zealand, and Norway—rates close to 20 are being recorded. This is in marked contrast to the experience of some twenty-five years ago when only three countries, New Zealand, Australia and the Netherlands, had recorded infant mortality rates of 40 per 1,000 live births or less. To be sure, the infant mortality rate in the low nineteen-thirties

for New Zealand was unusually low for that period, and not too unfavourable even by present day standards. However, the presently recorded lows are about one-half of the infant mortality rate for New Zealand in 1935.

2. Reductions in mortality have occurred in both the neonatal (first twenty-eight days following birth) and postneonatal (twenty-eight days to one year) periods of life. In Australia and New Zealand, the trend of the postneonatal mortality rate has been practically parallel to the trend of the neonatal mortality rate but at a substantially lower level. This is different from the experience of other countries where the postneonatal rates have been declining at a much faster pace than the neonatal mortality

Infant mortality rates: Selected countries, 1935-1962

(Rate per 1,000 live births)



trend. In Finland and Denmark, the post-neonatal mortality started at a much higher level than the neonatal mortality rate, but is now well below the neonatal rate as in other countries. Mortality among neonates in countries of low mortality now range from about 70 to 80 per cent of the total infant deaths.

3. Most of the gains in the past have come about from reductions in infant deaths from the infectious diseases, especially diarrhoea and

enteritis and pneumonia. Improved sanitation and, more particularly, antimicrobial therapy have contributed significantly to the decline in mortality from the infectious diseases and, hence, the total infant mortality rate.

4. The following table shows the per cent annual rate of decline in the infant mortality rates for the stated time periods for the countries of low mortality included in this review:

Country	Period I	Per cent annual rate of decline	Period II	Per cent annual rate of decline
England and Wales...	1943-1954	6.1	1955-1962	1.9
Norway	1945-1955	5.9	1956-1962	3.1
Finland	1951-1960	5.2	—	—
Sweden	1936-1955	5.0	1956-1962	2.0
Netherlands	1949-1956	4.7	1957-1962	2.6
Denmark	1948-1958	4.3	—	—
Switzerland	1945-1956	4.3	1957-1962	1.7
United States	1933-1949	4.3	1950-1962	1.1
Canada	1943-1960	4.1	—	—
New Zealand	1943-1953	3.3	1954-1961	0.5
Australia	1944-1954	3.2	1955-1962	1.4

5. The decline in infant mortality in England and Wales and in Norway in the immediate postwar period was exceptionally rapid, as was that for Finland, Sweden and the Netherlands. In eight countries (those with rates of declines of 4.3 per cent or more per year), the infant mortality rates were halved in a span of ten years or less. The rate of decrease in the infant mortality rate was the smallest for New Zealand and Australia, the two countries with the most favourable infant mortality rates some twenty-five years ago. However, an average rate of decline of a little more than 3 per cent per year sustained over a period of ten years or more amounts to a substantial overall reduction for these countries.

6. After a period of exceedingly favourable infant mortality experience, there began to appear in the early 1950's indications of deceleration in the rate of decline. This change appeared first in the trend for the United States and later in other countries. This levelling-off effect is now evident in the infant mortality trend for the various countries of low mortality with the possible exception of Canada, Denmark and Finland. The largest change in the rate of decline occurred in New Zealand, and the infant mortality rate over the past nine years has been practically stationary. The rate of decline in the infant mortality rate for England and Wales during the past seven years is about one-third of the rate for the period 1943-1954. For the United States, the annual rate of decline

in the past thirteen years is about one quarter of that for the period 1933-1949. Of the countries that are apparently undergoing a change in the infant mortality trend, Norway and the Netherlands are presently recording the highest annual rate of decline, 3.1 and 2.6 per cent, respectively.

7. There are problems in the interpretation of international vital statistics arising from differences in definitions and in registration and statistical practices. However, there is no evidence to indicate that the changes in the infant mortality trends are related to any artifacts in the data.

8. Increases in the incidence of prematures or of illegitimate births, or changes in the distribution of live births by age of mother and parity could have the effect of inflating the infant mortality rate. Data relating to these factors were not examined for all the countries, but for the United States the percentage of premature live births or of illegitimate births has not varied enough to account for the change in the infant mortality trend. Also, there have not been any changes in the distribution of live births by age of mother and parity which would account for the levelling off of the infant mortality rate.

9. Another possible explanation for the change in trend is that, because of obstetrical progress, more pregnancies that would have terminated in foetal death are now resulting in

live births which fail to survive through early infancy. The examination of perinatal mortality trends for the various countries do not give any indications that the shift in survivorship of foetuses to the early neonatal period accounts for the levelling off of the infant mortality rate.

10. The change in the infant mortality trend for the United States appears to have resulted from a combination of circumstances. The trend of the death rate for the infectious diseases, notably pneumonia, which has long been responsible for a large part of the decline in the infant mortality rate, has levelled off. This, coupled with the relatively flat mortality trends for the diseases of early infancy and for the congenital malformations which now constitute the major portion of deaths among infants, may account for the deceleration in the infant mortality rate. What is not explained is why the deceleration in the infant mortality rates have taken place at different levels for the different segments of the population (colour and sex), and for the different parts of the country.

11. Although comments on the future prospects of the infant mortality rate for countries of low mortality must await the results of studies now under way, it seems clear that further reductions in infant mortality appear possible, at least in the United States, and several other countries. However, for the United States, no marked change downward in the infant mortality rate can be expected unless the attack on the pneumonia problem is altered. The use of antibiotics and effectiveness of therapy among infants need to be studied. The factors surrounding deaths presently attributed to hyaline membrane disease and other respiratory diseases appear worthwhile exploring.

12. No substantial progress in reducing infant mortality will be made until there is a breakthrough in dealing with congenital malformations and the diseases of early infancy such as birth injuries, postnatal asphyxia and premature delivery of infants. The hard core of the infant mortality problem has been hardly touched.

13. Although there is still much to be done on the infant mortality problem, the prevention of infant deaths alone is regarded as a limited public health objective in some countries of low mortality. Already, attention is being directed toward problems of perinatal mortality and morbidity which are more complex and of greater magnitude than that of preventing infant deaths. Whether or not perinatal mortality encompasses wholly the area of pregnancy loss and foetal salvage is a matter of definition, but the ultimate goal in all countries will be the prevention of pregnancy loss.

14. The experience of countries of low mortality has significance for the developing countries which are now at the stage where many of the developed countries were some forty or fifty years ago. The availability of knowledge and of the technical means for preventing infant deaths from diseases of infectious origin makes it possible to reduce the infant mortality rate substantially in a relatively short period of time in the developing countries. Because infant mortality is an important determinant of the average length of life, the lowering of infant mortality can add significantly to the average life expectancy in areas attempting to cope with the problem of rapidly increasing population.

Mortality trends in the United Arab Republic

A. E. SARHAN

I. INTRODUCTION

1. The mortality rate in any society reflects the factors affecting the welfare and health status. Accordingly, the magnitude of mortality risks varies from one country to the other and, in the same country, it varies from time to time. In countries with a sound statistical system of reporting deaths, mortality trends would be the resultant of all forces affecting health conditions. Also, such trends would reflect an overall evaluation of the standard of living, as well as the effectiveness of health and medical and social care.

2. The object of this paper is to report and discuss the long-term mortality trends in the United Arab Republic and the factors that affected its fluctuations. In Egypt, reporting of death has been required by law since 1882. It is thought that this reporting was not complete during the last decades of the nineteenth century. The following analysis will deal with the period starting 1917, i.e., since the First World War. The data were collected from the annual statistical year books of the United Arab Republic during the period 1917-1960.

II. TRENDS OF CRUDE MORTALITY

3. Table 1 shows the trend of mortality rates, by sex, per 1,000 population. It is evident that the trend of female mortality followed about the same pattern as for males but at a slightly lower level. This observation is the same in most countries. The highest mortality rate for the period of study was noted for the year 1918, which was due to the influenza pandemic. It is of interest to note the consequence of this on the birth rate. The general trend of mortality shows fluctuations with peaks coinciding with communicable disease epidemics, e.g., the high wave of 1917-1922 coincided with the typhus wave in addition to the influenza epidemic. The same applies to the waves during the depression years of the nineteen-thirties. The effect of the Second World War is evident. Epidemics of typhus, relapsing fever and malaria swept the country during that period. After the Second World War, the mortality

trend decreased noticeably and reached a level of about 17 per thousand in 1960.

4. During the same period, the birth rate fluctuated above the level of 41 per 1,000 until 1939, with the exception of the early years after the First World War. At the beginning of the Second World War, there occurred a drop in the birth rate, which was associated with an increase in the marriage rate. The latter resulted in an increase in the birth rate which was evident in the later years of the Second World War. In general the death rate is declining while the birth rate is fluctuating around 40 per thousand.

III. INFANT MORTALITY RATE

5. The infant mortality rate showed a trend of increase during the period 1917-1932, which was due possibly to better reporting of infant deaths. During that period, a general trend of decrease occurred in urban areas while a trend of increase, which affected the general trend of the country, occurred in rural areas and was due possibly to the extension of health services resulting in better reporting of infant deaths in such areas. The 1932 peak may have been due to the CSF and influenza epidemics of that year. During the period 1932-1940, the general trend maintained a high level of about 165 per 1,000 live births. The war years resulted in a peak in 1942. During the post-war years, a general decreasing trend was noted and the rate of infant mortality reached 109 per 1,000 live births in 1960.

6. It should be emphasized that the infant mortality rate in urban areas is generally higher than in rural areas, mainly because of better reporting. Since about two thirds of the population live in rural areas, the mortality rate generally parallels the rural trends at a slightly higher level. The noted decline during the post-war years reflects the better health, medical and social care facilities extended to the deprived population in rural areas. The 1960 infant death rate in Egypt is about four times the rate in many developed countries, e.g., the United States, the Scandinavian countries and New Zealand. In the latter countries, the infant death rate is about 26 per 1,000 live births, and the

main causes of death are the still non-preventable causes. In Egypt most of the mortality, i.e., 64 per cent, is due to gastro-intestinal diseases, followed by respiratory diseases.

IV. STILLBIRTH RATE

7. Stillbirth registration in Egypt is believed to be poor. The stillbirth rate trend, except for the years 1917-1922, showed a consistent drop from 12.1 per 1,000 live births to 8.1 per thousand. After this level had been reached, the stillbirth rate stayed around 7 per thousand. The impression is that some of the reported stillbirths are not real stillbirths, some of them may be viable prematures who die during the first hours or days of their life and are reported as stillbirths.

V. PROPORTIONATE MORTALITY

8. Although the proportionate mortality does not express the risk of mortality from specific causes, yet it shows the magnitude and order of leading causes. Table 2 shows the proportionate mortality by important groups of causes, according to the international groups of causes of death, in the year 1951 and the latest available data for the years 1957-1960 inclusive. During the nineteen-fifties, the first leading cause of death was gastro-intestinal diseases, especially gastro-enteritis, which affects mostly infants and

children under five years of age. The second leading cause was respiratory diseases, especially bronchitis and pneumonia, which again affect mostly infants and children. The third leading cause was diseases of early infancy, especially prematurity which leads mostly to neonatal death. It is evident that these three leading causes have their greatest risks during infancy and childhood, and collectively they constitute about two thirds of the total mortality. While the first two leading causes are preventable, prematurity is still considered as the most important cause in the third group. In advanced countries, the latter cause accounts for most of the deaths during infancy. The above three causes maintained their position throughout the nineteen-fifties.

9. It is of interest to note that during that decade, heart and circulatory diseases which were the fifth leading cause in 1951 took fourth position during 1957-1961, while parasitic and infectious diseases, which occupied fourth position in 1951, took fifth rank. This may be explained by the improvement in the control practices of communicable diseases during the period, and by the trend of increased life expectancy of the population. Accidents occupied the sixth position. These six groups of causes accounted for more than 75 per cent of total mortality during the nineteen-fifties.

Table 1. Birth rates, death rates, natural increase, infant mortality rates and stillbirth rates for the United Arab Republic (1917-1960)

Year	Birth rate	Death rate			Natural increase	Infant mortality rate	Stillbirth rate
		Males	Females	Total			
1917.....	40.1	33.3	25.5	29.4	10.8	251	12.1
1918.....	38.9	45.9	33.3	39.6	0.7	282	12.6
1919.....	37.7	34.3	24.4	29.4	8.4	128	11.5
1920.....	42.2	32.3	23.7	28.0	14.3	137	11.7
1921.....	41.8	29.1	21.0	25.0	16.8	133	12.2
1922.....	43.1	28.9	21.3	25.1	18.0	140	11.4
1923.....	43.1	29.1	22.5	25.8	17.3	143	10.2
1924.....	43.8	27.9	21.9	24.9	18.9	150	9.3
1925.....	43.5	29.5	23.4	26.5	17.1	155	8.8
1926.....	44.2	29.7	23.8	26.7	17.4	146	9.2
1927.....	44.0	27.9	22.4	25.2	18.8	152	8.1
1928.....	43.6	29.0	23.7	26.3	17.3	151	7.9
1929.....	44.2	30.2	25.0	27.6	16.6	159	7.4
1930.....	45.4	27.0	22.8	24.9	20.6	151	7.5
1931.....	44.5	28.5	24.8	26.6	17.9	160	7.3
1932.....	42.5	30.4	26.7	28.5	14.0	174	7.6
1933.....	43.8	29.3	25.8	27.5	16.2	162	7.4
1934.....	42.2	29.6	26.0	27.8	14.4	166	7.3
1935.....	41.3	28.4	24.4	26.4	14.9	161	7.1
1936.....	44.2	31.2	26.5	28.8	15.3	164	7.6
1937.....	43.4	29.4	24.9	27.1	16.2	165	7.8
1938.....	43.2	28.5	24.1	26.3	16.9	163	7.3
1939.....	42.0	27.9	23.8	25.9	16.1	161	7.7
1940.....	41.3	28.5	24.1	26.3	15.0	152	7.7
1941.....	40.4	27.9	23.4	25.7	14.8	150	7.3

Table 1. Birth rates, death rates, natural increase, infant mortality rates and stillbirth rates for the United Arab Republic (1917-1960) (continued)

Year	Birth rate	Death rate			Natural increase	Infant mortality rate	Stillbirth rate
		Males	Females	Total			
1942.....	37.6	30.5	25.7	28.3	9.4	168	7.2
1943.....	38.7	30.4	24.9	27.7	11.1	160	7.3
1944.....	39.8	28.6	23.5	26.0	13.8	152	7.6
1945.....	42.7	30.2	25.3	26.7	14.6	153	7.7
1946.....	41.2	27.5	22.5	25.0	16.2	141	7.0
1947.....	43.8	22.4	19.5	21.4	22.3	127	7.1
1948.....	42.7	22.0	18.9	20.4	22.3	139	6.9
1949.....	41.8	22.1	19.2	20.6	21.1	135	7.0
1950.....	49.4	20.5	17.7	19.1	25.3	130	6.9
1951.....	44.8	20.6	17.9	19.3	25.5	129	7.9
1952.....	45.1	18.9	16.6	17.7	27.4	127	7.9
1953.....	42.5	20.3	18.7	19.5	23.0	146	8.4
1954.....	42.4	18.5	17.1	17.1	24.6	138	8.2
1955.....	40.2	18.2	17.0	17.6	22.6	136	8.5
1956.....	40.6	17.0	15.6	16.3	24.3	124	8.4
1957.....	37.8	18.5	17.1	17.8	20.1	130	7.7
1958.....	41.1	17.4	15.8	16.6	24.5	112	7.7
1959.....	42.6	16.9	15.5	16.2	26.4	109	7.0
1960.....	42.6	17.6	16.2	16.9	26.1	109	7.9

Table 2. Proportionate distribution of leading causes of deaths in localities in Egypt having health offices in 1951 and during the four-year period 1957-1960

Cause of deaths	Proportionate 1951	Distribution 1957-1960
Diseases of G.I. tract.....	37.8	39.4
Diseases of respiratory system.....	14.1	13.8
Diseases of early infancy.....	12.1	10.2
Infections and parasitic.....	4.5	3.7
Heart and circulatory diseases.....	3.8	7.5
Accidents	2.6	3.3
All other causes	25.1	22.1
(ill-defined)	15.2	13.5
TOTAL	100	100

Trends of mortality in Asia and the Far East

TAKEMUNE SODA, M.D.

I. APPARENT DECREASE OF MORTALITY RATES

1. A study of the vital statistics, available now, discloses that no clearly decreasing mortality trend could be observed before the Second World War in such Asian countries as Burma, Ceylon, India, Japan, Philippines, Taiwan and Thailand. Israel was an exception, in that a decrease in the mortality trends could be observed there since the end of the First World War. Generally speaking, mortality rates remained unchanged before the Second World War, reflecting the stagnant living conditions of the people of Asia and the Far East. In most countries, except Israel and the Philippines, mortality rates increased during the period of war, i.e., 1940-1945. The accuracy of vital statistics for these years is doubtful, but it cannot be denied that the wartime distress affected the health status of all the nations involved in war, however distant from active hostilities. It is noticeable that rapid decreases in the trend of mortality rates began to slow down in many countries after the end of the Second World War. Chile, Norway, United Kingdom and the United States experienced this decline around 1952, whereas Japan, Jordan, Ryukyu, Taiwan and Thailand underwent the same experience in 1955. The factors which caused this sudden change in the trends of mortality decline deserve a careful exploration.

II. MORTALITY RATES BY AGE

2. An examination of mortality rates by age in Asian countries shows a higher incidence of mortality at younger ages than at older ages (fig. I). The rate of decline of mortality rates is also more pronounced for the younger than for the older age groups. Differences in the mortality rates for age group one to four years strikingly distinguish the more developed countries from those in Asia and the Far East. The death rate for the youngest group, such as babies under one year old or four weeks after birth, is less reliable as the reporting of births and deaths seems to be incomplete when babies die in the early period of their lives. Even the peri-natal death rates do not sufficiently enable us to compare the real picture of mortality

around birth, because the reporting of still births is also incomplete. However, judged from the number of infant deaths estimated from the population census data and other sources, the death rate in infancy, as well as in early infancy, is very high in most Asian countries.

III. PROPORTIONAL MORTALITY RATIO (PMR)

3. The number of deaths to persons aged 50 years of age and over as a percentage of total deaths has been suggested (by Swaroop and

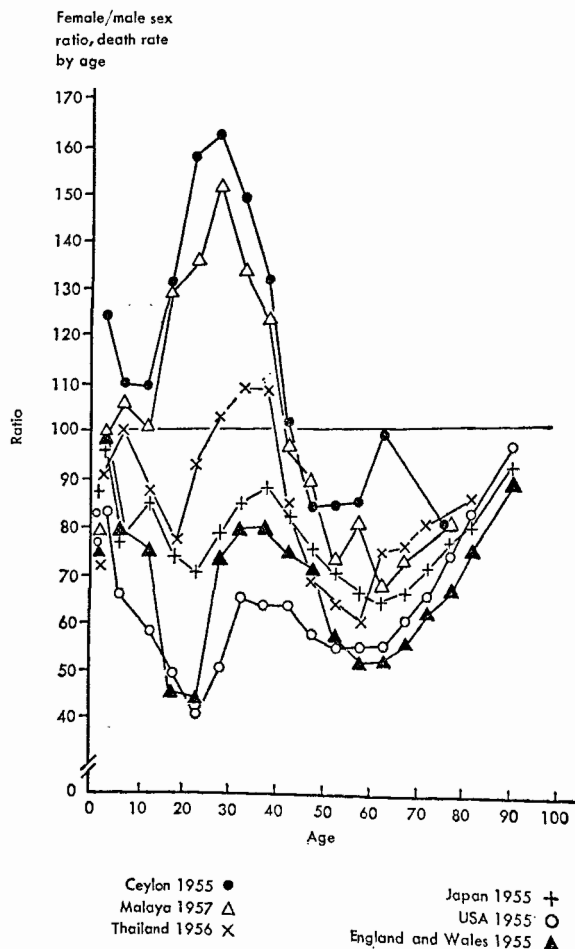


Figure I

Uemura) as a simple health indicator of a specific population group as long as its age structure is not disturbed by migration or by a change in the birth rate for a sufficiently long time. It is generally recognized that high mortality caused by adverse health conditions leaves fewer number of aged persons. The population with higher mortality is also apt to die during the younger period. The proportional mortality ratio (PMR) is very low in Asian countries at present, and is increasing parallel with the improvement of general mortality, especially among children. The change in PMR is more rapid in the Asian and Far Eastern countries than in the more advanced areas of the world.

IV. DEATH RATE BY SEX

4. The general belief that men are more liable to death than women is also true in most of the Asian and Far Eastern countries. However, some countries such as Burma, Cambodia and Ceylon, etc., show higher mortality rates of the female over the male and in most of the other countries in the region, where the male crude death rate exceeds the female, we find that the sex difference of the age specific death rate is rather small and the female rate sometimes exceeds that of the male. If we examine the secular change in the sex difference of male and female mortalities, particularly by age, the improvement in the female death rate is more remarkable than that of the male. Higher mortality of the female, if it existed, has diminished or disappeared, and where the female rate had already gone below the male rate, such a differential has increased with time.

5. Lower death rate of women, as compared to that of men, must be explained by reasons both biological and social in nature. It might be due to poor living conditions, such as low level of nutrition, hard work, heavy burden of pregnancy, frequent child bearing and nursing, insufficient medical and health care, etc. Therefore, in the present condition of the Asian and Far Eastern countries, the proportion of female death rate as a percentage of the male rate may be an index of health and living conditions in general. The heavy burden on the shoulders of housewives, especially in farming households, is reflected in the higher female/male sex ratio of the mortality rates at the child-bearing age-period of twenty to thirty-five years. Such rates have declined in some advanced countries like Canada and the United States while in other European countries, their trend is not so clear. If the age-specific death rates of the female are lower than those of the male, resulting in the accumulation of older persons in the female population, the rate of retardation of the crude female death rate will tend to decrease. In those countries where age-sex-specific death rates have been suppressed at sufficiently low levels a tendency to diminish the sex differences of crude death rates will result. This explains why the sex difference of crude rates is rather small in some of the European countries even though differences of age-specific death rates are quite noticeable.

V. LIFE TABLES

6. Age-sex-specific death rates are the basic data, on which the life tables are constructed. According to the table below, showing the

Life table figures

Countries	Year of survey	e_0		$1/e_0$		l_{10}	
		Male	Female	Male	Female	Male	Female
Cambodia	1958-1959	44.2	43.3	22.6	23.1	—	—
Ceylon	1954	60.3	59.4	16.6	16.8	0.761	0.739
China (Taiwan)	1959-1960	61.3	65.6	16.3	15.2	0.801	0.832
Cyprus	1948-1950	63.6	68.8	15.7	14.5	0.791	0.851
India	1941-1950	32.5	31.7	30.8	31.6	0.483	0.459
Israel	1960	70.7	73.5	14.2	13.6	0.905	0.921
Japan	1959	65.2	69.9	15.3	14.4	0.846	0.879
Malaya	1956-1958	55.8	58.2	17.9	17.2	0.707	0.706
Philippines	1946-1949	48.8	53.4	20.5	18.7	0.570	0.623
Ryukyu	1955-1957	65.8	72.0	15.2	13.9	0.830	0.871
Thailand	1947-1948	48.7	51.9	20.5	14.3	0.569	0.614
Turkey	1950-1951	46.0	50.4	21.7	19.8	0.552	0.620
Canada	1955-1957	67.6	72.9	14.8	13.7	0.870	0.913
United States	1959	66.5	73.0	15.0	13.7	0.861	0.913
France	1960	67.2	73.8	14.9	13.6	0.873	0.920
Netherlands	1953-1955	71.0	73.9	14.1	13.5	0.908	0.931
Sweden	1959	71.7	75.2	13.9	13.3	0.913	0.943
England and Wales	1960	68.3	74.1	14.6	13.5	0.900	0.931
Australia	1953-1955	67.1	72.8	14.9	13.7	0.876	0.916

expectation of life at birth ($\dot{e}_0$), the life table death rate ($1/\dot{e}_0$), and the probability of surviving at age fifty ($_{150}$), the backwardness of health status of the Asian and Far Eastern nations is unquestionably evident. As it is expected from the fact mentioned before, the expectation of life is longer for the female than for the male in most countries in the world, but in most of the Asian countries, the sex difference is not so large, and in some of them (such as Cambodia, Ceylon, India, etc.), the females show even shorter lengths of life than the males.

VI. ANALYSIS OF MORTALITY RATES ACCORDING TO CAUSES OF DEATH

7. If we classify all the causes of death, shown in the "B" list of the *International Classification of Sickness, Injuries and Causes of Death*, into the following broad groups by nature of the causes:

(a) Group A: mostly infectious and parasitic diseases (B.1-17, 23, 24, 30-32, 36, 43);

(b) Group B: mostly degenerative diseases of adult and older population (B.18, 19, 22, 25-29);

(c) Group C: mostly diseases and abnormalities of child-bearing mothers and children (B.40-42, 44);

(d) Group D: injuries, accidents and other external causes (B.47-50);

(e) Group E: other causes (listed in "B" list).

We recognize a large discrepancy in the distribution of deaths in the above five groups between the Asian countries and the well-developed countries in other regions. Generally speaking, the infectious and parasitic diseases (group A) are remarkably more prevalent, and maternal and infant mortalities (group C) much higher in Asian and Far Eastern countries, though the situation is improving with these causes of death even in Asian countries. On the other hand, the so-called adult diseases (group B), including malignant neoplasms, hypertensive disorders, heart diseases, are relatively rare in the Asian countries, and the deaths caused by accidents and other external violences are still sustained at a lower level than the more developed countries in Europe and the United States.

8. Next, we examined the deaths by some important items of the international "B" list of the causes of death for each country in Asia and the Far East, comparing with the data obtained for the developed countries. In order to find the most important causes of death for

each country, the author selected the most prevalent causes of death which showed death rates higher than 50 deaths per 100,000 persons per year. Contrary to the well-developed countries where B26 arteriosclerotic heart disease, B18 malignant neoplasms, and B22 apoplexia, are the main and common causes of death, the most common and important cause of death in the Asian and Far Eastern countries is "B31 pneumonia", and the second most important is "B36 gastritis, duodenitis, colitis and enteritis", excluding trash-basket or ambiguous items.

9. The above two causes have decreased in some exceptional countries, such as Israel, Japan, Ryukyu, and Singapore, where the above-mentioned causes of death, B26, B18 and B22, show the upward tendency as in the developed countries in Europe and America.

10. Tuberculosis (B1) is still prevalent in some countries, and the deaths from "other diseases of early infancy (B44)" are also raging in this area. Higher death rate by "deliveries and complications of pregnancy (B40)" in most of the Asian countries may be one of the main reasons of the higher mortality of the female, causing the increase of female/male sex ratio of mortality in Asian countries, especially at child-bearing ages, suggesting the urgent need for the development of maternal and child health services and the improvement of economic and social status of the women in these countries, though these problems relate also to the profound task of general social development of the whole country.

VII. ECONOMIC AND SOCIAL BACKGROUNDS OF THE MORTALITY STATUS

11. The economic and social backgrounds of the present status and the trends of mortality in Asian and Far Eastern countries are very broad and complicated, and it is beyond the scope of this study to discuss the problem completely. Mention ought to be made of a United Nations publication—*Compendium of Social Statistics: 1963*, comprising international social statistics of various kinds—which gives valuable hints on the demographic, social and economic facts which may affect the mortality status of the people. Though there is a variety in the stages of social development among many countries in Asia, the general characteristics of Asian populations are given below.

12. As a result of high mortality and fertility, Asian countries have a larger younger population than the advanced countries; medical facilities such as hospital beds, physicians, etc., are insufficient; their nutritional level, in fat, protein, especially of animal origins, the con-

sumption of meat, eggs, milk, etc., is still very low, even though the gradual improvement can be recognized in most countries. They are suffering from illiteracy, particularly of the female population, which is responsible for diet, child-bearing, nursing, and raising of children. The majority of the population is engaged in low productivity work, such as agriculture, and the proportion of the economically active population is rather high, of which unpaid family workers occupy a high percentage. Peculiarity of working women in Asia and the Far East does not lie in the amount but in the quality of their labour, which can be characterized as painful, under-paid, tiresome and subhuman. The wage, the per capita income, and then the per capita private consumption expenditure, seem to be very low, accompanied with very high Engel's index, in most of the Asian and Far Eastern countries.

VIII. SUGGESTIONS FOR THE EFFECTIVE MEDICO-SOCIAL SERVICES NEEDED IN ASIA AND THE FAR EAST

13. The following measures may be suggested to reduce the mortality rates in the area:

(a) Promotion of the maternal and child

health services to reduce the deaths among mothers, children, and younger population at large. The programme of family planning in this region can and should be carried out with the general MCH programme;

(b) Infectious and parasitic diseases, though they have begun to decrease, are still prevailing in this region. Control of tuberculosis, malaria and other tropical diseases, is an important task for the present;

(c) Relatively poor status of the female mortality in Asian countries as compared with that in advanced countries, suggests the urgent need of providing health services to raise the general standard of living for the working women;

(d) Concerning living conditions surrounding the labouring population in Asia, the establishment of health and medical facilities, including the recruitment of professional personnel to work therein, sufficient supply of nutrient food-stuff of better quality, elevation of level of education to combat the illiteracy, particularly among the women, etc., are the more important tasks for the improvement of the mortality status of this region.

Changes in mortality rates in Italy from 1951 to 1962

STEFANO SOMOGYI

1. Mortality in Italy showed very slight variations from 1951 to 1962, oscillating around 10 per one thousand (a minimum of 9.5 per one thousand and a maximum of 10.6 per one thousand). This, however, conceals the deep changes in the structure of mortality by cause, which pose considerable technical and scientific problems to both public health authorities and the medical profession, specially those concerned with research. These variations in diagnosis, concerning the seventeen sectors of causes of death, will now be dealt with. Some of the changes which are solely due to revision in the classification criteria for official statistics, in order to adhere strictly to directives formulated by the World Health Organization, will therefore not be discussed. These changes mainly concern certain diseases of the circulatory system only.

2. Comparing the relative frequency of deaths per 10,000 population for the seventeen sectors (sixteen for males) in the first and last year of the period in question (table 1), a decrease is seen for all sectors with the exception of those by neoplasms, diseases of the circulatory system, accidents (poisoning and violence), congenital malformations and diseases of the nervous system. Only the first three show increases worthy of notice: for neoplasms this is 41.7 per cent for males and 27.3 per cent for females; for diseases of the circulatory system, 36.6 per cent and 26.4 per cent respectively, and for accidents, poisoning and violence 22.2 per cent and 36.8 per cent respectively. For females only, there was an increase in sector III: allergic, endocrine system, metabolic and nutritional diseases and in the diseases of the skin and cellular tissue.

3. The decreases were of varying entities: worthy of mention are those concerning the sectors of infective and parasitic diseases (52.8 per cent and 69.4 per cent for males and females respectively), senility and ill-defined conditions (58.3 per cent and 51.0 per cent), diseases of the bones and organs of movement (46.4 per cent and 54.5 per cent) and mental, psychoneurotic and personality disorders (38.6 per cent and 46.0 per cent).

4. It is evident that the tendency of neoplasms to increase is not entirely due to better diagnosis, even though in some cases this may be true. It is due to the actual increase in the incidence of such disease; similarly the increase in diseases of the circulatory system is excessive, in spite of the fact that the practice of certain doctors who resort to this diagnosis when signing death certificates (for convenience) is becoming much less frequent. The increase in deaths by accidents is a consequence of the widespread increase in traffic and therefore in road accidents (the number of motor vehicles in circulation in 1951 was 1,703,640 and in 1962, 7,776,411, an increase of 3.56 per cent).

5. The decreases in infective diseases in turn are due to the influence of antibiotics and compulsory vaccinations for many diseases of infancy and those in the sector of ill-defined conditions, and senility, to the improved efficiency of doctors who carry out post-mortems, in indicating actual instead of general and imprecise causes of the death certificate.

6. The well-known difference in the mortality of the two sexes has not remained unchanged in the course of time: there was a slight increase for males, from 10.8 per one thousand to 10.9 per one thousand (male population) and a bigger decrease for females, from 9.6 per one thousand to 9.2 per one thousand (female population). These changes in the general mortality rates have caused variations in the mortality ratios of the two sexes in all sectors except that of congenital malformations. Taking the male mortality as a basis, it is evident that in most sectors there are further increases in the differences in 1962 as compared with 1951. (Compare last two columns of table 1.)

7. In the third sector, allergies etc., the male-female mortality ratio changed (from 83.3 in 1951 to 141.2 in 1962). The slight impact of such diseases should be remembered, however, so that a comparatively small quantitative variation involves considerable relative variations.

8. In diseases of the circulatory system, the higher female mortality rate dropped so that it

was practically identical for both sexes. Concerning diseases of the skin and the sector symptoms, etc., the female super-mortality has become even more pronounced as compared to the male.

9. It should be mentioned that a comparison of the first and last years of the period in question is not imprudent, since the trends show very slight oscillations and the recorded tendencies are substantially in harmony with the characteristics stated previously. This is particularly clear if the percentage distributions of the seventeen categories of causes are observed (table 2).

10. Infective diseases, certain diseases of early infancy, senility and ill-defined conditions show a decisive and uninterrupted reduction in the number of deaths for both sexes. For diseases of the blood, mental, psychoneurotic and personality disorders and diseases of the bones, an identical but less intense tendency is also recorded for both sexes. For females only, the subsequent uninterrupted reduction is shown in the diseases of the digestive and the genitourinary system and in maternity causes (sector XI).

11. A contrasting tendency, with an uninterrupted increase, is seen for neoplasms and diseases of the circulatory system and accidents and violence etc. Comparing the percentages for the first and last years, we find the following order in 1951: (1) circulatory system; (2) nervous system; (3) neoplasms; (4) respiratory; (5) ill-defined conditions and senility; (6) digestive; and (7) infective, for both sexes. In 1962 we find: (1) circulatory; (2) neoplasms; (3) nervous system; (4) respiratory; (5) accidents; (6) digestive; and (7) certain diseases of early infancy, with slight differences for females, where nervous system is at second place (even though very close to neoplasms) and ill-defined conditions and senility at fifth place. The changes in the order cause repercussions which are more unfavourable than favourable, from both a health viewpoint and the cost of defending such.

12. The variations reveal very specific features if the behaviour of the phenomena is studied for different age groups, rather than if the total incidence of the diseases is studied. Concerning this, only five groups have been taken as illustrative examples; children under five years of age, 5 to 25 years of age; 25-55; 55-75 and finally over 75 years of age (table 3).

13. It is highly significant, that in the older age groups, for some of the seven more important sectors, mortality rates for males have increased (neoplasms, circulatory and digestive

systems, accidents, etc.), even if as a whole there has been a decrease. For females the case is similar, but to a lesser degree. With the exception of infective and mental diseases, the situation deteriorated for males from 1951 to 1962, as well as for the 55-75 age group. For females this is only true for neoplasms and accidents. For males, the middle age group has had an unfavourable trend for all sectors in question, excepting those of respiratory and digestive systems. For females this is the case for neoplasms only.

14. These sectors of diseases, together with accidents, are to be feared the most, since in all age groups (with the exception of 5-25 age group for accidents) there has been an increase in mortality. The specific mortality rates by age have increased, in the twelve year period in question, for two other sectors as well, i.e., for mental diseases and diseases of the circulatory system.

15. The transformations in diagnostic practices have multiple social consequences. Demographically, the decrease in mortality from diseases of maternity (also an evident sign of greater care in pregnancy and child-birth) improves the offspring, born under more favourable conditions, reducing thus the impact of endogenous causes in peri-natal and infant mortality. The considerable decrease in widespread infective and parasitic diseases, especially those which affect children and young people either involving high mortality rates or long illness, has greatly eliminated the bad effects, felt in later years, on mental capacity and other diseases involving physical resistance. As a result, the physical and mental conditions of youth have improved, resulting in the need for less medical care and therapy than past generations, therefore, reducing the burden of expenditure.

16. Whereas the benefits from changed conditions in morbidity are felt by youth, the continual increase in neoplasms, cardiovascular diseases and accidents incurs severe economic and social damage. Neoplasms eliminate not only an ever increasing number of old aged persons before their time, but also remove from production less older persons. Owing to deaths and illnesses, public and private enterprises have therefore to replace persons who still have high productive capacity. Family economies are in turn weighed down by the high expense of treatment as well as loss of the income.

17. Cardiovascular diseases are even more widespread in age groups, where in the past they occurred only sporadically and infrequently. Such diseases, even when they do not

cause death, make the general health conditions of persons concerned very precarious. The working capacity is reduced, both owing to lengthy illness and because the body cannot afterwards be expected to make the same physical efforts that the work previously required. No less is the damage to families and the community, owing to the necessity of constant administration of medicines, which are normally rather expensive.

18. Since cardiovascular diseases affect mainly the middle aged, this causes serious social disturbances, frequently necessitating the removal of persons from their homes to special hospitals or clinics, which is damaging to both the family and the patient, who suffers psychological or mental complications owing to such removal.

19. The increasing mass of individuals who are involved in accidents of every nature, especially accidents at work and road accidents, eventually influence all the other sectors of causes, even though there may be no direct impact on the mortality levels (specially for females). Accidents (poisoning, intoxication etc.) make the body less resistant to the de-

molishing action of other morbid conditions, which subsequently damages the organism. The factors that are of great importance are the long periods of illness, the temporary or permanent disablement, and physical impairments. The consequences of these are felt much more acutely when the persons afflicted are of older ages. Thus economic, financial and social repercussions, instead of diminishing in the course of time, often become greater.

20. If the network of such diseases and accidents is serious in the life of the community, of no less importance are the repercussions in the hospital and the medical world. Diagnostic changes that are too rapid transfer medical interest too quickly to new sectors, with which neither hospitals and clinics, nor social welfare, can adequately keep up. Due to such changes considerable equipment is often rendered obsolete or of less use. In these circumstances, the importance of health and medical statistics grows continually. Only by their accurate and rapid availabilities can problems of health defence be suitably tackled by public authorities and those concerned with research.

Table 1. Mortality rates and variations from 1951 to 1962 by sectors of causes of death in Italy

Sectors ^a	Mortality rates per 10,000 population				Index numbers			
	Males		Females		Mortality 1962 (1951 = 100)		Male mortality = 100	
							Females 1951	Females 1962
	1951	1962	1951	1962	Males	Females		
I	7.2	3.4	4.9	1.5	47.2	30.6	68.1	44.1
II	12.0	17.0	11.0	14.0	141.7	127.3	91.7	82.4
III	2.4	1.7	2.0	2.4	70.8	120.0	83.3	141.2
IV	0.44	0.34	0.40	0.30	77.3	75.0	90.9	88.2
V	0.70	0.43	0.50	0.27	61.4	54.0	71.4	62.8
VI	14.7	15.1	13.6	14.6	102.7	107.4	92.5	96.7
VII	23.2	31.7	25.0	31.6	136.6	126.4	107.8	99.7
VIII	11.4	10.5	10.0	7.9	92.1	79.0	87.7	75.2
IX	9.4	7.6	6.8	4.7	80.9	69.1	72.3	61.8
X	2.9	2.6	1.5	1.2	89.7	80.0	51.7	46.2
XI	—	—	0.53	0.35	—	66.0	—	—
XII	0.13	0.13	0.15	0.17	100.0	113.3	115.4	130.8
XIII	0.28	0.15	0.44	0.20	53.6	45.5	157.1	133.3
XIV	0.86	0.93	0.74	0.80	108.1	108.1	86.0	86.0
XV	6.3	4.9	4.8	3.5	77.8	72.9	76.2	71.4
XVI	9.6	4.0	10.0	4.9	41.7	49.0	104.2	122.5
XVII	6.3	7.7	1.9	2.6	122.2	136.8	30.2	33.8
TOTAL	108.0	109.0	96.0	92.0	100.9	95.8	88.9	84.4

^a I, infective and parasitic diseases; II, neoplasms; III, allergic, endocrine system, metabolic, and nutritional diseases; IV, diseases of the blood and blood-forming organs; V, mental, psychoneurotic, and personality disorders; VI, diseases of the nervous system and sense organs; VII, diseases of the circulatory system; VIII, diseases of the respiratory system; IX, diseases of the digestive system; X, diseases of the genito-urinary system; XI, deliveries and complications of pregnancy, childbirth, and the puerperium; XII, diseases of the skin and cellular tissue; XIII, diseases of the bones and organs of movement; XIV, congenital malformations; XV, certain diseases of early infancy; XVI, symptoms, senility, and ill-defined conditions; XVII, accidents, poisoning, and violence.

Table 2. Percentage distributions of deaths for sectors of causes for both sexes, 1951-1962

<i>Sectors</i>	<i>1951</i>	<i>1951-1953</i>	<i>1954-1956</i>	<i>1957-1959</i>	<i>1960-1962</i>	<i>1962</i>
<i>Males</i>						
I	6.68	5.55	4.61	4.18	3.43	3.12
II	11.45	12.08	13.74	15.15	16.15	16.16
III	2.24	2.45	2.06	1.69	1.51	1.62
IV	0.41	0.41	0.38	0.36	0.33	0.32
V	0.66	0.70	0.49	0.44	0.42	0.40
VI	13.56	13.92	14.46	14.71	14.07	13.84
VII	21.37	22.54	25.35	26.64	28.31	28.96
VIII	10.51	10.03	9.25	9.23	9.19	9.66
IX	8.66	8.21	7.03	6.91	7.04	7.03
X	2.67	2.62	2.74	2.60	2.48	2.46
XII	0.13	0.13	0.17	0.16	0.13	0.13
XIII	0.26	0.25	0.21	0.19	0.16	0.14
XIV	0.80	0.86	0.98	0.88	0.89	0.85
XV	5.88	5.84	5.68	5.31	4.73	4.49
XVI	8.88	8.36	6.02	4.57	3.97	3.74
XVII	5.84	6.05	6.83	6.98	7.19	7.08
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00
<i>Females</i>						
I	5.14	4.16	3.00	2.61	1.91	1.73
II	12.23	12.73	14.34	15.36	15.89	15.64
III	2.44	2.65	2.56	2.39	2.47	2.70
IV	0.41	0.43	0.42	0.39	0.37	0.35
V	0.52	0.62	0.44	0.36	0.32	0.30
VI	14.24	14.72	15.76	16.58	16.28	15.92
VII	26.09	27.41	30.76	31.71	33.51	34.39
VIII	10.42	10.00	8.84	8.52	8.24	8.62
IX	7.11	6.61	5.49	5.30	5.25	5.18
X	1.64	1.64	1.65	1.52	1.39	1.36
XI	0.55	0.54	0.51	0.45	0.43	0.38
XII	0.16	0.15	0.19	0.20	0.20	0.19
XIII	0.46	0.43	0.36	0.31	0.26	0.23
XIV	0.79	0.82	0.84	0.86	0.87	0.86
XV	5.03	4.99	4.83	4.51	4.04	3.83
XVI	10.75	10.13	7.70	6.31	5.64	5.40
XVII	2.02	1.97	2.31	2.62	2.93	2.92
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

Table 3. Deaths by sex, age groups and sectors of causes—1951 and 1962

<i>Sectors</i>		<i>Total</i>	<i>Up to 5</i>	<i>5-25</i>	<i>25-55</i>	<i>55-75</i>	<i>Over 75</i>
<i>Males</i>							
I.	1951.....	7.2	10.2	2.8	8.7	12.3	7.1
	1962.....	3.4	4.5	0.6	3.0	9.2	7.8
II.	1951.....	12.3	1.3	0.8	6.9	53.3	95.0
	1962.....	17.5	1.4	1.0	7.9	68.3	131.4
V-VI.	1951.....	14.5	2.8	0.7	2.8	54.3	248.7
	1962.....	15.6	2.9	0.6	2.9	45.8	245.8
VII.	1951.....	22.9	0.6	1.1	6.9	77.0	411.1
	1962.....	31.4	0.4	0.7	8.2	90.6	507.9
VIII.	1951.....	11.3	34.6	0.8	2.7	23.7	149.6
	1962.....	10.5	22.0	0.5	2.0	25.5	133.5
IX.	1951.....	9.3	38.8	0.9	4.2	20.1	43.1
	1962.....	7.6	12.7	0.4	3.9	23.3	47.4
XVII.	1951.....	6.3	3.6	3.8	6.5	11.9	19.4
	1962.....	7.7	2.9	4.8	7.5	12.9	31.0
TOTAL	1951.....	107.2	177.7	11.9	43.0	288.2	1,336.4
	1962.....	108.5	115.2	9.4	37.7	293.2	1,286.0
<i>Females</i>							
I.	1951.....	4.9	10.1	3.4	4.9	5.4	5.6
	1962.....	1.6	4.3	0.5	1.1	2.6	5.2
II.	1951.....	11.7	0.9	0.6	7.5	40.4	80.6
	1962.....	14.3	1.4	0.8	7.8	42.5	93.4
V-VI.	1951.....	13.7	2.3	0.5	2.4	43.2	203.5
	1962.....	14.9	2.6	0.4	2.2	35.0	203.0
VII.	1951.....	25.0	0.5	1.3	6.0	69.3	409.9
	1962.....	31.5	0.3	0.7	4.8	64.1	487.0
VIII.	1951.....	1.0	31.4	0.8	1.5	17.2	133.5
	1962.....	7.9	18.9	0.4	0.9	11.6	103.5
IX.	1951.....	6.8	36.8	0.6	2.0	10.8	34.0
	1962.....	4.7	11.4	0.3	1.5	10.7	33.7
XVII.	1951.....	1.9	2.9	1.0	1.2	3.1	13.8
	1962.....	2.7	2.3	1.0	1.4	4.3	23.4
TOTAL	1951.....	95.9	158.5	9.5	29.9	216.2	1,204.4
	1962.....	91.7	96.3	5.0	22.3	185.8	1,099.9

Levels and trends of mortality in Latin America in terms of age

JORGE L. SOMOZA

[Translated from Spanish]

INTRODUCTION

1. In this document a series of life tables for Latin American countries is considered, and the level of mortality over the period 1950-1960 is estimated on that basis. In addition, where the requisite data are available, a study is made of the trend of the probability of death at selected ages over certain periods of time.

2. For the purposes of the study, it was necessary to select a series of mortality indices on a limited basis. For each table in the series four probabilities were developed, corresponding to four widely separated five-year age intervals. In each case, the probability of death is an index of the risk of a person dying within five years after reaching a specific age (*5qx*). The selected ages are: 0, 10, 40 and 70 years, so that the probabilities of death analysed refer to infancy (0-5 years), late childhood (10-15), a period of adult life (40-45) and finally to a corresponding period in old age (70-75). Consequently, these four probabilities provide a fairly complete yet synthesized picture of the level of mortality and its variation according to age.

LIMITATION OF THE BASIC DATA

3. The under-registration of deaths and the small number of population censuses make it difficult to compute mortality rates by ages and hence to establish life tables. In most of the countries of the region under-registration is so widespread that the life tables that could be developed on the basis of registrations would grossly under-estimate the real level of mortality.

4. In order to analyse only information that is reasonably accurate, it is necessary to select from the available tables only those based on relatively reliable statistics; in other words, it is necessary to judge the quality of the basic information used in the establishment of each table. This is not a simple task that can be carried out completely objectively. The author's personal views may have led him to discard from the series examined a number of tables

which, on the basis of different criteria, would have been accepted, and on the other hand he may have included others which, judged more strictly, should have been omitted.

5. The final result of the process of criticism and selection is a series of thirty-five tables relating to nine countries. The number of tables selected is very small, when one considers that there are twenty countries in Latin America and that to study the present level of mortality it would be necessary to have recent tables for each of them, and that to analyse mortality trends a number of life tables covering different periods would be necessary in each case.

6. Fortunately, in this series there are tables corresponding to very different levels, from those showing a very high mortality (Guatemala, 1949-1951; El Salvador, 1950-1961) to the one showing the lowest level in the region (Argentina, 1959-1961), there being others in between which possibly reflect the situation of the majority of the population (Chile, 1960-1961; Mexico, 1959-1961; Panama, 1950-1960). It is therefore likely that the selected series of tables provides a representative picture of the mortality level throughout the region.

LEVEL OF MORTALITY DURING THE PERIOD 1950-1960

7. In order not to limit the estimation of the level of mortality to those few (three) countries for which life tables for the year 1960 were available, it was decided to establish a period of ten years, 1950-1960, and examine the values given in the available tables for years within that period. On this basis there were eighteen tables relating to seven countries.

8. Table 1 summarizes the information on the level of mortality in Latin American countries between 1950 and 1960. It gives the maximum and minimum probability-of-death figures for the selected age groups dealt with in the series of eighteen tables under consideration. For purposes of comparison, this table also contains the corresponding figures given in model life tables drawn up by the United

Nations and in life tables for the United States, with levels of life expectancy at birth similar to those observed in Latin America. Table 2 contains the same information from each table in the selected series.

9. Consideration of the column giving the minimum values recorded prompts the following comments:

(a) A number of countries in the region have attained fairly low levels of mortality. The expectation of life at birth is about 63 years for men, 69 for women;

(b) Taking into consideration the relationship between life expectancy at birth and the probability of death, it may be concluded that the mortality rate in the first years of life (0-5 years) for males is approximately that contained in the United Nations model life tables¹ and is higher than that contained in life tables for the population of the United States. The mortality rate for the female sex in this age group is higher than might have been expected on the basis of the same criteria;

(c) In the age groups corresponding to late childhood (10-15 years) and to old age (70-75), the probability-of-death figures for Latin America seem lower than might have been anticipated in view of the level of life expectancy at birth. This is true for both sexes and when compared with both the model life tables and the United States life tables;

(d) The level of mortality in adulthood (40-45) approximates fairly closely to the estimate that would be reached on the basis of the same terms of comparison.

10. The series of maximum values recorded have the following characteristics:

(a) Life expectancy at birth is about 43.5 years, with little difference between the two sexes;

(b) The most notable deviation between the Latin American probability figures and those in the model life tables is found in the age group 10-15. The observed value is much greater than might have been estimated in terms of the life expectancy. There is a similar but less important deviation in the age group 40-45;

(c) The probability of death in infancy (0-5 years) is somewhat lower in Latin America than that indicated in the model life tables for an equal expectation of life at birth;

(d) Finally, the old-age group (70-75 years) shows the same tendency referred to in the

comments on the minimum values: the observed level of mortality is relatively low, and lower than expected.

11. A comparison of the minimum and maximum values shows how far the countries of the region which have a high mortality rate still have to go to reach the level of those with a lower mortality rate. In absolute terms, the differences are greatest in the age group 0-5, and in relative terms in the age group 10-15.

MORTALITY TRENDS

12. For the purposes of investigating the movement in time of the probability-of-death figures, information relating to only three countries was available. Fortunately, this group comprises populations with very different mortality characteristics: Argentina, which has reached a relatively low level, and Chile and Mexico, countries which clearly illustrate what has certainly occurred in most of the region in recent years, i.e., a marked decline from very high probability-of-death levels. The period analysed in this section is between 1914 and 1961. Information from twenty-four tables is taken into consideration: six relating to Argentina, ten to Chile and eight to Mexico. In this case, the series of life tables by sex for the total population of the United States between the years 1900 and 1960 is taken as a basis of comparison. The results are summarized in table 2.

13. The information presented in table 2 gives rise to the following comments:

(a) A certain parallel can be drawn between the movement of the levels in Argentina and the United States. The probability of death in the United States is always lower than in Argentina (with the exception of the probability of death for men in the age group 70-75) and has been decreasing at an approximately similar rate;

(b) The level of mortality in Chile and Mexico was very high in the years marking the beginning of the study (1920 for Chile, 1930 for Mexico). In both countries very sudden drops occurred in the four age groups studied, which shortened the gap, both absolute and relative, between the levels in Chile and Mexico and those in Argentina and the United States;

(c) The decline in Chile shows a lack of regularity: it is very pronounced between 1920 and 1930 and between 1940 and 1952, but it is slow in the other two periods of time considered. The slowing down of the decline in mortality in Chile has been carefully examined

¹ United Nations, *Age and sex patterns of mortality: model life-tables for under developed countries* (United Nations publication, Sales No.: 55.XIII.9).

in a recent study² and is a phenomenon of great interest. It has been maintained, in view of such facts, that for a decline in mortality to continue beyond a certain limit significant progress must be made in raising the standard of living of a population, i.e. in economic and social development;

(d) The tables studied reveal that mortality in Mexico is declining at a steadier rate than in Chile. There are indications,³ however, that in the years around 1960 the decline was less than in the quinquennium 1950-1955, which would mean that it was following a trend similar to that observed in Chile. The high probability-of-death figures for certain ages, 0-5 and 10-15 in particular, would seem to

indicate that a steady rate of decrease could be maintained.

CONCLUSIONS

14. The following brief conclusions may be drawn from the foregoing:

(a) Reliable basic data, at the regional level, for proper measurement of the level of mortality and adequate study of its evolution are lacking in Latin America;

(b) Despite this limitation, the analysis of the life tables available for certain countries in the region clearly shows that in recent years mortality was very high in some instances, moderately high in perhaps the majority of the countries, and relatively low in a few of them;

(c) The downward trend in the probability-of-death figures, which was very marked in fairly recent periods, has become much less marked. There are signs, possibly indicative of the conditions prevailing in the region, that at present the decline in mortality is slow.

² H. Behm, *Recent Mortality Trends in Chile*, U.S. National Center for Health Statistics, U.S. Department of Health, Education and Welfare, Public Health Service (Washington, 1964).

³ Zulma Recchini and Miguel Clavira, *Proyección de la población de México por sexo y grupos de edad: 1960-1980* (Population projection by sex and age for Mexico: 1960-1980) (CELADE E/CN.CELADE/C.33, B.63.2/3/Rev.1, unpublished (Santiago, 1964).

Table 1. Level of mortality in Latin America between 1950 and 1960 (based on the series of life tables considered) and comparison with the corresponding model life tables drawn up by the United Nations and life tables for the United States

Life expectancy probability of a person of x years of age dying within the period $(x-x+5)$ (${}_5q_x$)	Low level of mortality			High level of mortality	
	Minimum observed value ^a	United Nations model life table value ^b	United States life table value ^c	Maximum observed value ^a	United Nations model life table value ^b
Male					
e_x^0 (in years)	63.13	63.59	63.54	43.82	43.93
${}_5q_x$					
$x-x+5$					
0-5	0.07524	0.07960	0.05150	0.22903	0.23693
10-15	0.00397	0.00527	0.00482	0.03349	0.01736
40-45	0.02501	0.02147	0.03031	0.07000	0.05849
70-75	0.22000	0.24771	0.27475	0.31906	0.34621
Female					
e_x^0 (in years)	68.87	68.83	68.43	43.52	43.57
${}_5q_x$					
$x-x+5$					
0-5	0.06777	0.05450	0.04122	0.22135	0.23786
10-15	0.00291	0.00357	0.00328	0.02999	0.02124
40-45	0.01592	0.01579	0.02146	0.06482	0.05657
70-75	0.18341	0.20066	0.21580	0.31483	0.32452

^a SOURCE: see table 2.

^b The model life tables used are the following:

Male: Nos. 8 and 23.

Female: Average values of Nos. 6 and 7, and model No. 24.

SOURCE: see table 2.

^c The values in the United States tables are an average figure derived from the 1939/1941 and the 1949/1951 tables.

SOURCE: see table 2.

Table 2. Life expectancy and probability of death for selected age intervals, by sex, in a series of life tables for Latin America and the United States

Country	Period covered	Life expectancy (e_0) (in years)	Probability of a person of exactly x years of age dying within the period $x \cdot x + 5$ Age interval				Source
			0-5	10-15 (${}_5q_x$)	40-45	70-75	
Males							
Argentina	1914	46.93	0.19754	0.01306	0.06330	0.31543	<i>a</i>
	1946/48	58.68	0.09622	0.00613	0.03541	0.29875	<i>b</i>
	1959/61	63.13	0.07524	0.00397	0.02501	0.25043	<i>c</i>
Brazil	1940/50	39.96	0.25860	0.03582	0.06947	—	<i>d-e-f</i>
Chile	1919/22	30.90	0.37614	0.02419	0.10978	0.41249	<i>i</i>
	1929/32	39.47	0.30090	0.01460	0.07054	0.33777	<i>i</i>
	1939/42	40.65	0.28557	0.01468	0.06619	0.34705	<i>i</i>
	1952/53	52.95	0.16146	0.00871	0.04502	0.29925	<i>j</i>
	1960/61	54.35	0.15405	0.00608	0.04477	0.28320	<i>j</i>
Costa Rica	1949/51	54.65	0.15892	0.00761	0.03313	0.29806	<i>g</i>
Cuba	1943/53	50.73	0.17833	0.01300	0.04710	0.30071	<i>h</i>
El Salvador	1950/61	44.71	0.21900	0.03349	0.07000	0.22000	<i>k</i>
Guatemala	1949/51	43.82	0.22903	0.02530	0.06740	0.31906	<i>l</i>
Mexico	1930	32.44	0.38515	0.02856	0.08422	0.34523	<i>m</i>
	1940	37.92	0.29879	0.02080	0.08363	0.34970	<i>m</i>
	1949/51	47.94	0.20136	0.01347	0.05932	0.28144	<i>n</i>
	1959/61	57.63	0.12142	0.00772	0.04120	0.22315	<i>o</i>
Panama	1950/60	56.32	0.13888	0.02063	0.03512	0.24533	<i>p</i>
United States	1900/02	47.88	0.19452	0.01389	0.05583	0.30251	<i>m</i>
	1909/11	49.86	0.17282	0.01216	0.05533	0.31622	<i>m</i>
	1919/21	55.50	0.11495	0.01179	0.04283	0.28618	<i>m</i>
	1929/31	57.71	0.08706	0.00869	0.04379	0.29856	<i>m</i>
	1939/41	61.60	0.06376	0.00587	0.03414	0.28537	<i>m</i>
	1949/51	65.47	0.03923	0.00376	0.02647	0.26414	<i>q</i>
	1960	66.58	0.03390	0.00279	0.02290	0.26076	<i>r</i>

Note: The life tables for Brazil, Cuba, El Salvador and Panama considered in the table were established on the basis of a comparison of the results of two censuses.

Country	Period covered	Life expectancy (e_0) (in years)	Probability of a person of exactly x years of age dying within the period $x \cdot x+5$ Age interval				Source
			0-5	10-15 (${}_5q_x$)	40-45	70-75	
			Females				
Argentina	1914	48.86	0.18357	0.01517	0.05654	0.27534	<i>a</i>
	1946/48	62.95	0.08824	0.00564	0.02520	0.22314	<i>b</i>
	1959/61	68.87	0.06777	0.00291	0.01592	0.18341	<i>c</i>
Brazil	1940/50	43.80	0.24390	0.01620	0.06572	—	<i>f</i>
Chile	1919/22	32.21	0.36654	0.02709	0.09806	0.38300	<i>i</i>
	1929/32	41.75	0.28310	0.01664	0.06104	0.27511	<i>i</i>
	1939/42	43.06	0.27187	0.01626	0.05558	0.28596	<i>i</i>
	1952/53	56.83	0.14830	0.00782	0.03468	0.23504	<i>j</i>
	1960/61	59.90	0.13646	0.00499	0.02836	0.22454	<i>j</i>
Costa Rica	1949/51	57.05	0.14365	0.00594	0.03303	0.27596	<i>g</i>
El Salvador	1950/61	47.39	0.19950	0.02999	0.06399	0.20151	<i>k</i>

Table 2. Life expectancy and probability of death for selected age intervals, by sex, in a series of life tables for Latin America and the United States (continued)

Country	Period covered	Life expectancy (e_0) (in years)	Probability of a person of exactly x years of age dying within the period $x-x+5$ Age interval				Source
			0-5	10-15 (e_{15})	40-45	70-75	
Females (continued)							
Guatemala	1949/51	43.52	0.22135	0.02388	0.06482	0.31483	l
Mexico	1930	34.07	0.36869	0.02698	0.06815	0.37947	m
	1940	39.79	0.28806	0.01923	0.06549	0.35044	m
	1949/51	51.51	0.18528	0.01169	0.04302	0.26334	n
	1959/61	60.29	0.11638	0.00648	0.03085	0.21379	o
Panama	1950/60	57.14	0.13321	0.01633	0.04193	0.24128	p
United States	1900/02	50.70	0.16881	0.01331	0.04875	0.28015	m
	1909/11	53.24	0.14883	0.01093	0.04366	0.29150	m
	1919/21	57.40	0.09620	0.01053	0.03890	0.26665	m
	1929/31	60.99	0.07211	0.00700	0.03523	0.26027	m
	1939/41	65.89	0.05152	0.00426	0.02538	0.23488	m
	1949/51	70.96	0.03092	0.00229	0.01753	0.19672	q
	1960	73.15	0.02638	0.00164	0.01402	0.16924	r

Note: the life tables for Brazil, El Salvador and Panama considered in the table were established on the basis of a comparison of the results of two censuses.

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n: Raúl Benítez Z., *Tablas abreviadas de vida por sexo para México 1949-51* (Abridged life tables by sex for Mexico 1949-1951), CELADE, B.58.1/1, unpublished, Santiago (1958).

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p: Vilma Médica, *Análisis de la situación demográfica de Panamá entre 1950 y 1960 y proyección de la población total entre 1960 y 1980* (Analysis of the demographic situation in Panama between 1950 and 1960 and projection of the total population between 1960 and 1980), CELADE, unpublished, Santiago (1964).

q: U.S. Department of Health, Education and Welfare, "United States Life Tables 1949-51", *Vital Statistics Special Reports*, vol. 41, No. 1, Washington (1954).

r: U.S. Department of Health, Education and Welfare, *Life Tables*, Public Health Service, Vital Statistics of the United States 1960, Washington (1960).

Recent mortality in countries of traditionally low mortality

MORTIMER SPIEGELMAN

1. The current health situation in countries of traditionally low mortality is largely the product of gradually developing and smoothly integrated scientific, social, and economic forces. However, even for these countries which are principally the western European and English-speaking countries elsewhere, the history of mortality reduction is not long; the longest record—that for Sweden—dates back only two centuries (fig. 1). The trend of mortality in the West for the century since 1840 was examined by Stolnitz.¹ Patterns of mortality around 1930 and for 1950 in countries of traditionally low mortality were reviewed by the present author at the World Population Conference, Rome, 1954.² This was supplemented by a later paper

which considered the older ages in detail,³ and by another which paid particular attention to trends in causes of death from 1950 to 1960.⁴ For most of the countries of the West, a brief analysis of data for periods about 1960 and 1950 regarding expectation of life, together with crude death rates for each year from 1950 to 1962, and certain other mortality data, was recently made by Biraben, Péron, and Nizard.⁵ This paper surveys patterns of mortality in 1960 for countries of traditionally low mortality and makes some comparisons with like data for 1950 and about 1930 which had previously been presented by the author.

2. *The situation in 1960.* For the sake of comparison, age-adjusted death rates in 1960

¹ G. J. Stolnitz, "A century of international mortality trends: I", *Population Studies*, vol. IX (July, 1955), p. 24.

² Mortimer Spiegelman, "An international comparison of mortality rates at the older ages," *Proceedings of the World Population Conference, 1954*, vol. I (United Nations publication, Sales No.: 55.XIII.8), p. 289, and also "Recent trends and determinants of mortality in highly developed countries, trends and differentials in mortality," *Proceedings of the 1955 Annual Conference* (New York, Milbank Memorial Fund), p. 51.

³ Mortimer Spiegelman, "Recent trends in mortality at the older ages in countries of low mortality," *International Population Conference, New York, 1961*, vol. I (London, International Union for the Scientific Study of Population, 1963).

⁴ Mortimer Spiegelman, "Mortality trends for causes of death in countries of low mortality," *Demography*, vol. II (1965).

⁵ J. N. Biraben, Y. Péron and A. Nizard, "La situation démographique de l'Europe occidentale," *Population*, 19^e année, numéro 3 (Juin-Juillet, 1964), p. 439.

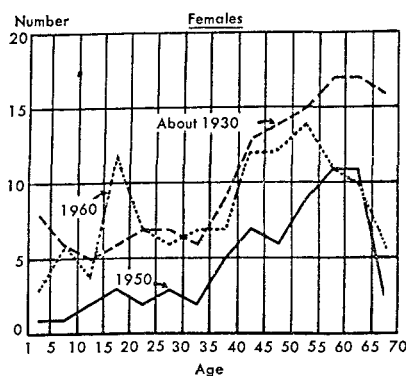
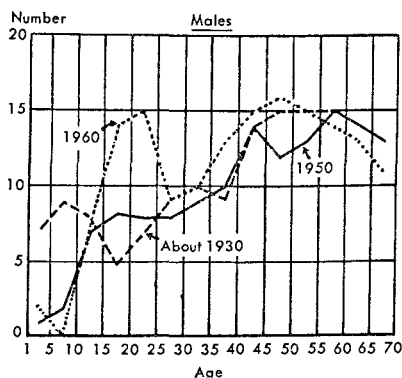


Figure 1

Number of countries^a with age-specific death rates lower than the United States (white persons): 1960, 1950 and 1930^b

^a Total of 18 countries of Western Europe and English-speaking countries elsewhere.

^b The years range from 1930 to 1932 for individual countries.

for four broad age groups and for all ages combined have been computed on the same basis as on the previous occasion, namely the age distribution of the total population of the United States in 1950. The results are shown at the left in table 1. For all ages, age-adjusted death rates in 1960 averaged 10.3 per 1,000 for males and 7.0 for females. For each sex, the lowest death rates were experienced in Norway, with the Netherlands a close second. On the other hand, the highest age-adjusted death rates were recorded in Portugal, where they were more than 50 per cent greater than in Norway, the Netherlands, or Sweden.⁶

3. *Comparisons with 1950 and 1930.* The averages of age-adjusted death rates for 1960 according to sex and age are compared with those for 1950 and about 1930; these data appear in the lower part of table 1. They show a reduction in mortality for each sex-age category, except for males at ages 65 and over in 1960. However, the crude death rates of Biraben, Péron, and Nizard show that most of the mortality reduction in the decade since 1950 occurred during the early years. Analysis according to cause of death indicates that this situation may be due to a slackening of improvement or a regression in the trend of mortality from the cardiovascular-renal diseases and also from influenza and pneumonia.⁷

(a) The general reduction in mortality from 1950 to 1960 in the countries under review was accompanied by a lessening in the extent of variation in their death rates. This is apparent from the smaller standard deviations for 1960 than for 1950 in each sex-age category except for males at ages 65 and over. The decrease in variation thus continued a trend since 1930, noted previously by the author, and more generally for the century since 1840 by Stolnitz;

(b) Notwithstanding the substantial mortality reductions from 1930 to 1960 and the corresponding lessening in the extent of variation in their death rates, there has been relatively little change in the ranking of the countries under review according to mortality level. Thus, the coefficient of rank correlation for all ages combined between 1950 and 1960 was 0.92 for males and 0.93 for females. As might be expected, for the longer interval of comparison, between 1930 and 1950, the coefficient of rank correlation was somewhat smaller, namely 0.83 for each sex.

4. *Ratio of death rates—1960 to 1950.* For each of the four broad age groups shown in table 2, the average reduction in age-adjusted death rates from 1950 to 1960 for the countries under consideration was greater for females than for males. Also, the rate of reduction tended to decrease with advance in age. These characteristics are a continuation of those observed previously from about 1930 to 1950.

(a) Each of the countries under review recorded lower age-adjusted death rates at ages under 25 years in 1960 than in 1950. For males, the average reduction was 31 per cent, while that for females was 35 per cent. Finland established the best record for improvement, with reductions of 46 per cent for males and 53 per cent for females. Improvement was slowest in the Union of South Africa, the reductions amounting to only 9 per cent for males and 15 per cent for females. Although the standard deviation in the ratio of 1960 to 1950 death rates was only 0.03 for males, it was as high as 0.11 for females;

(b) The reduction in death rates at ages 25-44 from 1950 to 1960 was 19 per cent for males and 35 per cent for females. The range of variation in these changes was appreciable. Thus, Ireland had reductions of 39 per cent for males and 54 per cent for females. On the other hand, males in South Africa were alone in showing a rise in death rates, the increase amounting to 6 per cent; females in Denmark had the lowest rate of mortality reduction, namely 19 per cent. The standard deviation of the ratios of death rates in 1960 to those of 1950 was 0.11 for males and 0.09 for females;

(c) On the whole, the age-adjusted death rates for males at ages 45 and over for 1960 were little different from those in 1950. For ages 45-64 years, the average reduction amounted to only 4 per cent while at ages 65 and over there was practically no change. Also, there was relatively little variation among the countries in the ratios of death rates in 1960 to those in 1950, the standard deviation amounting to only 0.02 for both ages 45-64 and 65 and over. In other words, the rate of change in the death rates for males at ages 45 and over varied little in general from one country to another. On the other hand, the average reduction for females amounted to 18 per cent at ages 45-64 years and 8 per cent at ages 65 and over. Although the respective standard deviations in the ratios of death rates of 1960 to 1950 (namely 0.04 and 0.05) were somewhat larger than for males, they were still small enough to indicate relatively little variation among the countries in their rates of

⁶ Spain is omitted from this review, as it was omitted previously by the author, because the population base was not then available for the computation of age-specific death rates.

⁷ Mortimer Spiegelman, "Mortality trends for causes of death in countries of low mortality," *Demography*, vol. II (1965).

change over the decade. It is noteworthy that, at ages 65 and over, death rates were higher in 1960 than in 1950 for seven out of the nineteen countries under review in the case of males, but in only one for females. At ages 45-64 years, there were four countries with such experience for males and none for females.

5. *Ratio of death rates—males to females.* These ratios are shown at the right of table 1. In 1960, the average of the age-adjusted death rates for males to the average for females was 1.5 at all ages combined, compared with 1.3 for 1950 and 1.2 about 1930. In other words, the relatively greater reduction in mortality of females compared with males previously observed from 1930 to 1950 has continued through 1960. This continuing advantage for females was shared by each of the four broad age groups. In general, for each of the three periods of comparison, this advantage of females was greatest at ages 45-64 and least at ages 65 and over. However, in five out of the nineteen countries under review, this advantage was not held at ages 45-64 years.

6. *Rank.* The ranking of countries on the basis of a single index of mortality, such as an age-adjusted death rate for all ages, masks their variation in rank when considered according to sex and age. Thus, among the nineteen countries under review, white males in the United States in 1960 were outranked by eight countries with lower age-adjusted death rates for all ages; in the case of white females in the United States, there were four such countries. However, the accompanying graph shows that, for white males in the United States in 1960, no country had a lower death rate at ages five to nine years, but that there were fifteen such countries at ages 20-24

years, a situation arising from the very high accident mortality in the United States. The coefficient of rank correlation between the age-adjusted death rates for ages under 25 and ages 65 and over provides an index of the shift in rank with advance in age; this coefficient was 0.58 for males and 0.47 for females. It may be noted, incidentally, that the model life tables for developing countries prepared by the United Nations would show a coefficient of 1.⁸

7. *Conclusion.* It has been observed that "... to a surprising extent in any society, disease occurs in definable patterns that closely reflect the over-all pattern of that society".⁹ The very low death rates before midlife in the countries of western Europe and English-speaking countries elsewhere reflect not only the control of infectious diseases, but also advances in medical therapy and surgery; as a consequence, the chronic diseases have emerged as their major health problems. This is distinct from the mortality situation in the developing countries where infectious diseases are endemic on a large scale; these areas still have substantial room for improvement in their public health and medical care programmes. Their progress will undoubtedly bring them toward the mortality patterns of the countries already in a high stage of economic development, and also toward the health problems associated with industrialization.

⁸ United Nations, *Age and Sex Patterns of Mortality: Model Life-Tables for Under-Developed Countries* (United Nations publication, Sales No.: 55.XIII.9).

⁹ K. M. West, ed., *First national institutes of health international symposium*, Public Health Service Publication No. 1210 (U.S. Department of Health, Education and Welfare), p. 9. The quotation is from Dr. Walsh McDermott, Cornell University Medical College.

Table 1. Age-adjusted death rates* per 1,000 in broad age groups by sex for selected countries of low mortality, 1960

Death rates per 1,000															
Country	Males					Females					Ratio of male to female death rates				
	All Ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over	All Ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over	All Ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over
United States, white	10.5	2.3	2.4	15.0	70.9	6.4	1.5	1.3	7.3	48.4	1.6	1.5	1.8	2.1	1.5
England and Wales.	10.5	2.0	1.7	13.4	78.6	6.6	1.4	1.2	7.0	51.9	1.6	1.4	1.4	1.9	1.5
Scotland	11.7	2.3	2.1	16.1	84.4	7.9	1.7	1.5	8.6	61.5	1.5	1.4	1.4	1.9	1.4
Australia ^a	10.6	2.1	2.2	13.5	77.7	6.7	1.5	1.4	7.3	51.3	1.6	1.4	1.6	1.8	1.5
New Zealand ^b	9.4	1.8	1.8	11.9	70.0	6.3	1.4	1.1	6.7	49.3	1.5	1.3	1.6	1.8	1.4
Canada	9.9	2.6	2.2	12.8	67.8	6.6	1.8	1.3	7.0	49.3	1.5	1.4	1.7	1.8	1.4
Union of South Africa ^c	12.3	3.2	3.5	16.8	80.2	7.8	2.2	1.8	9.2	55.1	1.6	1.5	1.9	1.8	1.5
Ireland	9.9	2.4	2.0	12.0	71.6	7.6	1.8	1.6	8.6	57.3	1.3	1.3	1.3	1.4	1.2
Netherlands	8.1	1.7	1.5	9.7	60.5	6.0	1.2	1.0	5.7	49.8	1.4	1.4	1.5	1.7	1.2
Belgium	11.2	2.7	2.2	14.4	79.9	7.3	1.9	1.3	7.1	57.7	1.5	1.4	1.7	2.0	1.4
France	10.6	2.4	2.5	14.0	73.5	6.4	1.7	1.4	6.7	47.9	1.7	1.4	1.8	2.1	1.5
Switzerland	9.7	2.3	2.0	11.4	72.0	6.7	1.4	1.1	6.5	54.6	1.4	1.6	1.8	1.8	1.3
Germany, Federal Republic	11.2	3.0	2.3	13.4	80.2	7.8	2.1	1.5	7.3	61.7	1.4	1.4	1.5	1.8	1.3
Denmark	8.6	1.9	1.6	10.1	65.3	6.7	1.3	1.3	6.8	54.5	1.3	1.5	1.2	1.5	1.2
Norway	8.0	1.9	1.8	9.2	59.0	5.8	1.2	0.9	5.2	48.3	1.4	1.6	2.0	1.8	1.2

Table 1. Age-adjusted death rates * per 1,000 in broad age groups by sex for selected countries of low mortality, 1960 (continued)

Death rates per 1,000															
Country	Males					Females					Ratio of male to female death rates				
	All Ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over	All ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over	All ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over
Sweden	8.3	1.7	1.6	9.2	64.8	6.3	1.1	1.1	6.1	52.8	1.3	1.5	1.5	1.5	1.2
Finland	12.5	2.2	3.3	17.3	86.4	7.9	1.4	1.4	7.6	65.4	1.6	1.6	2.4	2.3	1.3
Portugal	12.8	6.5	3.0	13.1	79.9	9.5	5.5	1.8	7.0	64.5	1.3	1.2	1.7	1.9	1.2
Italy	10.5	3.5	2.1	12.3	72.6	7.5	2.8	1.4	6.7	55.8	1.4	1.3	1.5	1.8	1.3
Average: 1960....	10.3	2.6	2.2	12.9	73.4	7.0	1.8	1.3	7.1	54.6	1.5	1.4	1.6	1.8	1.3
1950.....	11.1	3.8	2.8	13.6	73.2	8.5	3.0	2.1	8.7	59.6	1.3	1.3	1.3	1.6	1.2
About 1930....	14.4	7.5	5.1	16.0	79.7	12.2	6.5	4.5	12.4	69.6	1.2	1.2	1.1	1.3	1.1
Standard deviation:															
1960....	1.4	1.0	0.5	2.3	7.5	0.9	1.0	0.2	0.9	5.4	0.12	0.11	0.27	0.21	0.12
1950.....	1.7	1.8	0.9	2.7	7.1	1.1	1.7	0.6	1.0	4.5	0.11	0.12	0.20	0.21	0.11
About 1930....	2.4	2.5	1.5	3.1	8.7	1.7	2.5	1.0	1.7	5.7	0.07	0.06	0.14	0.19	0.08
Coefficient of variation:															
1960....	0.14	0.41	0.25	0.18	0.10	0.12	0.52	0.18	0.13	0.10	0.08	0.08	0.16	0.11	0.09
1950.....	0.15	0.48	0.31	0.20	0.10	0.13	0.58	0.28	0.11	0.08	0.08	0.09	0.15	0.13	0.09
About 1930....	0.16	0.34	0.29	0.19	0.11	0.14	0.39	0.21	0.14	0.08	0.06	0.05	0.13	0.15	0.07
Coefficient of rank correlation: ^d															
1960 versus 1950.	0.92	0.91	0.86	0.93	0.75	0.93	0.83	0.86	0.90	0.84	—	—	—	—	—
1950 versus 1930.	0.83	0.86	0.81	0.80	0.71	0.83	0.89	0.69	0.61	0.44	—	—	—	—	—

SOURCE: the statistical measures for 1950 and about 1930 were taken from an earlier paper by the author, "An international comparison of mortality rates at the older ages," *Proceedings of the World Population Conference, Rome, 1954*, vol. I (United Nations publication, Sales No.: 55.XIII.8), p. 289. Data for Spain were then omitted, since a population base was not available for the computation of rates.

* Adjusted on the basis of the age distribution of the total population of the United States census of April 1, 1950.

^a Excluding full-blooded aboriginals.

^b Excluding Maoris.

^c Europeans only.

^d Spearman coefficient comparing ranks.

Table 2. Ratio of death rates in 1960 to those in 1950 by age and sex for selected countries of low mortality

Country	Males					Females				
	All ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over	All ages	Ages under 25	Ages 25-44	Ages 45-64	Ages 65 and over
United States, white.....	0.95	0.82	0.86	0.97	0.98	0.85	0.79	0.76	0.84	0.90
England and Wales.....	0.92	0.74	0.74	0.92	0.97	0.83	0.67	0.63	0.83	0.88
Scotland	0.95	0.68	0.75	0.95	1.03	0.83	0.61	0.54	0.84	0.92
Australia ^a	0.95	0.78	0.92	0.94	0.98	0.86	0.79	0.78	0.84	0.90
New Zealand ^b	0.93	0.78	0.95	0.98	0.94	0.83	0.82	0.65	0.79	0.86
Canada	0.98	0.70	0.92	0.99	1.06	0.85	0.64	0.65	0.82	0.92
Union of South Africa ^c	1.04	0.91	1.06	1.01	1.09	0.91	0.85	0.78	0.93	0.94
Ireland	0.84	0.60	0.61	0.87	0.93	0.75	0.51	0.46	0.80	0.87
Netherlands	0.96	0.71	0.88	1.07	0.98	0.82	0.67	0.71	0.79	0.86
Belgium	0.93	0.60	0.71	0.96	1.04	0.82	0.58	0.59	0.78	0.94
France	0.88	0.59	0.76	0.94	0.95	0.78	0.53	0.61	0.79	0.88
Switzerland	0.89	0.70	0.80	0.86	0.96	0.82	0.61	0.61	0.76	0.90
Germany, Federal Republic.....	0.99	0.64	0.79	1.06	1.11	0.86	0.58	0.71	0.85	0.96
Denmark	0.92	0.70	0.84	0.98	0.97	0.84	0.68	0.81	0.83	0.87
Norway	0.95	0.68	0.90	1.03	0.99	0.85	0.60	0.64	0.80	0.93
Sweden	0.92	0.77	0.84	0.92	0.96	0.83	0.73	0.69	0.78	0.87
Finland	0.89	0.54	0.73	0.89	0.99	0.83	0.47	0.56	0.82	0.95
Portugal	0.84	0.61	0.59	0.87	1.03	0.83	0.59	0.51	0.78	1.09
Italy	0.95	0.63	0.75	0.98	1.10	0.82	0.57	0.64	0.82	0.95
Average of ratios.....	0.93	0.69	0.81	0.96	1.00	0.83	0.65	0.65	0.82	0.92
Standard deviation.....	0.05	0.03	0.11	0.02	0.02	0.03	0.11	0.09	0.04	0.05
Coefficient of variation.....	0.05	0.04	0.14	0.02	0.02	0.04	0.16	0.14	0.05	0.06
Indices of change: 1950 from about 1930 ^d										
Average of ratios.....	0.77	0.49	0.54	0.85	0.92	0.69	0.44	0.46	0.70	0.86
Standard deviation.....	0.07	0.09	0.08	0.09	0.08	0.06	0.08	0.08	0.07	0.08
Coefficient of variation.....	0.08	0.17	0.14	0.11	0.09	0.08	0.19	0.18	0.10	0.09

SOURCE: see table 1.

^a Excluding full-blooded aboriginals.

^b Excluding Maoris.

^c Europeans only.

^d The indices of change exclude Germany.

Recent mortality declines in Latin America, Asia and Africa: review and some perspectives

GEORGE J. STOLNITZ

1. The post-war revolution in mortality among the world's lowest income areas pursues an ever-widening course. Headlong mortality declines in such areas first became prominent about two decades ago in a few scattered instances. Today, they have become commonplace and near-continental. Large parts of Latin America and Asia have already experienced such declines and much of Africa seems likely to do so in the near future. With amazing regularity, the nations of these regions which provide reasonably reliable information show recent ten- to twenty-year trends which match or exceed the maximum declines ever found in the industrialized, low-mortality parts of the world.

2. The basic causal factors behind the recent closing of the "mortality gap" between richest and poorest nations have been non-economic or barely economic in the main. Rather, they appear to have involved much more the availability of public health and disease control methods which (a) are essentially new in degree of effectiveness relative to the costs and personnel required to implement them; (b) can be imported far more easily than ever before; and (c) have been almost unhindered by the social and structural obstacles besetting other forms of development. To explain the mortality trends encountered in Latin America, Asia and Africa, we need to look primarily at governments and public health agencies, not general economic development or even fiscal capacities. Equally, we need to look for prime causes at international, rather than domestic sources of medical skills, and even more at the effectiveness with which available resources can be organized than at their overall supply. The new systems of public health in today's developing areas seem to break with the past almost as strikingly by their innovations in form as by their results.

3. A generation or so ago, the comparative mortality position of Latin America, Asia and Africa was almost as simple as it was stark. About 1920, expectation of life practically everywhere in each of these regions was far

below the levels found in western Europe three quarters of a century earlier, about 1850.

4. The inter-war period, with its occasionally noteworthy trends may have modified the details of the gap but not its essence. A convenient and revealing standard in this regard is provided by the populations of "the West", or Western, Northern and Central Europe, Canada, Australia, New Zealand and the United States, which have led the world's mortality transitions in the modern era. An estimate derived at length elsewhere suggests that only 5 to 10 per cent of the total 1950 population of Latin America, Asia and Africa had reached a level of life expectancy such as was already average for the West in 1900, a half-century earlier.¹ The onset of modern, twentieth century mortality conditions among major parts of any of the first three regions, therefore, began well under two decades ago.

5. Taking the years between the 1930's or 1940's to the latest period for which a life table has been published by the United Nations, the available evidence on trends in life expectancy at birth within Latin America, Asia and Africa is summarized in table 1. Also shown are selected values for populations in various European areas, to permit comparison with the levels of this measure in relatively higher income areas. The selected values range from the low Portugal measure to the high Swedish level. As is well known, such international comparisons of levels are entirely meaningful. Unlike crude death rates, life expectancy measures are determined by mortality alone and are unaffected by differences in age composition or fertility.

6. Table 2, on death rates, deals with Latin America, Asia and Africa only and is intended to be viewed mainly for its indications of trends. Because inaccuracies make the published death rates for many populations in these regions highly dubious, even for examining

¹ G. J. Stolnitz, "A century of international mortality trends: I", *Population Studies*, vol. IX, No. 1 (1955), pp. 24-55.

trends, the areas cited are restricted to those believed to have relatively reliable information. Table 2 helps round out the picture somewhat on life expectancy in low income areas, by presenting the mid-points of ranges of estimation recently prepared by the Economic Commission for Latin America. Since the original ranges are themselves open to uncertainty and the use of mid-points raises further questions still, the tabulation permits only loose inferences about either levels or trends. Nevertheless, the availability of uniform periods for calculating changes offer advantages not provided by table 1. Probably the indicated changes suggest adequately the order of magnitude of the upward thrust of life expectancy in much or most of Latin America.

7. The outstanding aspect of all these compilations is, of course, the enormous sweep of change they suggest. Converted to an annual basis for uniformity, the average increases in expectation of life in table 1 average 0.5 years in nearly every case. Often they are close to or above one year per annum. It is interesting that also table 2, despite its inadequacies, suggests an average annual rise exceeding 0.5 years for most of Latin America.

8. Perspective on these magnitudes is afforded by Western experience. As has been indicated elsewhere "... an annual rise of only two-thirds of a year is well above the largest short-run increases found in Western nations." Before 1900 in the West, according to available records, "the average rise in life expectancy amounted annually to about two-tenths of a year ... The increases since 1900, although larger, have been only four-tenths ...".² Percentage comparisons would be correspondingly one-sided.

9. Corresponding perspectives are again suggested by the trends for death rates. Except for Argentina, every area listed in table 3 shows a decline between 1935 to 1939, and 1955 to 1959, which is in excess of 6 per 1,000.³ The most rapid twenty-year declines ever recorded among the nations of the West occurred roughly in 1890 to 1910 or in 1910 to 1930, and the largest of these was in Germany, about

5 to 6 per 1,000. The Netherlands had the next largest decline, 4 to 5 per 1,000; and almost all other Western areas had changes under 4 per 1,000. Earlier twenty-year declines during the nineteenth century, when Western mortality levels were more comparable with the under-developed areas a decade or two ago, rarely, if ever, exceeded these lower magnitudes. Thus, even with due allowance for possible distortions in comparing changes in death rates, it is clear that the recent trends in much of Latin America and in parts of Asia and Africa have involved an entirely different and higher range of magnitudes. In the West changing death rates over twenty-year periods almost never raised the annual growth rate by as much as one-half per cent. In every less-developed area with comparatively reliable data, and probably a fair number of cases not shown here, the recent shifts have either exceeded or far exceeded this level. More typically, the effects on the growth rate have been more like 1 per cent.

10. As to the future, the evidence seems far more persuasive that the recent mortality declines on record will be preserved or enhanced, and large declines registered in still other areas, than that the current record will prove abortive or atypical. No signs of relapse are found for any of the areas providing a basis for judgement. So far as can be seen from the 1960-1963 death rates in table 3, mortality has invariably continued to come down or has at least stayed the same.

11. Similar indications of enormous recent mortality declines and sustained directions of change are found in a great many other parts of Latin America, Asia and Africa, which either have smaller populations or less reliable data than the areas cited in tables 1 and 3.

12. As a broad hypothesis, it would appear that a life span of at least 50 to 55 years should be soon attainable in all low income parts of the world where Governments are willing to seek such targets. Beyond the point of some 50 to 55 years, the going may be slower. Although it would be surprising if a very considerable number of populations in all three of the regions under study did not exceed the 60 level in the next decade or two, it would be more surprising if a great many more did not reach 50 within the same near future. Other things equal, such a development would imply a considerable convergence of population growth rates throughout the under-developed world, to the levels now found mainly in parts of Latin America and Asia.

² Stolnitz, op. cit.

³ In a sense, the exception is largely extraneous to the present discussion. Together with Uruguay, Argentina has historically been well ahead of economic developments in most parts of Latin America (as well as in less-developed areas elsewhere) and contains a population ethnically atypical for this region. Possibly for these reasons, both countries had experienced before the war very substantial long-run declines in both fertility and mortality.

Table 1. Recent trends in expectation of life at birth, Latin America, Asia and Africa, by sex

<i>Population</i>	<i>Periods</i>	<i>Male</i>	<i>Female</i>
<i>Latin America</i>			
Chile	1940	40.9	43.2
	1952	49.8	53.9
El Salvador	1949-51	49.9	52.4
	1960-61	56.6	60.4
Jamaica	1940-42	51.7	54.5
	1950-52	55.7	58.9
Mexico	1940	37.9	39.8
	1956	55.1	57.9
	1960	56.9	60.4
Panama	1941-43	50.5	53.5
	1952-54	60.4	63.1
Puerto Rico	1939-41	45.1	46.9
	1960	67.3	72.1
Trinidad and Tobago	1930-32	44.5	47.0
	1945-47	53.0	56.0
	1957	59.9	63.4
Venezuela	1941-42	45.8	47.6
	1950-51	56.3	58.8
<i>Asia</i>			
Ceylon	1947	52.6	51.0
	1954	60.3	59.4
India	1941-50	32.4	31.7
	1957-58	45.2	46.6
Japan	1935-36	46.9	49.6
	1949-50	56.2	59.6
	1962	66.2	71.2
Taiwan	1936-41	41.1	45.7
	1959-60	61.3	65.6
<i>Africa</i>			
Mauritius	1942-46	32.2	33.8
	1951-53	49.8	52.3
South Africa, Asiatic	1945-47	50.7	49.8
	1950-52	55.8	54.8
South Africa, Col.	1935-37	40.2	40.9
	1945-47	41.7	44.0
	1950-52	44.8	47.8
<i>Other regions, selected recent levels</i>			
Czechoslovakia	1960-61	67.6	73.1
Ireland	1950-52	64.5	67.1
Italy	1954-57	65.8	70.0
Portugal	1957-58	59.8	65.0
Sweden	1962	71.3	75.4

SOURCE: United Nations, *Demographic Yearbook*, 1957, 1961 and 1963 (United Nations publication, Sales Nos.: 57.XIII.1, 62.XIII.1, 64.XIII.1, respectively), supplemented by *Population Index*, vol. 30, No. 4 (October 1964) and earlier issues for Venezuela.

Table 2. ECLA estimates of expectation of life at birth, 1945-1950 and 1955-1960, Latin America, combined sexes (mid-points of ranges of estimation)

<i>Population</i>	<i>1945-1950</i>	<i>1955-1960</i>
<i>Temperate South America</i>	58.6	62.6
Argentina	61.5	65.0
Chile	49.0	54.5
Uruguay	63.5	66.5

Table 2. ECLA estimates of expectation of life at birth, 1945-1950 and 1955-1960, Latin America, combined sexes (mid-points of ranges of estimation) (*continued*)

<i>Population</i>	<i>1945-1950</i>	<i>1955-1960</i>
<i>Tropical South America</i>	44.0	51.6
Bolivia	39.0	42.5
Brazil	44.0	54.0
Colombia	46.0	50.5
Ecuador	40.5	45.5
Paraguay	50.0	54.0
Peru	44.0	51.5
Venezuela	47.5	55.0
<i>Central America and Antilles</i>	46.0	52.0
Costa Rica	55.0	59.0
Cuba	55.0	59.0
Dominican Republic	41.5	47.0
El Salvador	43.5	50.0
Guatemala	39.5	43.0
Haiti	35.0	40.5
Honduras	43.0	47.5
Mexico	46.5	53.0
Nicaragua	48.5	52.5
Panama	50.5	56.5

SOURCE: A. Sauvy, "La population des pays d'Amérique latine," *Population*, No. 1 (March, 1963).

Table 3. Trends in crude death rates, 1935-1939, 1955-1959 and 1960-1963 Latin America, Asia and Africa^a

<i>Population</i>	<i>1935-1939</i>	<i>1955-1959</i>	<i>1960-1963</i>
<i>Latin America</i>			
Argentina	11.6	8.6	8.1
Barbados	20.6	10.5	9.5
British Guiana	21.8	10.9	8.6
Chile	23.7	12.6	11.9
Costa Rica	20.0	9.6	8.4
El Salvador	21.1	13.2	11.0
Guatemala	26.5	19.9	17.0
Jamaica	16.6	9.7	8.9
Mexico	23.3	12.5	10.9
Puerto Rico	19.0	7.1	6.8
Trinidad and Tobago.....	16.6	9.6	7.6
<i>Asia</i>			
Ceylon	24.5	9.9	8.4
Federation of Malaya.....	20.8	11.3	9.2
Hong Kong	29.1	7.2	5.9
Japan	17.4	7.8	7.4
Singapore	22.1	7.3	6.0
Taiwan	20.2	8.0	6.5
<i>Africa</i>			
Cape Verde Islands.....	23.7	13.2	13.2
Mauritius	27.3	12.0	10.0

SOURCE: United Nations, *Demographic Yearbook*, 1954 and 1963 (United Nations publication: Sales Nos.: 54.XIII.5 and 64.XIII.1 respectively) supplemented occasionally by: United Nations, *Population and Vital Statistics Report*, vol. IV, No. 4 (United Nations publication, Sales No.: 54.XIII.6).

^a Listed areas are essentially all belonging to the three regions which have had a population over 100,000 in a recent year, providing published death rates for the indicated periods, and having a vital registration system which is coded in the 1963 yearbook as "C" or at least 90 per cent complete. Ceylon is not so coded but has been included since a 1953 survey estimated very nearly this level of completeness. Surinam has been excluded as showing highly questionable prewar data, though otherwise eligible. "European" populations of Africa are excluded as atypical of the region, although a number of these meet the above requirements formally. Several averages are for fewer years than shown. See above sources for additional explanatory comments.

Mortality in South-East Asia

H. WIESLER

[Translated from French]

I. INTRODUCTION

1. Roughly speaking, South-East Asia includes the area between the Tropic of Cancer and latitude 10° South, and between longitudes 95° and 150° East, and therefore takes in the following States (or territories): Thailand, Cambodia, Laos, North Viet-Nam, the Republic of Viet-Nam, the Federation of Malaya, Singapore, Indonesia, the Philippines, New Guinea, Timor, Brunei, North Borneo and Sarawak. The total population of the region is about 200 million, half of it in the Indonesian archipelago. The two Viet-Nams together and the Philippines each have populations of about 30 million, while that of Thailand is somewhat less.

2. Because of its position near the Equator, this vast region has a fairly uniform climate, characterized by intense heat, high humidity and rainy and dry seasons. However, it varies considerably in altitude and ethnic composition. Immense plains where the main crop is rice form a contrast with mountainous regions. Besides the Indonesian peoples there are several million Chinese concentrated chiefly in the towns, and many indigenous tribes, sometimes of unknown origin, live in the remote mountain areas.

3. Mortality cannot, of course, be the same throughout such a huge region, since it contains towns with good health facilities as well as agricultural and mountain areas where many diseases are still rife (malaria, yaws, tuberculosis, amoebiasis, etc.).

4. With a few exceptions, mortality statistics in these territories are of very poor quality and the few available figures are untrustworthy. The main reason for this is under-registration of deaths, which is due to many factors. Thus, in rural areas, registry offices are often very scattered, so that many of the inhabitants do not go to the trouble to report deaths, particularly, since people can be buried without great formality.

5. We find that, with the exception of the Federation of Malaya, the mortality figures

obtained for an entire country are useless for measuring mortality in a given country, so that sample surveys have to be made instead. Such surveys have been carried out in Cambodia and (by the author of this paper) in the Republic of Viet-Nam. In this paper, these results are supplemented by an analysis of mortality in the Federation of Malaya.

II. METHOD OF MEASUREMENT

6. To measure mortality we shall use the life table method, which, of course, provides the most accurate and at the same time the most detailed figures. However, since both deaths and the number of survivors exposed to risk are given only by age groups, we have to use a group method to construct the life table. We shall use a method which was first published in 1947 by the author of this paper and which has been used on a number of occasions since then in several countries.¹

7. *Life table for the Federation of Malaya.* The number of persons exposed to risk is taken from the census of June 1956. As we are working on the basis of deaths for the years 1955, 1956 and 1957, we use that figure multiplied by three. Since the census date is approximately in the middle of the observation period and this is not long—so that the balance of migration is negligible—the central death rate is an accurate reflection of actual mortality. The census was taken carefully, and the registration of births and deaths is among the best in South-East Asia. Persons whose age could not be determined have no significant effect: they accounted for 535 male and 243 female deaths, and 1,031 males and 783 females in the surviving population. The results of the calculations are shown in tables 1, 2 and 3.

8. *Life table for Saigon-Cholon and its suburbs.* At present, it is virtually impossible

¹ Fuller details of this method can be found, *inter alia*, in: H. Wiesler, "Une méthode simple pour la construction de tables de mortalité abrégées" *Proceedings of the World Population Conference, Rome 1954*, vol. IV (United Nations publication, Sales No.: 55.XIII.8) pp. 1,063-1,073.

to construct a life table for the whole territory of Viet-Nam, or even for South Viet-Nam alone. The many obstacles include: lack of knowledge of the exact size of the population and its age and sex distribution; major omissions, particularly in rural areas, in the registration of births, marriages and deaths; considerable internal migration for which there are no statistics; constant immigration, particularly from the northern part of Viet-Nam.

9. Nevertheless, we believe that we have the necessary data, at least for Saigon and its suburbs, to construct a life table giving a fairly accurate picture of the mortality of the population in that area in normal times. More specifically, this applies to the city of Saigon and the four suburbs of Bint-Hoà, Thanh-my-Tay, Hanh-Thông and Phu-Nhuân.

10. The table relates to deaths occurring in the years 1958-1959. It is true that two years constitute a short period for a table covering only the population of one city, even though it has about 1.5 million inhabitants. Because of this we have to take into consideration substantial random deviation, but we avoid systematic deviations, which are of course a much greater danger. Indeed, as already stated, there is considerable population movement inside the country. For this reason, the size and particularly the age and sex structure of the population can change in a short time. As in the majority of countries, we do not have progressive statistics accurate enough to determine the population and its structure at the end of each year. In addition, the further back we go, the more incomplete the registration of births and deaths becomes. Moreover, we did not feel we could use observations for the year 1960, since there was some movement towards the city because of the lack of security in rural areas. For these reasons, we confined our observations to the years 1958 and 1959, thus including the date of the population survey at the end of 1958.

11. However, the mortality figures collected by registry offices require correction for one factor. Since the main hospitals are in the capital, there is some inflow of sick people for treatment there, particularly civil servants. Those who die are included in the mortality figures for Saigon, where a *de facto* registration system operates. On the other hand, many elderly people who are followers of the ideas of Confucius withdraw to their birth-place in the country when they feel their end approaching.

12. Thus, these movements to some extent offset each other, but, as already pointed out, we have no exact data on them. By contrast,

hospital statistics, on the one hand, and comparison of the population pyramids for city and provinces, on the other hand, can afford useful guidance. The study of these figures led us to make a correction in the crude probabilities of death, reducing these values by 10 per cent from age 40 onwards.

13. Since it was not possible to take a recent general census of the whole population of Viet-Nam, or even of its cities, the National Statistical Institute carried out a sample population survey in the main cities of South Viet-Nam. These investigations yielded numerical data on the population and its structure by sex, age, marital status, level of education, occupation, branch of industry activity, etc.²

14. From the number of deaths and survivors, we constructed a life table whose results are shown in tables 1, 2 and 3. The complete tabulation is given in table 4.³ In view of the many difficulties encountered in preparing this table and the virtual impossibility of obtaining estimates on the very considerable migratory movements of women, we confined our calculations to males. As far as practical applications are concerned, this table is the only one used in the majority of cases.

III. RESULTS AND COMPARISONS

15. Unfortunately, there are very few modern tables for Asian countries which can be compared with ours. Since mortality has fallen considerably in this region during recent years, the comparison of tables prepared at an interval of ten years or so would be of little value. Hence, we shall not reproduce here the values for the survivorship function and life expectancy from the tables for the Philippines in 1946-1949 and for Thailand in 1947-1948; on the other hand, we show for the sake of comparison the values for Taiwan in 1956-1958 and Japan in 1957. In table 1 we also show the annual (central) death rates for Thailand, Singapore, Taiwan and Japan, leaving out those for the Philippines because of the unduly frequent omissions.

16. A striking element when we first examine the death rates shown in table 1 is the heavy mortality among pre-school children. However, it should be remembered that the birth rate in the region is very high, and as

² Secretariat of State for the National Economy, National Statistical Institute, *Etude démographique au Viet-Nam en 1958* (Saigon, 1959).

³ More complete details on the method of construction are given in the National Statistical Institute's publication *Table de mortalité pour Saigon-Cholon et ses faubourgs, 1958-1959* (Saigon, 1961).

we know, the death rate for children at the breast is generally proportional to the birth rate. In the case of Saigon, we must bear in mind the fact that a small number of women come from the provinces for their confinements in clinics and maternity homes in the capital, and since registration is on a *de facto* basis, this increases the number of births. However, since the majority of sickly children also die in the first hours or days after birth and are thus also counted in the figures for the capital, the death

rates are not greatly affected. Nevertheless, there is still a small number of children who are born in the capital but die in the provinces. Consequently, the rates published here should be considered as minima. In view of the very frequent omissions in the registration of births, particularly the births of children who later die, and the uncertainty which we find in practice regarding stillbirths and live-born children, the various infant mortality rates, for the majority of Asian countries, are scarcely comparable.

Table 1. Annual male death rates
Annual deaths per 1,000 population in each age group

<i>Age in years</i>	<i>Federation of Malaya 1955-1957</i>	<i>Saigon 1958-1959</i>	<i>Thailand 1958^a</i>	<i>Singapore 1957^{a, b}</i>	<i>Taiwan 1957</i>	<i>Japan 1957</i>
Less than 1	84.9	66.9	65.7	48.8	39.6 ^c	43.9
1-4	10.5	12.2	16.2	4.6	11.6	3.7
5-9	2.8	2.9	4.2	1.5	1.8	1.3
10-14	1.7	1.7	1.9	1.0	1.1	0.7
15-19	2.1	2.1	2.1	1.2	1.4	1.4
20-24	2.8	3.6	3.9	1.6	2.6	2.5
25-29	3.5	4.4	4.9	1.5	2.7	2.6
30-34	4.5	5.3	5.1	2.7	3.3	2.7
35-39	5.6	6.7	5.9	3.8	4.4	3.4
40-44	8.4	9.7	8.0	6.0	6.1	4.6
45-49	12.6	13.3	10.7	11.0	9.1	7.2
50-54	16.7	20.0	14.2	17.7	14.9	11.4
55-59	27.2	30.6	22.6	27.8	23.1	18.5
60-64	35.3	43.5	40.9	49.9	34.9	29.1
65-69	59.7	60.6	45.7	70.8	56.4	45.0

^a Statistics based on year of registration and not year of event.

^b Rates calculated on the basis of a population figure which does not include transients or military personnel and officials resident outside the territory, or members of their families.

^c This rate does not take account of deaths of children occurring before the registration of their birth.

Table 2. Male survivorship function (l_x)
Survivors per 10,000 live births

<i>Age in years</i>	<i>Federation of Malaya 1955-1957</i>	<i>Saigon 1958-1959</i>	<i>Cambodia 1958-1959^a</i>	<i>Taiwan 1956-1958</i>	<i>Japan 1957</i>
0	10,000	10,000	10,000	10,000	10,000
1	9,151	9,331	8,730	9,637	9,577
5	8,775	8,888	7,863	9,254	9,436
10	8,652	8,760	7,593	9,178	9,377
15	8,580	8,677	7,495	9,129	9,344
20	8,490	8,584	7,272	9,064	9,278
25	8,371	8,441	7,093	8,943	9,163
30	8,224	8,257	—	8,825	9,044
35	8,044	8,040	6,624	8,678	8,917
40	7,813	7,778	—	8,488	8,768
45	7,491	7,445	5,815	8,227	8,570
50	7,032	7,006	—	7,870	8,262
55	6,466	6,408	4,653	7,321	7,798
60	5,641	5,587	—	6,537	7,095
65	4,724	4,588	3,133	5,485	6,102
70	3,594	3,556	—	4,167	4,787

^a Sample survey in a rural population of 345 villages.

17. In Japan, about 93 per cent of a generation is still living at age 15; on the other hand, in the Federation of Malaya and Saigon this figure is only 86 per cent, and in Cambodia it is 75 per cent. The survivorship function for Taiwan is not really significant since it does not take account of deaths of children below one year occurring before the registration of their birth.

18. It may be noted that mortality in the Federation of Malaya and the city of Saigon is

almost the same. We believe that the values for Saigon also held good for the other large cities in South-East Asia, such as Manila, Djakarta, Bandung, Phnom-Penh and Bangkok. On the other hand, we think that mortality in rural areas is appreciably higher, since many rural regions are still afflicted with diseases (particularly malaria) which have been practically eradicated in the cities mentioned above. In addition, health facilities are much less satisfactory in rural areas and child mortality is higher there.

Table 3. Male life expectancy (e₀)

Age in years	Federation of Malaya 1955-1957	Saigon 1958-1959	Cambodia 1958-1959	Taiwan 1956-1958	Japan 1957
0.....	56.6	55.9	44.2	60.45	63.24
1.....	60.8	58.9	49.6	61.73	65.01
5.....	59.4	57.7	50.9	60.20	61.96
10.....	55.2	53.6	47.6	55.67	57.32
15.....	50.6	49.0	43.2	50.96	52.52
20.....	45.6	44.5	39.4	46.30	47.87
25.....	41.2	40.2	35.4	41.89	43.44
30.....	36.9	36.1	—	37.42	38.98
35.....	32.6	31.9	27.5	33.00	34.50
40.....	28.5	27.9	—	28.68	30.04
45.....	24.6	24.1	20.6	24.51	25.67
50.....	21.1	20.4	—	20.50	21.53
55.....	17.7	17.1	14.5	16.84	17.65
60.....	14.9	14.2	—	13.54	14.14
65.....	12.3	11.8	9.2	10.63	11.01
70.....	11.0	9.7	—	8.18	8.31

Table 4. Male life table for Saigon-Cholon and its suburbs, 1958-1959

Age in years	Survivor- ship func- tion l_x	Annual proba- bility of death q_x	Age in years	Survivor- ship func- tion l_x	Annual proba- bility of death q_x	Age in years	Survivor- ship func- tion l_x	Annual proba- bility of death q_x
0.....	10,000	0.0669	35	8,040	0.0060	70	3,556	0.0562
1.....	9,331	250	36	7,992	63	71	3,356	587
2.....	9,098	111	37	7,941	65	72	3,159	617
3.....	8,997	74	38	7,889	68	73	2,964	652
4.....	8,930	47	39	7,835	72	74	2,771	687
5.....	8,888	0.0038	40	7,778	0.0076	75	2,581	0.0730
6.....	8,854	32	41	7,718	81	76	2,392	765
7.....	8,826	28	42	7,655	86	77	2,209	805
8.....	8,801	24	43	7,589	92	78	2,031	850
9.....	8,780	22	44	7,519	98	79	1,858	900
10.....	8,760	0.0020	45	7,445	0.0104	80	1,691	0.0980
11.....	8,742	19	46	7,367	112	81	1,525	1090
12.....	8,725	18	47	7,284	120	82	1,359	1220
13.....	8,709	18	48	7,196	128	83	1,193	1370
14.....	8,693	18	49	7,104	138	84	1,029	1540

Table 4. Male life table for Saigon-Cholon and its suburbs, 1958-1959 (continued)

<i>Age in years</i>	<i>Survivor- ship function l_x</i>	<i>Annual proba- bility of death q_x</i>	<i>Age in years</i>	<i>Survivor- ship func- tion l_x</i>	<i>Annual proba- bility of death q_x</i>	<i>Age in years</i>	<i>Survivor- ship func- tion l_x</i>	<i>Annual proba- bility of death q_x</i>
15.....	8,677	0.0019	50	7,006	0.0148	85	870	0.1730
16.....	8,661	20	51	6,902	160	86	719	1940
17.....	8,644	21	52	6,791	174	87	579	2170
18.....	8,626	23	53	6,672	190	83	453	2420
19.....	8,606	25	54	6,545	206	89	343	2690
20.....	8,584	0.0028	55	6,408	0.0227	90	250	0.2980
21.....	8,560	31	56	6,262	247	91	175	3230
22.....	8,533	33	57	6,107	269	92	116	3620
23.....	8,505	36	58	5,942	290	93	75	3970
24.....	8,474	38	59	5,769	314	94	45	4340
25.....	8,441	0.0040	60	5,587	0.0337	95	25	0.4730
26.....	8,407	42	61	5,398	362	96	13	5140
27.....	8,372	44	62	5,202	387	97	6	5570
28.....	8,335	46	63	5,000	410	98	3	6020
29.....	8,297	48	64	4,795	431	99	1	6490
30.....	8,257	0.0049	65	4,588	0.0450	—	—	—
31.....	8,216	51	66	4,381	472	—	—	—
32.....	8,174	53	67	4,174	496	—	—	—
33.....	8,131	55	68	3,967	520	—	—	—
34.....	8,086	57	69	3,760	542	—	—	—

SUMMARIES OF PAPERS

Some social implications of varying mortality

THOMAS K. BURCH

The general neglect of studies on the sociology of mortality is partly due to a concern with causes rather than with direct social consequences of differing mortality levels. Three examples given suggest that such consequences are widespread and important. The examples are: (a) an extension of Lotka's analytic work on the incidence of orphanhood; (b) United Nations results on the relation of mortality to family dependency burden; (c) Collver's comparative study of United States and Indian family life cycles. The paper then suggests some directions for future research. These include search for non-familial membership structures substantially affected by mortality level; study of institutions whose major function is to deal with contingencies associated with mortality level; and study of the precise mode of influence of mortality, to avoid uncritical relapse into demographic determinism.

The evolution of infant mortality in Poland

JERZY HOLZER

This paper describes the results of an analysis of infant mortality conducted in Poland during the period 1950-1960 on the basis of the complete population data as different from a selected sample. After preliminary definitions and general descriptions of methodology, infant deaths are examined according to (a) age—a steady decrease in the proportion of exogenic deaths is revealed; (b) sex—a growing relative disproportion between male and female infant deaths is noticeable; and finally (c) age and sex together—within the first six months of life more boys die than girls, both relatively as well in absolute numbers. Another interesting point is brought up by the data on mortality according to succession of childbirth. It has been found that the lowest mortality rate occurs with the first child born of the mother, whereas with the second, third and subsequent children the mortality rates increase steadily. The author concludes with remarks on the cause of infant death.

Infant mortality in Italy according to the profession of the father

FABRIZIO LIBERATI

Many factors influence general and infant mortality. This paper analyses the relationship of social class to infant mortality. Data were collected on the deaths of infants 0-1 years of age during the years 1955-1960, according to the profession of the fathers. Professions were divided into six professional and two non-professional groups according to the ISTAT (Istituto Centrale di Statistica) classification.

On the basis of the data thus collected, it was observed that the mortality ratio during the first week of life increases in direct relation to the professional economic situation, as we move from lower to higher socio-economic class. It was further observed that mortality differences among the different socio-economic groups are more marked after the first month of the life of the infant. Finally, it was estimated that if the mortality of the total live-births, in the period considered, had been the same as recorded for the most favoured professional groups, the volume of deaths of children 0-1 years old would have been reduced by about 20,000 per year.

Infant mortality trends in Latin America

MARÍA NYDIA MARAVIGLIA

Infant mortality has reached a low, almost stationary level in the highly developed countries of the world, while in Latin America it still remains high. No measure of incompleteness of infant death registration in this area of the world is available but data by age reveal that omissions are more frequent under one year of age and specially in deaths occurring in the first day of life. Evidence of this fact is presented by comparing the mortality risks of children under one day of age and the average risk per day of life in the following six days. In the Latin American countries the ratios of these two risks are considerably smaller than in the North American countries pointing to underregistration of deaths under one day.

Post-neonatal mortality trends in some Latin American countries are compared with the

long-term trends of the same indicators for the non-white population in the United States and it is shown that in those countries the decline of post-neonatal mortality is less than the one experienced by the non-white in the United States in previous years.

In the Latin American countries, there is a high proportion of infant deaths due to infectious diseases. A detailed study of these causes in each country would indicate the most urgent problems which need to be solved.

The mortality trend in Venezuela during the last twenty years

ERICH MICHALUP

This study investigates the mortality trend in Venezuela during the last two decennia. The author gives some information about the basic data used in constructing the life tables 1960/1961. The last census was taken on 26 February 1961 and the published data are based on a 1.5 per cent sample. For the first time in Venezuela the people were asked for the birthday and not only for the age, as in the eight previous censuses.

The comparison of the results of the three life tables constructed by the author for the years 1941/1942, 1950/1951 and 1960/1961 permits very interesting conclusions. The reduction of the mortality rates is very remarkable and reached nearly 80 per cent from 1941/1942 to 1960/1961, for some of the lower ages. The consequence is a rise of the life expectation, for males 17.64 years and for females 19.60 years. Then was determined the gain of years to live of the census population. The life potentiality raised from 299,000.000 years, based on the life tables 1941/1942 to 345,500.000 years based on the life tables 1950/1951 and finally to 376,000.000 years if we use the life expectation of the life tables 1960/1961. That represents a gain of 77,000.000 years of life for the census-population.

A special investigation refers to the mortality during the first five years of age. There are published the mortality rates for children born in each of the years from 1949 to 1963. In order to compare with the life tables there are constructed four children life tables for the observation during 1953/1954 and 1962/1963. We can appreciate a considerable reduction of the mortality rates and some conclusions are mentioned.

It was not possible to investigate the causes of death and their influence because the available statistics are incomplete.

The effect of declining mortality on old-age pension systems

ROBERT J. MYERS

Declining mortality trends have significant cost effects on old-age pension systems. For a particular hypothesized pension plan, the cost under mortality conditions of 60 years ago in the United States would have been about 25 per cent lower than under present mortality conditions. Similarly, improvements in mortality in the future would result in significant increases in pension costs. For example, a hypothetical table developed by an arbitrary reduction of 50 per cent in age-specific mortality rates at all ages would result in pension costs about 75 per cent higher.

One method of offsetting high pension costs is to increase the minimum pensionable age. Under mortality conditions of 60 years ago in the United States, a retirement age of 62 would be about equivalent costwise to an age of 65 according to current mortality levels. If the arbitrary mortality rates of the hypothetical table referred to previously were in effect, the equivalent pensionable age would be close to 72.

If retirement practices remain unchanged despite improving mortality, many important social problems will have to be solved so that retired persons will live useful lives during their longer retirement period. With growing automation, and thus vastly increasing productivity, it is possible that not only will the work week be shortened for active workers, but also the minimum retirement age may be left unchanged or possibly even lowered somewhat—all of this being accomplished with a higher standard of living for both the active and the retired populations. Such a utopian result of shorter working hours for the active population and higher living standards for the total population will be possible only by an increasing productivity shared among both the active workers and the pensioners.

Infant mortality in Israel, 1960-1961; a study based on matched birth and death records

E. PERITZ

Matching of birth-and-death notification for all death of infants born in 1960-1961 was carried out, mainly in order to study infant mortality by region of birth and period of immigration of the mother.

It was found that, although post-neonatal mortality was low in general, it was roughly

twice as high among infants of mothers immigrated from Asia or Africa since 1948 than in the rest of the population. Neonatal mortality was high among children of new immigrants from Europe as well as in the quite small group of children of old settlers immigrated from Asia or Africa. These differences are shown to hold also when birth rank and age of mother are taken into account. There is some indication that the differences in post-neonatal mortality may be less pronounced in the upper social classes than in the lower ones.

Reduction in child mortality of new immigrants in Israel

O. SCHMELZ

Under the impact of mass immigration from countries of Asia and Africa, the general infant

mortality rate of Jews in Israel rose from 29 per 1,000 in 1947 to 52 per 1,000 in 1949, but receded promptly and has been below 30 ever since 1959 (with a descending trend). Data which have recently become available give a vivid picture of the progress achieved. On the one hand, there are figures on early childhood mortality among the Jews in Asia and Africa prior to their immigration to Israel. These figures, though subject to certain reservations, strongly indicate the high degree of that mortality; they also reveal variations in child mortality according to period and country, and according to school attendance, age at immigration and birth order of mothers. Specific rates of infant mortality among Jews in Israel in 1960-1961 show not only its generally low level but also to what a large extent differentials by parents' country of birth have been overcome.

Meeting B.3

MORTALITY, MORBIDITY AND CAUSES OF DEATH

PAPERS

Structure of causes of death and level of mortality: an experience in Latin America

HUGO BEHM and HÉCTOR GUTIÉRREZ

[Translated from Spanish]

1. What is the role, in terms of reducing mortality, of modern medical techniques as applied in the context of the social and economic changes now occurring in the under-developed countries of Latin America? By way of a partial reply to this question, this study compares trends in the level of mortality and in the structure of causes of death in Chile with the trends noted in the past in countries which are now developed. Chile is the only country of the region which has an integrated National Health Service providing preventive and curative medical care for 70 per cent of the population. In addition, Chile has more comprehensive and better statistical information available to it than is usually the case in under-developed regions.

CHANGES IN MORTALITY IN CHILE, 1937-1963

2. The level of total mortality has decreased by 45 per cent during this period. The crude

general death rate dropped from 22 per 1,000 inhabitants in 1939-1941 to 12.1 in 1959-1961, and life at birth has increased from 42 to 58 years over the same period. This progress came to a halt in 1953-1954, and since that time the decrease has been very slight.

3. Any study of the causes of death is limited by the shortcomings of the basic data, which have been discussed extensively in another work.¹ Despite this fact, it has been possible to study the main causes of death over the period 1937-1963 (see fig. 1). It will be observed that the drop is to a very large extent linked to the decrease in the causes of infectious diseases. The main causes are set forth in the table below.

¹ Hugo Behm *et al.*, "Recent mortality trends in Chile", *Vital and Health Statistics*, Analytical Studies, Series 3, No. 2 (U.S. National Center for Health Statistics, 1964).

	Rates per 100,000 persons (age adjusted)		Decrease	Percentage of the decrease in general mortality
	1939-1941	1959-1961		
All causes	2,195	1,212	983	—
Pneumonia, etc.	507	242	265	27
Tuberculosis	253	56	197	20
Diarrhoea	188	52	136	14
Other infectious diseases ..	113	46	67	7

4. All these groups show a halt in the downward trend of mortality in recent years and some show a tendency to rise. The levels at which these deaths, the majority of which are avoidable, become stabilized are certainly high

when compared with the rates for more advanced countries. Moreover, the diseases peculiar to early infancy, which include preventable deaths due to accidents at birth, infections of the new born and malnutrition, continue to

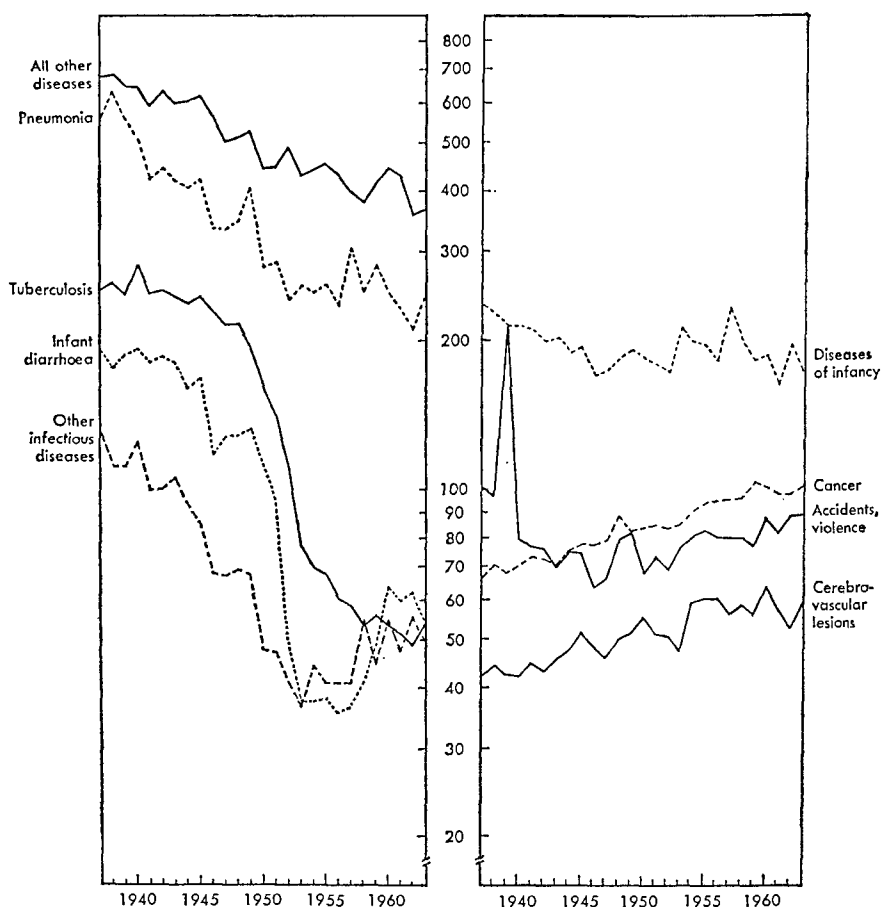


Figure 1
Mortality by groups of causes, Chile, 1937-1963
(Rates per 100,000 population)

have a high death rate and have now changed significantly over the past twenty years.

5. Accidents, cancer and cardiovascular diseases—the latter assessed only on the basis of trends in cerebro-vascular accidents—are found to have rates which move slightly upwards with a growing impact on the general death rate. This is one of the factors contributing to the stabilization of the general death rate, but the main factor is the halt in the downward trend of the causes of infectious diseases, which as late as 1959-1961 were still responsible for 38 per cent of all deaths.

COMPARISON WITH THE PAST EXPERIENCE OF DEVELOPED COUNTRIES

6. In 1963 the United Nations² prepared a first draft for a model table showing changes

² United Nations, *Population Bulletin*, No. 6 (United Nations publication, Sales No: 62.XIII.2).

in the structure of causes of death by the expectation of life at birth. In table 1, the changes observed in Chile at the same level of general mortality are compared with this model and with the figures for England and Wales. Comparison is possible only within three large groups of causes.

7. The figures show the following main facts:

(a) There is a general similarity in the structure of the death rate due to infectious diseases, cancer and violence;

(b) There is a surplus in the death rate due to accidents and violence which is in line with observations made in other Latin American countries;

(c) The rate of change is noticeably different. The increase in the expectation of life at birth from 42 to 52 years, which was noted in Chile in the period 1940-1950, occurs in

England and Wales over a period of 45 years, part of which was in the nineteenth century. The gain in the following decade in Chile falls to six years, while the time taken in England to achieve the same amount of progress is now less than twenty years.

8. This grouping of causes is too broad for the purpose of further analysis. The figures published by Mackeown³ on mortality in England and Wales during the nineteenth century give more details, so that at least the death rate for infectious diseases can be studied. In table 2 a comparison is made for consecutive decades starting from a similar crude death rate, namely 21-22 per thousand. The figures should be interpreted with the normal reservations, as regards the quality of the basic data and the criteria used for grouping, which may not be the same in each case. At the initial stage, infectious diseases have a great influence on general mortality in both countries: England 29.5 per cent and Chile 25.2 per cent. In England the mortality rate is greater for acute communicable diseases, *inter alia*, because of the existence of smallpox—a disease which has been eliminated in Chile through vaccination—and the high case fatality rate for scarlet fever in England in the last century. On the other hand, mortality due to diarrhoea is much higher in Chile.

9. Over the following thirty years, the decrease in mortality for this group of causes is much higher in Chile (72 per cent) than in England (34 per cent). The crude death rate thus falls in England from 21.3 per thousand to 18.2 per thousand over this period, while in Chile it declines from 22 to 12.1 per thousand. The decrease in the group of causes studied contributes to the decline in total mortality for which the figures are 69 per cent and 41 per cent, respectively.

10. It should be noted that in Chile the level at which the mortality rate stabilizes is high, eight to ten times higher than the rates for England and Wales in 1962 (last column of table 2). The crude death rate in England for 1956-1957, adjusted by age, is 6 per thousand, which is exactly half the figure recorded in Chile in recent years.

11. What conclusions can be drawn from these facts? Mackeown believes that the decrease in mortality in England in the last century was basically due to improvements in the level of living, particularly better sanitation and personal hygiene. Medical knowledge of

prevention and treatment was not very great in those days and was but scantily applied. He thinks that there was a spontaneous change in the case fatality rate for scarlet fever. We do not have any data with which to compare changes in the levels of living of both countries over the period studied. If we assume that they were not very different—judging from the similar initial level of general mortality—the high decreases in mortality in Chile might be an indicator of the role played by medical techniques as applied to an underdeveloped country with the same characteristics as Chile.

12. Figure 1 shows that the accelerated decline in mortality for this group of causes began in the years 1945-1950 since when antibiotics, sulfas, and other modern therapeutic drugs have been available. The effect of these drugs when the level of mortality is very high is noticeable, even though inadequate living conditions continue. A good example of this is typhoid fever in Chile: the incidence of the disease continues to be high owing to inadequate sanitation (rates estimated at 120 per 100,000 inhabitants) but the mortality rate has declined by 78 per cent.

13. The fact that the mortality rate stabilizes at levels which are still high, with a high proportion of deaths due to preventable causes, would thus seem to be due to the fact that there is a limit to the efficacy of medical techniques when applied to under-developed communities at a slow rate of development. Thus social and economic factors persist which cause a high frequency of disease and death, and in addition, the actual application of medical techniques is limited because resources are restricted and are used inefficiently.

14. We have examined this kind of problem in Chile with reference to infant mortality, an indicator which is particularly sensitive to the various components of the level of living.⁴ In 1957 the infant mortality rate was 147 per 1,000 for children born of working-class parents not receiving medical care, 102 per 1,000 for children born of working-class parents receiving medical care and 57 per 1,000 for those born of middle-class parents receiving medical care. These figures give an idea of the possible effect, dynamic but limited in scope, that medical techniques may produce in under-developed conditions.

15. The facts suggest that in those underdeveloped countries with high mortality rates, due in part to diseases for which we have effec-

³ T. Mackeown and R. G. Record, "Reasons for the decline of mortality in England and Wales during the nineteenth century", *Population Studies*, vol. XVI (1962), pp. 94-122.

⁴ Hugo Behm, *Mortalidad infantil y nivel de vida* (Chile, Ediciones de la Universidad de Chile, Santiago, 1962).

tive control measures—even in communities with a low level of living—for the prevention of disease (smallpox and malaria, for example) or for treatment (tuberculosis, typhoid)—a relatively rapid and large decrease in the level of mortality should be expected. This, however, is based on the assumption that these medical techniques reach large sectors of the population.

16. When general mortality has been reduced to levels which might correspond to crude mortality rates of 10-12 per 1,000—for the young age structures characteristic of these populations—and to an expectation of life at

birth of 55-60 years, progress requires increasingly marked and genuine improvements in the level of living, including more efficient health care reaching the large majority of the population, particularly the most vulnerable social and economic groups. It is very difficult to fulfil these conditions and therefore downward movements in the mortality rate are slower. Strictly speaking, no health plan should be developed without consideration being given to all the activities contributing towards improving the population's level of living, which in face determine its feasibility and its scope.

Table 1. Structure of mortality by selected causes at the same general level of mortality: Chile, England and Wales, United Nations model^a

(Rates per 100,000 population, age adjusted)

<i>Group of causes^b</i>	<i>United Nations</i>	<i>England and Wales 1848-1872</i>	<i>Chile 1939-1941</i>	<i>United Nations</i>	<i>England and Wales 1901-1910</i>	<i>Chile 1949-1951</i>	<i>United Nations</i>	<i>England and Wales 1921-1930</i>	<i>Chile 1959-1961</i>
Infectious diseases ..	931	978	873	486	511	548	304	321	344
Cancer	91	35	83	91	83	92	91	105	106
Violence	81	76	78	67	59	76	59	46	84
All causes	2,240	2,258	2,195	1,504	1,620	1,694	1,174	1,109	1,212
e ^o (years).....	42.0	41.8	42.0	52.0	50.5	52.4	58.0	59.0	58.0
<i>Percentage of mortality for all causes</i>									
Infectious diseases..	41.6	43.3	39.8	32.3	31.5	33.5	25.9	28.9	28.4
Cancer	4.1	1.6	3.8	6.1	5.1	5.6	7.8	9.5	8.7
Violence	3.6	3.4	3.6	4.5	3.6	4.7	5.0	4.1	6.9

^a See bibliographical reference, foot-note 2.

^b Infectious diseases: groups B1-17 and B30-32. In England and Wales and the United Nations model, includes bronchitis only below the age of five years; cancer: group B18; violence: group B47-50.

Table 2. Mortality by infectious diseases, Chile 1939-1961, England and Wales 1871-1900 and 1962

(Rates per 100,000 population, age adjusted in Chile)

<i>Causes of death^a</i>	<i>England and Wales</i>				<i>Chile</i>				<i>England and Wales 1962</i>
	<i>1871-1880</i>	<i>1881-1890</i>	<i>1891-1900</i>	<i>Percentage decrease over 30 years</i>	<i>1939-1941</i>	<i>1949-1951</i>	<i>1959-1961</i>	<i>Percentage decrease over 30 years</i>	
All causes.....	2,127	1,908	1,819	14	2,195	1,694	1,212	45	—
Tuberculosis	288	243	201	90	253	165	56	78	6.6
Acute communicable diseases	246	167	141	43	113	54	46	59	4.6
Diarrhoea	94	67	74	21	188	112	52	72	5.5
All infectious diseases	628	477	416	34	554	331	154	72	16.7
Percentage of total deaths	29.5	25.0	22.9	—	25.2	20.3	12.7	—	—

^a Acute communicable diseases include: Chile: groups B3-17; England: smallpox, measles, scarlet fever, diphtheria, pertussis, typhus, enteritis, and simple continued fever; diarrhoea and dysentery include: Chile: group B36; England: diarrhoea, dysentery, cholera. (List B, Abbreviated List, International Statistical Classification of Diseases, Injuries and Causes of Death.)

The importance of morbidity statistics in the evaluation of public health

L. A. BRUSHLINSKAYA

[Translated from Russian]

1. From the very first days of its existence, the Soviet State has assumed responsibility for the protection and constant improvement of the health of the whole population. It has pursued this goal through a complex of economic, social and medical measures. A vast programme is being carried out in the Union of Soviet Socialist Republics for the prevention and drastic reduction of disease, the elimination of epidemic infectious diseases and the further extension of man's expectation of life.

2. Medical services in the Union of Soviet Socialist Republics are provided by a large force of doctors and an extensive system of curative and preventive medical institutions. Thanks to the wide public use of these institutions, which offer free medical care by qualified personnel to all, exhaustive and reliable statistics can be collected on morbidity and causes of death in the Union of Soviet Socialist Republics.

3. Statistics of morbidity in the Union of Soviet Socialist Republics are used to define levels and variations in public health and to check the effectiveness of curative and preventive measures. They also provide a valuable source of information for use in planning health services.

1. SOURCES AND METHODS USED IN THE STUDY OF MORBIDITY

4. The main sources used for the study of morbidity in the Union of Soviet Socialist Republics are:

(a) Records of diseases treated at curative or preventive medical institutions;

(b) Records of preventive medical examinations; and

(c) Records of causes of death.

5. Morbidity studies are pursued along the following lines, by appropriate methods:

(a) *General morbidity statistics.* These statistics give a picture of the incidence and distribution of specific diseases and groups of diseases among the population of the Union of Soviet Socialist Republics as a whole. Records

of diseases are kept in all localities by all general and specialized clinics and polyclinics, which register every case of acute or chronic disease on the patient's first visit for that disease in the given year.

(b) *Statistics of infectious diseases* are compiled from the data contained in the emergency notices of such diseases. The emergency registration of infectious diseases is compulsory throughout the Union of Soviet Socialist Republics, for thirty main diseases. A doctor who diagnoses or suspects a case of infectious disease must make out an emergency notice and send it within twelve hours to his district or city public health and epidemiological station, which compiles monthly, quarterly and yearly records of confirmed cases of such diseases. The records of the principal infectious diseases kept under the emergency registration system are of great practical value, being used extensively in connexion with anti-epidemic measures.

(c) *Statistics of the principal non-epidemic diseases.* Morbidity from these causes is studied on the basis of the special registers of new cases of active tuberculosis, venereal and fungoid diseases, trachoma, and cancer and other malignant neoplasms. The doctor attending any person suffering from one of these diseases is required to make out a notice and send it to the appropriate specialized clinic. These clinics keep the patients under observation, take the necessary curative and prophylactic measures, and compile records of patients by numbers, age, sex, site and seriousness of the disease.

(d) *Statistics of illnesses causing temporary incapacity for work.* Under the Soviet system of social insurance, all industrial, clerical or professional workers suffering temporary incapacity for work receive a State allowance until they are completely fit for work again. Illnesses causing temporary incapacity for work are studied on the basis of the data entered by doctors in the "temporary incapacity certificates" required for sick leave and the receipt of an allowance. Particular attention is paid in the Union of Soviet Socialist Republics to the medical care and health supervision of workers.

All illnesses, whether they resulted in incapacity for work or not, are recorded on a special personal card kept for every employed person. Health studies relating to employed persons can be made on the basis of the information entered on these personal cards.

(e) *Statistics relating to disability: i.e., permanent or long-term incapacity for work.* In the Union of Soviet Socialist Republics, the term "disability" implies the entitlement of the person incapacitated for work to State and public assistance. Records are required to be kept not only of all cases of initial disability but also of all subsequent re-examinations of disabled persons. The disability statistics give a picture of the effects of morbid and traumatic conditions on the fitness for work of the employed population. Disability figures depend to a considerable extent on the legislation governing the retirement on pension of disabled persons. Since such legislation varies from one country to another, national disability figures vary also, and are not comparable. The commonest cause of disability in the Union of Soviet Socialist Republics in 1963 was cardiovascular diseases, followed by tuberculosis, malignant tumours, diseases of the nervous system, diseases of the bones and joints, etc.

(f) *Statistics of preventive medical examinations.* Large sections of the population of the Union of Soviet Socialist Republics undergo annual medical examination with a view to the early diagnosis of tuberculosis, cancer and other diseases. Periodic medical examinations are also given to specific categories of the population (children, expectant mothers, athletes, workers etc.) under the systematic health supervision scheme. Thus, 46.3 million persons were examined in 1961 for tuberculosis alone in clinics, clinical sections and special departments of city hospitals, and rural hospitals.

(g) *Mortality by cause of death.* In the Union of Soviet Socialist Republics the cause of death is registered by a doctor. In rural communities deaths may be registered on the basis of a death certificate issued by a *feldscher* (medical auxiliary) in certain circumstances, such as the absence of the doctor for any reason. Death certificates issued by doctors or medical auxiliaries are the source of the data on causes of death. A summary analysis of these data is made every month, and a full analysis, with a breakdown of causes of death by sex and age, every year. The most common cause of death is cardio-vascular diseases (including rheumatism and vascular diseases of the brain) which were responsible for 37 per cent of deaths among the urban population of the Union of

Soviet Socialist Republics in 1960 (29.3 per cent of male deaths and 44.9 per cent of female deaths). The second most important cause of death was cancer and other malignant neoplasms.

6. In recent years mortality in the Union of Soviet Socialist Republics has been the lowest in the world (7.3 per thousand in 1959-1963). The crude death rate in the Union of Soviet Socialist Republics has fallen to a quarter of the pre-revolutionary rate, standing at 7.2 per thousand in 1963 as against 29.1 per thousand in 1913.

7. There has been an almost ninefold reduction in infant mortality, from 269 per thousand births in 1913 to 30.9 per thousand in 1963. Mortality in the other age groups has been reduced also.

8. In 1962 the crude death rate among the urban population of the Union of Soviet Socialist Republics was 2.8 times lower than in 1940, while mortality from diseases of the digestive organs was reduced by a factor of 14 and from infectious diseases reduced by a factor of 12 times over the same period. Particularly impressive decreases being recorded in deaths from scarlet fever, which decreased 122 times; diphtheria—75 times; measles—62 times, and whooping cough—47 times. This drop in mortality was brought about by reduced morbidity and a very considerable reduction in the fatality rate of the diseases referred to.

9. Thanks to the reduction achieved in the mortality of all age groups of the population, and particularly in infant mortality, there has been a considerable increase in probable length of life in the Union of Soviet Socialist Republics, which in 1960-1961 reached 70 years, or 2.2 times the pre-revolutionary figure; in 1896-1897, for example, probable length of life was only 32 years.

10. Statistics of causes of death do not of course fully reflect the state of public health, since they cover only serious illnesses culminating in death. The statistics mainly used to determine the state of public health are general morbidity statistics, since these cover all types of sickness for which members of the population seek medical aid. All other types of morbidity statistics cover either only certain diseases or only certain sections of the population; these statistics are of very great practical importance. The statistics of causes of death provide an index to the part of the national morbidity represented by diseases having a fatal outcome; they are also essential for determining the fatality rate from diseases and for the study of measures to reduce it.

2. THE DEVELOPMENT OF MORBIDITY STATISTICS IN THE UNION OF SOVIET SOCIALIST REPUBLICS

11. The health statistics kept by the Russian *zemstvos* represent the first use of morbidity data to determine the state of health of the population—a fact noted by the participants in the international health exhibition held at Dresden in 1911.

12. The *zemstvos*, which were organs of local self-government, were set up in the 1860's, soon after the abolition of serfdom in Russia. Among the duties of the *zemstvo* authorities was the provision of medical services for the peasant population. The great majority of doctors serving the *zemstvos* appreciated the need for large-scale sanitary measures; they were at once physicians and public health officers, and carried out studies of the morbidity of the population they served. In this work, those responsible for the *zemstvo* health statistics had to blaze their own trail, for morbidity studies had not yet been started in any other country. Their investigations revealed the causes of the high morbidity and mortality among the rural population in pre-revolutionary Russia.

13. Both health statistics and public health services as a whole have greatly improved since the establishment of the Soviet Union.

14. The Union of Soviet Socialist Republics has the highest doctor-to-patients ratio in the world. The number of doctors per 10,000 population increased from 1.8 in 1913 to 22.1 in 1963, i.e., over 12 times. In 1963 the Union of Soviet Socialist Republics had 501,000 doctors (excluding those in the armed forces).

15. Morbidity statistics have assumed nationwide importance. Population morbidity is studied over the entire territory of the Soviet Union.

16. In the Kirghiz, Uzbek, Turkmen and Tadzhik Republics hardly any medical services were available to the population before the Revolution. In the Turkmen Soviet Socialist Republic, for example, there were only 70 doctors in 1913 for a population of 1,042,000: i.e., one doctor to about 15,000 inhabitants. Now, however (1 January 1964), the number of doctors in the Turkmen Soviet Socialist Republic has risen to 3,579: i.e., 1 doctor per 504 inhabitants. In Ashkhabad, the capital of the Republic, a detailed study of morbidity was made in 1939 and a second such study in 1959. These studies demonstrate the great advances in public health which have taken place over the last twenty years. Thus, the incidence of tuberculosis and venereal disease has been

sharply reduced, while malaria and trachoma have been completely stamped out, to say nothing of cholera and smallpox, which were completely eradicated over thirty years ago.

17. A particular feature of the present system of morbidity statistics is that it is closely linked with actual medical practice so that doctors are able to keep informed of the morbidity situation of the population they serve. Another feature of the system is that separate records are kept of new cases (i.e. cases diagnosed for the first time in the given year).

18. In the developing countries, where health services have not yet reached the desirable level, particular attention should be paid to studying the state of public health. Such studies should be undertaken by special missions of medical specialists set up to carry out large-scale detailed medical examinations of the population. Medical examinations of this kind are a valuable source of information on the regional pathology of a country's population.

3. THE ORGANIZATION AND METHODOLOGY OF GENERAL MORBIDITY STUDIES

19. In the Soviet Union, public health statistics are part of the unified State statistical system. All urban and rural clinics, polyclinics, health centres and doctors are required to keep records of cases of disease. The main methods used for compiling statistics on general morbidity are the following.

20. A record must be made of every first request for medical treatment of the given disease in the given year. Records are kept of diseases diagnosed by doctors at curative and preventive medical institutions or on domiciliary visits, and of diseases diagnosed during mass prophylactic examination campaigns or in the course of the regular examinations undergone by wide sections of the population under the "dispensary system".

21. The medical file of an ambulatory patient includes a special "final (confirmed) diagnosis sheet" on which the doctor enters the confirmed diagnosis of the disease. This "sheet" provides the basis for the completion of the "statistical stub" which is used for the preparation of morbidity statistics. A disease diagnosed in a patient for the first time in his life is marked with a special sign (+), as is every new case of acute disease or injury. The results of the analysis of the statistical stubs are included in the report of the medical institution.

22. Thanks to the registration system, detailed investigations of morbidity can be carried out in accordance with a broad programme. Such investigations are also carried out in census years, since censuses provide accurate

data on the age and sex distribution of the population. The programme for an investigation of this kind carried out in 1958-1960 covered a broad range of 257 diseases, with a breakdown of patients by sex and age into sixteen groups, including six groups for children, and provided information on a number of questions relating to hospitalization, fatality rates, etc.

23. A detailed study of morbidity, timed to coincide with the 1959 population census, was carried out in the Union of Soviet Socialist Republics in 130 towns, 94 rural areas and 100 industrial enterprises of the Union of Soviet Socialist Republics with a total population of 31.5 million persons, including about 20 million in towns in the Russian Soviet Federative Socialist Republic. The material obtained was processed locally in accordance with a co-ordinated programme, the results being correlated in the Union Republics.

4. SOME CONCLUSIONS FROM THE POPULATION MORBIDITY STUDY

24. A comparison of levels of morbidity at different periods shows that infectious disease has been considerably reduced in the Soviet Union.

25. Dangerous infectious diseases like cholera, plague, smallpox and typhus, which caused great human suffering in the past, have been eradicated in the Union of Soviet Socialist Republics. Malaria has now been practically eliminated, and diphtheria and poliomyelitis greatly reduced, while sickness from brucellosis, trachoma, tuberculosis and other diseases continues to decline.

26. Tuberculosis was very prevalent in pre-revolutionary Russia. The very incomplete data

available show that even in Moscow and St. Petersburg twenty to twenty-five persons per thousand population suffered from pulmonary tuberculosis. Today, the tuberculosis rate in urban populations is tens of times lower than in the past and is continuing to fall. In 1961, the frequency of tuberculosis in urban populations had fallen to half the 1950 figure, while the mortality rate from tuberculosis had fallen more than fourfold.

27. The frequency of many other diseases has also declined appreciably. The data for the Russian Soviet Federative Socialist Republic for 1963 show that the frequency of diphtheria and poliomyelitis in that year was twenty-one times less than in 1955.

28. The reduction in the frequency of the diseases mentioned above and of certain other diseases closely and directly associated with environmental factors has been due to the rise in the standard of living and cultural level of the population, the expansion of housing construction, the improvement in municipal services and amenities and living and working conditions, and advances and improvements in the prophylactic work of medical institutions.

29. No steady reduction has yet been achieved in the frequency of a number of diseases whose causes are as yet insufficiently known, such as malignant neoplasms, glaucoma, diabetes, diseases of the kidneys and urinary system, angina, etc.

30. A distinction is made in morbidity studies between data on cases of disease diagnosed for the first time in the given year, and data on the "prevalence" of diseases, which cover not only cases diagnosed for the first time but also cases treated for diseases already recorded in previous years.

Table 1. Morbidity in 65 towns (about 20 million persons) of the Russian Soviet Federative Socialist Republic in 1958

Categories of diseases and specific diseases	Total number of cases (new cases plus cases already diagnosed in previous years) per 1,000 population		
	Males	Females	Both sexes
Infectious diseases	225.8	197.1	208.8
Influenza	78.8	64.0	70.4
Angina	65.2	66.9	65.7
Phlegmons and abscesses	14.2	14.5	14.4
Parasitic diseases	15.2	17.2	15.9
Injuries	148.9	80.3	110.3
Poisoning	1.5	1.4	1.4
Vitamin deficiency diseases	0.8	0.5	0.7
Rheumatism	5.5	10.0	8.1
Metabolic diseases and allergies	6.9	8.3	7.7
Diabetes	0.8	1.1	0.9
Bronchial asthma	1.4	1.9	1.7

Table 1. Morbidity in 65 towns (about 20 million persons) of the Russian Soviet Federative Socialist Republic in 1958 (*continued*)

Categories of diseases and specific diseases	Total number of cases (new cases plus cases already diagnosed in previous years) per 1,000 population		
	Males	Females	Both sexes
Neoplasms	9.3	14.2	12.3
Malignant neoplasms	3.7	5.9	5.2
Diseases of the endocrine system....	1.9	10.0	6.4
Thyrototoxicosis	0.9	4.1	2.7
Goitre	0.7	4.9	3.1
Diseases of the haematopoietic system	0.6	0.8	0.8
Psychiatric disturbances	10.2	5.0	7.4
Schizophrenia	1.9	1.7	1.8
Alcoholism and drug addiction.....	2.4	0.2	1.2
Diseases of the nervous system.....	48.9	57.6	54.4
Cerebral vascular lesions, lumbo- sacral radiculitis and other ner- vous diseases	27.2	25.4	26.2
Neuroses	12.5	20.8	17.7
Eye diseases	61.9	68.1	65.5
Conjunctivitis	26.7	27.3	27.0
Refractive errors	14.0	18.4	16.6
Ear, nose and throat diseases.....	240.6	218.0	227.5
Acute catarrh of the upper respira- tory tracts	170.5	145.2	156.2
Diseases of the respiratory system...	51.0	38.5	44.0
Bronchitis (acute and chronic)....	25.9	20.2	22.7
Lobar pneumonia	16.0	11.5	13.6
Circulatory diseases	50.5	71.5	62.8
Angina pectoris	4.4	4.3	4.3
Atherosclerotic cardiosclerosis	11.6	17.6	15.0
Hypertonia	14.7	26.8	21.6
Diseases of the digestive system....	56.8	56.7	56.3
Acute gastritis	5.7	5.3	5.7
Chronic and unspecified gastritis...	13.6	14.5	14.1
Ulcers	8.2	2.0	4.7
Enteritis and colitis.....	6.3	5.1	5.6
Appendicitis	6.3	9.3	7.9
Diseases of the liver.....	4.8	11.3	8.2
Diseases of the bones, muscles and joints	33.6	34.0	33.8
Skin diseases	64.8	58.7	61.4
Diseases of the kidneys and urinary system	7.4	16.5	13.6
Nephritis and nephrosis.....	0.8	0.6	0.6
Calculi of the kidney and urinary tract	2.0	1.9	2.3
Diseases of the male genital organs..	3.1	—	1.4
Diseases of the female genital organs	—	60.2	34.0
Other types of diseases.....	2.3	14.9	11.6

31. The prevalence of certain diseases, such as angina, phlegmons and abscesses, diseases of the nervous system, conjunctivitis, etc., is almost the same in both males and females. However, the prevalence rates of other diseases, such as neuroses, diseases of the endocrine system, rheumatism, ulcers, cholecystitis and cholangitis etc., show sharp differences as between males and females.

32. Age and sex differences in the incidence rates of diseases are very significant. This is shown by the following table giving the numbers of first diagnoses of diseases per 1,000 population (from the data assembled on morbidity in 65 towns of the Russian Soviet Federative Socialist Republic in 1958).

33. So far as the adult population is con-

Table 2

Age group	Ulcers		Angina pectoris		Diseases of the endocrine system		Neuroses		Hypertonia		Cholecystitis and cholangitis	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
15-17.....	0.5	0.1	0.03	0.02	1.1	5.3	3.1	3.8	0.5	0.4	0.4	0.7
18-19.....	0.9	0.3	0.07	0.06	1.9	7.7	4.8	5.6	1.9	0.9	0.5	1.2
20-24.....	1.4	0.2	0.1	0.1	1.5	9.0	5.7	8.1	1.5	1.0	0.7	1.7
25-29.....	2.7	0.6	0.4	0.4	1.7	11.4	7.4	14.6	2.5	2.2	1.8	4.0
30-39.....	3.2	0.8	1.0	1.0	1.7	10.0	10.8	19.1	3.3	4.4	2.2	4.6
40-49.....	3.3	1.0	3.8	3.4	1.2	5.8	12.4	21.6	7.8	12.2	2.6	5.3
50-59.....	2.6	0.9	6.2	4.5	0.8	3.0	8.1	11.9	14.6	18.9	2.4	4.3
60-69.....	1.2	0.4	4.0	2.8	0.6	1.2	2.9	3.4	14.7	18.7	2.1	3.2
70-79.....	0.5	0.2	2.7	2.0	0.4	0.4	1.3	1.2	14.5	15.7	1.9	2.3
80 and over.....	0.4	0.2	2.5	1.4	0.5	0.5	1.3	0.9	12.2	10.5	0.8	1.9

Table 3

	Injuries		Rheumatism		Lobar pneumonia	
	Male	Female	Male	Female	Male	Female
Up to 1 year.....	17.2	15.4	0.2	0.4	175.6	144.7
1.....	48.1	42.0	0.3	0.5	122.8	113.5
2.....	59.3	52.2	1.0	1.1	86.6	86.1
3-4.....	59.5	44.7	2.2	2.2	51.2	51.3
5-6.....	68.6	42.2	4.0	3.9	25.5	25.9
7.....	80.6	48.1	5.1	4.8	21.3	20.8
8-14.....	95.4	58.7	4.7	6.2	7.9	8.4
15-17.....	226.4	88.3	2.4	3.8	4.6	2.2
18-19.....	240.3	112.1	2.6	3.7	5.4	2.5
20-24.....	156.2	88.7	1.7	4.0	3.3	2.3
25-29.....	229.3	97.6	2.0	4.5	6.0	3.5
30-39.....	181.6	81.0	2.2	4.2	6.0	3.6
40-49.....	164.9	99.3	1.8	3.6	7.4	4.9
50-59.....	138.1	91.3	1.5	2.2	9.2	6.3
60-69.....	89.1	67.3	0.9	1.1	9.4	7.0
70-79.....	76.3	50.3	0.9	0.7	10.7	8.2
80 and over.....	84.2	39.9	1.3	0.6	18.9	10.4

cerned, the evolution of morbidity with age may be broadly described as follows:

(a) Morbidity embraces both acute and lasting or chronic illnesses. The latter, in their turn, embrace both diseases diagnosed for the first time in the given year and diseases diagnosed in previous years for which patients have sought medical treatment in the given year;

(b) With increasing age, there is a decline in the proportion of requests for medical treatment in respect of the categories of diseases most directly and closely associated with public health and sanitation factors and the cultural level of the population (infectious diseases, ail-

ments due to exposure to cold, parasitic diseases, acute gastro-intestinal diseases, suppurative skin diseases, injuries etc.). The frequency of these diseases falls from 96 per cent in age group 15-17 to 77 per cent in age group 40-49 and 40 per cent in the age group 80 and over, while with increasing age there is also a fall in the frequency of new disease cases and a rise in the frequency of lasting or chronic illnesses requiring regular treatment by a specialized clinic. The frequency of these diseases rises from 10 per cent in age group 15-17 to 27 per cent in age group 40-49 and 52 per cent in the age group 80 and over. This is to a large extent due to the increase in the frequency of cardio-vascular diseases in the older age groups.

Population morbidity as indicated by hospital statistics

M. A. HEASMAN

I. INTRODUCTION

1. Morbidity has been defined recently as "a departure from a state of physical or mental well-being resulting from disease or injury of which the individual is aware".¹ Although this does not cover illness of which the patient is not aware, it will be quite adequate for the purposes of this paper.

2. It will immediately be obvious that such a definition constitutes a spectrum of severity from the fit person at one end to death at the other. This can be illustrated diagrammatically for a hypothetical disease in figure 1.

3. The length of each stage varies not only for each patient, but also for each disease. The disease process may be halted or reversed at

¹ National Centre for Health Statistics, U.S. Department of Health, Education and Welfare, *Health Survey Procedure*, Series 1, No. 2 (Washington, 1964).

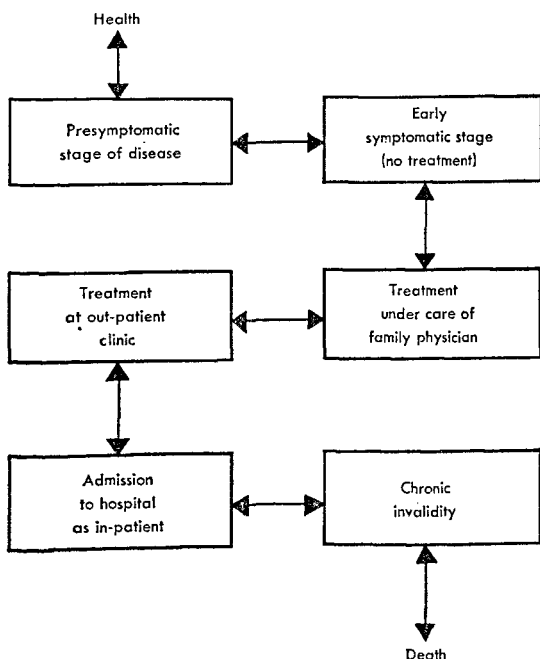


Figure 1

Diagrammatic representation of morbidity process

any stage short of death, and this may occur spontaneously or as a result of treatment. Further, although in the diagram the patient only passes through each stage once, in real life he may pass through some of them, such as a spell in hospital, on several occasions.

4. Consideration of these facts will immediately show that for hospital statistics to be of value in the measurement of population morbidity, certain conditions have to be met. These include as a *sine qua non* that a patient must enter hospital. However, if the disease process is extremely variable and only a small proportion of cases become serious enough to require admission then a consideration of the number of hospital admissions will give little indication of the level of the disease in the community. Thus we shall obtain very little information on the incidence and prevalence of the common cold by reference to hospital statistics and but a rough guide of the position of bronchitis in the community.

5. However, extrapolation from hospital statistical data presents difficulties even when in-patient treatment should ideally be regarded as obligatory for all cases or for the more severely affected. These depend upon the provision and use of hospital facilities and the type of statistical data in normal use. They are discussed in more detail below.

II. THE PROVISION OF HOSPITAL FACILITIES

6. To use hospital statistical data to indicate levels of population morbidity it is necessary for hospital bed provision to be adequate for the necessary care and treatment of all patients with the condition under review, for this provision to be evenly spread geographically, and for it to be available to all, and to be used by all when their condition warrants it. If beds are in short supply, are geographically or socially inaccessible, or if fear and superstition keep patients away then extrapolation from hospital data is bound to give a misleading picture.

7. For example, it is known that beds for the care and treatment of the mentally sub-normal are in short supply, and that there are

some geographical differences in this. Patients admitted are those who are either more severely afflicted or for some reason cannot be cared for at home. The levels at which these medical or social factors become operative will differ according to the supply of beds in a particular area. Thus statistical data of hospital patients cannot give more than minimum figures of the prevalence of mental subnormality. In addition, statistics of those known to be waiting for admission are also misleading for the names of many patients are not entered on waiting lists when the possibility of admission is remote.

8. A second example deals with uterovaginal prolapse, a condition which requires hospital admission if any radical treatment is to be undertaken. The data in table 1 show that the discharge rate for this condition varies by almost a factor of two in different regions of England and Wales (chosen as examples). It seems hardly conceivable that this represents a real variation in morbidity in these regions which, though not identical, are racially, culturally and socially not dissimilar. The difference appears to be caused by a disparity in the provision of beds for gynaecological treatment also shown in table 1. Despite these large differences in bed provision there is little real evidence available of an excess of beds in one region or of a deficiency in the other. It would seem that despite their apparent similarity the women resident in the two hospital regions or their personal physicians have developed different attitudes to the treatment of this disease. Whether this is the reason for, or the result of the availability of different hospital facilities is not known.

9. Thus adequate provision is a relative term. Variation in provision and use make accurate morbidity measurement difficult even in a country where hospital services are regarded as highly developed. However the type of statistical data adds more difficulties.

III. THE TYPE OF STATISTICAL DATA

10. With certain exceptions most hospital statistical data are of the "single event" type, i.e., a single spell of admission to hospital is treated as a separate occurrence in the statistics and each occasion on which a patient is re-admitted to hospital, even if for the same condition, is treated as a discrete episode with no attempt to relate the admission to any previous one. For some diseases single event data provide an adequate statistical picture but very often when a disease causes illness serious enough to require admission to hospital, admission is likely on more than one occasion.

11. This is particularly true of patients with malignant neoplasm. In well-developed countries almost all patients with cancer are admitted to hospital at least once, yet one can obtain little idea of the level of cancer in the community by a consideration of single-event hospital statistics. For example, in England and Wales in 1961 there were estimated to be 34,530 admissions² for carcinoma of the lung, a disease which is still almost invariably fatal and yet there were only 22,810 deaths³ assigned to the same cause. One must assume that most of this difference is due to multiple admissions of the same persons. For carcinoma of cervix uteri there were 10,600 admissions and 2,504 deaths. This latter form of cancer is not by any means invariably fatal but from other data it is estimated that the 5-year survival is 42 per cent.⁴ Thus the number of admissions is well above one per person. In fact, it has been calculated that although the average length of stay per spell for carcinoma of the cervix is 18.7 days, the total time spent in hospital for each patient with the disease is 48 days.⁵ Thus any statement on the incidence of carcinoma of the cervix based entirely upon single-event hospital statistics would grossly overstate the position.

12. Further, the treatment policy as shown by hospital admission varies considerably between regions, thus making geographical comparisons of incidence and prevalence difficult. This is shown in figure 2 where the hospital discharge rate for malignant neoplasm of lung is shown as a percentage of the mortality rate. If hospital treatment policy was uniform throughout the country one would expect that this percentage would be reasonably constant in different areas. In fact, there are differences of more than 50 per cent in this ratio, which can only be due to variations of admission policy—perhaps occasioned by availability of beds.

13. There are however a few conditions for which, once diagnosed, hospital admission can be regarded as almost obligatory, and which usually require only one admission. Hospital statistical data will give a fairly accurate indication of morbidity for these. Some of the conditions are enumerated in table 2. They are

² Hospital admission data unless otherwise stated is taken from Ministry of Health and General Registrar Office, *Report on Hospital In-Patient Enquiry*, (London, H.M.S.O., 1964).

³ Mortality data in this paper is taken from: Registrar General, *Statistical Review for England and Wales*, part I Tables Medical (London, H.M.S.O., 1963).

⁴ J. C. Bailar, *Symposium on End Results of Cancer Therapy* (Oslo, 1963).

⁵ L. Lipworth, personal communication (1964).

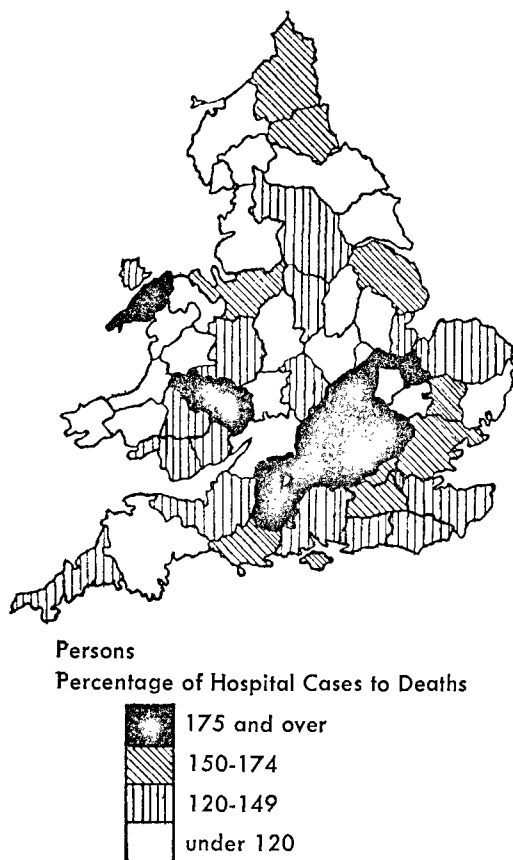


Figure II

Malignant neoplasm of lung: discharge from hospital expressed as a percentage of deaths from the same cause for each county in which resident, 1959

SOURCE: Ministry of Health and General Register Office, *Report on Hospital In-Patient Enquiry, 1959* (London, H.M.S.O., 1963).

based upon British experience, and although the list does not pretend to be exhaustive, it does show how relatively few are the conditions which fulfil these criteria.

IV. TEMPORAL COMPARISONS IN HOSPITAL STATISTICS

14. The foregoing discussion shows some of the difficulties in extrapolating from hospital to community morbidity on a geographical basis. Temporal comparisons are as difficult. Table 3 shows the secular trend in the number of discharges for some selected conditions in England and Wales. In none of the examples shown can one be certain whether the trend shown represents a real change in morbidity, a change in treatment policy or a change in the morbidity

or treatment of other diseases releasing or closing beds for the treatment of the disease under review.

V. THE VALUE OF "SINGLE EVENT" HOSPITAL STATISTICS

15. Thus far I have been considering data collected in a country where a National Health Service is in existence, where virtually all hospitals take part in the statistical enquiry and where populations are accurately known. Where these desiderata do not exist the use of hospital statistics for morbidity purposes is even more difficult.

16. Are we then to dismiss hospital statistics as useless? The answer to this is surely "no". Despite their many shortcomings they still have manifold uses. The first use of hospital statistics is in the assistance that they can give in the administration of the hospital. To study a hospital's performance and to try and improve it requires an efficient statistical system so that managerial decisions can be based as far as possible upon fact. However this particular use is beyond the scope of this paper.

17. Secondly one must remember that hospital statistics are only rarely studied in isolation. They may be compared with data of another type, e.g., mortality data, or of a similar type from another region or country. In addition, those who study the hospital statistics of a country rarely do so without some background knowledge of the spectrum of disease in that country. This means that hospital statistics can be a useful adjunct to a more complete understanding of morbidity. It is true that only on rare occasions will it be possible for estimates to be made of the level, or of the trend of a particular disease in a particular community but accurate estimates are not required particularly in those countries which are less well developed. What is required is data which can be added to other knowledge to help to build up a picture of morbidity. The fact that this can only be understood in comparatively non-statistical terms does little to detract from its value. With the growth of understanding of the relationship of a particular set of data to corresponding morbidity in the community it becomes possible to use hospital statistics in a more formal statistical sense, but the time when this position arises must be left to the judgement of those working in a particular area.

VI. "LINKED" HOSPITAL STATISTICS

18. We must now consider the future of hospital statistics in those countries, such as

England and Wales, where both the state of the hospital service and of the statistics collected therein can be regarded as advanced. In the discussion earlier in this paper, I have pointed out how difficult it was to arrive at accurate estimates of morbidity in the community whether these be absolute or, where comparisons are concerned, relative ones. What is needed to make the statistics more valuable as far as population morbidity is concerned?

19. It has been shown that "single event" statistics are difficult to use in this way. What is required is a process by which subsequent admissions of the same person are related. If this can be achieved then statistics can be produced which indicate not the number of admissions for a particular disease but the number of persons admitted with that disease. This means that as long as any particular disease is likely to lead to hospital admission at some time then hospital statistics of this type, usually known as "linked statistics" will provide an accurate indication of the prevalence of a disease in the community. The list of diseases which fulfil these criteria is very much longer than that given in table 2 and may be as much as half the diseases and conditions separately identified in the International Classification.

20. Linked statistics are possible at two levels. The first and easiest to attain is the linkage of admissions of the same person on more than one occasion to the same hospital. This requires no more than the carrying through of the information contained in the normal hospital records into the hospital statistics. However this does not seem to have been widely used. The great drawback to this type of data is that it makes no attempt to link the admission of one patient with a single disease to more than one hospital. This is a frequent occurrence and will be necessary if hospital statistics are to be of value in the accurate measurement of morbidity. Such a scheme involves the setting up of a central (or regional) organization to do the necessary linking of records (usually of summaries) and is inevitably costly.

21. It has been realized for many years that statistics based upon linked records are necessary for both administrative and epidemiological purposes in the study of psychiatric illness, and mental health statistics in England and Wales have been produced on a linked basis since 1954. Cancer registration schemes, although

primarily of use for the follow-up of the individual patient, are also valuable, with complete coverage, in overcoming the problems introduced by repeated admission in estimating the incidence of disease from "single-event" hospital data.

22. It is only in recent years that the need for general hospital statistics on a linked basis has been overtly expressed. This has been due to the decreasing value of mortality statistics as useful indicators of morbidity, the rising interest in population morbidity *per se* and in epidemiology generally, and finally by the development of automatic data processing allowing the linkage of records by computer.

23. The problems involved in the collection and linkage of routine hospital data are now being investigated in England and Wales by Acheson.⁶ He has set up an experimental scheme in Oxfordshire which sets out to link not only hospital records of the whole population but also birth and death certificates with possible future extension to other data.

24. In its first year Acheson's study showed that 22,525 in-patient spells referred to 18,366 patients. Re-admissions were particularly common among patients discharged from radiotherapy, neurosurgery, dermatology and thoracic surgery departments.

25. It is to be hoped that, in the next few years, work such as Acheson's will reveal the full potentialities of hospital statistics, both as tools of administration, but more important, in the context of the present paper, as a most important weapon in the armoury of epidemiologists in their studies of the origins and extent of serious diseases.

VII. OUT-PATIENT DATA

26. This paper has been concerned only with a consideration of in-patient statistics. There is however a great need for the development of out-patient statistics on a diagnostic basis. It will be apparent that strictures placed upon the use of in-patient data for epidemiological purposes will apply with even greater force to out-patient data. It will be essential for linkage not only of successive attendances of the same person but also of in- and out-patient treatment of that person if the data are to be of any value in an epidemiological sense.

⁶E. D. Acheson, "Oxford record linkage study", *British Journal of Preventive and Social Medicine*, vol. 18 (1964), pp. 8-13.

Table 1. Hospital treatment of uterovaginal prolapse in two regions of England and Wales—1961

<i>Region</i>	<i>Number of discharges per 10,000 population</i>	<i>Mean duration of stay (days)</i>	<i>Number of gynaecology beds per 10,000 population</i>
East Anglia	12.7	14.8	2.85
Leeds	22.9	16.8	5.27

Table 2. Common conditions requiring hospital admission and for which treatment is completed in one spell

	<i>I.C.D. No.</i>
Benign neoplasm of respiratory system.....	212
Benign neoplasm of breast.....	213
Uterine fibromyoma	214
Other benign neoplasm of uterus.....	215
Benign neoplasm of ovary.....	216
Ulcer of stomach with perforation.....	540.1 ^a
Ulcer of duodenum with perforation.....	541.1 ^a
Acute appendicitis	550
Hernia of abdominal cavity with obstruction.....	561 ^a
Intussusception	570
Congenital hypertrophic pyloric stenosis.....	756
Injuries of a certain severity ^b	—

^a These conditions may re-occur in the same person but each occurrence is usually regarded as a separate event.

^b Admission to hospital is regarded by some as indication of a "major" injury.

Table 3. Estimated number of discharges in England and Wales

<i>Diagnosis</i>	<i>1955</i>	<i>1956</i>	<i>1957</i>	<i>1958</i>	<i>1959</i>	<i>1960</i>	<i>1961</i>
Diabetes mellitus	26,000	27,000	28,900	29,900	31,600	32,960	35,630
Diseases of eye.....	72,500	76,900	79,500	85,600	86,100	86,960	84,830
Bronchitis	35,400	47,600	47,800	57,600	60,200	61,450	68,330
Peptic ulcer	74,000	73,300	68,900	67,600	66,500	68,000	67,040
Diseases of gall bladder and biliary ducts	35,200	34,800	37,300	38,100	38,800	39,580	41,550

Infant mortality in Madras city

S. CHANDRASEKHAR

1. In most developing countries, and particularly in countries like India, population is increasing very rapidly. Because of this, government efforts to decrease the death rate, and specially the infant mortality rate, may be unconsciously slackened. Large annual increases in existing population are due more to the definitive decline in the death rate than any increase in the birth rate. And yet the need to effect a rapid decrease in infant mortality is obvious for the infant mortality rate is considered a sensitive index of the total health conditions, and the overall cultural *milieu* in a community. The importance of the study of infant mortality in a developing country cannot be overestimated, particularly in the light of the fact that in most underdeveloped countries, roughly one out of every five or six infants dies before completing its first year of life. A high infant mortality rate means not only that the community is underdeveloped in the sense that all that is possible in the area has not been done but also that the infant mortality statistics are inadequate and rather unreliable.

2. *The city of Madras.* The city of Madras, capital of the Madras State and one of the major cities in India, is situated on the east coast of India. The city has grown from a small fishing village with an estimated population of 7,000 in 1639, to about 400,000 in 1871 when the first census was taken, to a near-modern metropolis of nearly 2 million in 1964. The area of the city has increased from approximately 27 square miles to the present area of 49.85 square miles.

3. *Sources of data.* While the vital statistical data for the country as a whole and particularly for the rural areas are defective and suffer from underrepresentation, the record of births and deaths, including those of infant deaths, are relatively accurate in major cities because of the availability of certain health services and strict enforcement of the registration of vital occurrences. Both the level of education of the average citizen as well as the statistical consciousness of the concerned officials are considerably higher in the cities. And among the Indian cities Madras and Bombay rank high for their efficient vital representation.

4. Madras city affords a good example for a study of infant mortality because it has an uninterrupted record of these rates for nearly a century. What is more, certain field studies carried out in recent years have tended to confirm the official statistics. In other words, the magnitude of underrepresentation, particularly in recent years, is small enough to be negligible.

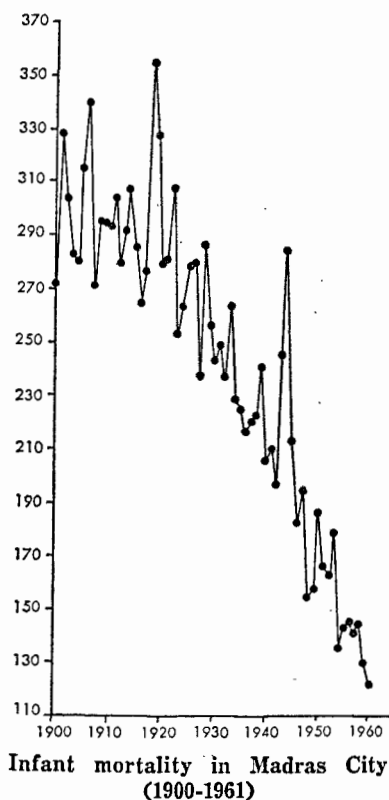
5. The corporation of the city of Madras has been publishing two comprehensive reports a year since 1880. One is the *Administration Report of the Corporation of Madras* which reviews the administrative problems for the preceding year and how they have been dealt with. The second publication is the *Annual Report of the Health Department of the Corporation of Madras*. This gives a detailed account of all the births, deaths (including infant and maternal deaths), the mid-year population estimate, the diseases responsible for the mortality rate, the various measures taken by the health department and the degree of success achieved. This report also estimates the completeness of vital representation and the problems encountered in registering all births and deaths and in ascertaining the causes of the latter. Besides this unverifiable primary official data, some new data have been collected from a demographic survey of Madras city conducted by the Indian Institute for Population Studies during 1962-1964.

6. *Growth of Madras city's population.* Although the history of the growth of Madras city and its population can be traced to the early beginnings of the seventeenth century, reliable figures for the population of the city are available only from the first Indian census of 1871. The population of the city in that year was 397,552. In less than a century the population has increased from this relatively small number by more than four times to the 1961 census figure of 1.7 million and to the estimated population of 1.8 million in mid-1964. The rate and pattern of growth of the city population reflects in a large measure the population growth of the country as a whole and her cities in particular. Though the population of the city has been increasing steadily, the rate of growth has been uneven. The percentage of growth as

shown in table 1 varies from 1.6 in 1921 to 61.8 in 1951—a wide range indeed for a city of its size.

7. During the closing years of the nineteenth century the population of the city tended to increase rather rapidly. The rate of growth was only 2.1 per cent in 1871-1881, whereas in 1881-1891, and 1891-1901 it was 11.5 and 12.6 per cent respectively. The two subsequent decades were a period of slow growth, the rates being 1.8 and 1.6 respectively. This is the period of least growth in the century under review. During the next three decades 1931-1961 the rate of growth steadily increased, reaching the all-time high rate of 61.8 per cent during the decade 1941-1951 (the decade that witnessed the birth of free India) but during the next decade 1951-1961 the rate of growth dropped to 21.8 per cent (see table 1).

8. *Infant mortality trends in Madras city.* The accompanying graph shows the trend of infant mortality rates from 1900 to 1960. It has declined from 280 per one thousand births in 1900 to 116 in 1960. The highest rate of 360 was registered during the influenza epidemic at the end of the First World War (table 2). This table gives the infant mortality rates in the city (from 1925 to 1961).



9. It is obvious that general infant mortality rates decrease when general mortality decreases. The decline in the general mortality rate depends on such a variety of conditions in the developing countries as the available food supply, the level of community sanitation and hygiene and the existence of certain basic health and medical services including preventive, diagnostic and curative services. This implies the existence of hospitals or clinics, general physicians, obstetricians, paediatricians and other specialists. What is even more important is that these services be available to all the needy, irrespective of their ability to pay for them. There is also, naturally, a correlation between the decline in infant mortality and the decline in female mortality, particularly maternal mortality.

10. A study of the available official data for the city of Madras shows that the infant mortality rates for some sixty years more or less reflect the trend of general and maternal mortality rates in the city. The improvements in this area are particularly noticeable in the last ten years. Table 3 presents the data for birth rates and general, infant and maternal mortality rates for the city of Madras during the last decade.

11. The crude general death rate has been almost halved during the last decade. It declined from 29.31 to 16.15 in 1962. The birth rate, on the other hand, was around 39 for the major part of the decade. The improvement in the death rate explains to a great extent the spurt in the rate of natural increase. Again, the infant mortality and maternal mortality rates, which are better indices of the total health conditions prevailing in the community, have also declined significantly. The infant mortality rate has declined from 166 in 1951 to 115 in 1962, while the maternal mortality rate for the corresponding period has dropped from 2.5 to 1.1. Both reflect the decline in the general mortality rate.

12. The improvement in the mortality conditions in the city during the last decade can be ascribed to several causes. First, the various measures taken by the Corporation Health Department to improve the sanitary conditions and the efforts to mitigate the effects of two minor epidemics were beginning to take effect. Among the health measures taken by the city authorities are compulsory vaccination, the training of midwives and the provision of certain basic prenatal and postnatal services to mothers and infants in the various maternity clinics. Perhaps the most important factor is that more than 80 per cent of the confinements in the city take place in the hospitals. This

factor of hospital delivery is particularly important because in the country as a whole about 85 per cent of the infants are delivered in the homes of the mothers where aseptic conditions do not exist. And in rural, and even in certain urban areas, births are not attended by any medical or even para-medical personnel.

13. Further, the Malaria Control Program which was launched in Madras city in 1955 and which was later converted into the Malaria Eradication Program reduced the number of adult and infant deaths due to malaria. This programme has also had an indirect influence on the general level of health in the city. Those already weakened by malaria are especially vulnerable to infection from other diseases, and with malaria more or less eradicated in the city, resistance to other diseases has been increased to some extent, particularly among the vulnerable groups of infants and mothers.

14. This brief discussion reveals that while the present infant mortality rate of 115 per 1,000 live births is a high figure in comparison to what has been achieved in the advanced countries (between 20 and 25 per 1,000 live births), the present rate represents considerable progress in relation to the conditions two decades ago. Secondly, an action programme to reduce infant mortality in the future must be based on reliable classification of causes of death. Here is a weak area as far as Madras city is concerned. When accurate information on the causes of infant mortality is gathered

the task will become easier. However, in the light of the present limited knowledge, it can be pointed out that infant mortality rates respond whenever a community has sufficient resources to ensure hospital delivery, improve sanitation and public hygiene and impart a modicum of health education to its citizens and especially to expectant mothers. In the rural areas adjacent to Madras city the infant mortality rates are much higher than those in the city. And the simple reason for this differential is, of course, that the rural areas do not have even a small part of the health and medical services that the citizens of the city enjoy. In a word, a low infant mortality rate is a purchasable "commodity", particularly in an underdeveloped country.

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Table 1. Decennial growth of the population of Madras city, 1871-1961

Year	Population	Increase in population	Percentage increase in population
1871.....	397,552	—	—
1881.....	405,848	8,296	2.1
1891.....	452,518	46,670	11.5
1901.....	509,346	56,828	12.6
1911.....	518,660	9,314	1.8
1921.....	526,911	8,251	1.6
1931.....	647,230	120,319	22.8
1941.....	777,481	227,954	35.2
1951.....	1,416,056	540,872	61.8
1961.....	1,729,141	312,085	23.4

Table 2. Infant mortality rates in Madras city, 1925-1961

<i>Year</i>	<i>Infant mortality rates</i>	<i>Year</i>	<i>Infant mortality rates</i>
1925.....	279	1944.....	284
1926.....	282	1945.....	214
1927.....	240	1946.....	183
1928.....	289	1947.....	196
1929.....	259	1948.....	157
1930.....	246	1949.....	159
1931.....	251	1950.....	188
1932.....	239	1951.....	167
1933.....	268	1952.....	164
1934.....	232	1953.....	180
1935.....	227	1954.....	136
1936.....	118	1955.....	143
1937.....	224	1956.....	145
1938.....	222	1957.....	140
1939.....	242	1958.....	145
1940.....	206	1959.....	129
1941.....	209	1960.....	121
1942.....	197	1961.....	116
1943.....	247		

Table 3

<i>Year</i>	<i>Birth rate</i>	<i>Death rate</i>	<i>Infant mortality rates</i>	<i>Maternal mortality rates</i>
1951.....	41.11	29.31	166.57	2.50
1952.....	42.28	29.03	163.82	2.40
1953.....	35.20	28.37	180.28	2.78
1954.....	37.12	20.78	136.24	2.47
1955.....	—	—	—	—
1956.....	39.59	19.90	145.24	2.18
1957.....	39.35	20.91	139.71	2.08
1958.....	39.65	20.34	144.60	1.95
1959.....	33.24	15.88	129.17	1.93
1960.....	32.88	15.27	121.60	1.58
1961.....	41.61	18.71	115.79	1.15
1962.....	42.47	16.15	115.10	1.12

Migration and the convergence of white and Negro rates of mental disease

EVERETT LEE

1. In recent years there has been a rapid convergence of Negro and white rates of mortality, as measured in terms of the absolute differences in rates, whether crude or age specific, and with some exceptions, regardless of cause of death. By and large, this development can be attributed to the improving social and economic status of the Negro relative to the white, but migration has also played a part, since the redistribution of the Negro has been from areas in which mortality was high into areas where mortality was low. This has been particularly true of infant mortality and mortality from infectious diseases.

2. Whether or not the convergence in mortality rates has been accompanied by a convergence in morbidity rates is uncertain. Surveys of morbidity by color are now a part of the National Health Survey but there are few data before 1950 which can be compared with the more recent materials. Furthermore, days lost from school or work or days of restricted activity, the usual criteria for morbidity surveys, have different meaning for different income or ethnic groups, representing in addition to illness attitudes toward school and economic differences between wage and salary workers. For such reasons, morbidity comparisons are often restricted to serious chronic illnesses to which the response is necessarily much the same for everybody.

3. By adopting such a severe criterion it is possible to make one of the most difficult of morbidity comparisons, that of relative rates of mental disorder, and it is possible to explore the role played by migration in the changes which have occurred. This fortunate situation results from the excellence of admissions data to hospitals for mental disease in New York State, where for a long time there has been no discrimination against any ethnic group in admissions policy. No one is refused admittance because of lack of space and careful distinctions are made between the mentally ill and the mentally defective. Reports are assembled for admissions to all types of hospitals for the mentally diseased—private, criminal, and veterans' as well as public hospitals. Thus, the

statistics cover all admissions for mental disease, except those made to psychiatric wards of general hospitals and those of persons who leave the state to be hospitalized. Nonresidents who come to New York State for treatment have been excluded from this study since the population at risk is that of New York State.

4. One of the most important advantages of New York State data is that comparisons can be restricted to rates of first admission. For many disorders readmissions are common, and these are more characteristic of some diseases than others, and consequently more common among some ethnic groups than others. By eliminating readmissions it is possible to compute incidence rates for persons admitted to hospitals for the first time within a given interval.

5. For two- or three-year periods centering around the censuses of 1940, 1950, and 1960, rates of first admission by age, sex, race or color, and migration status have been computed for New York State. For each of these periods first admissions of New York State residents numbered 40,000 to 60,000 and even small differences in rates are significant from the purely statistical point of view. Though rates were computed for specific psychoses and for psychoneuroses as well, we are forced by lack of space to restrict this paper to total admissions. It is worthy of note, however, that the relationships established here for total mental disorders hold equally well for total psychoses. There are, however, marked differences in the epidemiological relationships found for individual psychoses and for psychoneuroses, sometimes reversing the usual racial or socioeconomic differentials.

6. Throughout the period, 1939-1941 through 1959-1961, the differences between rates of first admission for whites and nonwhites in New York State have been diminishing. This in effect means that differences between whites and Negroes have been decreasing since Negroes form the overwhelming bulk of the nonwhite population of this state. For ages 15 and over, age standardized rates by the direct method are shown below:

	<i>White</i>		<i>Nonwhite</i>		<i>Ratio white to nonwhite</i>	
	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
1939-1941.....	146	129	410	291	281	226
1949-1951.....	148	144	355	268	240	187
1959-1961.....	167	160	353	260	211	163

7. The differences in trends are striking. The rate for white males increased by 14 per cent from 1939-1941 to 1959-1961 while that for nonwhite males fell by an equal proportion. For white females the rate rose by more than a fifth and for nonwhite females it fell by more than a tenth. At the earlier period rates for nonwhite males were nearly three times as high as those for their white counterparts, but only twenty years later they were little more than twice as high. And among females the differential fell from about 125 per cent to little more than 60 per cent.

8. Sex differentials within the races were also affected, particularly among whites. Rates of mental disorder have traditionally been higher for males than for females in the United States, but by 1950 the over-all differences by sex had become unimportant among whites. Not so among nonwhites, where the differential has consistently been greater than among whites. In 1939-1941 rates for nonwhite males were 40 per cent higher than for nonwhite females and this relationship had changed only slightly by 1959-1961. It may be that the continuing high differential among nonwhites is related to differences in family structure and the position of the female. Among nonwhites, the female continues to be a mainstay of the family and assumes responsibilities which are ordinarily born by males in white society.

9. For Negroes the decade of the 1940's

seems to have been a crucial one in many respects. The 1930's were marked by the Great Depression, from which Negroes suffered more than whites. In the 1940's, however, the war engendered demand for labor and the continuing prosperity thereafter brought not only a sharp rise in income for the Negro but many psychological satisfactions as well. Data for 1929-1931, which are not completely comparable with that presented here, suggest that rates of mental disorder among Negroes in New York State were much higher in 1939-1941 than in 1929-1931, reflecting perhaps the great impact of the depression of the 1930's upon this racial group. The subsequent fall in rates of mental disorder among Negroes is therefore, to some degree, a return to a situation in which lower rates prevailed and in which the white-nonwhite differentials were not so great.

10. In order to examine the effect of migration upon the over-all rates presented above, each of the four sex-color groups is broken into three segments: those born in New York State, whom we shall refer to as nonmigrants; those born in other states of the continental United States, the internal migrants; and the foreign born or external migrants. Age specific rates were computed for these groups as for the total populations but the age standardized rates presented below are for ages 20 and over rather than for ages 15 and over.

	<i>Male</i>			<i>Female</i>		
	<i>Born in New York State</i>	<i>Born in other states</i>	<i>Foreign born</i>	<i>Born in New York State</i>	<i>Born in other states</i>	<i>Foreign born</i>
<i>White</i>						
1939-1941.....	137	216	162	115	199	154
1949-1951.....	157	179	155	137	180	165
1959-1961.....	161	214	143	150	196	148
<i>Nonwhite</i>						
1939-1941.....	304	455	342	207	316	304
1949-1951.....	297	372	230	243	282	204
1959-1961.....	313	381	201	190	280	223

11. For all three periods and for all four color-sex groups the migration differential was considerable. The rate for migrants from other states was invariably higher than that for any other group, exceeding the rate for the New York State born by 50 to 70 per cent during the first period. By 1959-1961 this differential had dropped from 20 to 30 per cent, except for non-white females, for whom it was about the same at the end of the twenty years as at the beginning. During this period migration had doubtless become easier and it is possible that migrants were not as different from non-migrants in education and other socio-economic factors as they had been at the end of the great depression.

12. For the first two periods rates for foreign-born whites were intermediate between those of the nonmigrants and the migrants from other states, but in 1959-1961 rates for foreign-born whites were lower than those of either native group. Among nonwhite males the rates for the foreign-born were below those of the New York State born in 1949-1951 and in 1959-1961, but among nonwhite females only in 1949-1951. Concomitant with the theory that females find assimilation in a new country more difficult than do males the relationship between rates for natives and the foreign-born is consistently more favorable for males than for females.

13. Whereas rates for native nonmigrants are often below those of the foreign-born, there is not a single instance in which the rates for the migrants from other countries were not below those of the migrants from other states, and often by a considerable amount. A partial explanation for this phenomenon may be that migrants from abroad are better selected than migrants from other parts of the United States and, though their problems of adjustment may be greater than those of internal migrants, they are better equipped physically and psychologically, to cope with them. Especially in recent years white immigrants have been disproportionately represented among professional and skilled workers, and it is generally believed that foreign born Negroes enjoy a higher social standing than do native Negroes, particularly migrants to New York State from the Deep South.

14. Trends in first admissions rates differ considerably by migration status. Among whites born in New York State the rate increased by about 20 per cent for males and 30 per cent for females. But among migrants from other states the rate was essentially unchanged and there was some decline among foreign-born whites.

The increase in over-all rates of mental disorder among whites in New York State is therefore entirely a result of increases among the indigenous population.

15. With nonwhites a similar situation prevails. Among the New York State born rates rose slightly for males and declined slightly for females over the twenty years. Among migrants from other states, however, there was a decrease of nearly 15 per cent, and rates fell even more sharply among the foreign born. All of the decrease in first admissions among non-white males and the greater part of the decrease among nonwhite females is therefore attributable to changes in rates among migrants.

16. A comparison of rates of whites and nonwhites by sex and migration status furthermore reveals that a good part of the difference in over-all rates for the two races is due to the difference in composition by migration status. A high proportion of nonwhites (indeed, among older persons, more than half) are born in other states and migrate to New York, whereas the great majority of whites living in New York State were born there. At each of the three time periods the ratios between white and nonwhite rates were less for each of the sub-groups by migration status than for the total population. In 1959-1961, for example, the differentials between white and nonwhite males was 111 per cent, but for persons born in New York State it was 94 per cent, for migrants from other states 78 per cent, and for the foreign born only 41 per cent. Among females, the results of this type of comparison are even more striking. Whereas the differential for the total white and nonwhite female populations was 63 per cent, it was only 27 per cent for the New York State born, 43 per cent for migrants from other states, and 51 per cent for the foreign born. Adjustment for migration status as well as for age would reduce the over-all differentials by approximately a fifth.

CONCLUDING REMARKS

17. In this paper three major points have been made. In the first place, there is a considerable difference between rates of first admission to hospitals for mental disorder for the indigenous population of New York State and for migrants from other states. Secondly, though nonwhite rates remain much higher, there has been a considerable convergence between white and nonwhite rates. Thirdly, this convergence has resulted almost entirely from sharp decreases in rates for migrants as com-

pared with increasing or approximately stable rates for nonmigrants.

18. Whether changes in rates of first admission are related to concomitant changes in rates of mental disorder is impossible to say. Mental disorder can be defined to include trifling disabilities, little more serious than the common cold, or the term can be reserved for serious illnesses. The importance of the findings given above, however, is not negated by this reservation, since hospitalization is in itself an indication of the seriousness with which the disease is regarded and results in much state expenditure.

19. The convergence between white and non-white rates is in agreement with findings from mortality studies and, to some extent, is even more impressive. The general findings in mortality comparisons are that absolute differences in rates have lessened while ratios between white and nonwhite rates have remained more or less the same. Here, however, ratios have also fallen, indicating that whatever the fac-

tors are that have brought about the decrease they have operated more powerfully among nonwhites, where improvement was needed most.

20. A final point centers around the importance of considering migration in health studies. Migrants are not a random selection of the population at origin and they invariably differ from the population at destination. Sometimes these differences are positive and sometimes they are negative, but they are seldom negligible. For this reason alone migrants should be expected to differ from nonmigrants in matters of health, and their moves have impacts upon the general level of health of the populations of origin and destination. Furthermore, there are elements in the migration situation itself, the stress of adjustment to the new community for example, which have important health implications. As infectious diseases are conquered and socio-economic factors become even more important in epidemiological studies, migration needs increasingly to be taken into account.

Mortality at age forty-five and over: recent trends in Norway and other countries with low mortality levels

JACQUES LÉGARÉ

[Translated from French]

1. Since mortality at the younger ages has reached a very low level in many countries, an improvement in the expectation of life at birth is likely to come about only through a considerable decline in the life-table mortality rates of adult age-groups. During the last twenty-five years the expectation of life at age 45 has risen in most countries of the world.¹ In five countries it is at least thirty-one years; these are, in descending order, Norway, Puerto Rico, the Netherlands, Sweden and Israel. These five countries are the only ones which have an expectation of life of over thirty years for males at age 45. It is this fact which puts them in the lead for both sexes taken together, a number of other countries² having attained a level for females at least equal to that of the countries just mentioned.

2. In demography, as in many other fields, it is customary to predict the trend of a phenomenon in a given country from the observation of similar trends in a more advanced country. In the case of mortality forecasts, a mere transposition in time from one period to another has often been found to give sufficiently accurate results for countries with comparable mortality trends. A study of recent mortality trends after age 45 in the more advanced countries should therefore prove useful. We shall deal first with Norway, where expectation of life is highest, and then, by means of international comparisons, shall evolve some assumptions to explain the trends demonstrated by our descriptive analysis.

I. RECENT TRENDS IN NORWAY

3. A recent United Nations publication states that "mortality rates among the elderly population in the advanced countries have

shown relatively small reductions, and in some cases even a recent tendency to increase".³ This is particularly true of Norway, where, in the 1951-1955 life table, the expectation of life at age 45 was 32.1 years but in the 1956-1960 table was 32.0 years. For males, the figures are 31.0 and 30.6 years, respectively.⁴ In the most recent life table, the mortality rate for males of ages 55-75 is the highest of the post-war period; that for females shows a slackening rate of gain. Is this a transient phenomenon attributable to the oscillations of a few "bad years"? In order to grasp the full extent of the phenomenon, our analysis will begin at the end of the First World War.

4. As only five life tables were available for this forty-year period, it seemed preferable to use the annual death rates for each five-year age group in order to have as many indices as possible. Since, however, we were not interested in annual fluctuations, but only in the medium-term or long-term trend, we evolved five-year moving averages— $M^t_{x, x+4}$ —as follows: for each age group $x, x+4$

$$M^t = 1/5 \sum_{i=t-2}^{t+2} m^i$$

where m^i is the rate for the year " i ". Let us now analyse the trends for each sex.

5. The decline in female mortality since 1919 can be represented on a graph by a straight line, since the oscillations due to the last war are barely perceptible. As might be expected, the rate of decline slackens with increasing age (see table). From age 55 to age 75, however, the years 1956-1957 seem to indicate the lowest limits of the decline (fig. 1). Thereafter, in most cases, the rates remained steady at the

¹ "International gains in longevity after midlife", *Statistical Bulletin*, vol. XLV (New York Metropolitan Life Insurance Company, 1964), pp. 1-3.

² United States, Canada, England and Wales, Denmark, Spain, France, Poland, USSR, Cyprus and New Zealand (excluding Maoris).

³ United Nations, *Population Bulletin of the United Nations*, No. 6 (United Nations publication, Sales No.: 62.XIII.2) p. 11 *et seq.*

⁴ In the 1946-1950 life table, the expectation of life at age 45 for males was 30.7 years.

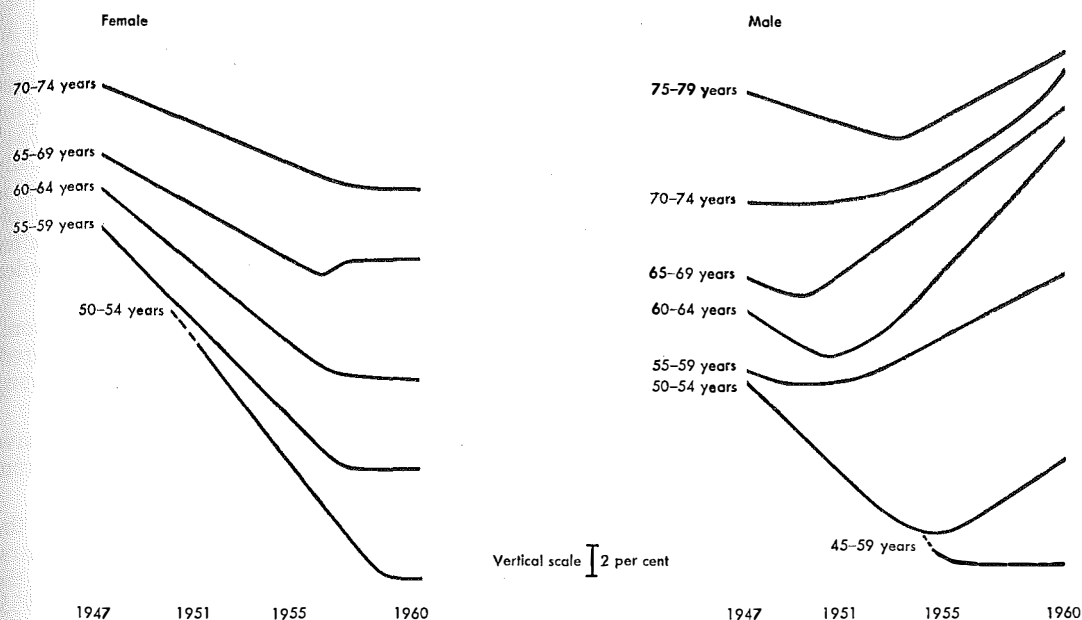


Figure I
Norway

Moving averages ($M_{x, x+4}^t$) of annual death rates ($M_{x, x+4}^{1947} = 100$)

Norway—1919-1962: moving averages of annual death rates (per 1,000 population);
average annual variations (per cent)

Age groups	45-49	50-54	55-59	60-64	65-69	70-74	75-79
<i>Male</i>							
$M^{1921} a$	8.68	10.71	14.52	21.72	32.66	51.37	84.62
$M^{t\alpha}$	4.05	6.58	10.35	15.77	24.82	42.03	69.18
$t\alpha b$	1955	1953	1948	1950	1949	1949	1953
$t\beta c$	—	1955	1951	1953	1949	1949	1953
$M^{t\beta}$	—	6.51	10.35	16.06	24.82	42.03	69.18
M^{1960}	4.03	6.90	11.31	18.66	28.67	46.64	74.25
Annual decrease (per cent)	1.57	1.20	1.06	0.95	0.86	0.65	0.57
Annual increase (per cent)	—	1.22	1.03	2.32	1.41	0.95 ^d	1.05
<i>Female</i>							
$M^{1921} a$	7.66	9.47	12.50	17.68	27.35	44.20	73.90
$M^{t\alpha}$	2.53	3.78	6.32	10.69	18.57	33.86	60.22
$t\alpha b$	1960	1959	1957	1956	1956	1957	1960
$t\beta c$	—	—	—	—	—	—	—
M^{1960}	2.53	3.84	6.30	10.57	18.90	33.61	60.22
Annual decrease (per cent)	1.72	1.58	1.37	1.13	0.92	0.90	0.48

^a Five-year moving average. Explained in paragraph 4.

^b $t\alpha$: last year of the long-term declining trend.

^c $t\beta$: first year of a marked rising trend.

^d Exceptional case of an exponential rise (fig. I).

minimum level.⁵ Does this mean that the point has been reached in Norway where the fight against death will henceforth depend on the discovery of new methods of treating the diseases characteristic of the second half of adult life? It should not be forgotten that during the period 1956-1960 the female population of Norway had reached the highest level of longevity ever recorded for these ages, viz., 33.4 years.⁶

6. The difference between the female and male rates continues to increase, in both absolute and relative terms; this is no longer the result of a less marked decline in male mortality but rather of a rise in male mortality at 50 years and over (see table).

7. Despite marked deviations due to the last war, the rates for males from 1947 onwards fall back into the pattern of the long-term trend. This trend is not, however, identical for both sexes because the time sequence differs in two ways. In the case of males, the lower limits of the decline occur around 1950, that is to say, for certain age groups, almost ten years before the same phenomenon occurs for females. An interval of the same magnitude occurs in the case of age differences at the same rate of decline. After a fairly long period of stable rates for males at the minimum level, the rates begin to rise, often quite rapidly (fig. I). For example, the average annual increase for ages 60-65 is 2.32 per cent. As a result, the 1960 rate is 18 per cent higher than the 1950 rate, the lowest recorded for that age group. The implication of this is clear; the rises, irrespective of the pace at which they occurred, leave no room for doubt on the recent trend. We are undoubtedly faced with a substantial rise in Norwegians' death rates, and nothing in the recent past gives grounds for hoping for a sudden halt to this rising trend in the immediate future.

II. INTERNATIONAL COMPARISONS

8. The case of Norway is not, however, exceptional.⁷ We studied the trend of male

⁵ This may indicate the first repercussions of an increase in cardiovascular diseases in women, as forecast by Jean-Noël Biraben, Yves Péron and Alfred Nizard, "La situation démographique de l'Europe occidentale", *Population*, No. 3 (1964), p. 467.

⁶ In more recent periods two other countries have reached this level:

Puerto Rico (1960): 33.6 years

USSR (1958-1959): 33.4 years

SOURCE: "International gains in longevity after mid-life", *Statistical Bulletin*, vol. XLV (Metropolitan Life Insurance Company, 1964), pp. 1-3.

⁷ United Nations, *Population Bulletin of the United Nations*, No. 6 (United Nations publication, Sales No.: 62.XIII.2), pp. 54-57; J.-N. Biraben, Y. Péron

mortality in Sweden and the Netherlands in view of the fact that their demographic history is comparable to that of Norway. In the case of the Netherlands, a rise similar to that for Norway occurred between ages 55 and 75;⁸ the rate of decline in Sweden is gradually slackening. The purpose of this comparison is to determine what trend male mortality followed or will follow in these countries after reaching the minimum levels already recorded in Norway.

9. The results which emerge from the comparison are not as clear as might be desired, since the situation varies from one age group to another:

(a) 45-50 years: all three countries have the same level—4 per 1,000 population—from 1956 onwards;

(b) 50-55 years: in the Netherlands the situation has changed little in the last ten years, the level being 7 per thousand; in Sweden, the minimum level recorded in Norway in 1955, viz., 6.5 per thousand, has just been reached;

(c) 55-65 years (fig. II): in Sweden the declining trend is still in progress but the Norwegian minima have not yet been reached; in the Netherlands, the trend is quite similar to that for Norway, but at a higher level—in other words, before the Netherlands rates began to rise, they had not at any time reached the low point of the Norwegian rates;

(d) 65-75 years (fig. II): the trend, upward or downward, is very slow and occurs at levels higher than the Norwegian minima—10 per cent higher in the Netherlands and 15 per cent higher in Sweden.

10. This analysis shows that Sweden is the country where the rates are most likely to go below the Norwegian minima; we shall have to wait a few years, however, before we can establish the subsequent trend. It would have been interesting to study comparable data for Puerto Rico in view of the high level of mortality in that country at the beginning of the century. Unfortunately, the information we have is much too fragmentary to permit any detailed analysis. In the case of Israel, we did not consider it advisable to study that country's statistics in view of the somewhat exceptional history of its population.

III. CONCLUSION

11. For a number of years past, some research workers have been trying to assess

and A. Nizard, "La situation démographique de l'Europe occidentale", *Population*, No. 3 (1964), p. 466.

⁸ Denmark, with a slightly higher mortality level, shows a similar rise between ages 55 and 70.

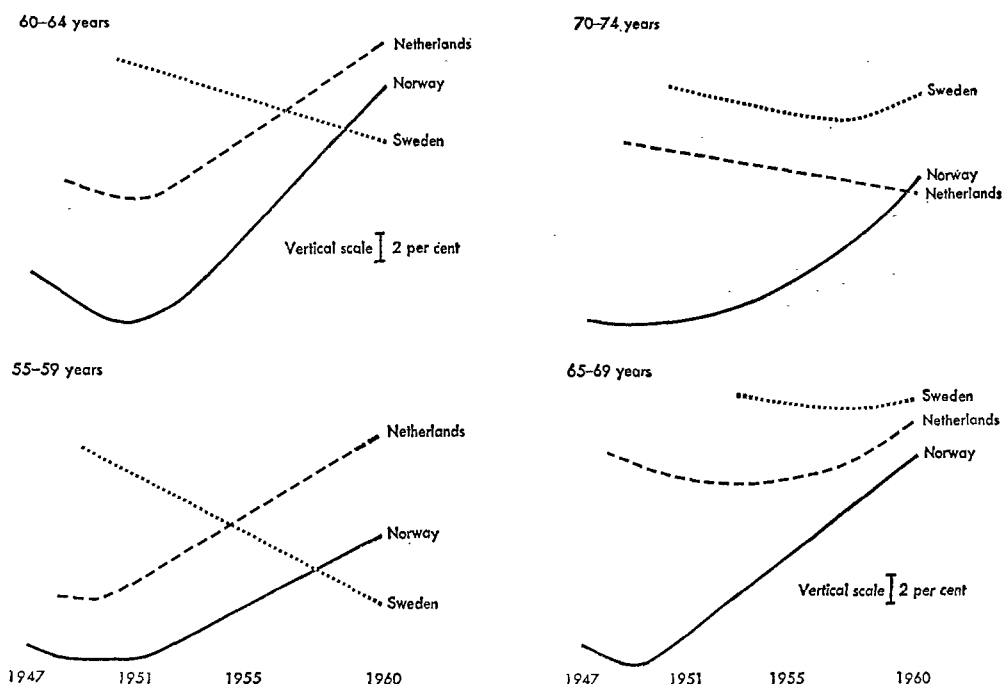


Figure II

Norway-Sweden-Netherlands: males

Moving averages ($M'_{x, n+4}$) of annual death rates ($M^{1947}_{x, n+4}$ (Norway) = 100)

the effects and consequences of an increasingly apparent absence of natural selection by mortality; they are, in effect, trying to assess the effects of the more remote past on current events, or, in demographic terms, the generation effect. For many demographers, however, death rates, which differ in this respect from other demographic indices such as fertility rates, would not be greatly influenced by the generation effect. In their view, current indices, such as those we have studied, would provide a fairly accurate picture of living conditions during the period under review. There are many others, however, who believe that the conditions of modern life—particularly life in large urban centres⁹—may have increasingly adverse physical and mental effects on persons approaching the later years of their active lives. It would seem that as fast as medical science gains control over certain diseases, others—of a completely new type—develop.

12. Let us suppose, to reduce the matter to

its simplest terms, that these two types of factor come into play at the time of a person's death: that is to say, his recent and remote past, and the circumstances of the moment. Where, as in Norway, there is a rise in mortality, it may be assumed that the preponderant factor is having increasingly harmful effects. The question is, however, which factor is actually the preponderant one? It is here in particular that the situation in a country like Puerto Rico, where living conditions are gradually approaching those found in highly developed countries, is deserving of closer study. If that stage of development were to be attained before new methods of treatment were found for diseases characteristic of advanced ages, and if a certain degree of stability—or a rise—in the mortality level at these ages became apparent, the second type of factor could be identified. If, however, such a situation did not arise, it might be assumed that the absence of natural selection by mortality is the factor having the greatest effect on survival at age 45 and over, for natural selection by mortality was, at the beginning of the century, much more significant in Puerto Rico than in the Nordic countries. Another means of detecting this factor would be to make a very thorough analysis of the generation life tables.

⁹ The very low level of mortality at advanced ages which has long been characteristic of Norway may be partly explained by the fact that many Norwegians live in rural areas. R. L. Gwilt, "Mortality in the past hundred years", *Transactions of the Faculty of Actuaries*, vol. XXIV (1956), pp. 60-61.

13. What will be the future trend of mortality after age 45 in countries with very low mortality levels? Recent forecasts of mortality trends in the United States¹⁰ indicate that at the beginning of the twenty-first century the life-table mortality rates for males between the ages of 55 and 65 will be roughly 70 to 80 per cent of the minimum rates recorded in Norway. Moreover, these forecasts assume,

¹⁰ Paul H. Jacobson, "Cohort survival for generations since 1840", *The Milbank Memorial Fund Quarterly*, vol. XLII, No. 3 (1964), pp. 36-53.

contrary to recent trends (see paragraph 6), that there will be a substantial decline in male excess mortality. It has, of course, been found that past mortality forecasts were always based on over-conservative assumptions, since progress in health and sanitation has greatly exceeded expectations. Will this happen again, now that the battle is being waged against the biological factors which control human life? It seems to us, in view of the study we have just submitted, that there is reason to be rather sceptical about the extent of any such decline.

Morbidity factors and trends and their connexion with the level of mortality in the Union of Soviet Socialist Republics

V. K. OVCHAROV

[Translated from Russian]

1. Morbidity and morbidity trends depend entirely on the social and economic conditions underlying the state of a country's health.

2. At the beginning of the twentieth century, the state of the nation's health in Russia was quite similar to what it is today in the economically developing countries. At that time, epidemics of cholera, smallpox, exanthematous typhus and other infectious diseases often broke out in Russia, as they do today in many Asian, African and Latin American countries as a result of unfavourable social, economic and living conditions and the rudimentary level of development of the public health services. In 1913 alone, 72,000 cases of smallpox, 184,000 cases of exanthematous typhus, 324,000 cases of cholera and 535,000 cases of plague were recorded in Russia. In the same year, 1.2 million cases of syphilis were detected. This represents an average rate of 77 per 10,000 persons; in the large towns it was two to three times higher. The incidence of tuberculosis in the large towns was 2 to 2.5 per cent of the total population.

3. The absence of any government health service, as well as the lack of physicians and hospitals, and, consequently, the poor availability of medical services, greatly limited the detection of cases. Morbidity, especially that attributable to epidemic diseases, was recorded in only part of the country, where the medical services administered by the district councils were more advanced.

4. Most patients under medical care were suffering from acute diseases related to unfavourable environmental factors. According to the statistics for 1914, 18 per cent of the conditions treated represented diseases of the digestive organs, 16 per cent infectious diseases, 11 per cent diseases of the respiratory system, 9 per cent skin diseases, 8 per cent parasitical diseases, 7 per cent traumatic conditions and 31 per cent other diseases and affections.

5. Mortality was another indication of the serious state of the nation's health in pre-

revolutionary Russia, the crude death rate in that period being 29.1 per 1,000 population.

6. Mortality was still higher in areas where unfavourable living conditions were made worse by the almost complete absence of physicians. In provinces, where there were approximately 4,000 persons to every physician, the death rate was 22.1 per 1,000 population, but where there were approximately 20,000 persons to every physician, it was 33.1 per 1,000. In 1913, infant mortality in Russia was 269 per 1,000 births.

7. In 1914, of the causes of death in ninety-two Russian towns where there was medical registration of deaths, 18 per cent were attributed to diseases of the digestive organs, 15 per cent to acute infectious diseases (excluding croupous pneumonia), 14 per cent to diseases of the respiratory system (including croupous pneumonia), and 12 per cent to tuberculosis. Diseases of the circulatory system accounted for 6 per cent and malignant neoplasms for 4 per cent of the causes of death in that year.

8. After the October Socialist Revolution of 1917, a broad programme of measures for the prevention and treatment of disease was made the basis for the activities of the State in the matter of protecting the nation's health. As its immediate tasks, the Soviet Government undertook to introduce sanitation in populated areas, place public catering on a scientific and hygienic basis, take steps to prevent the development and spread of infectious diseases, pass health legislation, and combat tuberculosis, venereal disease and alcoholism. At the same time, the foundation was laid for a State system of universal, free and competent medical care, including the provision of medicaments.

9. Soviet health measures in the twenties were aimed at eliminating such consequences of foreign intervention and the civil war as epidemics of parasitic typhus and smallpox and at combating tuberculosis, syphilis and other diseases.

10. Compulsory smallpox vaccination was introduced by government decree in 1919. As a result, by September 1920, at Petrograd, for example, smallpox had fallen to eight or ten cases a month, compared with 800 before the decree was promulgated.

11. An extensive network of institutions for the treatment and prevention of disease was established, the number of medical workers was increased, and health education was accorded considerable importance. All this, together with the successful restoration and development of a war-ravaged economy, made it possible, even in the first ten years of the Soviet State's existence, for the country's health situation to be considerably modified.

12. The incidence of acute infectious diseases declined sharply, although the actual trend was somewhat obscured as a result of the more complete recording of morbidity data by comparison with 1913. If the recording of morbidity data had been the same in 1913 as in 1928, the decline would have been even greater (table 1).

Table 1. Incidence of acute infectious diseases in pre-revolutionary Russia and in the Union of Soviet Socialist Republics

(Per 10,000 persons)

	1913	1928
Exanthematous typhus	8.1	2.1
Recurrent typhus	2.2	0.3
Typhus abdominalis and paratyphoid fever	27.5	7.5
Dysentery	34.9	9.6
Malaria	216.6	222.3
Diphtheria	34.4	5.6
Scarlet fever	31.0	22.0

13. Smallpox, cholera and plague were eradicated shortly after the revolution, and great advances were made in the fight against parasitic diseases.

14. In Moscow, where the recording of diseases was the most complete, the syphilis rate fell from 206 per 10,000 persons in 1913, to 84 in 1926 and 22 in 1932. The prevalence of tuberculosis with temporary loss of working capacity fell from 8.9 cases per 100 workers (in nineteen branches of industry) in 1925 to 2.3 in 1931. The tuberculosis death rate in Moscow fell from 236 per 100,000 persons in 1915 to 147 in 1931.

15. The basic scientific and organizational problems involved in fighting malaria were successfully solved in the USSR in the 1930's. In 1934, there were more than 9.5 million recorded

cases of malaria in the Union of Soviet Socialist Republics, but in 1940 there were only 3.2 million. In 1950, there were 781,000 and in 1955, 36,000, and since 1960, only isolated cases, primarily of foreign origin, have been recorded.

16. During the period before the Second World War, the country's health services were considerably strengthened, especially as regards measures for the eradication of epidemics. Up to the outbreak of the war, 1,943 epidemic control stations, almost 1,500 bacteriological laboratories and institutes and about 3,000 malaria control stations and clinics had been set up. A staff of 12,500 physicians was assigned to the epidemic control services. By 1940, the number of hospital beds had tripled and the provision of medical care had expanded almost fivefold. In urban areas, the number of doctor's visits increased from 136 per 100 persons in 1913 to 653 in 1940.

17. The Second World War, unleashed by the German fascists, brought vast destruction to the Soviet Union. As regards public health facilities, they destroyed and pillaged 6,000 hospitals, 33,000 polyclinics, dispensaries and out-patient clinics, 976 sanatoria and 656 rest homes. We needed no less than seven to eight years to restore the pre-war level of the economy. It should be noted, however, that although the Soviet health services suffered heavy losses during the war years, the country did not experience any outbreaks of the epidemic diseases commonly encountered in time of war. This was possible because an extensive network of medical institutions had been set up in the period of peaceful socialist construction, which were able to reorganize their work under the difficult war conditions in such a way as to prevent the emergence of epidemic diseases.

18. With the end of the Second World War and the elimination of its consequences, radical changes occurred in morbidity and mortality trends in the Union of Soviet Socialist Republics. There was a fundamental change in living conditions, and the country's medical and sanitary organization was expanded and improved. By comparison with 1913, the national per capita income was 4.5 times higher in 1940, and nineteen times higher in 1962.

19. The transition to a seven-hour and a six-hour working day for all manual and non-manual workers was completed in our country in 1960. Despite this shortening of the working day, the level of incomes was maintained and even raised. The prescribed length of the working day for adults in industry was reduced, on the average, from 9.9 hours in 1913 to 6.93

hours in 1963. Taking into account the shortening of the working day which precedes the day of rest or a holiday, and taking into account also holidays which are in addition to the normal days of rest, the average length of the working day for industrial workers is 6.67 hours. The average length of the working week for industrial workers is forty hours, and the average length of the working week for all manual and non-manual workers in the national economy of the Union of Soviet Socialist Republics (with due allowance for the shorter working day of teachers and of medical and various other workers) is 39.4 hours.

20. The real income of workers (real wages, taking into account free education and medical treatment, pensions, allowances and other payments and benefits from public funds, and also taking into account the reduction in working hours) was 5.9 times higher in 1963 than in the pre-revolutionary period. The rise in wages greatly exceeded the rise in the prices of goods and services. Expenditure on rent and public utilities is now five to six times less than before the Revolution, when it ranged from more than 20 per cent to as much as one third of a worker's wages.

21. Apart from wages, workers in the Union of Soviet Socialist Republics receive considerable sums from public funds in the form of social insurance, various allowances, pensions, scholarships, paid holidays, free education, free medical services and so on. The total payments and benefits received by industrial and construction workers in addition to their wages were, on a comparative price basis, twenty-five times greater in 1963 than in 1913.

22. The real income of peasants (income in cash and in kind from public and private agriculture, including income added to the indivisible funds and reserves of collective farms) had increased sevenfold by 1963, compared to the income of peasant workers in pre-revolutionary Russia, who, in addition, were subject to various kinds of payments and taxes amounting to considerable sums. These included land dues, rent, insurance and various taxes and obligations which totalled approximately 20 per cent of the income from agriculture. Today, dues and taxes paid by members of collective farms amount to about 3 per cent of their income from agriculture. On a comparative price basis, the payments and benefits received by individual peasant workers on collective farms in the USSR from public funds (including pensions, family allowances, free education and medical services and other forms

of social and cultural services) were approximately forty times greater in 1963 than in 1913.

23. In 1963, the real per capita income of manual and non-manual workers was 2.2 times higher, and the real per capita income of peasants 2.7 times higher, than in 1940. The real per capita income of all workers rose by 61 per cent over the last ten years (1954-1963).

24. Nutrition has greatly improved under the Soviet system. For example, the results of research on the family budgets of textile workers both in the pre-revolutionary period and in 1962 show that in the latter period consumption had increased as follows: meat products 2.5 times, dairy products 4.5 times, fish products 2.3 times, eggs 3.8 times and sugar 3 times.

25. Considerable changes in the pattern of consumption took place between 1953 and 1963. The consumption of products of animal origin increased, and the consumption of cereal products and potatoes decreased. Thus, in the families of industrial workers, the consumption of meat products rose by 52 per cent, dairy products by 47 per cent, fish products by 41 per cent and eggs by 67 per cent, while the consumption of cereal products fell by 18 per cent and potatoes by 10 per cent.

26. An important factor in raising the general health level has been housing construction, which has proceeded at a rate considerably higher than the rate of population growth. Under the Soviet régime, the urban population has increased fourfold, and the urban housing stock more than sixfold (1,128 million square metres in 1963, as against 180 million square metres in 1913).

27. In the period 1954-1963 alone, 85.3 million persons moved into new dwellings, and during the last ten years a total of 108 million persons, or almost half the population, moved into new dwellings or improved their housing situation. Between eleven and twelve dwelling units per 1,000 persons are built each year in the Soviet Union.

28. A higher level of general culture as well as of health standards was also an important factor in improving the nation's health. Illiteracy, which had formerly affected more than three-quarters of the population, was eradicated. As of 1 January 1963, seventy-five out of every 1,000 persons had received a complete or partial higher education or special secondary education, whereas in 1913 there were only two such persons per 1,000.

29. Under the programme laid down in the Union of Soviet Socialist Republics, competent medical care has been made fully available to

all persons without charge, and the provision of specialized medical care to all persons is becoming increasingly important (table 2).

Table 2. Provision of medical services

Year	Physicians (excluding military medical officers)		Hospital beds (excluding beds in military hospitals)	
	Total (in thousands)	Per 10,000 persons	Total (in thousands)	Per 10,000 persons
1913.....	28	1.8	208	13
1940.....	155	7.9	791	40
1962.....	480	21.5	1,942	87
1963.....	501	22.1	2,043	90

30. If sanatoria are included, there were more than 100 beds per 10,000 persons in 1962, i.e., almost eight times more than before the Revolution. The number of physicians is twelve times greater than before the Revolution, and the Soviet Union now has more physicians per 10,000 persons than any other country in the world. The changes between 1913 and 1962 were particularly great in the Central Asian Republics, the former outlying semi-colonial area of Russia. For example, the number of physicians per 10,000 persons in Uzbekistan increased by fifty-one times, in Kazakhstan by thirty-eight times, and in Turkmenistan by twenty-nine times. The number of hospital beds in these Republics increased over the same period by thirty-six, twenty-seven and thirty-two times, respectively.

31. The preventive aspects of public health and reliance on dispensary services are coming increasingly to the fore. Systematic medical observation is provided for children from birth to the completion of schooling and for working youths, workers who come into contact with harmful substances, persons engaged in physical culture and sports, pregnant women and others.

32. The system of home visits, together with an increase in the number of paediatricians and a consequent reduction in the number of children per paediatrician, has made it possible to reduce the infant mortality rate in a number of towns and regions in recent years to between twenty and twenty-five per 1,000 births.

33. The difference in the availability of medical services as between urban and rural areas has been practically eliminated; in 1961, twenty patients per 100 inhabitants in urban areas and seventeen patients per 100 inhabitants in rural areas were treated in hospitals.

34. Considerable assistance in the efforts to reduce morbidity and mortality is provided

by health statistics, which make use of a wide range of health indices. Special registration of infectious diseases is compulsory throughout the USSR and covers thirty basic types of infection. Statistics for the most important non-epidemic diseases are based on the special registration of new cases of active tuberculosis, various types of venereal and fungal diseases, trachoma and cancer and other malignant neoplasms.

35. Statistics of temporary disablement are compiled on a sampling basis and cover approximately 60 per cent of manual and non-manual workers in the basic sectors of the national economy. Statistics of permanent disablement include all cases where employment has ceased because of the worker's disability.

36. Statistics of hospital patients are compiled from the individual records of hospital admissions.

37. In the planning of health measures, considerable help is derived from the statistics of mass examinations for the detection of the early stages of diseases which are most amenable to effective treatment.

38. Medical registration of the cause of death is compulsory in the USSR. The data derived from such registration make it possible to determine the level of mortality for the various diseases and to decide on the direction in which efforts must be concentrated in order to improve the health of the people and reduce mortality.

39. In addition to the above-mentioned methods of studying the people's health, the records of visits to obtain medical assistance are used in the USSR to compile general morbidity statistics, which provide a comprehensive view of the nature and extent of individual diseases and groups of diseases.

40. As a result of the extensive measures to improve the lot of the workers, and because of the progress made in medical science and in

the organization of public health services over the last twenty years, significant advances have been made in reducing morbidity and mortality in the USSR (table 3).

Table 3. Fertility, mortality and natural population growth

Year	Births (Per 1,000 population)	Deaths (Per 1,000 population)	Natural growth	Infant mortality (per 1,000 births)
1913.....	45.5	29.1	16.4	269
1940.....	31.2	18.0	13.2	182
1962.....	22.4	7.5	14.9	32
1963.....	21.2	7.2	14.0	30.9

41. The population replacement rate has reacted favourably to the improvements in the general health situation, the net reproduction rate in 1960-1961 being 1.255.

42. According to the statistics of visits to obtain medical assistance, there has been a change in the structure of morbidity. As a result of the increased availability of medical assistance, the less serious diseases seem to be the most prevalent. In the town of Ivanovo in 1955, for example, a classification of initial visits by the ailments for which treatment was sought gave the following results: influenza and catarrh of the upper respiratory system—19.6 per cent; traumata—9.6 per cent; infectious diseases—8.9 per cent; diseases of the digestive organs—6.8 per cent; eye diseases—6.6 per cent; and various types of angina—6.3 per cent. By comparison with 1914, the proportion of medical visits at Ivanovo for the treatment of infectious diseases and diseases of the digestive organs was 2 to 2.5 times less. On the other hand, over the same period there was a threefold to fourfold increase in that town in the proportion of visits for the treatment of diseases of the circulatory system. In 1955, out of all patients seeking medical assistance, 7 to 10 per cent were suffering from the last-mentioned type of disease. Special surveys carried out in a number of towns (Noginsk, Frunze and others) showed that in the period 1955-1960 the average number of cases of cardiovascular diseases (including rheumatism and vascular affections of the brain) was 140-150 per 1,000 inhabitants. The increase in circulatory diseases is connected with increased longevity and the consequently greater number of elderly people in the general population. The average incidence of cardiovascular diseases at various ages is as follows: under forty years—5 to 6 per cent of the population;

forty to fifty-nine years—about 33 per cent; and sixty years and over—above 50 per cent.

43. Cases of malignant neoplasms in the urban population rose from 119.2 per 100,000 persons in 1958 to 147.5 in 1961. Here, too, one of the reasons was the increased proportion of elderly people. The incidence of malignant neoplasms among males per 100,000 persons was as follows: seven under thirty years of age, forty-eight between thirty and thirty-nine years of age, 185 between forty and forty-nine years of age, 461 between fifty and fifty-nine years of age, and 822 aged sixty years or over.

44. The mental health of the population has also improved. According to data from the Moscow psychoneurological dispensaries, where specialized assistance has long been available to all, the number of initial visits to the dispensaries fell from 54.4 per 10,000 persons in 1940 to 33.95 in 1959. The number of visits for schizophrenia were, respectively, 5.5 and 3.3, for epilepsy 3.5 and 1.1, and for reactive depressions and neuroses 16.4 and 6.3. During this period, the only cases to show an increase were psychoses resulting from vascular brain damage (from 2.6 per 10,000 persons to 3.2) and psychoses connected with traumata (from 2.3 per 10,000 persons to 3), these conditions being mainly the result of the Second World War.

45. During the Soviet period, there has also been a decline in the incidence of various other diseases. In 1950, the number of cases per 100,000 persons of active forms of syphilis was still 24.7 and of acute gonorrhoea 81.6. In 1961, these figures had declined to 1.5 and 55.4 per 100,000 persons, respectively.

46. In 1958, the incidence of diphtheria in the Soviet Union was 5.3 times lower than in 1913. At Leningrad, cases of diphtheria fell

from 19 per 10,000 persons in 1942 to 0.07 in 1959; today, only isolated cases are recorded.

47. The changes in the country's morbidity pattern over the past decade have also been due to improvements in methods of treatment and diagnosis, and in particular, to the detection of diseases previously difficult to diagnose. For example, the increase in cases of stenocardia, myocardial infarction and hypertonia is largely due, apart from the changes in the age structure of the population, to the widespread use of electrocardiography, that is, to more accurate diagnosis. The same applies to inalignant tumours of the internal organs (lungs, stomach, liver, etc.) and to a number of other diseases. Among recent advances are differential diagnosis and the more effective detection of virus influenza, acute respiratory diseases of viral origin, infectious hepatitis, epidemic poliomyelitis and other diseases.

48. One of the most important direct factors in the change in morbidity and mortality patterns is the reduction in the case fatality rate, especially as regards diseases of young children and infectious diseases. For example, the case fatality rate for scarlet fever at Leningrad, which was 16 per cent in 1910-1914, fell to 3 per cent in the pre-war years and was reduced to zero in the 1950's.

49. In the period 1955-1960 alone, the case fatality rate for ulcers fell from 1.3 per cent to 0.9 per cent, that for acute dysentery in children from 3.3 per cent to 1.8 per cent, and that for bronchial pneumonia from 4.3 per cent to 2.9 per cent.

50. Maternal mortality has declined sharply. According to the data from maternity homes, where almost all births now take place, the maternity death rate is 6 per 10,000 births, i.e., less than one fifteenth of what it was in 1913 and less than one third of the rate in 1940.

51. Among the causes of death, the decline in mortality was far above average for diseases of the digestive organs, infectious diseases and diseases of the respiratory system. For example, in the town of Krasnodar, the general death rate by comparison with 1939 is now 2.2 times less, whereas the death rate for infectious diseases is 8.6 times less, that for diseases of the digestive organs is 15.3 times less, and that for diseases of the respiratory system is 7.3 times less. In the same period, the death rate for diseases of the circulatory system increased by 6.4 times—this being related to a 4.6 per cent increase in

the proportion of population aged sixty years and over—and the death rate for neoplasms increased by 43 per cent.

52. The principal causes of death at Krasnodar in 1939 were infectious diseases (27.3 per cent of all causes of death, including tuberculosis—14.1 per cent), diseases of the digestive organs (18.9 per cent) and diseases of the respiratory system (15.5 per cent), followed by neoplasms (7.4 per cent) and rheumatism (6.8 per cent). Diseases of the circulatory system constituted only 2.2 per cent of all causes of death and were tenth on the list. In 1958, diseases of the circulatory system constituted 31.8 per cent of all causes of death, neoplasms 23.3 per cent, diseases of the central nervous system 11.4 per cent, traumata 7.6 per cent, and infectious diseases 6.9 per cent. Diseases of the digestive organs and of the respiratory system fell from the top of the list to sixth and seventh places, respectively.

53. The summary statistics for causes of death in urban areas of the USSR reflect the same trend. In 1960, 37 per cent of all deaths were attributable to cardiovascular diseases (29.3 per cent for males and 44.9 per cent for females). These were mainly arteriosclerotic and cardiosclerosis, hypertonia, cerebral arteriosclerosis and myocardial infarction. In 1958, the adjusted mortality rate for cardiovascular diseases was 12 per cent lower than in 1939 (taken as base year = 100). This means that the rise in the crude death rate was connected with the changes in the age and sex structure of the population.

54. Urban mortality due to malignant neoplasms increased during the period 1940-1960 from 79.6 to 124.5 for males, and from 79.7 to 119.6 for females. The adjusted mortality rate increased by 29 per cent for males, and by 7.5 per cent for females, owing mainly to the rise in mortality from malignant neoplasms of the respiratory system. There was a marked decline in urban mortality from tuberculosis, the rate for 1961 being less than one fourth of that for 1950.

55. There has been a considerable decline in infant mortality as a result, in particular, of the decline in infant deaths from diseases of the digestive organs, infectious diseases and diseases of the respiratory system. The infant mortality rate, which in 1955 was 60 per 1,000 births, stood at 30.9 per 1,000 births in 1963.

56. In the final analysis, the real significance of the above-mentioned morbidity and mortality trends is the saving of millions of lives. According to the current life table, 70 to 80 per cent of the population lives to the age of sixty years, and the expectation of life at birth is far higher than formerly—in 1960-1961 it was seventy years (sixty-five years for males and seventy-three years for females) as against thirty-two years in 1896-1897 and forty-four years in 1926-1927. In the forty-six years of the Soviet régime—almost twenty of which were years during which the country was fighting the wars forced upon it or recovering from their consequences—the health of the nation has reached a level which the advanced capitalist countries took eighty to 100 years to achieve. This is the result of the radical changes in living conditions which have taken place under the Soviet system.

The inter-American investigation of mortality *

RUTH R. PUFFER and G. WYNNE GRIFFITH

1. Wide variations in death rates from cardiovascular diseases¹ and specially from arteriosclerotic heart disease in countries of the world indicated the need for investigation of mortality statistics. The World Health Organization Study Group² on the Classification of Atherosclerotic Lesions suggested that comparative studies of death certificates of different countries be made. The variations might reflect differences in nosological concepts, in terminology or in procedures of medical certification and classification. Thus studies were indicated to review the terminology in use and to promote comparable procedures for stating the underlying cause of death for classifying the causes in accordance with the International Classification of Diseases.³ The World Health Organization Center for Classification of Diseases and the Latin American Center in Venezuela could assist in these.

2. These events in 1957 indicated to the Pan American Health Organization (PAHO) the need for research to prepare for epidemiological studies of cardiovascular diseases. The Organization, with field staff in countries and in zone offices, was uniquely qualified to develop a collaborative research programme in the region. In 1960 the interest in and feasibility of a large scale project in the Americas with participation of schools of public health and medicine were explored. In order to study cardiovascular deaths information would need to be obtained for all deaths. Thus the simultaneous study of the other causes, malignant neoplasms in particular, was envisioned.

3. The exploratory work indicated the need to

bring together specialists in mortality statistics, cardiovascular diseases and cancer from WHO, PAHO, NIH (National Institute of Health) and others to advise the Organization regarding research of this kind. A Planning Conference for Regional Development of Epidemiological Studies⁴ was therefore held from 1-4 May 1961 for which a small working group⁵ prepared a draft proposal. The Conference concluded that the main objective of producing an accurate and comprehensive account of mortality was important enough to justify the necessary effort and expense.

4. In 1961 principal collaborators were selected and standard procedures agreed on. A consolidated application for a research grant providing for field work and a central office was approved by the National Institute of Health. The development and methodology of the Inter-American Investigation of Mortality⁶ has been described elsewhere and this paper deals briefly with three aspects. First, the method of study in twelve widely scattered cities is outlined. Second, preliminary results for eight cities for the first year of the investigation are provided to indicate the type of material becoming available. Third, the uses are described of the results as bases for epidemiological studies and for improving the quality and comparability of mortality statistics.

I. METHOD OF STUDY OF DEATHS

5. In order to obtain complete information regarding deaths including clinical, surgical, laboratory and autopsy findings, the investiga-

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¹ R. R. Puffer and L. J. Verhoestrate, "Mortality from cardiovascular disease in various countries, with special reference to atherosclerotic heart disease", *Bulletin*, World Health Organization, vol. 19, p. 315 (1958).

² World Health Organization, "Classification of atherosclerotic lesions, report of a study group", *Technical Report*, Series No. 143 (1958).

³ World Health Organization, *Manual of the International Classification of Diseases, Injuries and Causes of Death*, revision (World Health Organization, Geneva, 1955).

⁴ This Planning Conference was supported by a grant GM-8682 from the Division of General Medical Sciences of the National Institute of Health, U.S. P.H.S.

⁵ Dr. Percy Stocks, formerly Director of the World Health Organization Center for Classification of Diseases; Dr. Dario Curiel, Director of the Latin American Center for Classification of Diseases; Dr. Iwao Moriyama, of the U.S. National Center of Health Statistics and Miss Mary Burke and Dr. Ruth R. Puffer of PAHO.

⁶ R. R. Puffer, G. W. Griffith, D. Curiel, and P. Stocks, "International collaborative research on mortality", accepted for publication in *Public Health Papers of World Health Organization* and published in Spanish in *Boletín of Pan American Health Organization*, vol. 58 (January 1965).

tion was established in large cities which are medical centers. Differences in availability of medical facilities were thereby minimized.

6. Nearly all deaths in the selected cities are certified by physicians and hospital and autopsy reports are available on relatively high proportions. Field work was conducted under the supervision of experts who collaborated in the study.⁷ The project was designed to study approximately 40,000 deaths occurring during a two-year period of persons 15-74 years of age and residents of the cities. In four cities all deaths in that age span are investigated. In the other eight cities, a sample is taken at regular intervals to give approximately 2,000 deaths annually. Each principal collaborator has a small staff consisting of at least one physician, one or more public health nurses and secretarial assistance. For every death included in the investigation, a visit is made to the home by the public health nurse to ascertain the dates and places where medical attention had been given to the deceased. Age and residence are verified and the place of birth and occupation noted. The interviewing physician assembles clinical information relevant to establishing the cause of death. Hospital records are abstracted and surgical and autopsy findings, the results of laboratory examinations, of radiology, of electrocardiography, or of other special investigations are recorded. The physicians who had attended the deceased are interviewed whenever

advisable. Completed questionnaires are sent in duplicate to the Organization.

7. In the central office, each questionnaire is reviewed for the necessary processing and for the uniform assignment of causes of death. Questionnaires are sorted into two groups according to established procedures, namely:

(a) Those to be sent to the two medical referees (Dr. Dario Curiel and Dr. Percy Stocks) who independently assign the causes of death according to international rules; and

(b) Those with only one cause of death involved in the fatal sequence. In selecting the underlying cause of death all the information collected is taken into account and the principles for coding death certificates laid down in the International Classification of Diseases are followed. An unusual feature, fully described elsewhere, is the weighting system devised by Dr. Percy Stocks and used in assignment of causes of death.⁸

8. Important data from the questionnaires are transferred to code sheets in the central office from which punch cards are prepared for routine tabulation at Headquarters of the World Health Organization under the direction of Mr. K. Uemura, Division of Health Statistics. Material from the first year of the investigation was reviewed at a Conference of Principal Collaborators on 1-5 February 1965. Each collaborator will analyse material from his city with comparisons of data from other cities. Analyses are to be published for the completed project.

II. PRELIMINARY RESULTS

9. For the first time, data are available for cities in which standard procedures of collection and assignment of the cause of death have been followed throughout. In the past, frequently account was not taken of residence in the limited data for Latin American cities. At this time preliminary data are presented from eight cities; final results will be given for the two complete years at a later date. There are wide variations in mortality by age group, by sex and by specific causes. Hitherto, the importance of environmental factors on mortality in infancy and early life has been emphasized but the death rates in these cities show marked differences also in adult life. Some differences undoubtedly indicate health problems amenable to attack while others require further investigation.

10. The wide variations in the age specific death rates for males and females in these eight cities are noteworthy (fig. 1) with the greatest

⁷ Bogota, Colombia: Dr. Luis E. Giraldo, Director, National Institute of Health, Ministry of Public Health; Bristol, England: Professor R. C. Wofinden, Medical Officer of Health, City and County of Bristol; Cali, Colombia: Dr. Pelayo Correa, Professor of Pathology and Chief, Department of Pathology, Faculty of Medicine, University of Valle; Caracas, Venezuela: Dr. Carlos L. Gonzalez, Professor of Preventive Medicine, Vargas Medical School, Central University of Venezuela; Guatemala City, Guatemala: Dr. J. Romeo de Leon, Jr., Epidemiology Branch, Institute of Nutrition of Central America and Panama (INCAP); La Plata, Argentina: Dr. Carlos Ferrero, Professor of Biostatistics, School of Public Health, University of Buenos Aires; Lima, Peru: Dr. Abelardo Temoche, Chief of Biostatistics, Ministry of Public Health and Professor of Medical Statistics, San Marcos Medical School; Mexico City, Mexico: Dr. Miguel Angel Bravo Becherelle, Scientific Investigator, Institute of Health and Tropical Diseases; Ribeirao Preto, Brazil: Dr. Geraldo Garcia Duarte, Associate Professor, Department of Preventive Medicine, Faculty of Medicine of Ribeirao Preto, University of São Paulo; San Francisco, California; U.S.A.: Dr. Ellis D. Sox, Director of Health, City and County of San Francisco, California, United States; Santiago, Chile: Dr. Adela Legarreta, Professor of Biostatistics, School of Public Health, University of Chile; São Paulo, Brazil: Dr. Elza Berquo, Professor of Biostatistics, Department of Statistics, Faculty of Hygiene and Public Health, University of São Paulo.

⁸ R. R. Puffer, G. W. Griffith, D. Curiel, and P. Stocks, *op. cit.*

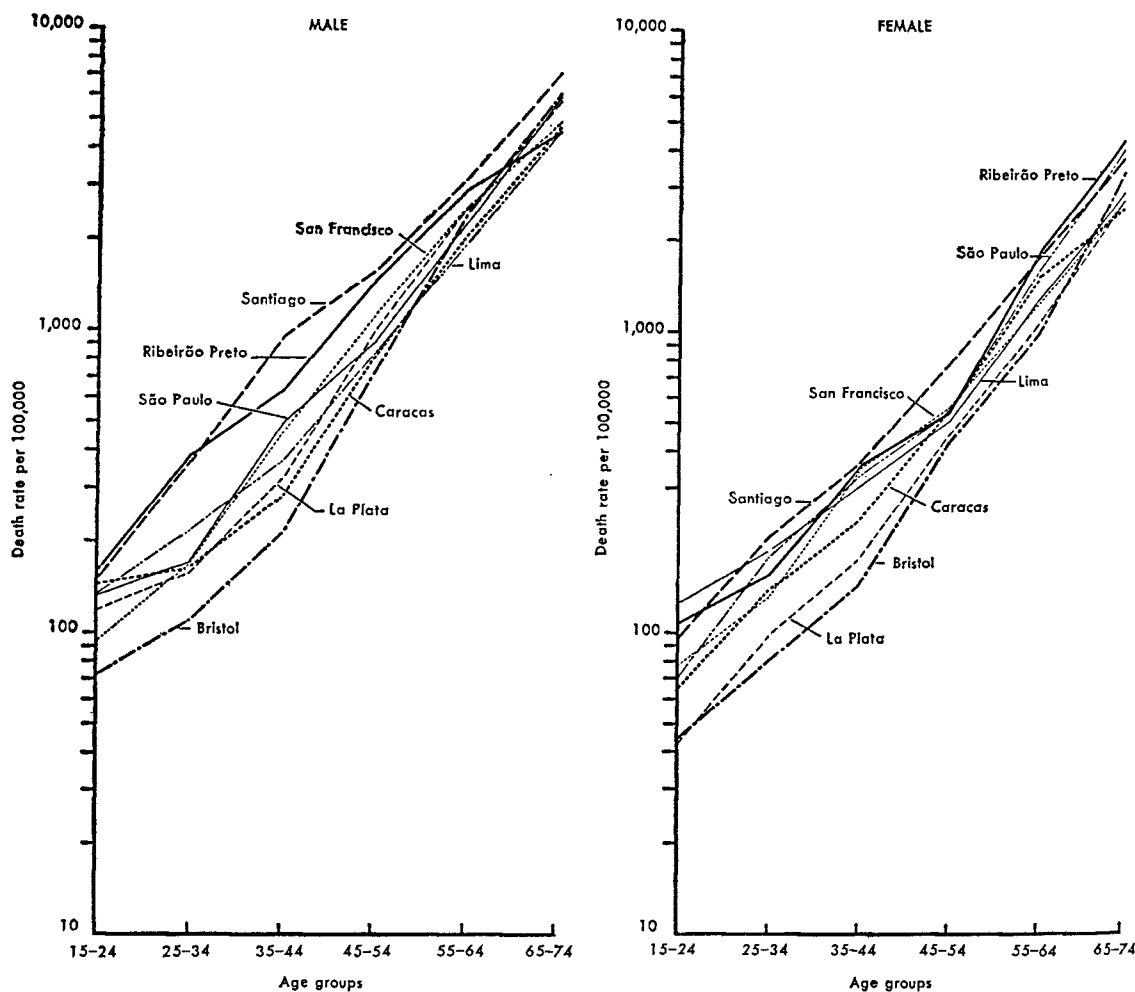


Figure I

Death rates by 10-year age groups for adults 15-74 years of age in eight cities of the first year of inter-American investigation of mortality

differences in the younger age groups. The male death rate for the age group 35-44 years for one city was over four times the rate in another. Variations of this type suggest that environmental factors and social conditions must be involved.

11. Age adjusted death rates for groups of causes with limited subdivision are shown in table 1 and graphically in figure II. The male death rates from infectious and parasitic diseases varied from 11.9 per 100,000 population in one city to 200.9 in another. In the latter city, Chagas' cardiopathy was largely responsible for the excessive mortality. In two others death rates for tuberculosis were also high. For malignant neoplasms, the variation in mortality was greater for males than females

and death rates from cancer of several specific sites showed marked differences. Two notable ones, cancer of the trachea, lung and bronchus in males and the cervix uteri are shown in figure II. The death rates from cardiovascular diseases differed widely. For males the rates from arteriosclerotic and degenerative heart disease were much higher in the two English speaking cities than in the Latin American cities and accounted for a much higher proportion of the total rates. The causative factors must presumably exert their effects principally on males. Two cities have excessive mortality from respiratory diseases particularly in males and in one bronchitis was the major contributor. An unexpected finding is the range of the death rates from digestive diseases with cirrhosis of the liver largely responsible for the variation.

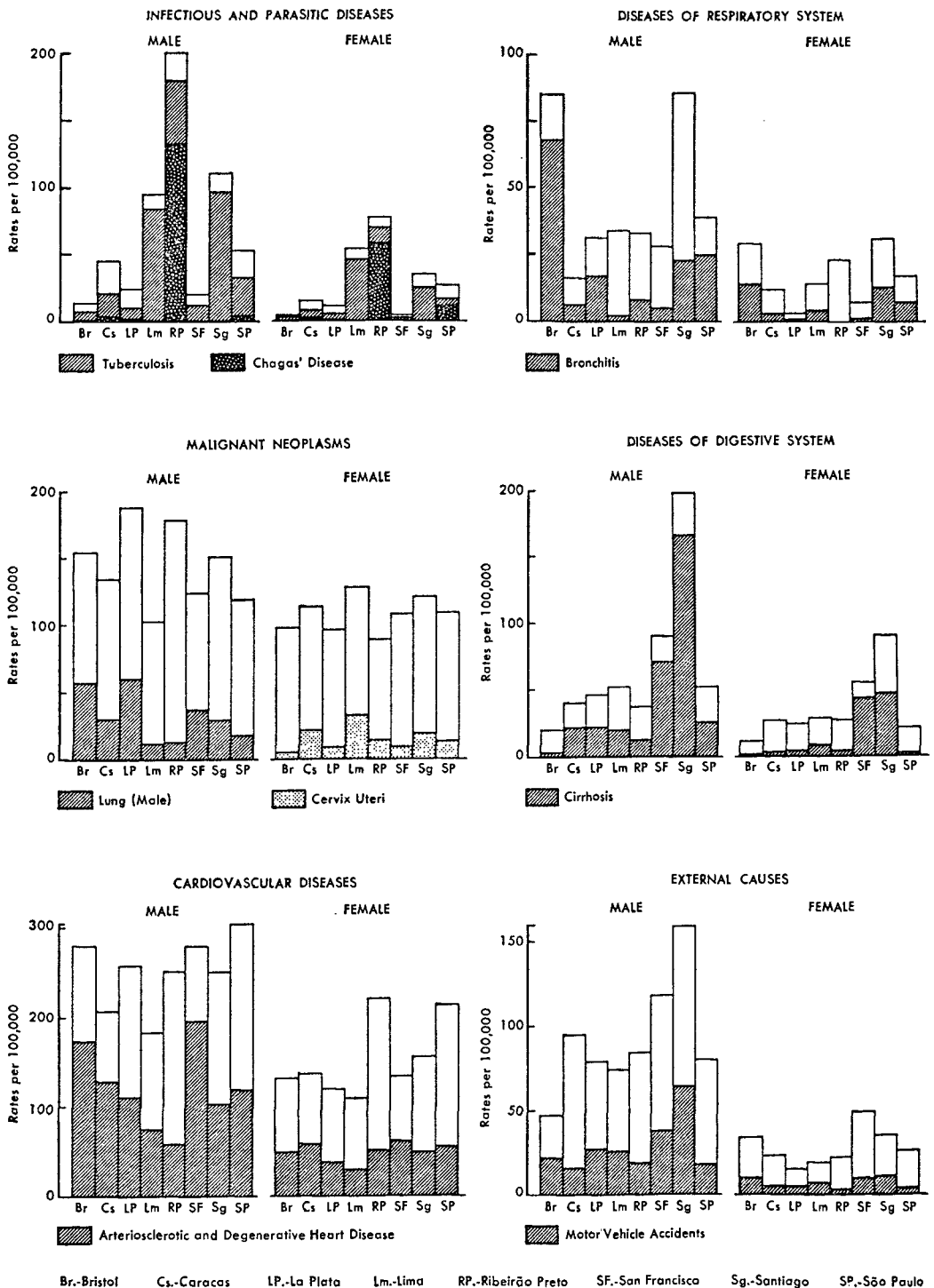


Figure II

Age-adjusted death rates per 100,000 for males and females 15-74 years of age for six cause groups in eight cities from first year of inter-American investigation of mortality

External causes contributed substantially to the high mortality among males in several cities. Differences in death rates from motor vehicle accidents, suicide and homicide require further study.

12. The additional information obtained through interviews of physicians and from hospital and other records resulted in many changes of assignments from those on the original death certificates and generally to more specific categories. Table 2 provides information regarding changes for broad cause groups and for several specific categories for the eight cities combined. For the groups, infective and parasitic diseases, malignant neoplasms and cardiovascular diseases, the total changes were less than 10 per cent with an increase in the number of deaths assigned to cancer and a reduction in deaths due to cardiovascular diseases. Within these groups, more marked changes were noted such as a consistent increase in deaths assigned to cervical cancer and a reduction of nine per cent in the number due to arteriosclerotic and degenerative heart disease. Additional information and review resulted in a reduction of 39 per cent in deaths assigned to influenza and pneumonia. The increase of 29 per cent in maternal deaths is an important finding. Significant increases occurred in the number of deaths due to cirrhosis of the liver. There were major changes in the group of external causes; in fact the results of investigations of such deaths frequently were not included on death certificates in all cities and thus the official statistics did not reflect the true situation. In the cities concerned the importance of motor vehicle accidents, suicides and homicides is now more clearly delineated.

III. USES OF RESULTS

13. Variations in death rates by age group

and by causes provide some measure of the magnitude of the health problems in adult life. Some differences are obviously environmental in origin or due to the habits and customs of the people, for example, the excessive death rates in two cities due to cirrhosis of the liver and to external causes. Tuberculosis remains an important cause of death in some cities and maternal mortality is excessive in several. For many other diseases, however, the reasons for the differences are not known. Striking variations are noted in mortality from cancer of the lung, stomach, cervix and other sites. Likewise, the range of mortality from the groups of cardiovascular diseases raise many questions to be answered by further investigations. The causes of the high death rates from respiratory diseases in two cities also require study. These statistics, therefore, on the one hand provide a firm basis for health programmes and on the other indicate the need for epidemiological studies.

14. The research programme has shown that considerable information is available in hospital records, autopsy reports and from physicians, which is often not utilized in the statement of underlying cause on the death certificate. There is need of developing methods to supplement official certificates with such additional data. Operational research may indicate new methods for the routine collection and utilization of such additional information for assignment of causes of death. A critical appraisal is needed of procedures of producing mortality statistics. With the increased availability of computers, methods of collecting and processing such data is an important field for further investigation. Mortality statistics can serve an increasingly important role in research and health programmes if steps are taken now to build soundly for the future.

Table 1. Age-adjusted death rates per 100,000 population for groups of causes on final classification for adults 15-74 years of age, eight cities, for the first year of the inter-American investigation of mortality, 1962-1963

Groups of causes	Males								Females							
	Bris- tol	Cara- cas	La Plata	Lima	Ribe- rao Prcto	San Fran- cisco	San- tiago	Sao Paulo	Bris- tol	Cara- cas	La Plata	Lima	Ribe- rao Prcto	San Fran- cisco	San- tiago	Sao Paulo
All causes	646.3	612.9	707.6	616.6	876.8	711.7	1,070.1	722.2	337.6	400.7	329.3	432.7	538.2	407.8	555.4	491.2
Infective and parasitic diseases (001-138)....	11.9	44.6	24.4	95.1	200.9	20.2	110.7	52.6	3.4	15.3	11.2	54.2	77.3	4.3	35.5	27.0
Tuberculosis (001-019)	7.1	17.9	10.2	84.3	49.1	11.6	97.5	32.2	3.2	7.9	6.4	46.4	10.9	1.7	25.2	11.2
Chagas' disease (121)	—	3.5	0.4	—	132.4	—	—	4.5	—	2.4	0.5	—	58.4	—	—	5.8
Malignant neoplasms (140-205)	154.2	134.1	188.1	103.5	178.5	124.2	150.7	119.5	98.2	114.5	96.7	127.7	88.8	107.6	122.0	109.4
Of stomach (151)	24.2	32.8	23.0	27.6	60.2	9.1	42.4	35.9	8.3	13.0	11.7	24.0	16.0	7.7	19.5	19.8
Of trachea, lung and bronchus (162, 163) ..	56.8	30.2	60.1	11.6	12.9	35.0	30.0	17.8	5.8	4.1	2.8	5.4	5.5	8.5	7.2	4.3
Of cervix uteri (171)	—	—	—	—	—	—	—	—	5.4	22.0	9.0	32.8	13.7	8.6	19.2	13.0
Cardiovascular diseases (330-334, 400-468)...	280.2	207.1	258.4	182.7	252.2	279.7	249.3	303.7	132.1	137.2	120.4	109.9	221.3	134.1	155.5	213.5
Vascular lesions affecting central nervous system (330-334)	60.4	41.1	72.5	63.3	104.8	40.3	82.9	89.3	47.5	39.6	38.7	35.0	88.7	40.0	53.9	63.2
Arteriosclerotic and degenerative heart dis- ease (420-422)	173.2	129.1	111.2	66.2	59.5	196.2	102.9	119.8	50.4	59.2	37.6	29.9	50.7	62.1	50.2	55.4
Other heart diseases (400-416, 430-443)....	28.4	27.9	46.6	40.3	73.4	22.7	47.5	74.7	28.3	30.8	34.1	35.3	71.3	16.0	38.4	87.0
Diseases of respiratory system (470-527)	85.3	15.9	31.2	33.6	33.3	27.7	85.9	38.6	28.9	12.0	2.7	14.0	22.3	6.8	30.6	17.4
Influenza and pneumonia (480-493)	10.5	8.1	4.4	23.0	11.2	10.5	47.2	8.1	11.8	5.4	1.3	7.1	15.4	2.4	15.1	6.0
Bronchitis (500-502)	67.7	6.1	17.2	2.5	7.8	5.2	23.2	25.5	14.5	2.6	0.6	3.6	—	1.4	13.1	7.2
Diseases of digestive system (530-587)	20.2	40.5	45.6	51.9	36.8	90.3	198.1	52.2	10.0	26.0	23.6	28.4	26.6	55.3	89.8	20.9
Cirrhosis of liver (581)	3.0	22.2	22.1	20.0	11.6	71.5	166.2	24.8	1.3	3.0	3.6	8.1	3.8	44.4	47.1	2.5
Diseases of genito-urinary system (590-637) ..	10.0	19.5	11.4	14.7	23.3	9.7	22.3	10.5	4.9	9.7	6.1	13.8	13.2	5.9	13.2	11.6
Deliveries and complications of pregnancy, childbirth and puerperium (640-689)	—	—	—	—	—	—	—	—	—	15.2	11.0	19.3	7.1	1.1	32.8	10.9
All other diseases (remainder of 210-795)....	37.5	56.3	69.5	61.1	63.0	42.1	83.6	65.0	26.3	47.4	42.2	46.4	59.6	43.5	40.7	54.3
Accidents, poisonings and violence (E800-999)	47.0	94.9	79.0	74.0	88.8	117.8	169.5	80.1	33.8	23.4	15.4	19.0	22.0	49.2	35.3	26.2
Motor vehicle accidents (E810-835)	21.8	16.3	27.1	25.6	19.4	38.5	63.1	17.8	10.4	5.3	5.5	7.2	2.6	10.0	11.0	4.3
Suicide and self-inflicted injury (E963, 970- 979)	12.7	15.6	21.2	14.7	10.3	38.4	26.9	18.1	11.3	7.7	7.1	4.6	7.8	22.9	9.7	9.7
Homicide and operations of war (E964- 965, 980-999)	—	40.4	11.2	4.4	14.4	12.7	26.3	9.5	2.2	2.8	1.4	—	—	3.5	2.6	2.3

Table 2. Changes from original to final assignment of causes of death with percentage change in eight cities for the first year of the inter-American investigation of mortality, 1962-1963

<i>Groups of causes</i>	<i>Original</i>	<i>Final ^a</i>	<i>Per cent change</i>
All causes	13,996	13,996	—
Infective and parasitic diseases (001-138).....	886	956	+ 7.9
Tuberculosis (001-019)	613	642	+ 4.7
Chagas' disease (121).....	100	98	- 2.0
Malignant neoplasms (140-205).....	2,996	3,110	+ 3.8
Of stomach (151)	489	515	+ 5.3
Of trachea, lung and bronchus (162, 163).....	472	489	+ 3.6
Of cervix uteri (171).....	117	193	+65.0
Cardiovascular diseases (330-334, 400-468).....	5,227	5,018	- 4.0
Vascular lesions affecting central nervous system (330-334).....	1,355	1,411	+ 4.1
Arteriosclerotic and degenerative heart disease (420-422).....	2,470	2,247	- 9.0
Other heart diseases (400-416, 430-443).....	892	1,004	+12.6
Diseases of respiratory system (470-527).....	890	785	-11.8
Influenza and pneumonia (480-493).....	442	268	-39.4
Bronchitis (500-502)	248	370	+49.2
Diseases of digestive system (530-587).....	1,052	1,181	+12.3
Cirrhosis of liver (581).....	530	627	+18.3
Diseases of genito-urinary system (590-637).....	303	275	- 9.3
Deliveries and complications of pregnancy, childbirth and puerperium (640-689)	122	157	+28.7
All other diseases (remainder of 210-795).....	1,249 ^b	1,220	- 3.3
Accidents, poisonings and violence (E800-999).....	1,271	1,294	+ 1.8
Motor vehicle accidents (810-835).....	265	369	+39.2
All other accidents (800-802, 840-962).....	619	410	-33.8
Suicide and self-inflicted injury (963, 970-979).....	242	332	+37.2
Homicide and operations of war (964-965, 980-999).....	145	183	+26.2

^a Shown to nearest integer.^b Included 15 with no local coding supplied.

Structural changes in mortality by cause, sex and age group in the Romanian People's Republic over the last three decades

I. SANDU and P. MUREȘAN

[Translated from French]

1. The continual rise in the standard of living and cultural level of the people and the increased efficiency of health services led to an improvement in the health of the population during the period following the Second World War. This phenomenon is illustrated by a considerable decline in general and infant mortality and stillbirths and by a gradual decrease in deaths from tuberculosis, syphilis and other infectious and parasitic diseases, some of which are being eradicated (relapsing fever, malaria) and others are disappearing completely (diphtheria, poliomyelitis, tetanus, typhoid fever, rabies, etc.). The considerable improvements noted in the physical development of children and adolescents and the lengthening of the mean length of life are indicative of the success achieved by our country in the matter of health protection.

2. As in other European countries having good health conditions, the mortality trends noted in the Romanian People's Republic show an appreciable decline in mortality from tuberculosis, diseases of the respiratory, digestive and uro-genital systems, infectious and parasitic diseases, diseases of pregnancy, childbirth and the puerperium, diseases peculiar to early infancy, etc. There has, however, been a rise in mortality from diseases of the circulatory system, vascular lesions affecting the central nervous system, malignant neoplasms and congenital malformations, which produced basic changes in the structure of causes of death.

3. In 1963, mortality from diseases peculiar to early infancy was 12.4 times less than in 1938, mortality from diseases of the respiratory system was 3 times less and mortality from diseases of the digestive system was 4.9 times less. The latter reduction, which relates mainly to infants and children, is the result of prophylactic measures, the care of mothers and children, better food, and the improved medical infrastructure available to the health services (medical institutions, specialists).

4. During the same period, mortality from tuberculosis became 5.8 times less, mortality from infectious and parasitic diseases (except tuberculosis and venereal diseases) 7 times less, mortality from diseases of pregnancy, childbirth and the puerperium 10.3 times less, etc.

5. Because more of the population were in the older age group, there was an increase in the death rate for diseases of the circulatory system (1.7 times greater) and for vascular lesions affecting the central nervous system (2.8 times greater). There was also an increase in death rates for malignant neoplasms (2.6 times greater) and for congenital malformations (twice as great). However, the last-mentioned figure was influenced by an improvement in diagnosis.

6. In 1963, therefore, the ten most frequent causes of death were: diseases of the circulatory system, diseases of the respiratory system (including influenza), malignant neoplasms, vascular lesions affecting the central nervous system (the last three types of disease follow each other very closely in order of frequency; malignant neoplasms and vascular lesions affecting the central nervous system tend to take second and third place respectively), accidents, diseases of the digestive system, tuberculosis, diseases peculiar to early infancy, diseases of the uro-genital system and infectious and parasitic diseases.

7. Although mortality by sex continued until recent years to show a higher rate for males, the rates for the two sexes are nevertheless showing a tendency to come closer together.

8. However, there have been considerable changes over the past twenty-five years in the structure of mortality by disease and by sex. In 1938, for example, mortality from malignant neoplasms (including neoplasms of lymphatic and haematopoietic tissues) was much higher for females than for males. In urban areas, where

the causes of death were certainly more accurately diagnosed, there was a female mortality of 139.2 per 100,000, compared with a male mortality of only 91.8 per 100,000. In subsequent decades, this difference became much less marked and finally, in 1963, male mortality was higher (142 per 100,000) than female mortality (136.3 per 100,000) in urban areas.

9. This trend, which is characteristic of many other countries with high health standards, are caused by a more rapid increase in male mortality from malignant neoplasms of the buccal cavity and pharynx, the stomach and the rectum, the larynx, the bronchi, the trachea, the lungs and the pleural membranes and from lymphosarcoma. Females, however, had a higher mortality from malignant neoplasms of the intestine and, naturally, of the breast.

10. The high mortality from certain malignant neoplasms is now tending to decline particularly because the neoplasms are being diagnosed and treated earlier, as every person under medical supervision has to undergo an oncological examination. This is particularly true for neoplasms of the uterus (35.3 per cent in 1938, compared with 21.9 per cent in 1963¹) and neoplasms of the oesophagus.

11. Other disorders, such as diseases of the circulatory system and vascular lesions affecting the central nervous system, which in 1938 caused more deaths among males, today cause considerably more deaths among females; this is true, for example, of vascular lesions affecting the central nervous system and arterial hypertension. However, this trend is characterized by the predominance of females in the structure of the elderly population, which has a high death rate from these diseases.

12. The situation is the reverse for diseases of the uro-genital system, in the case of which the death rates were almost equal in 1938; the mortality from these diseases is declining for both sexes (mainly in the case of nephritis) but the decline in the rate for females is more rapid.

13. In the last three decades, the decline in death rates was found in all age groups, particularly the younger age group. However, an examination of the causes of death by age groups reveals the following basic differences:

(a) *Mortality from diseases of the circulatory system* is increasing considerably but only for persons aged 65 and over. The death rate for these diseases among persons who have not yet reached this age is declining, mainly be-

cause of the preventive measures taken against infections and parasitic diseases. If one considers that in 1963 persons aged 65 and over accounted for 7.3 per cent of the total population, compared with only 4.3 per cent in 1938, it will be seen that the upward trend of mortality is largely attributable to the increase in the mean length of life (twenty-six years longer than the pre-war period) and also to the fact that causes of death are more accurately determined. For example, the senility-attributed mortality, which was 301.9 per 100,000 inhabitants in 1938, had fallen to 0.2 per 100,000 inhabitants by 1963. This means, in other words, that a considerable number of the deaths formerly attributed to this cause were in fact caused by diseases of the circulatory system. In urban areas where, even at that time, the determination of causes of death was more accurate than in rural areas, mortality is declining in all age groups, including the over-65 group. These data show that both the successful prevention of infectious and parasitic diseases, tuberculosis, syphilis, disorders caused by disease of known site and obvious forms of cardiac rheumatism, and careful treatment of such disorders have helped to prevent cardiovascular diseases and to postpone cardiovascular deaths until the highest age groups. The capacity for physical and intellectual work is consequently improved and the length of active life extended;

(b) *Mortality from diseases of the respiratory system* is declining considerably among all age groups, with the exception of the rural population aged over 65. This also reflects the increase in the proportion of elderly persons in the total population (4.3 per cent in 1938, compared with 7.3 per cent in 1963—rural area). The most marked decline is among young people and adults and particularly among children aged 1 to 4 and infants who, because of the numerous measures of protection, show the largest decrease in the number of deaths;

(c) *Mortality from malignant neoplasms and neoplasms of the lymphatic and haematopoietic tissues* is increasing considerably among all age groups, particularly among persons over 65 years of age. It is gratifying to note, however, that the adult population in urban areas has shown a reduction in mortality from malignant neoplasms because of early diagnosis and treatment as a result of the compulsory oncological examination. In the period 1938-1963, the decrease was 36.6 per cent for persons aged 25 to 34, 42.1 per cent for persons aged 35 to 44, etc.;

(d) *Mortality from vascular lesions affecting the central nervous system* is increasing in the

¹ Percentages of the total female deaths from malignant tumours.

population aged 65 and over, particularly among females. The causes of this phenomenon must be sought in the new situation already mentioned in connexion with diseases of the circulatory system: the considerable lengthening of the mean length of life and more accurate diagnosis of causes of death;

(e) *Mortality from accidents* is increasing slightly (from 41.3 per 100,000 in 1938 to 42.3 per 100,000 in 1963), mainly because of traffic accidents; on the other hand, the number of occupational accidents is steadily decreasing. However, female mortality from accidents is tending to decline. Lastly, there is a particularly marked decline in the case of children in the 1 to 4 age group;

(f) *Mortality from diseases of the digestive system* has also declined very substantially in the case of all age groups, with the exception of elderly persons in rural areas and the factors mentioned in the analysis of mortality from diseases of the respiratory system also apply in this case. Here again, it is the under-5 age group and particularly the 1-4 age group which shows the largest decrease; as in the other case, this is a result of the measures taken to prevent and treat nutritional and digestive disorders. The analysis of the causes of death from diseases of the digestive system, by age groups, reveals widely differing characteristics: children are most subject to acute digestive and nutritional disorders; elderly persons are afflicted with cirrhosis of the liver and, less often, by intestinal obstruction; the adult population is mainly afflicted with ulcerous diseases;

(g) *Mortality from tuberculosis* also shows a very marked decline due mainly to improved housing, better food, early diagnosis (by biological and radiographic methods used on a large scale), effective treatments and special measures designed to localize and combat the disease. It is the young and adult age groups which show a particularly marked decline in mortality;

(h) *Mortality from diseases peculiar to early infancy* has declined considerably, as has infant mortality in general. While the death rate in 1938 was 326.9 per 100,000, it was only 26.3 per 100,000 in 1963 and is dropping every year. It should be emphasized that girls have a lower

death rate (about one third lower) than boys; this difference is less pronounced, however, in urban areas than in rural areas.

(i) *Mortality from infectious and parasitic diseases* declined during the same period in all age groups and particularly among children aged 1-4, young people and adults below 40 years of age. The decrease is also noticeable in the case of infants and persons over 40 years of age. Because of the improvement in social, economic, hygienic and sanitary conditions, in drinking water supplies, in food and in housing and as a result of preventive vaccinations (over 20 million are given each year), a whole series of infectious and parasitic diseases has ceased to be a cause of death, except in extremely rare cases (diphtheria, poliomyelitis, paratyphoid fevers and other infections of salmonella, anthrax, scarlet fever, etc.);

(j) *Mortality from diseases of the urogenital system* decreased by 70 per cent during the period 1939-1963. This decrease is found in all age groups, particularly among children aged 1-4 years. The highest rates are found among persons over 65 and are mainly due to chronic nephritis and hyperplasia of the prostate. The growth of this age group in relation to the total population slowed the downward trend of mortality for this age group.

14. The trend of the number of deaths recorded over the last few decades therefore indicates a steady decline in mortality from the large majority of diseases, particularly infectious and parasitic diseases, tuberculosis and diseases of the respiratory and digestive systems. As far as malignant neoplasms are concerned, it should be emphasized that, although the aetiology and pathogenesis of these disorders are not yet known, mortality from them can be reduced by the early diagnosis and treatment made possible by compulsory oncological examinations of the entire population.

15. Lastly, with regard to diseases of the circulatory system and other chronic diseases (diseases of the liver, kidneys, metabolic disorders, etc.), mortality may still be reduced considerably among young persons and adults, since the highest rates are now found in the older age groups; this would require corresponding prophylactic measures.

The social implications of morbidity in the United Kingdom

ALWYN SMITH

1. It may perhaps be necessary to begin a paper on the social implications of morbidity by indicating the scope of the terms employed. In strictly statistical discussions it has become common to restrict the use of the term "morbidity" to the description of illness about which information has been gained other than from statistics of cause of death. This is an arbitrary restriction; for the several quite important groups of diseases where a fatal outcome is virtually the rule, statistics of cause of death furnish the most reliable data likely to be available. In the present paper the term will be used in its more usual sense to mean all sickness, whether accompanied by a fatal outcome or not, but it will be useful to distinguish between fatal and non-fatal illness because there are important differences in the ways in which diseases behave in populations according to whether they are usually fatal or not.

2. Information on the occurrence of fatal morbidity is much more generally available than for morbidity not leading to death. This is particularly the case when secular trends are considered, and these are important not only for an understanding of how present circumstances have arisen but also for their predictive value. Most of the reservations that one would have concern the interpretation of diagnostic consistency but this is irrelevant when mortality is considered as a whole.

3. In the United Kingdom during the past one hundred years there have been striking changes in the patterns of mortality. These relate principally to changes in diagnostic distribution, and in sex and age distribution. Examination of changes in diagnostic distribution need not detain us here beyond the observation that there has been a striking reduction in mortality from infections, particularly from tuberculosis, and that there seems to have been a relative, and possibly an absolute, increase in mortality attributed to neoplastic and degenerative diseases.

4. The sex differences are more susceptible to interpretation since it is likely that sex has

been more consistently recorded on death certificates than has diagnosis. There have been increasing differences in the sex specific death rates both crude and age specific in that whereas female death rates have shown a steadily falling death rate for the period, male rates ceased to fall some twenty five years ago and have indeed begun slightly to rise. There seems little doubt that the differences are mainly due to sex specific differences in morbidity from coronary artery disease, and lung cancer, but more important than their causes are the consequences of these trends. They result in the female population's age structure changing with respect to that of the male and in an increasing predominance of females among the elderly population, so that by the end of the century we may expect females to outnumber males by about two to one at ages over 65 years.

5. Changes in the association of mortality with age have been particularly striking. There has been a drastic reduction in mortality between the ages of one month and fifty years so that survivors of the neonatal period are now extremely unlikely to die before late middle age. McKeown (1964)¹ has examined these changes and has concluded that the virtual abolition of death in this period of life has been the consequence of a substantial reduction in the contribution of environmentally determined morbidity in post-natal life. Selection effects would have already ensured that genetically determined morbidity played little part in mortality at these ages. By the same token the relatively small effect of environmental changes on mortality during the post-reproductive period of life may be attributable to the relatively much larger contribution of genetically determined causes at these ages. Thus we may have to accept in future that many diseases may be unpreventable and that control of community health will depend on the treatment more than on the prevention of disease.

6. In the United Kingdom, mortality at these later ages is at present very largely attri-

¹ T. McKeown, *Population Studies*, vol. XVII (1964), p. 239.

butable to cardiovascular disease, malignant disease and obstructive lung disease. That these diseases have an environmental component in their aetiology is almost certain, but it is also very clear that a substantial part of this component derives more from the behaviour of individual persons than from agents in the physical environment. The likelihood that there is also a substantial hereditary component makes it clear that attempts to prevent such diseases by general social action will pose very different problems from those encountered by the pioneers of public health in the nineteenth century. The crucial difference is that, in the last century the features of the environment that required to be altered had for long been considered undesirable before it was at all clearly known that they exerted an adverse influence on health. Thus there existed a social consensus in favour of the necessary social action. The behavioural factors that are important in morbidity today often involve widely enjoyed pleasures whose desirability is thought of as outweighing the risk they represent. Even in the very long run it is unlikely that humanity will develop a genetically determined repugnance for these hazards as it probably did for human filth, since the selective effect of a distaste for over-eating, under-exercise, or cigarette smoking is likely to be minimal, as these habits predominantly influence mortality in the post-reproductive period of life, whereas human filth mainly affected mortality in earlier life.

7. There is an additional consideration that at first seems discouraging. It is quite clear that the environmental factors involved in many of the important morbid conditions of the present day are very widely prevalent and that an unfavourable consequence of exposure to them has a small overall probability. As an example we may take lung cancer. It is almost certain that the majority of cases are substantially due to cigarette smoking but at the same time the proportion of smokers who contract the disease is very small. As the habit is pleasant and widespread and the risk of lung cancer relatively small, it is extremely difficult to justify the indiscriminate discouragement of cigarette smoking, and for similar reasons it is difficult to accomplish. The problem might be easier to solve if it were possible to identify the individuals at especially high risk so that preventive advice might be specifically directed. That individual risk is variable and that its variation may be at least partly genetically determined is suggested by certain features of recent secular trends in age specific mortality rates

(Smith, 1964).² This possibility, that high risk is to some extent genetically determined, paradoxically enhances the possibility of control of this disease by environmental means since it raises the possibility of eventual early identification of individuals at high risk. The implication that preventive medicine may in future depend more on the identification and specific education of high risk persons has social consequences not only relevant to the functions and organisation of health services and the training of doctors but also for the general education of the public.

8. Similar implications are also raised by the question of mortality in very early life. Because of the effects of selection it is unlikely that genetic causes are particularly important in determining fatal morbidity at this period of life, and likely that mortality is very substantially determined by the circumstances of pre-natal and intra-natal experience. In so far as certified causes are concerned this view is borne out by the predominance of prematurity, congenital malformations, asphyxia and birth injury. But the recorded circumstance most sharply associated with variation in perinatal mortality is the social class of the parents. Despite progressive improvements in perinatal mortality over the past twenty-five years the differences between the classes remain largely unaffected. For many causes of foetal mortality, infants whose parents are from social class V (unskilled workers) have from twice to five times the risk of dying in the perinatal period compared with infants whose parents are from class I (professional and managerial workers). The importance of this difference is difficult to exaggerate; for example if all births in Scotland enjoyed the perinatal mortality rates of social class I, there would be about 1,500 fewer deaths each year, representing a saving in years of human life comparable with what would be achieved by the eradication of death from cancer. Because a substantial part of this excess mortality derives from causes which are preventable by good obstetric care during pregnancy and delivery it must be concluded that the prevention of such mortality depends on identifying and altering the factors which determine access to good care. There seems little doubt that important among these factors are the educational, psychological and social background of the mother, and the attitude of doctors to their role in a national health service.

9. In considering the problem of morbidity

² A. Smith, *Supplement to Annual Report of Registrar General for Scotland, 1963* (Her Majesty's Stationery Office, 1964).

that is not fatal the polarisation of prevalence at the extremes of the age range is much less noticeable. However the important problem is the difficulty of obtaining data to which any important significance may be attached. Whereas death is a unique and unambiguous incident in the life of a person, illness is not. Few countries attempt to obtain data on the total occurrence of disease, and in the absence of any very clear definition of disease this is not surprising. Such statistics as are generally available relate to the use of medical care rather than to sickness and it is often assumed that no important bias is introduced if data on all types of available medical care are included. It is however, only necessary to consider the variation in use of medical care for the relatively unambiguous condition of normal pregnancy to recognise that self selection for presentation to the health services constitutes an important and little understood element in the interpretation of any morbidity statistics.

10. This is particularly important in the United Kingdom since it is likely that the substantial majority of morbidity relates to mental illness and to illness in the elderly, areas where it is reasonable to suppose that self selection plays a particularly large part in determining whether morbidity is reported through the usual statistical procedures.

11. Some evidence of the importance of this consideration so far as concerns mental illness may be obtained from consideration of mental hospital admission rates during the past half century. The increase from 80 per 100,000 in Scotland in 1901 to 280 per 100,000 in 1961 cannot conceivably be attributed to a commensurate increase in the frequency of serious mental illness and must be very largely due to a changed view of the function of psychiatric care prevalent not only among patients but also among their doctors. Changes over a more recent period are even more difficult to interpret since a progressive tendency to shorter durations of hospitalisation has been accompanied by a rising admission rate, so that average residence rates have remained constant within the limits of the lower bed occupancy imposed by the higher turnover. This might be interpreted in terms of a primary effect of therapeutic innovations leading to shorter periods of hospitalisation which would permit a higher admission rate. Alternatively, the pressure for admission may have resulted in shorter hospitalisation facilitated rather than caused by therapeutic innovations. In either case the prevalence of hospitalised mental disease may be

seen to depend more on the availability of accommodation than on either the prevalence of mental disease or the efficacy of its treatment. The social consequences of these changes in the pattern of psychiatric treatment are bound up with changes in the prevalent attitudes to mental illness.

12. When demographic characteristics are examined interpretation is no less difficult. There has been a most striking change in the sex ratio of mental hospital admissions. Fifty years ago in the United Kingdom (as in the U.S.A. at present) male admission rates exceeded female whereas the reverse is now the case. The relative excess of females appears to relate mainly to middle aged, married women from the economically better off sections of the community and to be associated with a diagnosis of affective psychosis (Lowe and Garratt, 1959).³ It is difficult to be certain to what extent this change reflects a change in the distribution of mental illness or whether it reflects mainly a change either in diagnostic or admission practice.

13. The other large area of morbidity in the United Kingdom concerns diseases prevalent among the elderly. A recent study (Williamson and other, 1964) has revealed not only that there is a high prevalence of disability among the elderly but also that relatively little of this disability is known to their general practitioners.⁴ The reasons for the discrepancy are far from clear but there is little doubt that much morbidity goes unchecked because of social isolation and because neither patient nor doctor appreciate the potentially progressive nature of many initially trivial disabilities.

14. The social implications of the current state and discernible trends of morbidity may now be summarized:

(a) That control of community health now depends more on intervention in the course of disease than on prevention;

(b) That preventive medicine can no longer be effectively achieved independently of individual co-operation in the maintenance of personal health;

(c) That the efficacy of medical care still depends as much on its accessibility as on its technological efficiency.

15. These implications which arise from a

³ C. R. Lowe and F. N. Garratt, *British Journal of Preventive and Social Medicine*, 13 (1959), p. 88.

⁴ J. Williamson, J. H. Stokoe, S. Gray, M. Fisher, A. Smith, A. McGhee, and E. Stephenson, *Lancet* i (1964), p. 1,117.

consideration of the more important problems of present-day morbidity, all point to the need for improved communication between organized medicine and the individuals of whom the community is composed. They confirm the simultaneous needs for informed monitoring and control of national health services and a continuing and probably developed conception of a personal health and medical service. The

two needs may seem incompatible; their simultaneous promotion certainly presents difficulties. Those societies that are confronted with the difficulties have so far made relatively little progress in resolving them. But it is fair to observe that the problems have relatively recently been posed and the authority to tackle them has only recently been placed in public hands.

Relation of population problems to mental health

ERIK STRÖMGREN

1. The principal method suitable to the study of relation between population problems and mental health consists in the determination of occurrence of mental disorders in different population groups. Such studies must have two parts of a qualitative and a quantitative nature, respectively. Firstly, do the same types of mental disorder exist in all populations? And, secondly, with which frequencies do the different types occur in different populations?

2. The reputation of the psychiatric classification is not too good. The concepts are said to be vague, and the terminology varying. This is, of course, to a certain degree true, but it remains to be proven that conditions in this respect are worse within psychiatry than within most other clinical disciplines. With regard to a number of important classes of mental disorder there is a general consensus, and, with sufficient care, comparisons between different population groups can be made.

3. There would, for instance, be little opposition against the establishment of four main groups of mental abnormalities: (a) psychoses; (b) neuroses; (c) behaviour disorders, personality disorders, psychopathic states; and (d) mental deficiency. The first two groups have in common that they constitute diseases, which attack individuals who may previously have been sound, and which may in many cases disappear again more or less completely. The two last groups, in contrast, comprise abnormal states, which somehow characterize the individuals in question through their whole lifetime. If, on the other hand, we look at the four main groups from the viewpoint of possibility for exact delimitation, we would be inclined to group psychoses and mental deficiency together; in these cases it is much easier to define what is abnormal than in the case of neuroses and behaviour disorders; between these two groups and the normal personalities there is completely gradual transition, and we have no tools for any sharp delimitation. It is therefore obvious that statistical studies of the occurrence of mental disorders can only be made with a reasonable degree of accuracy in the case of psychoses and mental deficiency, whereas

frequency figures for neuroses and behaviour disorders must be accepted with great reserve; they can only be understood when detailed definitions and exemplifications have been given by those applying the concepts.

4. The concept "frequency" has to be broken down. Within psychiatric statistics three types of frequency measures are used: (a) disease expectancy; (b) incidence; and (c) prevalence. By disease expectancy is meant the lifetime expectancy for the disease in question, i.e., the risk of acquiring the disease in case the individual lives through the whole "danger zone" during which the disease may at all occur. By incidence is meant the number of new cases of the disorder arising in a certain population during a certain period of time, usually one year. Prevalence means the percentage of the population suffering, at a certain point of time, from the abnormality in question. It is obvious that these three concepts mean quite different things and that figures from the three different groups can never be compared directly. The methods for determining such figures also differ quite a lot. Disease expectancy figures, which are of special importance for genetical studies, have traditionally been determined by means of studies of families, i.e., the relatives of certain "probands" or "index cases", comprising information concerning these relatives during their whole lifetime regardless of whether they are alive at the time of investigation or not; this means that errors coming from differential mortality of affected and non-affected members are of little importance. Incidence figures are, for the more serious disorders at least, usually derived from hospital statistics, and they, therefore, only comprise a selection of cases, the nature of which must vary with the conditions of hospitals. Prevalence figures are usually derived either from statistics on institutionalized individuals in a larger area, or from field investigations comprising all individuals living in a certain smaller area.

5. Frequency studies throughout the world concerning psychoses have tended to show an amazingly small degree of variation with regard to disease expectancy for the main psychoses,

first of all schizophrenia which in most parts of the world is the most important mental disorder, by far, and which in most populations has an expectancy of around 1 per cent. There are, of course, exceptions; expectancies as large as 3 per cent have been found occasionally, but such findings have only been made in relatively small isolated population groups which are not representative of the total population.

6. Other kinds of psychoses have varying expectancies, especially those of an organic type, based on infections, vitamin deficiencies, or other physical disorders which affect the brain directly or indirectly. In the Western world such diseases are of very limited importance from a quantitative point of view. In developing countries they may constitute a large fraction of mental disorders.

7. Incidence figures appearing in the psychiatric literature are mostly derived from hospital statistics, and their dimensions are primarily correlated with the number of available hospital beds than to the true occurrence of the diseases in the population. Such figures are, therefore, of a very limited value, especially when different countries are compared.

8. Prevalence figures are first of all of great social importance; they illustrate, for example, the need for therapeutic assistance. The relation of prevalence figures to disease expectancies is, however, quite loose. Whereas expectancy figures are independent of the age distribution of the population, of differential mortality of affected members of the population, etc., the prevalence figures are greatly influenced by such factors. If the average life expectancy in a developing country is, for instance, thirty years, the prevalence of manic-depressive psychosis, the danger zone of which is evenly distributed over the age from fifteen to at least seventy years, cannot possibly be very high as contrasted to a population where the mean lifetime is sixty years. Such differences are often accentuated by the fact that in populations, where general mortality is high, the excess mortality of psychotics is usually especially high, pressing down the prevalence of psychoses to a minimum. In countries with an efficient public health system the excess mortality of psychotics has decreased dramatically in recent decades. In northern Europe the excess mortality for schizophrenics forty years ago was as high as 500 up to 1,000 per cent; in recent years it has decreased to a negligible figure.

9. Migration processes are of importance for the prevalence of psychoses. Internal migration within a population, for instance in the form of increasing urbanisation, usually affects the

mentally sound part of the population more than the mentally disabled part. Mental defectives, epileptics and chronic psychotics tend to stay where they are; when, then, the sound part of the population tends to leave the area in question, the relative frequency, the prevalence, of mental disorder in the "residual population" increases. In contrast, the prevalence of such disorders is low in the suburbs of great cities, which constitute the areas to which immigration mostly takes place. Recent studies in Denmark concerning all hospitalized cases of psychiatric disorder, performed with intervals of five years, have illustrated these developments quite clearly, and similar experiences have been made in other countries. The Danish figures may, however, be of special reliability, because the Danish population is so homogeneous from an anthropological point of view, making it improbable that the differences found could be explained anthropologically. It seems clear, then, that the low prevalence of mental disorder in suburbs is not due to especially good living conditions in these areas; it can, at least, be explained as effect of migration factors.

10. Are social factors of no relevance at all for the aetiology of mental disorders? Although there is at the present moment probably no indication that the major mental disorders, as schizophrenia and manic-depressive disorder, are conditioned to any important degree by social factors, there are some other mental deviations for which such factors are obviously of some relevance. This can be illustrated by some studies performed a few years ago in the suburbs of the City of Copenhagen. The admission rates to psychiatric wards in general hospitals from two parts of the suburbs, being relatively wealthy and relatively poor, respectively, showed that the rate of the latter was more than twice the rate of the first. On closer analysis it turned out that this was mainly due to an excess of admissions caused by acute environmental and social factors and not reaching the degree of psychoses. If, on the other hand, the admission rates from the two areas to the local mental hospital were compared, it turned out that the rates were exactly the same, i.e. the more serious and long-lasting disorders, first of all the major psychoses, had the same frequency in these two socially different populations.

11. Comparisons of frequencies of mental abnormalities in different social strata of the population are greatly hampered by the fact that the possibilities for receiving adequate treatment may differ very much in the different strata. A condition, which in one social group

invariably leads to ascertainment by health authorities may be completely "silent" in a different group. On a higher social level a neurosis is much more likely to receive psychiatric treatment than is the case with a similar condition arising in a slum. Conversely, certain types of alcoholism can exist for a long time in wealthy circles without interference from health authorities or social agencies, even if the degree of alcoholism is so excessive that a similar patient of a lower social status would invariably be detected by such authorities.

12. On the whole, it can be said that with regard to most mental disorders, the sensitivity of the population to mental disorders, and the possibilities for treatment of such disorders, vary much more than their true incidences, making it impossible to make any reliable conclusions from crude incidence figures to the existence of true variations and differences in disease expectancy or incidence of mental disorders.

13. In recent years much attention has been paid to the apparently wide variation of suicide rates in different populations. The interpretation of these rate figures must, however, be made with special caution, because the degree of ascertainment of suicides differs so much from one population to another. On the whole it can be said that countries with high official suicide rates are identical with the countries which have the most accurate and comprehensive registration of suicides. The most reliable comparisons are those made between rates in different parts of the same population. All sources of error taken into consideration, there is, however, no doubt that great variations with regard to suicide rate are a reality. Such variations cannot be traced back to variations in the expectancies for mental disorders which are connected with a special suicide risk; it seems as if there are other forces which are more important, consisting in cultural traditions. In some populations suicide is a frequent solution of mental conflict, be it of a normal or an abnormal (pathological) nature. In other populations suicide simply does not belong to the pattern of culture. As an example we can mention

differences between conditions in the Faroe Islands and the rest of Denmark. In Denmark as a whole the suicidal risk is quite high; in the Faroe Islands, on the other hand, suicides practically do not occur, and this in spite of the fact that, for instance, manic-depressive psychosis which usually gives a high suicide rate is definitely more frequent in the Faroe Islands than in the rest of Denmark.

14. There is no doubt that suicides are relatively frequent in the central parts of large cities. This may, to a certain degree, be caused by the special living conditions in such populations, first of all the isolation of many individuals. On the other hand, it is obvious that migration phenomena are of importance; there is a tendency for certain types of mentally deviant persons with an inherent high risk of suicide to move to these central parts of the cities where the isolation to which they are inclined will be further accentuated.

15. In which directions will changes with regard to frequency of mental disorders in a developing country most probably go? First of all a number of organic psychoses caused by infections, vitamin deficiencies, etc., will decrease in frequency; secondly, the increase of the lifespan will cause an increase of prevalence of involutional disorders; thirdly, the change of the age distribution will also lead to a higher prevalence of schizophrenia and especially manic-depressive psychosis; nevertheless, the increase in numbers of schizophrenics will probably become even more conspicuous than that of manic-depressive psychoses, because the excess mortality of schizophrenics will decrease rapidly. With regard to personality and behaviour disorders it seems impossible to say whether there will be any changes in expectancy or prevalence; an increasing number of these individuals will, however, pass from the hands of the penal authorities to those of medical men. Finally, there is no doubt that more attention will be paid to the problem of neuroses, but it will depend on local conditions how many spoonfuls of the ocean of neuroses will be consumed by therapists.

The influence of changing morbidity upon the productive capacity of the labour force

MILOŠ VACEK

I. PURPOSE, BASIC DATA

1. The changes in the morbidity pattern resulting in a considerable decrease of death-rate during the past fifty years undoubtedly influenced also the productive capacity of the labour force. Many factors, however, were involved affecting the morbidity, in comparison with the mortality, not only in a different degree but sometimes even in an opposite direction. It seems therefore expedient to study separately three main components of the total loss of working capacity: short-term incapacity for work (w_x), permanent disablement (i_x) and death before the onset of permanent disablement (q_x). To establish the trends a rather long observation period is necessary. We shall use the statistical data of employed men in Czechoslovakia from 1962 and 1935-1937. For the time around 1900, only data from Germany are available. Unfortunately no comparable data are at our disposal for the important age group above sixty years. We shall therefore have three sets of data:¹

- (i) The rates w_x based on observations (1887-1907) of the Sickness Insurance at Leipzig; invalidity and death rates from the experience of the Prussian Railways 1868-1884;
- (ii) The rates w_x , i_x , q_x from Social Insurance in Czechoslovakia 1935-1937;
- (iii) The rates w_x , i_x , q_x from National Insurance in Czechoslovakia 1962.

2. The "populations" (i), (ii) and (iii) are defined by distributions w_x , i_x , q_x derived from population groups which by no means were quite homogeneous. A detailed analysis, that cannot be given here, has shown, however, that the selected data are not seriously biased. Even if they cannot measure the effect of changing morbidity on the productive capacity in an exact way, they can at least give a reasonable estimate of the trend of development.

II. METHOD

3. Let l_x denote the number of men aged x who are not permanently disabled; then

$$l_{x+i} = l_x (1 - i_x - q_x) \quad l_{20} = 100.000$$

where the yearly probability of becoming permanently disabled is denoted by i_x , of dying in activity (i.e., before the onset of permanent disablement) by q_x . The losses (in years) of the productive life below sixty years of age resulting from events at the age (x , $x+1$) are:

$l_x q_x (60 - x)$ losses from death before the onset of permanent disablement; and

$l_x i_x (60 - x)$ losses from the permanent disablement, including the losses from subsequent death.

4. The number of men temporarily incapacitated at the age of x will be $l_x w_x$. In the appended graph two curves are drawn for each of the populations (i), (ii) and (iii):

$y = l_x$ the upper curve; and

$y = l_x (1 - w_x)$ the lower one.

5. The area between both curves represents the losses from short-term incapacity for work; it is subdivided by vertical lines into four areas corresponding to the losses in respective age groups. The area above the upper curve represents the losses from permanent disablement (black areas) and death in activity (areas marked by vertical lines). The losses resulting from the events occurring within age groups 16-29, 30-39, 40-49 and 50-59 have been summed up (cf. graph). The technical details of the computations need not be given here.

III. RESULTS

6. General information on the results can be obtained from the summary table 1.

7. The total loss has been steadily decreasing during the past seventy years as a result of the falling death rate while the losses from permanent disablement were comparatively stable and the short-term incapacity even increased during the same period. The per-

¹ Bibliography can be obtained on request from the author.

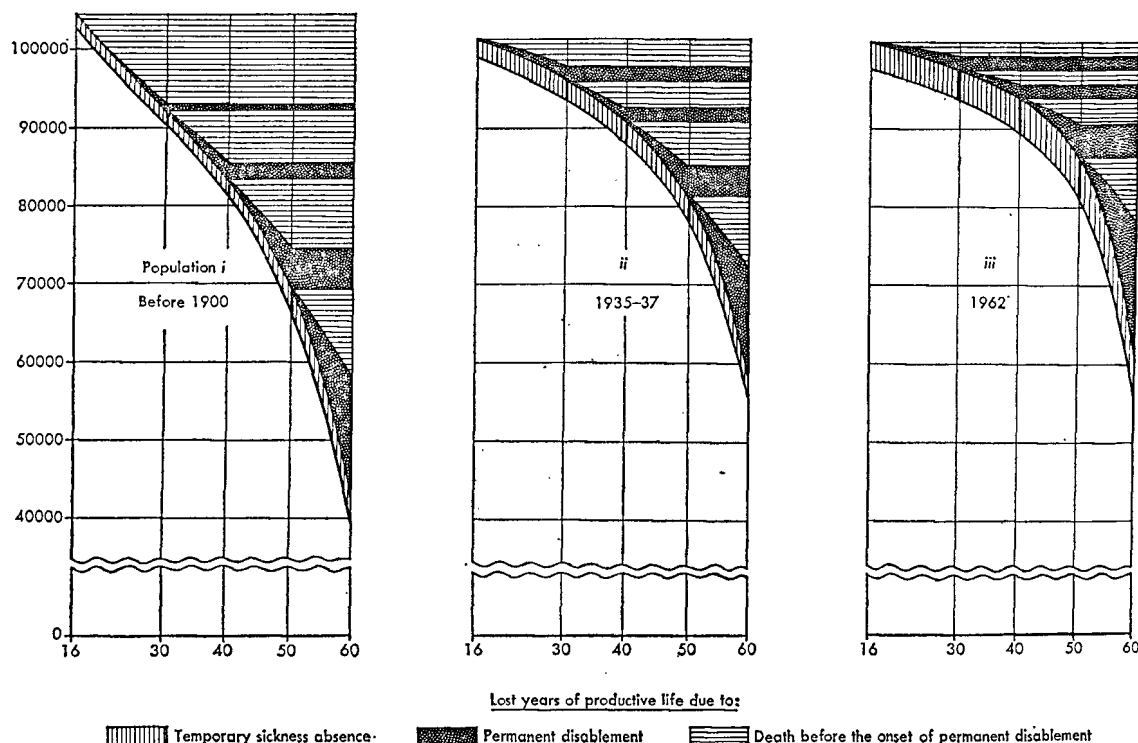


Table 1. Average years of productive life per person

Population	Lost as a result of			All causes
	Short-term incapacity	Permanent disablement ^a	Death in activity	
(i).....	0.93	2.05	7.51	10.49
(ii).....	1.11	2.24	3.20	6.55
(iii).....	1.74	2.29	1.86	5.89

^a Including the losses from subsequent death.

centage of sixteen-year-old men surviving to the sixtieth year while still active was respectively 41.3, 57.1 and 62.0 per cent in the populations (i), (ii) and (iii).

8. The different pattern of the structure of total permanent losses, depending on whether *persons* or *lost years* are taken as basis for comparison, can be seen in table 2.

Table 2. Total losses in per cent of the total caused by events in age group (x, x + d) years

Age group	By permanent disablement ^a		By death in activity	
	Persons	Lost years	Persons	Lost years
16-29.....	7.3 (5.2) ^b	27.0 (18.3) ^b	11.5 (8.2) ^b	34.5 (24.6) ^b
30-39.....	7.3	18.0	11.5	22.1
40-49.....	17.7	25.4	21.6	24.4
50-59.....	67.7	29.6	55.4	19.0
TOTAL	100.0	100.0	100.0	100.0

^a Including the losses from subsequent death.

^b Corrected for 10-year interval (divided by 1.4).

9. The total losses by age are given only for the populations (i), (ii) and (iii):

Table 3. Losses (in years) per one 16-year-old man caused by events in the age group ($x, x + d$) in the population

Age group ($x, x + d$)	(i)	(ii)	(iii)
16-29.....	4.63 (3.31) ^a	2.13 (1.52) ^a	1.73 (1.24) ^a
30-39.....	2.24	1.46	1.19
40-49.....	2.23	1.63	1.48
50-59.....	1.39	1.33	1.51
TOTAL	10.49	6.55	5.89

^a Corrected for 10-year interval (divided by 1.4).

All indicators decreased considerably—except between (ii) and (iii) in the highest age group. The rate of decrease fell rapidly with increasing age.

10. Let us examine next the total loss of future working time of an x -year old man:

Table 4

		Average loss of the future working life in the population					
		(i)		(ii)		(iii)	
Age x	The maximum duration of the future working time	In years	In per cent of the maximum	In years	In per cent of the maximum	In years	In per cent of the maximum
16.....	44	10.5	23.9	6.6	15.0	5.9	13.4
30.....	30	6.6	22.0	4.6	15.3	4.3	14.3
40.....	20	4.5	22.5	3.3	16.5	3.2	16.0
50.....	10	2.1	21.0	1.6	16.0	1.8	18.0

In (i) the average loss (in per cent of the maximum) decreased slightly with age, in (ii) it showed only minor variations, and in (iii) it increased with age.

11. Let us now compare the increase in the average length of working activity and average length of life, between (ii) and (iii):

Table 5

		e_x^0 men in Czechoslovakia			Average length of future working life ^a		
Age x		1929-1932	1960-1961	I.e., more by per cent	(ii)	(iii)	I.e., more by per cent
16.....		51.9	67.6	+ 30.3	37.4	38.1	+ 1.9
40.....		29.0	32.0	+ 10.3	16.7	16.8	+ 0.6

^a (60- x), minus the average total losses in years.

In contrast with the increase of the average span of life, the increase in the average future working life (up to 60 years of age) was very small. The causes of these different trends can be summed up as follows:

(a) Increase in e_x^0 was mainly achieved by the reduction of mortality from infectious diseases and other acute conditions most of which were more important as causes of death than as causes of disablement;

(b) Sometimes the lives can only be saved at the cost of an increased prevalence of diseases (diabetes mellitus), of a longer duration of short term incapacity for work, of an increased number of recurrent episodes of the underlying illness (myocardial infarction), or

the lower fatality rate may only result in prolonged permanent disablement (cor pulmonale);

(c) In many killing diseases medical science has been more successful in finding methods of treatment—which can avert death but often cannot restore patients to full health—than in devising preventive measures that could lower all main components of the losses of working capacity. (Notable exceptions were, a.o., tuberculosis and poliomyelitis.) The slowly increasing average length of working activity reflected, therefore, the actual stage of development of medical science and practice. Future discoveries in the aetiology and prevention of the leading causes of disablement and death may change this picture considerably.

Classification of population in terms of disability

THEODORE D. WOOLSEY

1. Many authors have treated the general subject of health as an aspect of demography, and often these authors have stressed "the difficulties in defining and measuring the essential components of the central concept—health."¹ This paper will deal with one component of health—disability—which can, perhaps, be objectively defined and measured and which has certain conceptual advantages as a classification variable for national populations, from the least developed to the most advanced. Much methodological work must yet be done, however, before disability can be widely accepted as a standard axis of classification, and the paper includes suggestions for future research.

2. Let us first consider briefly the usefulness of the concept of health in demographic analysis.

3. In almost all previous analyses involving health and the traditional demographic variables the index of health, whether it was mortality or morbidity, has been treated as the dependent variable. This is because these studies were directed toward public health or epidemiological objectives, with the level of health viewed as a resultant of social and environmental factors. However, a number of authors have shown the advantages of looking at health as an independent variable and examining what effect it has upon other demographic indices.^{2, 3, 4, 5}

4. To demonstrate the value of this it is only necessary to suggest some of the important

factors in the study of population which might be affected by health levels. The health of a population may well affect, for example: (a) its fertility; (b) its labor force participation rates, productivity, and family income distribution; (c) its migration patterns; (d) its school attendance rates and levels of educational attainment; and (e) its occupational distribution.⁶

5. Furthermore, we should not neglect study of the health of a population as a dependent variable in purely demographic investigations. Good health is innately desirable, and the degree of good health can be considered as one measure of the "quality" of a population.⁷ Such qualitative characteristics should probably receive as much attention in the study of population as size and rate of growth.

6. Thus, solution of the conceptual and methodological problems would open up a fruitful new area of population research.

7. What is meant by the term "disability"? Disability is a reduction in the individual's capacity to function in his social setting, resulting from morbidity. It is measured in terms of his inability to engage in activities that are normal for a person of his age, sex, and position in the family. Such activities ordinarily include the performance of productive work on the job or in the home, attendance at school, normal play activities, ability to move around without help, get up and down stairs or steps, or the performance of any one of a number of other customary daily activities.

8. Most often, in the past, disability has been expressed quantitatively as the number of person-days on which activity was curtailed in one way or another. These measures are very useful in public health, and in the United States totals of days of restricted activity, days confined to bed, days lost from work by workers, and days lost from school by school-age children are regularly estimated from the Health Interview Survey, and the results have

¹ Forrest E. Linder, "Health as a demographic variable", *International Population Conference, Vienna, 1959* (Vienna, International Union for the Scientific Study of Population, 1959).

² *Ibid.*

³ P. S. Lawrence, "Chronic illness and socioeconomic status", *Public Health Reports*, 63 (1948), pp. 1507-1521.

⁴ Jacob J. Feldman, "Barriers to the use of health survey data in demographic analysis", *The Milbank Memorial Fund Quarterly*, vol. 36 (1958), pp. 203-221.

⁵ John E. Gordon, John B. Wyon, and Theodore H. Ingalls, "Public health as a demographic influence", *The American Journal of the Medical Sciences*, No. 227 (1954), pp. 326-357.

⁶ J. J. Feldman, *op. cit.*

⁷ F. E. Linder, *op. cit.*

been published.⁸ However, for the purpose of classifying population, and throughout this paper, disability will be expressed as a characteristic of the individual as of the time of the census or sample survey. For this use it is more profitable to consider, not the day-to-day changes in activity status, but the typical status of the individual at the present time.

9. This present disability status is most likely to be the result of chronic disease, old injury, or physical impairment. Hence, to distinguish this from other indices of disability, the term "chronic limitation" has been introduced.⁹

10. The chronic limitation can be of varying degrees and can be measured along more than one axis. In the United States only two rather simple classifications have been used. One classification is called "chronic limitation of activity" and is intended to show the extent to which the person is able to participate in play (for pre-school children), in school (for school children), in keeping house (for adult women not in the labour force), and in work, meaning gainful activity (for all other persons). The other is called "chronic limitation of mobility" and is designed to characterize individuals according to their ability to move around without help.

11. In addition to the demographic uses suggested, it is worth mentioning the public health uses of measures of disability of the type just described.

12. Much of the morbidity experienced by a population, particularly that which is chronic in nature, is not preventable by means now known to medical science. It has been pointed out that increasing levels of prevalence of chronic disease are not inconsistent with improving health care.¹⁰ In the absence of means to prevent occurrence of disease, the efforts of medicine and public health are in large measure devoted to bringing cases under early treatment to prevent the ill effects of the morbidity, namely disability and premature death. But many diseases of public health importance in

the second half of the twentieth century are not important causes of death. (Arthritis is an outstanding example.) This accounts for the increasing interest in using other indicators to determine the proper priority of problems and to measure progress in overcoming them.

13. Disability, then, is such an indicator. It might be said to measure the degree of failure in our medical and public health efforts. We maintain that it is more appropriate than the total prevalence of morbidity as a barometer of the state of public health.

14. To illustrate how such classifications as those discussed here are used, some data for the United States from the national Health Interview Survey will be presented. The statistics shown are estimates for the civilian population of the country, exclusive of persons in resident institutions. They are based on probability samples of approximately 35,000-40,000 households interviewed each year by employees of the Bureau of the Census on behalf of the National Center for Health Statistics in the Public Health Service.

15. These data are averages from four years of interviewing, covering the period July 1, 1957, through June 30, 1961. During this period there was very little secular trend in the percentages of population in each limitation category.

16. As has been pointed out, the disability classification need not be shown as the dependent variable, but in these tables the public health practice has been followed since the tables were produced primarily to show indices of health of the population for various demographic groups.

17. Table 1 presents the classification by activity limitation status. Note that at one end of the scale the healthier population is first separated into those who gave no evidence in the interview of chronic ill health, and then those for whom some chronic morbidity was reported but no limitation of activity. The next group consists of those whose only limitation was in the amount or kind of "other" activities they could perform. These are people who were limited by chronic ailments in their participation in social, civic, recreational or sports activities but were not limited in the activity which constitutes their major role in society.

18. The fourth category, "limited in amount or kind of major activity," includes those who, though able to play, go to school, carry on gainful work, or keep house were somehow limited in the way they performed these major activities. Finally, there is the group who were

⁸ National Center for Health Statistics, Public Health Service, Department of Health, Education, and Welfare, "Current estimates from the health interview survey, July 1962-June 1963", *Vital and Health Statistics*, Series 10, No. 5 (Washington, D.C., 1964).

⁹ National Center for Health Statistics, Public Health Service, Department of Health, Education and Welfare "Health survey procedures—concepts, questionnaire development, and definitions in the health interview survey," *Vital and Health Statistics*, Series 1, No. 2 (Washington, D.C., 1964).

¹⁰ Barke S. Sanders, "Measuring community health levels", *American Journal of Public Health*, No. 54 (1964), pp. 1063-1070.

reported to be unable to carry on the major activity at all.

19. The criteria of major activity have already been described. For "preschool" the age limits are 0-5 years; for "school-age" they are 6-16 years; and those who are 17 years of age or over are, as has been said, separated into houseworkers, and all others. The major activity for this last group is gainful work. This means that for men at ages when they might be expected to be retired the criterion is, nevertheless, ability to work.

20. It may be seen from table 1 that limitation in "other" activities only tends to be less frequent than partial limitation in the major activity. In presentation these two categories are often combined. All forms of chronic limitation tend to increase in frequency quite sharply as age advances, but since among those with some chronic morbidity the proportion with disability rises rapidly with advancing age, there are fewer left with nondisabling chronic morbidity.

21. In table 2 the classification is according to limitation of mobility. The first category in the classification, those without reported chronic morbidity, is identical with the previous tabulation by limitation of activity. The second grouping contains persons reporting chronic morbidity but without any limit on their ability to move around. The third group includes people who can move around out-of-doors without the help of another person but not without some difficulty.

22. Next there is the group of people who do need the help of another person in getting around outside, and finally, there are those who are confined to the house all the time, except in emergencies. There can be no doubt that the last two groups, which together constitute only 1.2 per cent of the total, represent the most severely disabled persons, exclusive of those confined to institutions.

23. For public health purposes it is naturally of particular importance to be able to classify the disabled people according to the nature of the chronic ailments that brought about their disability. This is feasible in countries where a large fraction of the chronic conditions are under treatment by physicians and where knowledge of health matters is widespread. Under such conditions the family respondents can pass on to the interviewer a description of the disease or impairment as the family has learned it from the physician. This process is by no means perfect, but it does permit a

breakdown of the data by broad disease categories.¹¹

24. The kind of medical information of this kind that could be obtained in countries with few medical resources is problematical. There should be experimentation to see whether symptomatic descriptions could be classified into useful and meaningful diagnostic categories.

25. On the other hand, the great advantage of using the family as the source of information on disability is that the family members are best informed about what activities the disabled members can and cannot perform, and the extent to which they are able to move about without help.

26. The classifications discussed here can be refined with further research, and new scales can be constructed to measure other aspects of the individual's capacity to function in his social setting. Some scales will be so dependent upon the national culture that comparisons of distributions between different countries with widely different societies will not reflect differences in health alone. But other scales, particularly those that have been or might be constructed on axes of mobility, or other basic human activities, should prove very useful as summary measures of the effects of ill health for comparison of countries in varying stages of development or contrasting cultures.

27. Methodologically, the greatest advantage of the scales is that they are comparatively simple to apply in interview-type population sample surveys or censuses, and it is believed that errors of measurement, such as occur in all morbidity data collected by family interviews, are relatively low.

28. Their greatest methodological disadvantage, at least in the form in which they have been used in the United States, is that they divide the population into groups that are widely different in size. The most extreme form of chronic limitation usually applies to less than 1 per cent, or at most to 2 or 3 per cent, of the U.S. population, while the group labelled "not limited" may consist of 90 per cent or more. This, of course, is a reflection of the fortunate fact that these extreme manifestations of ill health are relatively rare in the population, but the result is that large samples have to be employed to produce reliable estimates.

29. Future research should be directed

¹¹ National Center for Health Statistics; Public Health Service, Department of Health, Education and Welfare, "Chronic conditions causing limitation of activities, United States, July 1959-June 1961", Health Statistics from the U.S. National Survey, Series B, No. 36 (Washington, D.C., 1962).

toward objective means of classifying the less severely disabled segments of the population in terms of activities they can and cannot perform; toward development of lists of physical activities

that are common to the culture in all parts of the world, and scales of disability based on these lists; and toward trial of the classification systems in many cultural groups.

**Table 1. Distribution of the population by degree of activity limitation, according to age:
United States, July 1957-June 1961**

	<i>All ages</i>	<i>Under 6</i>	<i>6-16</i>	<i>17-44</i>	<i>45-54</i>	<i>55-64</i>	<i>65-74</i>	<i>75 and over</i>
<i>Number in thousands</i>								
Total population (exclusive of institutional)	173,069	23,692	36,586	62,413	20,208	15,168	9,864	5,138
Persons with no chronic conditions	101,389	20,278	29,278	34,598	8,670	5,267	2,478	819
Persons with one or more chronic conditions:								
Not limited in activity	53,584	3,186	6,497	23,465	8,800	6,487	3,720	1,430
Limited, but not in major activity	4,747	14	518	1,484	839	829	679	384
Limited in amount or kind of major activity	9,574	173	198	2,457	1,567	1,923	2,000	1,255
Unable to carry on major activity	3,776	41	94	409	333	662	986	1,250
<i>Per cent distribution</i>								
Total population (exclusive of institutional)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Persons with no chronic conditions	58.6	85.6	80.0	55.4	42.9	34.7	25.1	15.9
Persons with one or more chronic conditions:								
Not limited in activity	31.0	13.4	17.8	37.6	43.5	42.8	37.7	27.8
Limited, but not in major activity	2.7	0.1	1.4	2.4	4.2	5.5	6.9	7.5
Limited in amount or kind of major activity	5.5	0.7	0.5	3.9	7.8	12.7	20.3	24.4
Unable to carry on major activity	2.2	0.2	0.3	0.7	1.6	4.4	10.0	24.3

Table 2 follows on page 450

Table 2. Distribution of the population by degree of mobility limitation, according to age:
United States, July 1957-June 1961

	<i>All Ages</i>	<i>Under 6</i>	<i>6-16</i>	<i>17-44</i>	<i>45-54</i>	<i>55-64</i>	<i>65-74</i>	<i>75 and over</i>
<i>Number in thousands</i>								
Total population (exclusive of institutional)	173,069	23,692	36,586	62,413	20,208	15,168	9,864	5,138
Persons with no chronic conditions	101,389	20,278	29,278	34,598	8,670	5,267	2,478	819
Persons with one or more chronic conditions:								
Not limited in mobility....	66,953	3,338	7,187	27,296	11,084	9,037	6,243	2,769
Has trouble getting around alone	2,761	17	59	336	306	560	708	775
Cannot get around alone...	975	34	35	95	72	143	227	370
Confined to the house.....	990	25	27	89	76	160	209	404
<i>Per cent distribution</i>								
Total population (exclusive of institutional)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Persons with no chronic conditions	58.6	85.6	80.0	55.4	42.9	34.7	25.1	15.9
Persons with one or more chronic conditions:								
Not limited in mobility....	38.7	14.1	19.6	43.7	54.8	59.6	63.3	53.9
Has trouble getting around alone	1.6	0.1	0.2	0.5	1.5	3.7	7.2	15.1
Cannot get around alone...	0.6	0.1	0.1	0.2	0.4	0.9	2.3	7.2
Confined to the house.....	0.6	0.1	0.1	0.1	0.4	1.1	2.1	7.9

SUMMARIES OF PAPERS

Trends of mortality by the aid of differential equations with parameters of urbanization and industrialization

FELIX BURKHARDT and LUCIE OSADNIK

When examining the development of death rate $q(t)$ the differential equations

$$d_q(t) = a \cdot q(t) \, dt \quad (i)$$

$$d_q(t) = b \cdot [q_0 - q(t)] \cdot dt \quad (ii)$$

may well be used.

It follows from differential equation (i) that the surplus mortality of industrial population is greater in towns than in villages.

Differential equation (ii) leads to the conclusion that the decreasing trend of mortality is greater in respect of the industrial population than in case of the agricultural population. Within the industrial population the surplus decrease of mortality is greater in towns than in villages. Therefore special attention should be devoted to the trend of the mortality of the rural population.

Socio-economic characteristics related to chronic morbidity among older urban males

ROBERT G. BURNIGHT

A prospective study is being conducted, the long range purpose of which is to investigate the changes which occur in health characteristics among males in the seventh decade of life, to interpret their functional significance, and to examine the interrelationship between these changes and socio-economic and demographic variables. The study population consists of a 27 per cent probability sample of the white non-institutionalized married males who were between the ages of 60 and 64 and were residents of Providence, R.I. on 1 May 1962.

Using procedures similar to those developed by the U.S. National Household Health Survey, a large schedule of information was obtained from 605 qualifying males. Among the items of information obtained were socio-economic characteristics, number and kind of chronic

conditions present, and the amount of disabling confinement which was a consequence of these chronic conditions.

The reporting of one or more chronic conditions by this population in 1962 is most clearly associated with labour force status and with own appraisal of financial position: the proportion reporting the presence of a chronic condition was significantly higher among those not in the labour force than among those in the labour force, and there was a significant inverse association between self-appraised financial position and reported chronic conditions. Education, family income, and nativity status showed a statistically significant association (at the 0.05 level) with reported chronic conditions, an association not observed for most recent or major life-time occupation. Considering the consequences of reported chronic conditions in terms of disabling confinement to house, bed, or hospital only financial status and labor force status showed a significant relationship. Other usual measures of socio-economic status—education and occupation—and nativity status did not show a significant association with disabling confinement.

Incidence of mortality from cardiovascular diseases in the Italian regions, by sex and age

NORA FEDERICI

Research carried out on the data of deaths from cardiovascular diseases in the different regions of Italy during 1961-1962 led to the following results:

(a) The death risk from these diseases, on the whole, is higher in the Northern regions as compared with the central and southern regions;

(b) The disadvantage of the North is much more evident among the males than the females and is more marked for pre-senile age groups;

(c) Among cardiovascular diseases, the arteriosclerotic forms have a higher supermortality in the North, whereas rheumatic cardiopathies have a higher incidence in the southern regions;

(d) Male super-mortality is recorded for all ages (up to 80-90 years) for most cardiovascular diseases. Female super-mortality is recorded for rheumatic and hypersensitive forms, although with considerable unevenness of age and without any systematic regional differentiation.

Multiple causes of death, United States, 1955

LILLIAN GURALNICK

For a large sample of deaths in the United States for 1955, all conditions reported on the medical certification were coded. The results were tabulated for all coded conditions by age, colour, and sex; and also for combinations of selected causes reported together. The data showed that more than half the deaths were reported with two or more conditions in the medical certification. A considerable amount of information important to public health programmes was gained through tabulation of associated causes, although the leading causes of death did not change radically, when all conditions rather than underlying causes were ranked. Tabulations of two conditions reported together indicated that a study of disease complexes could offer a better understanding of causes of death than study of the underlying cause alone.

A number of causes are characteristically reported alone; others are generally reported with contributory conditions or complications; and still other causes appear only as secondary causes either by virtue of the nature of the disease or condition, or as a result of the rules for selecting the underlying cause. Interpretation of multiple-cause of death data depends on knowledge of reporting and classification practices.

Development of peri-natal mortality statistics in Australia

L. G. HOPKINS

The World Health Organization defines the peri-natal period as extending from the twenty-eighth week of pregnancy to the seventh day of extra-uterine life. Australian authorities prefer a longer period, extending from the twentieth week of pregnancy to the twenty-eighth day after birth. The upper limit is extended because deaths in the second, third and fourth weeks of life are still mainly due to pre-natal causes, and these causes have been found to be ascertainable.

Surveys in Tasmania and New South Wales show that substantial numbers of children of less than twenty-eight weeks' gestation are born alive but do not survive the neo-natal period, and that it is practicable to get reports of substantial numbers of foetal deaths of under twenty-eight weeks' gestation, thus supporting the extension of the period at the lower limit. Notification of foetal deaths of twenty weeks' gestation is already the practice in two Australian territories and one state.

The line between a foetal death and a neo-natal death needs to be drawn for statistical purposes and is determined by criteria of signs of life. It is intended in Australia to adopt beating of the heart, rather than breathing, as the definitive sign of life.

The Classification of Causes of Stillbirth developed by W.H.O. in 1948 provides a better means of classifying causes of neo-natal deaths than does the Diseases of Early Infancy Section of the Injuries and Causes of Death proper, but needs to be adapted slightly to allow for neo-natal deaths from conditions arising after birth. Classification of neo-natal deaths in New South Wales in 1962 according to both systems illustrates the efficacy of the adapted stillbirth classification in reducing the numbers assigned merely to injury at birth and to immaturity.

Some of the information needed for classification of causes of neo-natal deaths according to the adapted stillbirth classification is not ascertainable from the ordinary certificate of cause of death. Hence a special certificate of cause of peri-natal death, to be used both for neo-natal and for foetal deaths is needed, replacing the ordinary death certificate in the case of neo-natal deaths.

Some aspects of the problem of obtaining research leads on atherosclerotic heart disease from reported mortality data

C. A. McMAHAN

This nonmedical discussion stems from reported differentials in mortality from cardiovascular diseases among selected Latin-American countries and the United States. In the attack on ostensibly analogous problems in the past, epidemiological methods seem to have made significant contributions to the understanding of disease where there existed fairly reliable knowledge of the disease under study or of the associated variables, and where the "time sequence of cause and effect" was relatively short. Neither condition seems to hold

firmly for the cardiovascular diseases. Nevertheless, it is generally accepted that epidemiologic studies, despite their limitations, have the potentiality of providing clues for investigation by other methods as well as for testing whether or not hypotheses are consistent with the distribution of a specified disease. Hypotheses concerning the relationship between a disease and selected factors represented in populations may be "tested" by making comparisons within and among such populations. In order to accomplish the latter, a first step is to determine if true differentials exist in the extent and severity of such a disease among populations with diverse environmental and hereditary characteristics.

This paper is concerned with only two crude and indirect methods of determining prevalence and severity of a disease: (a) mortality assigned to a specified cause—reported vital statistics; and (b) reported results of measurement of lesions in human post-mortem arterial specimens. Mortality rates from cardiovascular disease are derived from the systems of vital statistics in the respective countries, and result from the assignment of certain deaths to the cardiovascular diseases as the "cause of death". The second method involves the examination of arterial specimens (aorta, coronary arteries, and cerebral arteries) obtained from necropsies performed on certain patients in the respective countries; these specimens represent highly selected nonprobability samples. Thus a problem which arises is the relationship between data from the two sources.

Mortality trends and causes of death in Belgium

G. REGINSTER-HANEUSE, M.D.

The trend of mortality in Belgium during the past sixty years is shown for the natural population movement. The reduction in the case fatality rate is clear, but the level of that rate (11.58 per thousand inhabitants in 1961) is still too high; the aging of the Belgian population is to some extent responsible.

Some groups display, in the analysis by sex and by age, particularly marked progress; this applies, generally speaking, to the age-groups of under 45 and more especially to those of between 5 and 25 years. The position is the most satisfactory in respect of the female population.

The principal causes of death are shown in two groups: first, the illnesses making for a continuous rise in the case fatality rate (cardiovascular diseases, malignant tumours, traffic

accidents), and, secondly, the diseases in respect of which deaths are clearly declining (tuberculosis, infectious diseases, respiratory diseases, digestive diseases, pregnancy and confinement diseases).

Infant mortality has gradually declined over a period of some forty years. Separate charting for each sex shows the excess mortality suffered by men as compared with women.

The train of morbid events leading directly to death — a practical and methodological problem

J. STŘITESKÝ, M. ŠANTRŮČEK and M. VACEK

Accurate statistics of causes of death can be obtained only through a "medical certificate of cause of death" (CMD) duly completed by the practitioner. If he reports more than one diagnosis in the appropriate section of the CMD without specifying their relationship to one another and without indicating their relative importance, the real cause of death cannot be determined by applying the selection rules. If the quality of statistics of causes of death is to be improved, special attention must be given to the work of the practitioner who completes the diagnosis section of the CMD. Revision has shown that the sole cause of many errors is that medical practitioners are not sufficiently conversant with the rules for completing the CMD or do not attach sufficient importance to this work. It has also been found that these rules are not uniformly interpreted.

The following measures are therefore required: first, to make all medical practitioners acquainted with the rules for completing the CMD correctly; and secondly, to endeavour to define these rules more precisely. A long-term objective is accuracy in diagnosing the real causes of death. A subject which deserves special study in this connexion is that of the doubtful validity of a diagnosis based on incomplete information on the state of health of the deceased person and on the circumstances of his death.

The principal problems may be summarized in the following questions: Which conditions should be entered on the CMD? What is the exact meaning of the train of events leading directly to death? What are the minimum criteria for making a diagnosis?

It must be stressed that the problem of the cause of death cannot be solved by a mechanical statistical assessment of all the diagnoses entered very unsystematically on the CMD. The study of contributory causes of death is even more difficult than that of the primary

cause. As a first step towards solving this problem, the use of a uniform procedure by all practitioners completing the CMD is essential.

Statistics of causes of death cannot be expected to answer all questions on the state of health; for that purpose a system of morbidity statistics, including full epidemiological research, must be developed.

Measurement and projection of mortality by cause of death in developing countries

WALLIS TAYLOR

In many developing countries mortality rates are at present very high. Substantial falls in mortality would, therefore, have serious repercussions on the rate of natural increase and consequently on the rate of increase of the population. It is suggested that careful analysis of the statistics of cause of death for a country would enable estimates to be made of changes

in mortality which are likely to occur in the near future.

To illustrate this approach, material is used which derives from the model vital and health statistics unit set up in Nagpur, India in 1956 by the Government of India assisted by the World Health Organization.

A distinction is drawn between statistics of cause of death arising from institutions (medically-certified deaths) and material from non-institutional sources. Separation in this way is essential for accurate assessment of true cause of death, but it is also seen that some non-institutional reports are accurate and valuable.

To facilitate this research it is suggested that more centres of this nature should be instituted in other areas of high mortality and where mortality and fertility statistics are not yet of a high standard of accuracy. Thus the large falls in mortality which are likely to occur in developing countries as health and social problems are overcome could be foreseen and more reliable projections of population change could be made.

POPULATION GENETICS

PAPERS

Perspectives in genetic demography

WALTER BODMER and L. L. CAVALLI-SFORZA

1. The classical theory of population genetics, as developed originally by Fisher, Haldane and Sewall Wright, was formulated chiefly for simply inherited characters assuming discrete generations, mating at random with respect to these characters with selection measured as the relative proportions surviving from one generation to the next. One example of these inherited characteristics is the blood groups. Information in man is available in much more detail than specified by these models. Selection should be measured by quantities such as the intrinsic rate of population increase which take into account the age dependence of mortality and fertility. Many characteristics of interest are socio-economic and demographic variables with no simple pattern of inheritance. The associations between mates with respect to these characteristics are generally far from random. Persons preparing comprehensive human population genetic models must take account of these complications, which are largely demographic in nature, and require data to be collected with a family orientation. Linking demographic and other types of information can greatly facilitate such an orientation. We prefer the term "record linking" rather than "record linkage" to avoid confusion with the expression "genetic linkage" which has a rather different meaning. Two major categories of record linking exist. The first relates information from different sources on the same individual while the second relates information usually from the same source, on different individuals with a view to the construction of family groupings. A major problem of existing data such as a census is that information is collected by the household rather than by the biological family.

2. In this paper we shall discuss the inheritance of socio-economic and demographic variables; the comprehensive analysis of differen-

tial reproductivity; the analysis of mating structure; and an attempted synthesis of the "mechanics of populations".

3. Our review certainly is not intended to be exhaustive. Topics which we discuss as well as those we cannot cover are dealt with in part by the references listed in the footnotes.^{1, 2, 3, 4, 5, 6}

I. INHERITANCE OF DEMOGRAPHIC AND SOCIO-ECONOMIC VARIABLES

4. Strictly demographic variables of interest include duration of life or longevity; fertility; the sex ratio; and twinning. References to studies on the inheritance of longevity are given in the paper by Cohen in these conference proceedings. The inheritance of fertility was discussed by Fisher⁷ while emphasizing the importance of fertility as a contributing factor to

¹ R. H. Post, "Genetics and demography: summary of 'workshop conference' between demographers and population geneticists", *Eugenics Quarterly*, vol. XII, No. 2 (1965), pp. 41-71.

² Walter F. Bodmer, "A program for genetic demography based on data from large-scale social surveys," *Eugenics Quarterly*, vol. XII, No. 2 (1965), pp. 85-89.

³ L. L. Cavalli-Sforza, "Demographic attacks on genetic problems", United Nations-World Health Organization Seminar on use of vital and health statistics for genetics and radiation studies (United Nations publication, Sales No.: 61.XVII.8), pp. 221-233.

⁴ K. Mather, "Genetical demography," *Proceedings of the Royal Society of Biology*, No. 159 (1963), pp. 106-125.

⁵ J. Sutter and J. M. Goux, "Lethal equivalents and demographic measures of mortality," *Cold Spring Harbor Symposium*, vol. XXIX (1964), pp. 41-50.

⁶ H. B. Newcombe, "Pedigrees for population studies—a progress report," *Cold Spring Harbor Symposium*, vol. XXIX (1964), pp. 21-30.

⁷ Ronald A. Fisher, *The genetical theory of natural selection* (New York, Dover, 1958), pp. 213-218.

selective differences. This point has been stressed recently by Crow⁸ using his index of opportunity for selection. Some work has also been done on the inheritance of differences in the sex ratio and of twinning rates.^{9, 10, 11} Socio-economic variables generally available from routine surveys include schooling, occupation, income, migration history, and, in some cases, religion and race.

5. All these variables may be considered as determined essentially by behavioral characteristics, which undoubtedly have some genetic components. Their inheritance must be investigated by using techniques of quantitative inheritance and by assuming the characters may be affected by many genes. The major problem is to disentangle genetic effect from environmental effects. Because this unraveling requires the study of correlations between relatives, reconstructing degrees of relationship in routine demographic data is important. The following types of relationships are likely to be available: (a) identical twins reared together; (b) identical twins reared apart; (c) non-identical twins; (d) parent-offspring; (e) sibs; (f) half-sibs; (g) uncle-niece and aunt-nephew; (h) first cousins; (i) first cousins once removed; (j) second cousins; (k) other relationships, including adopted children. A major problem in human quantitative inheritance studies is the resolution of "between families" as opposed to "within family" environmental differences because social inheritance and the general cultural background impose a strong correlation on the environment of individuals within a family. Comparison between identical twins reared together and those reared apart is uniquely informative on this point.^{12, 13} Because the rarity of identical twins reared apart limits study of such a comparison it would seem worthwhile to devote an effort to utilizing demographic techniques for their detection. Analysis of quantitative inheritance in man could be greatly improved by the simultaneous use of many

approaches,¹⁴ including the analysis of the regression of the means of offspring from consanguineous matings on their inbreeding coefficients.

6. An important technique for the study of quantitative inheritance, which cannot be carried out with the use of demographic data routinely available at this time is studying the linking of quantitative traits with known genetic markers. Undoubtedly the ultimate resolution of the inheritance of behavioral traits will depend on the analysis of the biochemical basis of behavioral differences.

II. SELECTION

7. The biological fitness of an individual or group of individuals is measured ideally by their relative contribution to future generations. Given stable fertility and mortality distributions with respect to age fitness would be the corresponding intrinsic rate of increase or "Malthusian parameter". In so far as the characteristics in which we are interested have heritable components differences in fitness with respect to these characteristics will result in changes in their distribution in the population from one generation to the next. We must emphasize that only characters with heritable components will be affected.

8. A schematic representation of all the various factors (and their interactions) which contribute to differences in individual reproductivity is given, in terms of a flow diagram, in the figure. The flow sheet is in a form appropriate for writing a computer programme to simulate the reproductive process. Time is incremented by one unit ($t \rightarrow t + 1$) as indicated and encircled questions denote decisions to be made, which in general will be functions both of time and of the previous history of an individual. For example, the probability of marriage will depend on age, previous marital history if divorced or widowed and possibly previous reproductivity history. The probability of conception will depend on the length of time since the previous birth, the number of previous births, and on the age of the person. The probability of living will depend on marital history, fertility and age. The outcome of the process is the number of births. A new "life line" is initiated for each birth. There are four major components of this process, pre-reproductive mortality, mortality during the reproductive period, marriage, and fertility.

¹⁴ I. Barrai, L. L. Cavalli-Sforza and M. Mainardi, "Testing a model of dominant inheritance for metric traits in man", *Heredity*, vol. XIX, pp. 651-668.

⁸ James F. Crow, "Some possibilities for measuring selection intensities in man," *Human Biology*, vol. XXX, No. 1, pp. 2-13.

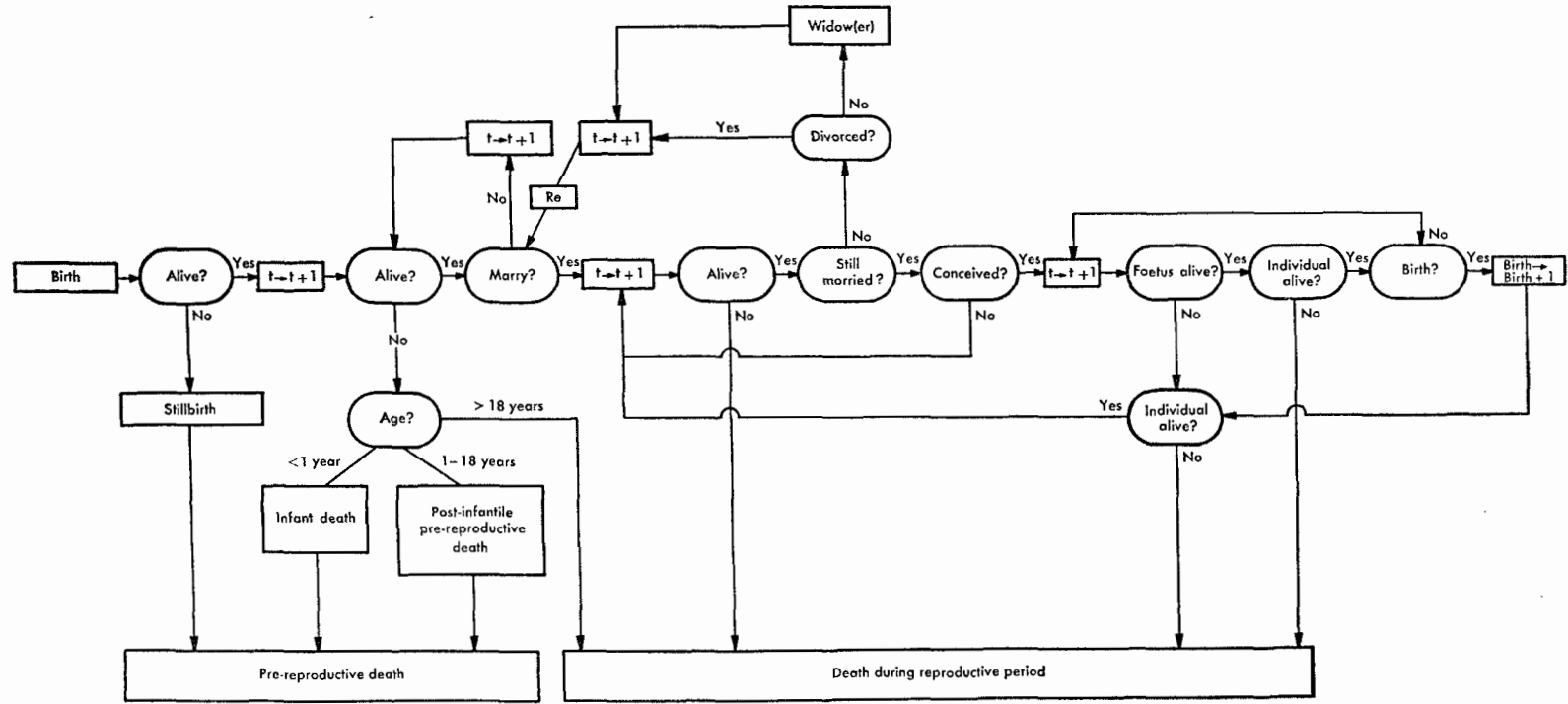
⁹ A. W. F. Edwards, *Genetics and the human sex ratio advances in genetics*, vol. II (New York, Academic Press, 1962), pp. 239-272.

¹⁰ L. L. Cavalli-Sforza, "Indagine speciale su alcune caratteristiche genetiche della popolazione italiana," *Note e Relazioni*, No. 17 (Istituto Centrale di Statistica, 1962).

¹¹ Curt Stern, *Principles of human genetics* (San Francisco, W. H. Freeman, 1960), second edition, pp. 540-543.

¹² H. H. Newman, F. N. Freeman, K. J. Holzinger, *Twins: a study of heredity and environment* (Chicago, University of Chicago Press, 1937).

¹³ J. Shields, *Monozygotic twins* (London, Oxford University Press, 1962).



Fitness flow chart

9. The effects of each factor may be thought of in terms of a reduction of the maximum reproductivity that can be achieved with optimal conditions for all factors other than the one in question. Maximum reproductivity will be achieved only if still-births, infant deaths, pre-reproductive or reproductive deaths are absent if marriage takes place as early as possible and is not broken by divorce or death of the mate, and if maximum fertility with a minimum post-partum sterile period is maintained throughout the maximum reproductive period that is possible. Ignoring multiple births, thirty seems nearly the maximum number of births each female can achieve. However, even high fertility populations, the achieved number is much smaller than thirty. In the Hutterites the median age at marriage is 22 for women (only about 1 per cent of either sex at age 45 has never been married) and birth control is never practised;¹⁵ nevertheless, the mean number of children born to women 45 years or older in 1950 was 8.9. The actually achieved reproductive rate at least approximately may be thought of as the maximum minus the sum of the reductions or "costs" contributed by all the individual factors. We thus obtain a balance sheet of the contributions of the various factors to the biological "cost of living". A detailed analysis of these ideas can be formulated and will be presented elsewhere.

10. Differences in fitness will be represented by differences in the various distributions for the components of the flow sheet. Interactions between individuals with respect to fitness, especially in so far as they relate to the characteristics of husband and wife, should be allowed for in any general model. These differences ultimately will need to be partitioned into their heritable and nonheritable components.

11. Selection between groups of individuals, for example, societies or cultural groups, can also be measured by relative intrinsic rates of increase of these groups. These, however, will not take account of important components affecting the overall rate of increase of groups defined by socio-economic and cultural attributes. These components relate to migration into the groups, for example, religious conversion, and to social inheritance, such as cases in which all children take on the social attributes of one or the other parent. These factors may enormously increase the rate with which one "culture" can overtake another as shown from the results of the industrial revolution.

¹⁵ J. W. Eaton, A. J. Maier, cited by Alan F. Guttmacher, "Factors affecting normal expectancy of conception", *Journal of American Medical Association*, vol. CLXI, No. 9 (1953), pp. 855-860.

III. MATING STRUCTURE

12. The mating structure is defined by the distribution of the frequencies of pairs of mates with respect to the characteristics in which we are interested. That the choice of mate is affected by age, by geographic location, by socio-economic and cultural factors and by religion and race is well known.

13. Two possible consequences of the mating structure exist. The first is selection due to the occurrence of some marriages in preference to others in a way that makes certain genetic types more or less frequently represented in the next generation. The second is an assortment of marriages which may affect the composition of the population without resulting in differential selection. Some assortative mating with respect to physical traits is known, but it should be emphasized that observed correlations between mates may be the consequence of social stratification and assortative mating for social conditions or of secular trends for the characteristics in question.¹⁶

14. Genetic relationship between mates is an important part of mating structure. Social rules which bar some "incestuous" marriages in practically all human societies make their occurrence infrequent. The degree of relationship is a complicated variable, depending on which ancestors and how many ancestors are common to the two mates. The existence of demographic records in past generations, as from parish books^{17,18} makes it possible to reconstruct genealogies for considerable numbers of generations. In some cases it has been possible to obtain the distribution of inbreeding coefficients for some individuals of a population.¹⁹

IV. POPULATION MECHANICS

15. We define population mechanics as the general study of the composition of populations, their changes in time and space, and the forces effecting these changes. In this section we give an outline of a general framework for the speci-

¹⁶ Lars Beckman, "Assortative mating in man," *Eugenics Review*, vol. LIV, No. 2 (1962), pp. 63-67.

¹⁷ M. Moroni, "Sources, reliability and usefulness of consanguinity data with special reference to catholic records," *United Nations-World Health Organization Seminar on use of vital and health statistics for genetics and radiation studies* (United Nations publication, Sales No.: 61.XVII.8), pp. 109-117.

¹⁸ I. Barrai, L. L. Cavalli-Sforza and A. Moroni, "Record linkage from parish book data," *M.R.C. conference on the use of mathematics and computer science in biology and medicine* (in press, 1964).

¹⁹ A. P. Mange, "Growth and inbreeding of human isolate," *Human Biology*, vol. XXXVI (1964), pp. 104-133.

fication of the problems of population mechanics.

16. At any given time an individual, I , is characterized by a large number of parameters which may be grouped as will be shown in the paragraph to follow.

17. I_f, I_m — are the individual identifiers of the father and mother respectively. These define the ancestry of an individual and his relationship with all other people in the population, past and present. Knowing for each individual the identifiers of the parents, it is possible to calculate the complete distribution of F (inbreeding coefficient values of his ancestors) and, of course, his own inbreeding coefficient, g , a vector defining the genotype, p , a vector defining the phenotype. Phenotype will include physical, cultural, and socio-economic attributes; $h(t)$ — is a vector defining the history of an individual to the present time t . This will include, for example, birth rate, birth place, marital history, fertility, migration, changes in phenotype (for example schooling, occupation, income, and perhaps physical conditions). The vector x defines the current geographic location of the individual. The set of quantities $z = (I_f, I_m, g, p, h(t), x)$ define a point in a multidimensional space. Each individual I , at a given time, will be associated with a given point in this space. The general problem of population mechanics is given at time t_0 the distribution of individuals in this space and all the genetic relationships between them, to predict this distribution of individuals and their relationships at some future time, t_1 . Demography and population genetics, as usually considered, are each concerned with only a part of this general problem. Of basic interest to both is the distribution $f(z, t)$ giving the density of individuals at the point z at time t .

18. Perhaps the most basic function of population mechanics is $P(z, t, z_1, t_1, r) =$ the

probability that an individual at z at time t has a relative, defined by a vector of parameters for relationship r , at z_1 at time t_1 . This function must include a specification of the laws of inheritance and of the fitness differentials between individuals. The second essential for the prediction of population changes is the definition of the mating structure. This is given by the function $M(z_1, z_2, r, t)$, the probability that an individual at z_1 marries an individual at z_2 , at time t , have a relationship given by r will be a function of M and P . Clearly, only certain subsets of the parameters of z will be defined, so that only changes with respect to these can be studied. The models of population mechanics define appropriate functions relating the variables contained within z , from which the functions P and M may be derived. The tests of these models, as for any other models, will be the matching of predicted changes and observations with observed changes and distributions. The analysis of the frequencies of various types of consanguineous marriages by Cavalli²⁰ and Hajnal²¹ provides a good illustration of this approach. The definition of migration patterns, especially as a function of relationship, is an important part of the definition of the function P . This can be obtained readily from many existing sources of demographic data such as the United States census.

19. Clearly population projections, which are an essential part of population genetics and of demography, require for their complete specification a knowledge of demographic parameters as a function of genetic relationship.

²⁰ L. L. Cavalli-Sforza, I. Barrai and A. W. F. Edwards, "Analysis of human evolution under random genetic drift", *Cold Spring Harbor Symposium on Quantitative Biology*, vol. XXIX (1964), pp. 9-19.

²¹ J. Hajnal, "Concepts of random mating and the frequency of consanguineous marriages", *Proceedings of the Royal Society of Biology*, vol. CLIX (1963), pp. 125-177.

Demographic studies of small populations on the basis of family-genealogical investigations

V. V. BUNAK

[Translated from Russian]

1. The study of small populations provides valuable material for the solution of many demographic problems. The monographic description of individual population groups becomes necessary in cases where there is need to obtain demographic information in countries not having a developed system for the registration of population data, or to establish, in countries which do have such a system, the demographic differences between isolated population groups (ethnic, religious, territorial — e.g., the inhabitants of individual mountain gorges). Of particular interest are the populations of individual, predominantly rural, inhabited localities in which there has been no significant inflow or outflow of population over a considerable period (say, centuries), as a result of which general indicators are on the whole sufficient to characterize the natural growth, fertility and mortality of the population.

2. Average rates of population growth for a whole country or large areas of a country do not for the most part accurately reflect the rate of natural increase, since territorial variations in growth are often considerable, and both internal and international migration make it difficult to compare the rates over time. For example, from 1867 to 1913 the population of the European part of Russia rose from 62.5 to 121.8 million — i.e., almost doubled — the mean annual rate of increase over the forty-eight years being about 15 per 1,000 population. In reality the rate of natural increase was considerably higher, since in the last twelve years alone of the period under review, 4.5 million people migrated from European Russia to Siberia, and 3.5 million to the northern Caucasus.

3. A thorough study of individual population groups throws more light on the relationship between the different demographic indicators — for example, between the age-specific fertility rate and the number of preceding births, and between that rate and other factors influencing fertility. In certain conditions it is

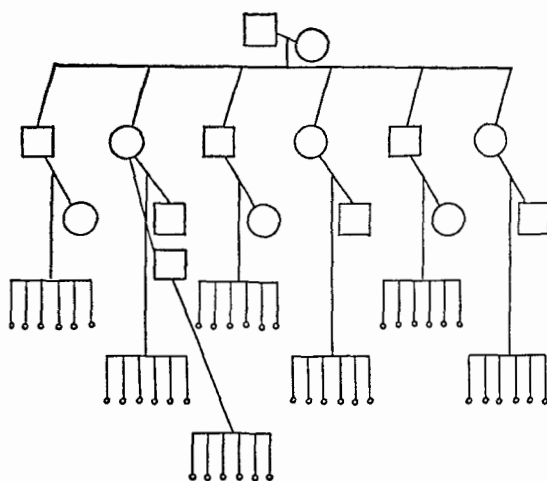
possible to calculate the intra-group correlation of rates and to determine the relative influence of each factor. With large masses of material covering wide geographical areas, even if it includes indicators of different kinds, it is impossible to achieve the same sharpness of definition. Average rates inevitably blur the actual relationship of the various factors in individual groups.

4. The dynamics of demographic indicators emerge with particular clarity from the study of specific groups, since the age groups compared, if they are properly selected, are representative of three directly linked generations — the primary, the parents', and the grandparents'.

5. Each specific group should, of course, comprise only one particular population type distinguished by certain features: for example, the rural agricultural population of a given area or the population of an industrial workers' settlement in a particular zone. The comparison of a few typical populations, each numbering 2,000 or 3,000, can give fairly indicative and statistically reliable results.

6. Some material for determining the demographic characteristics of individual population groups can be derived from current statistics. In the statistical publications of a number of countries, however, the data for administrative subdivisions relate only to units at the district or higher levels and are usually inadequate for the purpose of determining the relationship of different kinds of indicators.

7. The solution lies in carrying out special surveys adapted to the purpose of the operation and the size of the population being investigated. Data relating to one or two villages can be obtained through a questionnaire-type survey covering all or most of the population concerned. Surveys of this kind can be carried out by a small group of investigators in a comparatively short time. Soviet statisticians have in this connexion devised a special method known as the "anamnesic" method, which in-



cludes the retrospective study of demographic phenomena.

8. Closely related to the anamnestic method is the "family-genealogical" method. A special feature of the latter is the recording of the family relationship between the various respondents, this being a means of throwing additional light on many demographic questions. Genealogical data covering the greater part of the population of a given locality will, provided there has been no significant inflow or outflow of population, furnish a good description of the basic population unit which in United States literature has come to be termed "deme" (from the Greek *demos*).

9. Since the genealogical method is little used in demography, I shall describe its basic methods and some results of its use in the study of five groups among the Russian agricultural population of southern Siberia.¹

10. The first stage of the study — the registration of the subjects — is carried out with the aid of a chart showing the family ties of individuals within the limits of two, three and, if possible, more generations (see figure). Each member of the family tree is recorded, according to sex, as a square or a circle, in which the individual's ordinal numeral is entered. Blood relationships are indicated by vertical

lines, and conjugal ties by oblique lines. If a person has married more than once, a separate oblique line is drawn for each marriage.

11. The most convenient starting point for a family tree, the so-called "proband", is a man or woman of medium age (from twenty to forty-five years), one or both of whose parents are alive and who has children. The proband's father and mother constitute the first generation of the population under study, the proband himself and his siblings the second generation, and their children the third generation. The proband's parents and all their progeny are designated by consecutive Roman numerals; the proband and his siblings (in order of birth) by capital letters of the Latin alphabet, and their spouses by the same letters but with the figures 1, 2, etc. subscript; and representatives of the third generation by Arabic numerals. When symbols are used in the text, numerals denoting persons of one sex, preferably male, are underlined>. Thus, the second son of the proband's father (i.e., the proband's brother) from the VII branch of the family will be given the symbol VII B, his second wife the symbol VII B₂, and their third son the symbol VII B₃.

12. The family-tree chart attached by way of example is designed for the registration of six members of the second generation and six children each of the third generation. Intermediate and additional lines may easily be entered on the chart, particularly for childless representatives of the second generation. If the chart is not big enough, one family tree (under the same number) can be entered on two charts. In the circles and squares and under the figures of the last row may be entered the ordinal numeral of each subject. The necessary particulars are entered in the survey journal, under these numbers.

13. A family tree intended for demographic research should include not only members present at the time of the inquiry but also relatives not living in the locality and, of course, all deceased representatives of each of the three generations. In some cases it is possible to collect reliable data on the relatives of persons who belong to the family tree by reason of their marriage to one of its members. Such particulars are entered on separate charts and dealt separately as supplementary material.

14. The survey programme may be organized in a wide variety of ways according to its proposed scope. The following is a list of the items which are most important for determining the demographic characteristics of the group.

¹ I shall not deal with the genealogical method as applied to the incidence of consanguineous marriage, relationships by marriage and other similar questions of interest to sociologists, demographers, anthropologists and physicians. There is a wide-ranging literature on these questions, and a method has been developed for compiling genealogies and for using computers in the analysis of family trees.

(1) Surname, given name, patronymic (for control purposes);

(2) Date of birth and age of each member of the family tree; for deceased members, age at time of death and date of death (deceased persons are indicated by the sign +);

(3) For married persons, year of (and age at) marriage, first and subsequent;

(4) Occupation and occupational status;

(5) Place of birth of each subject;

(6) For those not born in area, length of residence there;

(7) For relatives who have moved away, place of permanent residence and date of departure;

(8) Since some representatives of the first, or older, generation are related, the degree of this relationship as between the members of different family trees should, as a means of verifying age data and for other purposes, be specially noted — for example, brother (sister) or male (female) first cousin VII of group VIII, XII and so forth. It is sometimes advisable to establish separate family trees for the grandparents' generation;

(9) Marriages between first cousins, and, if possible, those between more distant relations are recorded in the same manner as in (8).

15. The construction of family trees must be based on the personal statements of all the available adult relatives. A comparison of information obtained by different means has shown that the particulars supplied by women, other than those of very advanced age, concerning number of children and their ages at the time of the survey or at the time of their death is fairly reliable. Information given by the probands concerning their brothers and sisters serves to supplement and verify that obtained from other persons.

16. On the basis of the entries in the survey journal, tables are drawn up from which the various demographic characteristics of the group under study can be derived.

17. The programme in question makes it possible first of all to determine the rate of population migration: the number of permanent inhabitants of a given locality, the number of persons who have moved away and their ages at the time of departure, and the areas to which the flow of migrants is directed.

18. The second demographic characteristic — fertility — requires more detailed elaboration. The procedure for computing fertility rates is as follows:

(a) The total number of women aged 19 to 44 years, including women who have died at those ages, is computed. Most of these women belong to the second generation — probands, sisters and wives of probands and wives of probands' brothers. It does not include women who have moved away from the locality without leaving behind children; if they did leave children, these are included in the total. This cohort is broken down into age groups (under 20 years, 20-24 years, and so forth), which in turn are divided into subgroups comprising women with at least one child, living or deceased, and childless women;

(b) The number of children, living and deceased, corresponding to each age group of women;

(c) The relative number of children (births) corresponding to each age group of women and to the cohort as a whole, and to the subgroup of women with at least one child.

19. As a rule, the older the mothers the more children they have. At the present time, however, this is not true of women in the older age groups, since a considerable proportion of them have remained childless. The computations which have been made show that the average age of women who have borne half the total number of children is close to thirty years.

20. One means — in addition to the smoothing of the series in accordance with the general rules of the calculus of variations — of eliminating random fluctuations in the age structure of the maternal generation is to reduce the indicators arrived at to some standard female age distribution.

21. Thus, for the medium female generation (aged 19 to 44 years), the following indicators may be derived from the genealogical data: the proportion of childless women, the general fertility rate and the age-specific maternal fertility rate.

22. The available data can also be used to establish a somewhat conditional general male fertility rate by determining the total number of children born as a ratio of the total number of men, irrespective of their marital status, aged 19 to 50 years, excluding persons who have moved out of the area. The fertility rates, both male and female, relate, of course, to fertility not in the physiological but in the demographic sense of the term.

23. The fertility rate of the older age group can be determined in a similar manner. For this purpose use is made of the data on women aged 45 years and over, i.e., the mothers of the probands and in some cases the sisters and sisters-

in-law of the probands. Ideally, the older group should, like the medium group, include twenty-five individual years of age, viz., from 45 to 70 years; however, as already noted, information concerning young children given by very old women is not always reliable. It is therefore advisable to restrict the older group to fifteen individual years of age, viz., from 45 to 60 years.

24. In the rural agricultural groups with little inflow or outflow of population which we studied, the general fertility rate of women in the older age group who had completed the twenty-five year reproductive period is 4.01, which is indicative of a fairly high birth rate. In the medium age group, including women still capable of bearing children, the fertility rate, if only the ages from 26 to 44 years are considered, is somewhat lower, viz., 3.7.

25. As the male fertility rate and the distribution of fertility by female age groups are matters which require more detailed analysis, they are not considered in this paper, which is mainly concerned with methods.

26. In connexion with genealogical data, we shall touch on the question of the interval between successive generations. The replacement of one generation by the next is an uninterrupted process. Every year a group of people is born, whereas some of those living die, and the rest become a year older. Over a certain segment of time small children, their parents, grandparents and sometimes great-grandparents are all alive at the same time.

27. Closest attention is given to the middle, active generation; its lowest age group can be established without particular difficulty as the 18 to 20-year group. As far as the upper limit is concerned, it may, on the basis of demographic rather than physiological factors, be regarded as the age at which half the total number of persons who were alive at the age of twenty years are still living. Thus defined according to life tables, this age is somewhat high and tells us little.

28. Among other criteria which have been proposed are the average age of the father at the birth of his middle child in order of birth (Fournier) and the average age at marriage plus half the period of marital fertility (Rumelin). A survey of the various methods of specifying the length of a generation was published in a recent paper by Y. S. Ulitzky (1959).

29. We use, in somewhat modified form, a formula adopted by Deblin, which does not require any other statistical material than what is readily available concerning the number of

births for the various maternal age groups. If we break down the whole cohort of women of childbearing age, viz., from 15 to 45 years, by five-year age groups (15 to 19 years, 20-24 years, and so forth), and designate the number of children born to the mothers of each age group by the symbols [...], the corresponding number of mothers by the symbols [...], and the total number of mothers and children by the symbols [...] and [...] respectively, it is not difficult to determine the age of the mothers a by which half the total number of births have occurred (median number of births). Provided the median age undergoes no important change in the course of two or three decades, the age a will also designate the age at which the daughters of the investigated group bear half the total number of children, i.e., the length of the female generation.

30. The corresponding figure for the male generation can be found by adding to a the mean difference between the age at marriage of men and women respectively. In the groups we studied, the average length of the female generation was 25.7 years, the male generation 30.5 years, and the general average 28.7 years.

31. Death rates can be established on the basis of family-genealogical data by relating the number of deaths in a given five-year age group, and the number of older brothers and sisters alive or dead in the years following, to the sum of two groups, viz., the deceased members of the generation and those surviving each year of age. Since death rates in today's population are low and the comparison of data from different family trees rarely turns out to be sufficiently accurate, and since, furthermore, this operation is much more laborious than is justified by its results, other methods are preferred for determining mortality on the basis of genealogical data. Use has recently been made of a simplified method of constructing life tables by computing the proportion of deaths at a given age among the deaths at all ages. Tables prepared by this method have been used to determine mortality in the populations of bygone ages, known by their skeletal remains preserved in accident burial grounds (1957, 1959, 1962; 1954; 1960; 1957). Although the tables adopted contain some conditional assumptions and cannot be regarded as methodologically beyond reproach, they have made it possible to obtain a completely plausible picture of mortality, thus confirming their suitability for approximate diagnosis. The following figures represent the average length of life as

computed by Angelo for the population of Greece in various methods of the remote past:

Bronze Age	34.9
Iron Age (early)	35.8
Pre-Hellenic Epoch	31.3
Hellenic Epoch	40.4
Roman	38.1
Middle Ages	34.7

32. In mediaeval Hungary (tenth to twelfth centuries) the expectation of life at birth, according to data provided by Hungarian authors, was: 27.6 years (Kérpusta cemetery), 30.6 years (Halimba) and 35.4 years (Zalasar Chapel): in 1958 the average for the whole country was 67.3 years.

33. In determining death rates on the basis of genealogical data, a less detailed but more reliable method is to compute the proportion of deaths at a given age among the total number of recorded deaths and to compare the rates found in the group with the standard rates for the whole country. In the group we investigated the death rates in the two youngest five-year age groups were somewhat higher than the average for the country.

34. Population growth may be ascertained from the number of births and deaths registered during the year the group is surveyed or, better, during the four years up to and including the year of the survey. The size of the group in the year preceding the survey (in the absence of migration) is equal to the total membership of all families at the time of the survey minus the number of births and plus the number of deaths for that year. The size of the group in the next two preceding years is determined in the same way. The number of births and deaths in each year is then compared with these figures. The average for the four-year period is thus obtained and is then adjusted to eliminate random fluctuations in the rates. For the purpose of comparing different groups, the rates thus derived may be reduced to a standard age structure.

35. In a rural population with few immigrants and a moderate rate of out-migration to industrial centres, fertility and mortality rates are somewhat higher than the average for the country. The differences between the two rates (the rate of natural growth) in the population studied is somewhat lower than the general average and amounts to 16 per 1,000 population over the four-year period. If this growth rate is also characteristic of previous decades, the population must have doubled in fifty years,

and 100 years ago the original group must have been only one fourth its present size.

36. Genealogical data make it possible to gain some idea of growth rates over past decades. The ramification of family trees is very significant: the number of grandchildren, exceeding ten or twelve per pair of grandparents, bespeaks a high rate of population growth. If the great-grandparents' generation is taken into account, a period of seventy-five to eighty years can be covered. If the parents' (second) generation is divided into groups descended from a single pair of grandparents, the number of such groups (first cousins) in a rapidly growing population numbering 2,000 does not normally exceed twenty or thirty. Marriage between the descendants of the same pair of grandparents (first cousins) is the exception in a Russian population, but the intersecting of more distant branches is less rare, thus indicating that some of the founding pairs could be traced back from representatives of the same groups, *A* and *B*, *A* and *C*, *B* and *C*. The grandchildren of such pairs are descended from common grandparents, whose number roughly corresponds to the number of male second cousins in the current second generation.²

37. If the number of persons in a population who are related to one another in varying degrees is tabulated, it is possible, even if the genealogical tables are limited to two or three generations, to get an idea of the size of the original group 100 to 200 years ago. According to our data the results of such a calculation coincide with an analysis of family names. On the whole they indicate that the rate of population growth was higher in the second half of the nineteenth century than it is today.

38. In the case of a Russian rural agricultural population numbering 2,000 in 1955-1962, the size of the original group in the middle of the last century did not exceed 300 persons or fifty families, and in some cases comprised no more than thirty families.

39. In conclusion it may be said that family-genealogical data, even when collected on the relatively limited scale that is possible with the usual questionnaire method, provide a means of obtaining other demographic indicators which widen and deepen the analysis of fertility, mortality and population growth.

² According to our data 85 per cent of all marriages were between inhabitants of the same village. The most distant degree of relationship between the natives of a rural inhabited locality (aged thirty years and over) is that of second cousin, or the eighth degree (V. V. Bunak, 1964).

Some notes on the design and conduct of genetic field studies

BERNICE H. COHEN

I. VALUE OF THE FIELD STUDY IN GENETICAL RESEARCH

1. As an outgrowth of man's uniqueness among the species and the wealth of clinical, biological, and biochemical data accrued concerning his nature, the scope of human genetics today encompasses an infinitely broader area than the genetical study of any other species. For this reason, research in human genetics requires a flexible, broad-based methodology. Even with regard to the simplest problems of inheritance, the methods of human genetics must be different from that of experimental genetics. Man's sentient nature not only precludes experimental matings and inbred lines, requiring greater reliance on phenotypic relative to genotypic classification, but also favours small sibship size with long generation time, which enforces further limitations on the informative nature of available genetic data.

2. Clearly, some of the conventional methods used to circumvent the problems of dealing with human data have involved serious pitfalls. Kinships carried over many generations and recorded retrospectively are fraught with biases and exaggerations. A case in point is the famous Lambert pedigree of *ichthyosis hystrix gravior*, which was, for many years, the model of holandric inheritance. When the Lambert family was reinvestigated, Stern and Penrose found that on the basis of medical records and other documentation,¹ there was no longer consistency with Y-linkage. Even in studies where the validity of the individual classifications is acceptable, extrapolation to the population from the investigation of single kinships or collections of pedigrees, selected variously by design, chance, or by some unknown rationale, involves numerous assumptions that are neither testable nor reasonably well understood. Except for the study of rare traits and linkage, individual pedigrees appear to be of little value, other than for obtaining clues for a specific hypothesis to be investigated by more systematic and definitive methods.

¹ C. Stern, "The problem of complete Y-linkage in man", *American Journal of Human Genetics*, vol. IX (1957), pp. 147-166.

3. As a result of the inadequacy of these methods, as well as of the refinements in epidemiological techniques, it has become increasingly apparent that field studies are a most valuable approach, either as the basic method or as a concomitant procedure, for human genetical investigation. It seems worthwhile to consider some pertinent aspects of the design and conduct of genetic field studies and the genetic inferences which may be derived from them, including:

(a) The choice of sampling procedures, especially with regard to nonmatched versus matched samples;

(b) The major problems of data collection and analysis in genetic studies; and

(c) The establishment of an adequate basis for genetic inference.

II. FIELD STUDY DESIGN: SAMPLE SELECTION

4. In all field studies, the most critical aspect is the selection of the study groups. Serious problems can arise from collecting data on highly selected, stratified and unrepresentative segments of the population and making inferences from them as if they were probability samples. Lilienfeld has pointed out this fact in his writings.^{2,3} The ultimate choice of sampling procedure is dependent upon the problem under study and upon (a) the frequency of the critical characteristic (normal or pathological) in the population; (b) the ease with which the characteristic can be recognized and the reliability of diagnosis available; as well as (c) the age of manifestation. Unless unquestionably contraindicated by the specific nature of the condition being investigated, the population-based probability sample, either as the study group or the control group, is usually to be recommended because it has several advantages over other study samples. It is not only repre-

² A. M. Lilienfeld, "Sampling techniques and significant tests", in W. J. Burdette, ed., *Methodology in Human Genetics* (San Francisco, Holden Day, 1962), pp. 3-16.

³ A. M. Lilienfeld, "Problems and areas in genetic-epidemiological field studies", *Annals of the New York Academy of Science*, vol. XCI (1961), pp. 797-805.

sentative of the base population, but also yields statistics that are useful for comparative study, since standard errors and confidence limits can be calculated readily. In addition, the probability sample provides a most satisfactory type of study group for a wide range of genetical investigations (see table 1). Where total lists are not available for random sampling and the costs of random sampling are prohibitive, it is often feasible to use other types of probability samples, such as cluster sampling or "area sampling".^{4, 5, 6, 7}

5. In some case-control studies, there are certain basic epidemiological factors which so influence either the manifestation of the condition under study or the characteristics to be expected in relatives, that variation between cases and controls with regard to those factors may yield large case-control differences that are a function of factors, real and recognizable, but are other than those under investigation, for example, maternal age in mongolism. To resolve such problems, the common practice has been to "match" such characteristics as a definitive means of eliminating those extraneous contributions to the variance. In a study of family patterns of mortality, a community-based sample of deceased probands was matched with living control subjects of the same age, sex, race and neighbourhood.^{8, 9}

(a) While control matching may be helpful in decreasing variance, it is often such a costly and lengthy process that some statisticians have seriously questioned its merit relative to the increased expenditure in time, energy and funds required.^{10, 11, 12} Billewicz, citing the added

Table 1. Probability samples in genetical investigation

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A.	Samples of individuals for the derivation of base line gene frequencies required for:
	(a) Population characteristics;
	(b) Certain tests of genetic hypotheses;
	(c) Study of polymorphic traits;
	(d) Evaluation of associations between marker traits and common diseases, etc.;
	(e) Study of secular trends and geographic differences in populations;
	(f) Evaluation of factors influencing gene frequencies:
	(i) Selection;
	(ii) Mutation rates;
	(iii) Genetic drift;
	(iv) Gene flow through migration and/or racial admixture.
B.	Random samples of families for:
	(a) Tests of a specific simple genetic hypothesis, based on Snyder's ratios and/or the total set of Hardy-Weinberg ratios; or
	(b) Investigation of maternal-foetal blood group incompatibility association.
C.	Study samples for:
	(a) Determination of familial aggregation in common traits; and
	(b) Twin concordance on common traits (smoking habits).
D.	Control groups for:
	(a) Comparison with groups ascertained through index cases or index characteristic (i.e., requiring case-control studies):
	(i) Familial aggregation (morbidity, mortality, fertility, pathogenetic components);
	(ii) Genetic marker — disease associations;
	(iii) Associations between frequency of genetic markers and/or pathogenetic components of disease, drug response, etc.;
	(iv) Genetic — environmental interactions (evaluation of the effects of environmental agents, drugs, diet, etc., upon the characteristic under study);
	(b) Clinical trials in groups with different genetic characteristics.
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⁴ T. D. Woolsey, "Sampling methods for a small household survey", *Public Health Monograph No. 40, Public Health Report*, vol. LXXI (1956), pp. 827-829.

⁵ A. M. Lilienfeld, "Diagnostic and therapeutic X-radiation in an urban population", *Public Health Report*, vol. LXXIV (1959), pp. 29-35.

⁶ W. G. Cochran, *Sampling Techniques* (New York, John Wiley and Sons, 1963).

⁷ F. Yates, *Sampling Methods for Censuses and Surveys*, second ed. (New York, Hafner, 1953).

⁸ B. H. Cohen, "Family patterns of mortality and life span", *Quarterly Review of Biology*, vol. XXXIX (1964), pp. 130-181.

⁹ B. H. Cohen, "Family patterns of longevity and mortality", *Genetics and the Epidemiology of Chronic Diseases*, Public Health Service Publication No. 1163 (Washington, United States Department of Health, Education and Welfare, 1965).

¹⁰ W. G. Cochran, "Matching in analytical studies", *American Journal of Public Health*, vol. XLIII (1953), pp. 684-691.

¹¹ J. Worcester, "Matched samples in epidemiologic studies", *Biometrics*, vol. XX (1964), pp. 840-848.

¹² W. Z. Billewicz, "Method samples in medical investigation", *British Journal of Preventive and Social Medicine*, vol. XVIII (1964), pp. 167-173.

danger that matching might falsely "excuse the investigator from looking at more than one aspect of the data", presented a "plea for preserving matching for situations in which it is advantageous". These views are entirely consistent with the earlier findings of Cochran, who demonstrated statistically that there is no advantage over random sampling unless the

matched variable is highly correlated with the variable being measured;

(b) Applying these principles to actual field study problems, E. L. Diamond (personal communication) has suggested an alternative, a "balancing" procedure which utilizes a random number of household selection where the sampling probabilities are based on age, sex and racial distribution of the proband population to be matched. Not unlike what Billewicz described as "frequency" matching, this design is far more economical than individual proband-control matching, yet preserves much of the efficiency of the reduction of variance accomplished by matching. A detailed description of this design is to be published.

6. It is possible to incorporate the advantages of the referability and representativeness of population-based controls and the effectiveness of matched controls by using multiple comparison series. Such a plan has been followed in a study of ulcerative colitis, where a population control, as well as several sets of control subjects "matched" on different characteristics, are being utilized (M. A. Monk, personal communication). Although this multifaceted approach avoids the problem of making a choice among several types of controls, each of which has both advantages and disadvantages, use of multiple control groups is not always a practicable solution. When only a single control series is desirable, a population-based sample or some modification (the stratified population sample or at least the semi-matched population-based control "frequency sample") is usually chosen.

III. PROBLEMS OF DATA COLLECTION AND ANALYSIS

7. Besides the major problem of sample selection, numerous pitfalls are to be found in data collection and analysis in genetic studies as in other field studies. Faulty or disregarded assumptions concerning either the study sample itself or its comparability with the control series can lead to fundamental misinterpretations. Often ignored in tests of specific genetic hypotheses is the fact that the Hardy-Weinberg principle, and all statistical tests of specific genetic hypotheses based upon it, assume random mating with regard to the characteristic studied and equal fertility of different genotypes and mating types, as well as the absence of selection and disturbing frequencies of gene flow or mutation. Other common assumptions inherent in tests of hypotheses are sometimes handled as "assumptions of convenience", though recognized as not factual, as in the evaluation of the relative role of genetic and environmental

Table 2. Preliminary considerations for genetic inferences

1. *Assumptions*: have any questionable assumptions been made?
2. *Heterogeneity of data*: are the data as homogeneous as possible in the light of present knowledge?
3. *Sampling and the selection of controls*: is the sampling method satisfactory, and where controls are indicated, have they been selected by the best sampling methods available?
4. *Multiple criteria*: what additional criteria are necessary in order to increase the validity of the genetic inference?
5. *Power of test*: what is the power of the test being used?
6. *Penetrance and the secondary hypothesis*: have the various genetic hypotheses applicable to the situation under study been considered exhaustively?
7. *Nongenetic factors*: have environmental factors and artifacts which might be responsible for the observed associations been adequately excluded?
8. *Uniqueness of man*: has thinking in terms of non-human material led to specious or unwarranted conclusions?

contributions in twin studies where the intra-pair differences in environmental exposure are assumed to be similar monozygotic and dizygotic twins. This assumption is shown to be unrealistic.¹³

8. *Completeness and quality of data*. Where there is no objective assurance that a lacking segment follows the same pattern in critical characteristics as the observed portion, any unintended incompleteness of data or ascertainment of subjects can introduce an inestimable degree of bias and can distort the existing pattern. A relative deficiency of early childhood and late adult deaths ascertained in the data of Beeton and Pearson produced a bimodal curve in the frequency of recorded deaths, "a phenomenon not known in life tables for adults".^{14,15} Similarly, in the Hyde family the mode of the death curve was shifted downward from the usual age of seventy to eighty years to twenty to twenty-five years, due to the inclusion of persons who would not have a fair chance to

¹³ R. T. Smith, "A comparison of socioenvironmental conditions in monozygotic and dizygotic twins", presented at the Ninety-second Annual Meeting of the American Public Health Association, Genetics and Epidemiology Session (1964).

¹⁴ M. Beeton and K. Pearson, "On the inheritance of duration of life and on the intensity of natural selection in man", *Biometrika*, vol. I (1901-1902), pp. 50-89.

¹⁵ E. B. Wilson and C. R. Doering, "The elder Pierces", *Proceedings of the National Academy of Science*, vol. XII (1926), pp. 424-432.

live out their lives before the termination of the records.^{16, 17}

9. To attain maximum completeness and accuracy, the objectives of any investigation must be interpreted in a practicable plan based on pilot studies and extensive background information. Careful design of interview schedules and procedures; close supervision of field workers in data collection and of office staff in data recording, with prompt editing and follow-up of omissions and inconsistencies; and use of multiple respondents for each ascertained proband or family, as well as the incorporation of validity checks in field and office phases, all contribute to the quality of final results. Because of the dangers of reliance on secondary sources and unverified information, familiarity with the better-known means of verification (personal documents, such as family Bibles and records, and public and private records available from physicians, hospitals, schools, health departments, census offices, cemeteries, government and private agencies) and ingenuity in discovering less well-known source material can become critical elements in an investigation.

10. *Diagnostic accuracy.* Accuracy and specificity of diagnosis of the index characteristic is fundamental to the validity of any investigation—epidemiological, clinical or genetic. The pitfalls of misclassification in epidemiological studies have been discussed at length in other writings.¹⁸ They are at least as serious in genetic research, where the usual problems of misdiagnosis are compounded by the common situation of genetic heterogeneity, that is, the same phenotype resulting from two or more different genotypes involving different loci and different patterns of inheritance, as in the numerous types of genetically determined deafness,^{19, 20} six genetic types of glycogen storage disease,²¹

three types of muscular dystrophy,²² and at least nine types of genetically determined coagulation defects.²³ Pooling families in which there are similar phenotypes of different aetiological basis obviously yields results that fail to fit any calculated expectancies based on a single genetic hypothesis. While the use of a screening test to measure the fundamental protein error (for example, enzyme or haemoglobin) would be an ideal solution, such a test is often not possible, since the genetic studies themselves frequently lead to the discovery of different clinical forms of the disease. In cystinuria, a parallel dichotomy in clinical abnormality was detected through the dichotomy in genetic manifestation.

11. *Data processing—classification by age and cohort.* The influence of secular trends in disease frequency resulting not only from differences in patterns of diagnosis over a period of time, but also from secular differences in exposure to environmental agents, as well as differential manifestation in various age groups, can result in a great divergence in expectancies, even among family members with the same degree of genetic relationship. To control cohort group is important, as well as to utilize age-specific or age-adjusted rates. This can be particularly difficult in analysis of genetic data in which relatives are customarily grouped by category for frequency of a given trait, irrespective of ages or calendar time of observation.

12. *Adequate basis for genetic inference.* It is clear that the validity of a genetic inference can be increased by controlling extraneous factors or by prior evaluation and adjustment for their interaction with the genetic component. The field study, with its capacity to incorporate numerous test and control characteristics simultaneously, has a distinct advantage in contrast to the limitations of singular tests of specific genetic hypotheses, many of which seem to be relatively inefficient in distinguishing between genetic and non-genetic hypotheses. Using the binomial test, Lilienfeld has demonstrated that the characteristic, attendance at the University of Buffalo Medical School, shows a distribution consistent with a simple recessive trait, suggesting that traits not necessarily of genetic aetiology, but showing familial aggregation, often

¹⁶ A. G. Bell, *The Duration of Life and Conditions Associated with Longevity. A Study of the Hyde Genealogy* (Washington, Genealogical Record Office, 1918).

¹⁷ I.-C. Yuan, "A critique of certain earlier work on the inheritance of duration of life in man", *Quarterly Review of Biology*, vol. VII (1932), pp. 77-83.

¹⁸ E. L. Diamond and A. M. Lilienfeld, "Effects of errors in classification and diagnosis in various types of epidemiological studies", *American Journal of Public Health*, vol. LII (1962), pp. 1,137-1,144.

¹⁹ A. C. Stevenson and E. A. Cheeseman, "Heredity of deaf-mutism with particular reference to Northern Ireland", *Annals of Human Genetics*, vol. XX (1956), pp. 177-231.

²⁰ W. Tietz, "A syndrome of deaf-mutism associated with albinism showing dominant autosomal inheritance", *American Journal of Human Genetics*, vol. XV (1963), pp. 259-264.

²¹ H. Harris, ed. *Garrad's Inborn Errors of Metabolism* (Cambridge University Press, 1963).

²² C. S. Chung and N. E. Morton, "Discrimination of genetic entities in muscular dystrophy", *American Journal of Human Genetics*, vol. XI (1959), pp. 339-359.

²³ P. Didisheim and J. R. Lewis, "Congenital disorders of the mechanism for coagulation of blood", *Pediatrics*, vol. XXII (1958), pp. 478-493.

may fit a "simple genetic pattern".²⁴ In view of the questionable power of many genetic tests and Neel's admonition against the use of a secondary hypothesis of incomplete penetrance,²⁵ it is apparent that any *a posteriori* conclusions are imprudent.

13. Growing concern about the inconclusiveness of many available tests has led geneticists to emphasize the need for multiple criteria to increase the reliability of genetic inferences. In determining simple single factor inheritance, Dahlberg has suggested studying each category of relatives separately and comparing frequencies of the trait in them with expectancies based on genetic theory.²⁶ David and Snyder have pointed out that "the cogency of data on familial incidence or on twin concordance as evidence for the significant implication of genetic factors in the etiology of a disease rests ultimately upon the exhaustiveness with which it has been possible to exclude environmental factors as responsible for the associations

found".²⁷ In the same vein, James Neel, in an address before the American Society of Human Genetics, cautioned investigators to "Stop, look and listen before making genetic inferences". His four warnings and those of other investigators are included in table 2.

14. Because of the pitfalls in drawing conclusions from collected data, new and more powerful tests are needed, as well as suitable adjustments and correction factors which can be applied with existing genetic methods. Since the methodological objectives of genetic studies require a design that assures collection of the maximum amount of useful relevant data with minimal time, effort and funds,²⁸ it is apparent that the genetic field study, either alone or in combination with other procedures, probably provides the best opportunity for the specific accomplishment of these methodological objectives. To make this opportunity real and to provide meaningful results, the genetic field study must both fulfil genetic requirements and conform to the rigid statistical and epidemiological standards in design and conduct of all other field studies.

²⁴ A. M. Lilienfeld, "A methodological problem in testing a recessive genetic hypothesis in human disease", *American Journal of Public Health*, vol. XLIX (1959), pp. 199-204.

²⁵ J. V. Neel, "On some pitfalls in developing an adequate genetic hypothesis", *American Journal of Human Genetics*, vol. VII (1955), pp. 1-14.

²⁶ G. Dahlberg, "Genetic investigations in different populations", *Acta Genetica*, vol. III (1952), pp. 117-142.

²⁷ P. R. David and L. H. Snyder, "Genetics and disease", *Proceedings of the Second National Cancer Conference*, vol. II (1952), pp. 1,128-1,138.

²⁸ C. Sellitz, M. Johoda, M. Deutsch and S. W. Cook, *Research Methods in Social Relations* (New York, Henry Holt, 1960).

The frequency of subjects with chromosome abnormalities and some implications in relation to disease

W. M. COURT BROWN

1. In 1956 Tjio and Levan showed the human diploid number of chromosomes to be forty-six.¹ Following this disclosure, the discoveries in 1959 of the autosomal abnormality in mongolism and of the major abnormal sex chromosome complements of *XXY*, *XO* and *XXX* gave an initial impetus to the work on the relationship between chromosomal abnormalities and disease. The discoveries on the sex chromosome abnormalities owed much to the earlier work of Barr and his collaborators² on the dimorphism of male and female cells and the existence of the sex chromatin body in the nuclei of interphase cells of females.

2. An increasing number of reports link chromosomal abnormalities with disease. There are three classes of subject to discuss in this context: (a) those with an abnormal chromosome number; (b) those with a chromosomal structural rearrangement, not all of which are microscopically detectable in somatic cells (for example, paracentric inversions); and (c) those with an anomalous chromosome (always one with a secondary construction and commonly a homologue of pairs 13/15 or pair 16, or pairs 21/22). In the classes listed as (a) and (b), some subjects have been identified with chromosome mosaicism, and in the class listed under (c), the changes are inherited and are without phenotypic effect.

3. A rule exists that subjects with an abnormal chromosome number in all their cells, except *XXX* women, show alterations in phenotype. There is no convincing instance of autosomal monosomy involving a whole chromosome in post-natal life, presumably because of the lethal effect of the ensuing genetic imbalance. Although, in theory, 22 autosomal triso-

mies are possible, only three where every cell is presumed to be involved (trisomy 13/15, 17/18 and 21/22), have been identified with certainty. Mongolism is due to trisomy for a small acrocentric autosome, conventionally number 21, but here again uncertainty exists, for it is not yet clear whether 21 or 22 is involved. An important point is that trisomy 13/15 and trisomy 17/18 were not recognized as clinical syndromes until the development of human cytogenetics. The possibility exists, therefore, that more trisomic states may come to light and be recognized as new syndromes.

4. In mosaicism, the presence of a normal cell line may mask in varying degrees the phenotypic expression of the abnormal line. Instances are known of individuals who have a normal cell line and one trisomic for 21, but do not show overt features of mongolism. There are certain to be persons with various congenital abnormalities who can survive by virtue of their mosaic state, but who could not survive if they show uncomplicated trisomy. More experience is required before detailed systematization will be possible of autosome abnormalities and congenital defects.

5. Individuals with an *XO* complement, or with mosaicism with one cell line having an *XO* complement, may show congenital abnormalities. These factors can affect the development of the heart, kidneys, bone and subcutaneous lymphatic channels. By contrast, *XXY* and *XXYY* males are phenotypically normal at birth. Changes develop only at the time of normal puberty, the major one is degeneration of the seminiferous tubules of the testes. Other changes, such as breast enlargement and abnormalities of hair distribution, are variable in their impact. Although *XXX* females often have unimpaired physical development, they may have a precocious menopause and may show some underdevelopment of the sexual characters. There is a strong impression that any phenotypic male or female with additional *X* chromosome material has some intellectual impairment, but this impairment does not appear to be true for females with an *XO* complement.

¹ J. H. Tjio and A. Levan, *Hereditas*, vol. XLII (1956), p. 1.

² M. L. Barr, *Journal of Mental Deficiencies, Res.*, vol. III, p. 78; M. L. Barr and E. G. Bertram, *Nature*, vol. CLXIII (1949), p. 676; M. L. Barr, E. L. Shaver, D. H. Carr and E. R. Plunkett, *Journal of Mental Deficiencies, Res.*, vol. XIV (1960), p. 89; D. H. Carr, Personal communication, *Human Chromosome Newsletter*, No. 15 (1965); D. H. Carr, M. L. Barr and E. R. Plunkett, *Canadian Medical Association Journal*, vol. LXXXIV (1961), p. 873.

6. As far as is known, balanced structural chromosome rearrangements are not accompanied by phenotypic abnormality, but there is the hint of a circular argument here. If there is microscopically no obvious imbalance and phenotypically no obvious abnormality, the rearrangement is said to be balanced. Some logic prevails, however, for those rearrangements which, on inspection, appear unbalanced. Many, but not all, are associated with congenital abnormalities.

7. There have been a number of studies of the frequency of sex chromosome abnormalities in populations either having good health or suffering various disabilities. Investigations of normal populations include those of Kaplan and Norfleet (1961)³ who found two out of 1,000 male recruits of the US Armed Forces to be chromatin-positive, Paulsen and his associates (1964),⁴ who also found two chromatin-positive cases out of 1,000 male hospital patients, and Nakagome (1963),⁵ who, in studying Japanese schoolgirls more than 2 S.D. below average found 7.3 per cent were chromatin-negative. Many thousands of mental defectives also have been investigated; the over-all frequency in nearly twenty studies gives 1 per cent of chromatin-positive males, 0.5 per cent of doubly-positive females and 0.03 per cent of chromatin-negative females. Forssman and Lambert (1963)⁶ found 2 per cent of 760 male criminal or hard-to-manage subnormal patients to be chromatin-positive.

³ N. M. Kaplan and R. G. Norfleet, *Annual of Internal Medicine*, vol. LIV (1961), p. 461.

⁴ C. A. Paulsen, A. de Souza, T. Yoshizuma and B. M. Lewis, *Journal of Clinical Endocrinology*, vol. XXIV (1964), p. 1,182.

⁵ Y. Nakagome, I. Hibi, K. Konoshita, T. Nagao and M. Aikawa, *Lancet*, ii (1963), p. 412.

⁶ H. Forssman and G. Lambert, *Lancet*, i (1963), p. 1,327.

Ferguson-Smith and his associates (1957)⁷ report 3 per cent of all males attending a sub-fertility clinic to be chromatin-positive, and 11 per cent of men with severe oligospermia or azospermia. A sex chromosome abnormality was discovered by Jacobs and associates (1961)⁸ in 40 per cent of women referred to a gynaecological clinic with presumptive diagnosis of primary amenorrhoea.

I. THE GENERAL POPULATION IN THE EDINBURGH AREA

8. Information on the frequency of abnormal subjects in an urban population in a comparatively circumscribed area, Edinburgh, Scotland, and its environs, has been obtained from a survey of the nuclear sex of 20,725 consecutive live-born male and female babies, with chromosome studies done on those with an abnormal nuclear sex, together with chromosome studies on more than 1,000 adults. The full details for the studies on liveborn babies are given in the table, together with comparable data collected by other investigators. Chromosome studies on eighteen of the 21 abnormal males showed that between one third and one quarter had a mosaic constitution with one line having an XY complement, while all but one of the remainder had an XXY constitution. The single exception had an XXYY constitution. Clearly the extreme abnormalities, such as XXXY and XXXXY are rare, indeed. Three of the four chromatin-negative females had an XO constitution, while the fourth was a mosaic of the type XO/X deleted long arm X. Nine of the twelve doubly-chromatin positive females which could be examined had an XXX complement.

⁷ A. Ferguson-Smith, B. Lennox, W. S. Mack and J. S. S. Stewart, *Lancet*, ii (1957), p. 167.

⁸ P. A. Jacobs, M. Brunton and W. M. Court Brown, *Annals of Human Genetics*, vol. XXVII (1964), p. 353.

Sex chromosome abnormalities in new-born children (Buccal smear technique)

	Total number male births	Abnormal nuclear sex	Total number female births	Abnormal nuclear sex
Maclean <i>et al.</i> , 1964				
Edinburgh, Scotland ^a	10,725 ±	21 (1.96/1000)	10,000 ±	16 (4 chromatin-negative; 12 doubly chromatin-positive) (1.6/1000)
Moore, 1959				
Winnipeg, Canada ^b	1,911	5 (2.62/1000)	1,804	0
Bergemann, 1961				
Bern, Switzerland ^c	1,890	4 (2.12/1000)	1,838	1 (0.54/1000)

Sex chromosome abnormalities in new-born children (Buccal smear technique) (continued)

	Total number male births	Abnormal nuclear sex	Total number female births	Abnormal nuclear sex
Subray & Prabhaker, 1962 Bombay, India ^a	2,058	0	1,832	0
Marden, Smith & McDonald, 1964 Madison, Wisconsin ^e	2,195 ^h	7 (3.2/1000)	2,195 ^h	1 (doubly chromatin- positive) (0.46/1000)
Robinson & Puck, 1965 Denver, Colorado ^f	M + F: 3,367 ¹	M + F: 6 (1.78/1000)	—	—

^a N. Maclean, D. G. Harden, W. M. Court Brown, J. Bond and D. J. Mantle, *Lancet*, i (1964), p. 286.

^b K. L. Moore, *Lancet*, i (1959), p. 217.

^c E. Bergemann, *Schweiz med. Wschr.*, vol. XCI (1961), p. 292.

^d N. Subray and S. Prabhaker, *Science*, vol. CXXXVI, p. 1,116.

^e P. M. Marden, D. W. Smith and M. J. McDonald, *Journal of Pediatrics*, vol. LXIV (1964), p. 357.

^f A. Robinson and T. T. Puck, *Science*, vol. CXLVIII (1965), p. 83.

^g Consecutive live births.

^h Live births.

¹ Survey started on Buccal smears; majority eventually sexed from amniotic cells.

9. Information on an adult sample of 207 males and 231 females randomly selected from general practitioner lists was based on a chromosome study of each individual. The abnormalities found were as follows:

MALES

Autosomal structural re-arrangement	1
Structurally abnormal Y chromosome	1
Autosome variations	6
Y chromosome variations	4

FEMALES

Autosome structural re-arrangement	1
Autosome variations	3

aimed at finding by chance at least as large a difference in the direction recorded between the observed and expected numbers. All data were found to be mutually consistent, and the findings are summarized in percentages as follows:

	Percentages
Autosomal structural rearrangements	0.5
Autosomal variations: 13/15	0.5
16	0.5
(Satellites on short arm of one homo- logue) 17/18	0.4
21/22	1.2
Y chromosome: large	1.8
small	0.8

10. The data from the randomly sampled adults were compared with those from the following groups, in which all the studies were also based on blood cultures:

Males with suspected abnormal sex chromosome complement	116
Females with suspected abnormal sex chromosome complement	156
Males with ankylosing spondylitis	139
Subjects with cancer (epithelial)	44
Former luminous dial painters	63
Miscellaneous females	64

11. Data are available on 1,020 persons, including random sample subjects.

12. The consistency of the data was tested by calculating the expected number of subjects with an autosomal rearrangement, or variation, in each group based on the experience of all the groups. The probability was determined from a table of Poisson-probability-distribution

13. The frequencies quoted for subjects with a chromosome abnormality or variation relate to an urban population in one geographical area. Different results might be found in other areas (as suggested by the Bombay results given in the table), and in population isolates. Clearly, only a beginning has been made in studies of the general population, and these studies will be realized in full only through the development of automated techniques for chromosome analysis.

II. CHROMOSOME ABNORMALITY AND DISEASE

14. The implications for disease remain obscure on the whole, although certain advances have been made. One of the most noteworthy developments comes from the work of Carr, whose study of early spontaneous abortions shows the occurrence of chromosome abnormalities in about 20 per cent of the foetuses.

15. We may consider as primary those effects which follow directly from the observed abnormality and its nature, and as secondary those effects which are the risks of the same development which is appreciably increased in subjects carrying a particular abnormality. For example, the syndrome of abnormalities known as mongolism is the direct result of trisomy 21, while a secondary effect is an increased liability for the development of leukaemia (estimated to be about 15-fold in mongol infants). Another example of a secondary effect is the increased liability among males with more than one X in the chromosome complement to develop breast cancer. We know more about the primary effects of abnormalities of the sex chromosome complement in terms of the epidemiology of disease than we know about autosomes. For secondary effects, our ignorance remains lam-

table regarding abnormal complements of either the sex chromosome or the autosomes.

16. Finally, the point should be made that everything discussed represents only one side of the coin. In any sample of the general population that is large enough, studies using the blood culture technique will find subjects having a proportion of cells in a culture showing a variety of chromosome aberrations produced by exposure to therapeutic doses of radiation. Radiation is, therefore, an environmental agent which can produce abnormalities both in germ cells and somatic cells. It is most unlikely to be the only agent that can act in this way. Chemicals and viruses must be considered, and the aberrations caused by environmental action must be assessed in terms of their possible long-term effects in the production of abnormal offspring and the induction of cancer in their carriers.

Practice of consanguineous marriages and its genetic effects

NEWTON FREIRE-MAIA

1. Inbreeding rates vary widely in human populations. The highest coefficients of inbreeding found have been verified in Japan, India, Brazil and Israel; the lowest ones, in the United States. No homogeneity exists, however, within a country, a province or even a township. In Israel, for instance, inbreeding is relatively high in some communities, but not in others. In Brazil, the incidence of consanguineous marriages presents a "European" level in the south, but attains rather high levels in some other states, specially in the interior of the north-eastern region. Large cities are well known to possess low inbreeding compared with small towns and rural communities. In Japan, however, high frequencies of consanguineous marriages have been found even in its largest urban communities, such as Tokyo.

2. The highest coefficients of inbreeding detected in "modern" human communities generally lie around 0.015 and 0.020. Only in very few populations have coefficients higher than 0.02 been detected. Comparisons in this field are open, however, to strong biases because of various methods employed for obtaining the data on consanguineous marriages. When a complete genealogy of the population is available, distant degrees of relationship may be ascertained and, therefore, the estimates of F will represent the real situation much better than when only close relationship is reported. When the data are based on bishopric files, for instance, values of F are expected to be underestimates, since no information may be obtained for consanguinity more distant than second cousins. The extent to which marriages between distantly related partners occurs will influence the reliability of the estimates. In isolated communities founded by a small number of families, for instance, the inbreeding level may be much higher than that estimated on the basis of the dispensations from the canonic impediment of consanguinity.

3. A number of factors are known as capable of influencing the occurrence of consanguineous marriages: cultural pattern, economic level, migration, population density, degree of ruralization, economic interests, etc. It is im-

possible to isolate each for determining the degree of its individual contribution. The importance of each is expected to vary considerably from one population to another. It must be pointed out, also, that these factors are not independent from one another in their action. "Cultural pattern" is, for instance, highly influenced by economic level, migration, population density, ruralization, etc. Some behaviour patterns may be rather stable, however, in spite of changing social and demographic conditions. The fact that large cities in Japan present inbreeding levels comparable to those prevailing in small towns and rural communities of other countries is a clear indication that peculiarities of the marriage policy may resist the impact of changing conditions of the population.

4. The interconnexion of the factors which operate to define inbreeding levels also may be seen in the considerations to follow:

(a) Ethnic composition, cultural pattern, religious structure, degree of literacy, degree of urbanization and economic level may have changed in a given area through the influence of only one phenomenon, namely external migration;

(b) Illiteracy theoretically is expected to be an important factor in populations with high literacy rate, but, at least in some countries, illiteracy itself may be the result of factors such as isolation, poverty, and rural life. In areas with high illiteracy rates, however, the occurrence of consanguineous marriages is expected to be little influenced by the degree of literacy of brides and bridegrooms;

(c) In some regions, high social classes may be somewhat isolated within relatively poor and unsophisticated communities. In such cases, inbreeding levels are expected to be higher in the high socio-economic levels than in the middle and low classes. Money may act, however, in other populations, as a powerful agent to enlarge isolate boundaries and to decrease the incidence of consanguineous marriages.

5. The analysis of the problem in Brazil suggested that the most effective factors in the differential distribution of inbreeding levels are cultural pattern, economic level, migration and

degree of ruralization. Population density, in spite of its importance, does not seem to be a powerful agent by itself. Religious structure, a factor probably effective in other populations, seems to be unimportant; and the degree of literacy does not seem to play an important role by itself.

I. GENETIC LOAD AND INBREEDING EFFECT

6. The total genetic load of a population is divisible into several components. The terminology and classification only recently have begun to interest human geneticists (Haldane, 1957;¹ 1963;² Crow, 1958;³ Kimura, 1959;⁴ Crow and Morton, 1960;⁵ Freire-Maia, 1963a;⁶ Morton, 1963⁷).

7. The first definition of what we call the mutational and the segregational loads, as well as the basic mathematical formulations for estimating the role these two components play in the maintenance of the genetic variability, is, however, more than twenty-five years old (Haldane, 1937).⁸

8. One of the most important fractions of the genetic load is that revealed in the offspring of consanguineous marriages. This fraction is, in general, composed presumably of rare deleterious variants which are thought to be mostly maintained in the populations by mutation pressure. Inbreeding studies are, therefore, a tool for detecting and measuring the "mutational load".

9. Mutational load generally is defined as the load produced by genes which are main-

tained in equilibrium by recurrent mutation. This is a simple, clear and practical definition that goes back to Haldane (1937).⁹ It has been defined, however, as "the load contributed by genes which are detrimental in homozygotes and not beneficial in heterozygotes" (Freire-Maia, 1963b),¹⁰ and as that which results from elimination of harmful mutations (Kimura, 1959).¹¹ Both these definitions are too loose to be useful, since many different loads may be composed of completely deleterious mutations without necessarily being "mutational" loads. The working hypothesis of a high genetic load suggested for explaining the high death rates verified among inbred Negroes in Brazil (Freire-Maia and associates, 1961,¹² 1963¹³), therefore, is not necessarily connected with the fact that this load must be, for the most part, mutational in the strict sense only because it does not seem to be segregational (Freire-Maia, 1963a;¹⁴ Haldane, 1963¹⁵). This load could presently be a migrational one, developed on the basis of a probably previous mutational load (Freire-Maia, 1963c).¹⁶

10. The mutational load emerging in the offspring of consanguineous marriages must not be necessarily either a mutational, in the strict sense, or a segregational load, as is maintained by two schools of thought. The dispute may be put in terms of mutational in the broad sense versus segregational, mutational in a broad

⁹ J. B. S. Haldane, "The effect of variation on fitness", *American Naturalist*, vol. LXXI (1937), pp. 337-349.

¹⁰ N. Freire-Maia, "The effect of the load of mutations on the mortality rate in Brazilian populations", in Elisabeth Goldschmidt, ed., *The Genetics of Migrant and Isolate Populations*, Proceedings of the Conference of Human Population Genetics, Israel (Baltimore, Williams and Wilkins, 1963b), pp. 220-225.

¹¹ M. Kimura, "Genetic load of a population and its significance in evolution", *Japanese Journal of Genetics*, vol. XXXV (1959).

¹² N. Freire-Maia, A. Freire-Maia and A. Quelce-Salgado, "Lethal mutations in Brazilian human populations", *Nature*, vol. CLXXXIX (1961), pp. 80-81.

¹³ N. Freire-Maia, A. Freire-Maia and A. Quelce-Salgado, "The load of lethal mutations in White and Negro Brazilian populations, I. First Survey", *Acta Genetica*, vol. XIII (1963), pp. 185-198.

¹⁴ N. Freire-Maia, "Carga genética, o preço da evolução", in C. Pavan and A. B. da Cunha, eds., *Genética—Aspectos Modernos da Genética Pura e Aplicada* (Sao Paulo, Cia. Editora Nacional, 1963a), pp. 290-317.

¹⁵ J. B. S. Haldane, "The concentration of rare recessive genes in the past and in modern times", in Elisabeth Goldschmidt, ed., *The Genetics of Migrant and Isolate Populations*, Proceedings of the Conference of Human Population Genetics, Israel (Baltimore, Williams and Wilkins, 1963), pp. 243-247.

¹⁶ N. Freire-Maia, "The load of lethal mutations in White and Negro Brazilian populations, II. Second survey", *Acta Genetica*, vol. XIII (1963), pp. 199-225.

¹ J. B. S. Haldane, "The cost of natural selection", *Journal of Genetics*, vol. LXV (1957), pp. 511-524.

² J. B. S. Haldane, "The concentration of rare recessive genes in the past and in modern times", in Elisabeth Goldschmidt, ed., *The Genetics of Migrant and Isolate Populations*, Proceedings of the Conference of Human Population Genetics, Israel (Baltimore, Williams and Wilkins, 1963), pp. 243-247.

³ J. F. Crow, "Some possibilities for measuring selection intensities in man", *Human Biology*, vol. XXX (1958), pp. 1-13.

⁴ M. Kimura, "Genetic load of a population and its significance in evolution", *Japanese Journal of Genetics*, vol. XXXV (1959), pp. 7-33.

⁵ J. F. Crow and N. E. Morton, "The genetic load due to mother-child incompatibility", *American Naturalist*, vol. XLIV (1960), pp. 413-419.

⁶ N. Freire-Maia, "Carga genética, o preço da evolução", in C. Pavan and A. B. da Cunha, eds., *Genética—Aspectos Modernos da Genética Pura e Aplicada* (Sao Paulo, Cia. Editora Nacional, 1963a), pp. 290-317.

⁷ N. E. Morton, "The components of genetic variability", in Elisabeth Goldschmidt, ed., *The Genetics of Migrant and Isolate Populations*, Proceedings of the Conference of Human Population Genetics, Israel (Baltimore, Williams and Wilkins, 1963), pp. 225-236.

⁸ J. B. S. Haldane, "The effect of variations on fitness", *American Naturalist*, vol. LXXI (1937), pp. 337-349.

sense incorporating all the loads which are not due to selection agencies. In this sense, it is our impression that the load which emerges in the offspring of consanguineous marriages is mostly "mutational", that is, not maintained at its present level by any factor connected with a positive selection.

II. METHODS FOR ESTIMATING THE "MUTATIONAL LOAD"

11. Six methods are now available for estimating the genetic load emerging in the offspring of consanguineous marriages. Details on them may be seen in the original papers in which they have been presented and discussed. These papers are as follows: (a) Slatis, 1954;¹⁷ (b) Morton, Crow and Muller, 1956;¹⁸ (c) Morton, Crow and Muller, 1956;¹⁹ Schull, 1958;²⁰ 1959;²¹ (d) Böök, 1957;²² (e) Penrose, 1957;²³ Slatis and associates, 1958;²⁴ Freire-Maia and Freire-Maia, 1960;²⁵ (f) Freire-Maia and Freire-Maia, 1964.²⁶

12. Methods listed as (a) and (d) may be used only with data on specific anomalies due to autosomal recessive genes; method (c) is an appropriate approach based on the correct one here referred to as (b); methods (e) and (f) may lead to rather incorrect estimates in some situations; method (f) does involve simplification and leads to values which are equivalents to

these obtained with the aid of method (b). A detailed analysis of these methods has been presented previously (Freire-Maia, 1964).²⁷

III. ESTIMATES OF "MUTATIONAL LOAD"

13. Several papers have been published which present estimates of the frequency of lethal equivalents in different countries and ethnic groups. Some of these estimates refer to mortality from about the second month of pregnancy to early adulthood. Others refer only to segments of this "total mortality", generally peri-natal and infant-juvenile mortality. Obtained by different authors with different methodology, this large set of information presents dangers when making comparisons. It also is difficult to ascertain the amount of extraneous variables which may be operating to mask or exaggerate the inbreeding effect in each particular case. The range so far verified for the mean number of lethal equivalents per person may be defined as going from less than one to as far as ten. If the working hypothesis that human populations differ so widely in the number of lethons proves to be correct, the distribution of the load of mutations in man would be much better described as a series of values disposed along a line than as a group of means clustered around a point (Freire-Maia and associates, 1964).²⁸

IV. MUTATIONAL LOAD IN BRAZILIAN POPULATIONS

14. Data on inbreeding effect in Brazilian populations reveal a striking situation: Caucasians and Negroes living in the south of the state of Minas Gerais and belonging to similar socio-economic levels seem to be under the action of "loads" of rather different magnitude (Freire-Maia, 1963;²⁹ Freire-Maia and associates, 1963).³⁰ The extremes of the above-mentioned spectrum would be occupied, therefore, by two different ethnic groups living in the same region, sharing the same culture and occupying approximately the same socio-economic level. The data from other Brazilian regions show situations which are similar to those found in populations of the same ethnic

¹⁷ H. M. Slatis, "A method of estimating the frequency of abnormal autosomal recessive genes in man", *American Journal of Human Genetics*, vol. VI (1954), pp. 412-418.

¹⁸ N. E. Morton, J. F. Crow and H. J. Muller, "An estimate of the mutational damage in man from data on consanguineous marriages", *Proceedings of the National Academy of Science*, vol. XLII (1956), pp. 855-863.

¹⁹ N. E. Morton, J. F. Crow and H. J. Muller, *ibid.*

²⁰ W. J. Schull, "Empirical risks in consanguineous marriages: sex ratio, malformations, and viability", *American Journal of Human Genetics*, vol. X (1958), pp. 294-343.

²¹ W. J. Schull, "Inbreeding effect on man", *Eugenics Quarterly*, vol. VI (1959), pp. 102-109.

²² J. A. Böök, "Genetical investigation in a north-Swedish population. The offspring of first-cousin marriages", *Annals of Human Genetics*, vol. XXI (1957), pp. 191-223.

²³ L. Penrose, "A note on the prevalence of genes for deleterious recessive traits in man", *Annals of Human Genetics*, vol. XXI (1957), pp. 222-223.

²⁴ H. M. Slatis, R. H. Reis and R. E. Hoene, "Consanguineous marriages in the Chicago region", *American Journal of Human Genetics*, vol. X (1958), pp. 446-464.

²⁵ N. Freire-Maia and A. Freire-Maia, "Estimate of the human load of mutations from heterogeneous consanguineous samples", *Science*, vol. CXXXII (1960), p. 1,317.

²⁶ N. Freire-Maia and A. Freire-Maia, "Estimate of the genetic load disclosed by inbreeding", *Genetics*, vol. L (1964), pp. 527-529.

²⁷ N. Freire-Maia, "On the methods available for estimating the load of mutations disclosed by inbreeding", *Cold Spring Harbor Symposium on Quantitative Biology*, vol. XXIX (1964), pp. 31-40.

²⁸ N. Freire-Maia, Sister M. A. Guaraciaba and A. Quelce-Salgado, "The genetical load in the Bauru Japanese isolate in Brazil", *Annals of Human Genetics*, vol. XXVII (1964), pp. 329-339.

²⁹ N. Freire-Maia, "The load of lethal mutations in White and Negro Brazilian populations, II. Second survey", *Acta Genetica*, vol. XIII (1963c), pp. 199-225.

³⁰ N. Freire-Maia and associates (1963), op. cit.

backgrounds living in other countries. They also show Negroes with an apparently low mutational load, for instance, those from Bahia (A. Quelce-Salgado, personal communication) and from Espírito Santo (A. Freire-Maia, personal communication).

15. Historical information presents some evidence that the Negro from Minas Gerais may be the highest outbred among the Brazi-

lian Negroes (Carneiro, 1964).³¹ We do not know, however, if this fact could help to explain our findings. The need for additional investigations among Brazilian Negroes, both from other regions of Minas Gerais and from other Brazilian states, clearly emerges from these considerations.

³¹ Edison Carneiro, *Ladinos e Cricoulos* (Sao Paulo, Editora Civil, 1964).

Recent advances in the theory of population genetics

MOTOO KIMURA

1. The aim of population genetics is to investigate the laws which govern the genetical structure of natural populations and, through that study, to clarify the mechanism of evolution. The mathematical theory underlying population genetics first was extensively formulated around 1930 by R. A. Fisher, J. B. S. Haldane and S. Wright. The theory has had profound influence on the thinking of evolutionists and has had important application in forming theories of animal and plant breeding. No less important is its application to the genetical study of human populations. Indeed indications are growing that population genetics of man will be one of the most fertile and congenial fields for the work of population geneticists. In this paper I will review some of the recent advances in the theory of population genetics which are relevant to the genetical study of human populations.

2. *Maintenance of genetic variability.* Experimental and observational studies have shown quite clearly that a huge outbreeding population, such as man, contains a large amount of genetic variability. Not so clear, however, is the mechanism by which such variability is maintained. Various causes for the variability have been suggested. The following two may be especially important: (a) recurrent mutation counterbalanced by selection; and (b) overdominance, that is, heterozygote superiority in fitness. Which of these two causes is mainly responsible for the maintenance of genetic variability in natural populations has been disputed vigorously for the past ten years (classical versus balance hypotheses). The issue is by no means settled, but it is probable that, in almost all the loci (including "polymorphic" loci), the cause (a) exists, though the *per locus* contribution to the total variability may be very small. On the other hand, in any given mendelian population, the number of loci in which overdominant alleles are maintained may be relatively small, but as pointed out by J. F. Crow¹ each may contribute a disproportionately large

amount to the total variability, leading often to conspirous polymorphism. It should be emphasized that the cause of polymorphism is not restricted to overdominance. Recently, J. B. S. Haldane and S. D. Jayakar² proved an interesting theorem by considering a situation in which selection sometimes favours one phenotype and sometimes another thereby maintaining a polymorphism. As to the maintenance of genetic variability in quantitative characters, I have presented³ a new model which assumes that at every locus involved with the quantitative character, mutation can produce an infinite sequence of alleles and the effect of a new allele is only slightly different from the parental allele from which it was derived by a single mutational step. The new model is in sharp contrast with the conventional models in which mutation is assumed to occur only between a pair of alleles, say *A*, and *a*. Together with the additional assumptions that the genes are additive with respect to the quantitative character, that the optimum phenotypic value is fixed and that fitness decreases in proportion to the squared deviation from the optimum, the properties of the model have been worked out. This model enables one to make predictions about the relation between mutation rates, genotypic variance and mutational load. To check the validity of the model, extensive observational studies will need to be made to estimate the relationship between phenotypic value and fitness in quantitative characters.

3. *Measurement of selection intensity.* In order to study the action of natural selection, we must have an appropriate index to measure its intensity. Haldane⁴ defined the intensity of natural selection as $I = \text{Log}_{e}s_0 - \text{Log}_{e}S$, where s_0 and S are the fractions of survivors in the optimal phenotype and in the total population

² J. B. S. Haldane and S. D. Jayakar, "Polymorphism due to selection of varying direction", *Journal of Genetics*, vol. LVIII (1963), pp. 237-242.

³ M. Kimura, "Diffusion models in population genetics", *Journal of Applied Probability*, vol. I (1964).

⁴ J. B. S. Haldane, "The measurement of natural selection", *Caryologia*, vol. VI (1954), pp. 480-487.

¹ J. F. Crow, "Dominance and overdominance", *Heterosis* (Ames, Iowa, Iowa State College Press, 1952), pp. 282-297.

respectively. Crow⁵ proposed to measure genotypic selection intensity by genetic load which he defined as the proportion by which the population fitness is decreased in comparison with an optimum genotype, that is $L = (W_{op} - \bar{W})/W_{op}$ where $\bar{W}$ is the average fitness of the population and W_{op} is the fitness of the optimum genotype. Both definitions are related to the proportion of individuals that are eliminated in each generation by natural selection acting on genotypic differences and therefore adequate to measure the selection intensity. The concept of genetic load was successfully used by Morton, Crow and Muller⁶ to analyse data on the effect of inbreeding in man. Morton also derived a very useful principle in assessing the segregation load,⁷ namely, a minimum of the load is obtained by multiplying the frequency of one allele by the decreased viability of the homozygote for that allele.⁸ Some of the misdirected criticisms made in recent years against Crow's concept of genetic load would not have been made if the critics had known the original aim of Crow's definition. The load was defined in terms of intrapopulation fitnesses which may have little relation to the intergroup selective value of the population. I have proposed two terms, "internal" and "external loads" to make these points clear.⁹ The former refers to the decrease of fitness relative to the optimum genotype and relates to intragroup selection, while the latter relates to intergroup selection. Recent progress in the theory of genetic loads is reviewed by Crow and Kimura.¹⁰

4. *Breeding structure of populations.* Usually, a total population forming a species is not a random mating unit, because the distance of individual migration is usually much smaller than the entire distribution range of the species. This phenomenon which Wright called "isolation by distance" will lead to the random local differentiation of gene frequencies. He con-

sidered a model in which a population is distributed uniformly over a large territory, but the parents of any given individual are drawn at random from a small surrounding region. The size of neighbourhood, that is, the population number in such surrounding region, plays a fundamental role in his analysis. Wright studies by his method of path coefficients the pattern of change in the inbreeding coefficient of subgroups relative to a larger population in which they are contained.¹¹ He has shown that the tendency toward local differentiation is much stronger in a linear than in two dimensional habit. The problem of local differentiation may also be studied in terms of change in correlation with distance as considered by Malécot¹² since individuals living nearby tend to be more alike than those living far apart. In natural populations, individuals often are distributed more or less discontinuously to form numerous colonies, and individuals may be exchanged between adjacent or nearby colonies. To analyse such a situation, I proposed a model called the stepping stone model. Recently, the solution of this model was presented for one, two and three dimensional cases, with special reference to the correlation coefficient of gene frequencies between colonies.¹³ Man is probably one of the best materials for studying the migration pattern and breeding structure in relation to population genetics. Much work is yet to be done in this field. Here I would like to mention as an example, a study recently started by Cavalli and his collaborators. The purpose of the work is to develop a theory that can predict the frequencies of various types of consanguineous marriages, based on the frequency distributions of ages and migration distances of members that occurs in the pedigrees of these mating types.¹⁴ The work is still in progress.

5. *Stochastic processes in the change of gene frequencies.* In many mathematical studies of population genetics, the process of change in gene frequencies is treated as if it were deterministic. Such a treatment, started by

⁵ J. F. Crow, "Some possibilities for measuring selection intensities in man", *Human Biology*, vol. XXX (1958), pp. 1-13.

⁶ N. E. Morton, J. F. Crow and H. J. Muller, "An estimate of the mutational damage in man from data on consanguineous marriages", *Proceedings of the National Academy of Sciences*, vol. XLII (1956), pp. 855-863.

⁷ N. E. Morton, "The mutational load due to detrimental genes in man", *American Journal of Human Genetics*, vol. XII (1960), pp. 348-364.

⁸ J. F. Crow "Population genetics", *American Journal of Human Genetics*, vol. XIII (1961), pp. 137-150.

⁹ M. Kimura "Genetic load of a population and its significance in evolution", *Japanese Journal of Genetics* (1960), vol. XXXV, p. 33.

¹⁰ J. F. Crow and M. Kimura, "The theory of genetic loads", *Proceedings of XI International Congress in Genetics* (1963).

¹¹ S. Wright, "The genetical structure of populations", *Annual in Eugenics*, vol. XV (1951), pp. 323-354.

¹² G. Malécot, "Decrease of relationship with distance", *Cold Spring Harbor Symposium*, vol. XX (1955), pp. 52-53.

¹³ M. Kimura and G. H. Weiss, "The stepping stone model of population structure and the decrease of genetic correlation with distance", *Genetics*, vol. XLIX (1964), pp. 561-576.

¹⁴ L. L. Cavalli-Sforza, I. Barrai and A. W. F. Edwards, "Analysis of human evolution under random genetic drift", *Cold Spring Harbor Symposium* (1964).

Haldane some forty years ago, is often sufficiently realistic as a first approximation. Because of its simplicity, the deterministic treatment is still the most useful and often the only manageable way of approach to many problems. In nature, however, the process of change may not be quite deterministic, because of the existence of factors which produce random fluctuation in gene frequencies, of which two may be especially important, random sampling of gametes and random fluctuation of selection intensities. Ideally, the process of change should be treated as a stochastic process, where the term "stochastic process" means a mathematical formulation of a chance event which proceeds in time. The work in this line was initiated by Fisher and important contributions have been made by him and by Wright. Later progress along this line is presented in Moran's book¹⁵ and also in my review article.¹⁶ Here I will present some of the new developments which may be of interest to human population geneticists. Alan Robertson¹⁷ studied the process of decay of genetic variability in a small population, assuming a pair of overdominant alleles. He showed that when the equilibrium gene frequency is outside the range of 0.2 to 0.8 there are some circumstances where heterozygote advantage actually accelerates the rate of fixation and loss of alleles rather than retarding it. This finding was quite unexpected, since in the deterministic theory overdominance always leads to stable equilibrium of the allele frequency. Kimura and Crow¹⁸ studied the number of alleles that can be maintained in a finite population, assuming that each mutation is unique. Their results show that overdominance is extremely inefficient as a factor for keeping a large number of alleles in a finite population: in order to maintain a large number of alleles within a population, a high rate of production of new mutations is required. In a small population, the gene frequencies are subject to random fluctuations and the conventional treatment of mutation load based on the deter-

ministic theory may not be satisfactory. Actually, it was shown¹⁹ that in small populations the load is considerably larger than in a large population. Furthermore, for a wide range of population sizes, a mutant that is slightly harmful is more damaging to the fitness of the population than a mutant with greater harmful effect. The probability of fixation (that is, ultimate survival) of a mutant gene in a finite population is also an important subject of study for the stochastic treatment of gene frequencies. Given the selective advantages of a mutant gene in homozygous and heterozygous combinations, let us ask the question: What is the probability that the mutant gene will be fixed in a population of size N , if its initial frequency is p ? The answer to this question was given by the author,^{20, 21} who used the Kolmogorov backward equation and designated such probability by $u(p)$. The function $u(p)$ plays an important role in the theory of limits in artificial selection put forward by Robertson²². He referred to $u(p)$ as "the expected limit", because if we assign a value 1 to the phenotypic value of mutant homozygote, $u(p)$ is the expected value with respect to this locus at the limit. The total advance by selection is $u(p) - p$. Robertson showed that for a character governed by additive genes the total advance is $2N$ times the change in the first generation, provided that Ns per locus is small, where s is the selection coefficient. In contrast to the current theory of artificial selection, in which to enlarge the genetic gain to the greatest point each generation is the supreme concern, this new theory of limits may handle such problem as "Under what selection programme might the furthest limit be attained?". Not only is this theory important for animal and plant breeding, but it might become essential if man starts to improve his own genetic endowment under the grand project which Muller describes in his paper, "The guidance of human evolution".²³

¹⁹ M. Kimura, T. Maruyama and J. F. Crow, "The mutation load in small populations", *Genetics*, vol. XLVIII (1963), pp. 1,303-1,312.

²⁰ M. Kimura, "Some problems of stochastic processes in genetics", *Annual Mathematical Statistics*, vol. XXVIII (1957), pp. 882-901.

²¹ M. Kimura, "On the probability of fixation of mutant genes in a population", *Genetics*, vol. XLVII (1962), pp. 713-719.

²² A. Robertson, "A theory of limits in artificial selection", *Proceedings of the Royal Society*, 153 (B) (1960), pp. 234-249.

²³ H. J. Muller, "The guidance of human evolution", *Perspectives in Biology and Medicine* III (1959), pp. 1-43.

¹⁵ P. A. P. Moran, *The Statistical Processes of Evolutionary Theory* (Oxford, Clarendon Press, 1962).

¹⁶ M. Kimura, "A stochastic model concerning the maintenance of genetic variability in quantitative characters", *Proceedings of the National Academy of Sciences* (1964).

¹⁷ A. Robertson, "Selection for heterozygotes in small populations", *Genetics*, vol. XLVII (1962), p. 1,291-1,300.

¹⁸ M. Kimura and J. F. Crow, "The number of alleles that can be maintained in a finite population", *Genetics*, vol. XLIX (1964), pp. 725-738.

Measures affecting population trends and possible genetic consequences

EI MATSUNAGA

1. Modern population trends towards low mortality and break-down of isolates are almost universal. In advanced countries, mortality rates have been declining slowly for more than a century, while in the countries developing now this decrease in the death rate took place rapidly, owing to the swift introduction of modern medicine and public health measures. Where industrialization and urbanization proceed, geographical barriers are broken down between populations. The spread of education and democracy gradually are removing psychological barriers which had prohibited marriages between socially different groups.

2. As to birth rates, however, differences are considerable according to varying nations. In the countries where mortality rates had begun to fall many years ago, a decline in birth rates followed because of prevailing family planning practices and postponed marriage. In the developing countries, the rates of reproduction remain very high. This fact, combined with the sudden fall in mortality rates, has resulted in a rapid population growth, which hampers seriously the economic progress of these nations. For such countries, their most urgent population problem is to reduce birth rates.

3. Japan, caught in the throes of economic collapse after World War II, was strongly motivated to limit the size of families. A sudden population increase was brought about by repatriation of some 6 million people from abroad, by a post-war baby boom, and by a marked decrease in mortality rate made possible by the improvements of public health and medical care services. The Eugenic Protection Law passed in 1948 to replace the earlier National Eugenic Law, permits voluntary sterilization and induced abortions for economic reasons, as well as for considerations for the mother's health. This law puts emphasis on the encouragement of family planning by means of contraception. The law authorized the Japan Medical Association to appoint specially trained doctors to ensure safety and skill in the surgical operations. In addition, the law established a Eugenic Protection Consultation Office in

every health centre to give marriage counsel and to disseminate information concerning conception control.

4. Table 1 illustrates clearly what secular changes have taken place in Japan during the period from 1947 to 1960. The decline in births and in infant deaths was precipitous. The drop in births amounted to 50 per cent during that period—perhaps the swiftest drop in reproduction that ever has occurred in an entire nation. There has been postponement of marriages; the mean age of women at the first marriage was raised from 22.9 in 1947 to 24.2 in 1958. A family pattern of two to three children, born when the mother is twenty to thirty-four years old, has been established during the short period as standard for the whole country. It should be noted, however, that the Japanese people limited their family size in their private interests and that of their children, rather than from any concern with over-population in their homeland. The government policy, whose major concern was to guard against unsafe abortion and to try to replace abortion by contraception, only favoured this trend.

5. Under a demographic situation such as has emerged in Japan, a direct genetic consequence follows two striking changes. First, a substantial decline in the proportion of births of high parity should lead to reduction in the frequencies of such diseases as Rh-erythroblastosis, for which the risk is known to increase with increasing birth order. The incidence of the disease varies from population to population, depending upon the frequencies of the alleles concerned. In Europe and North America, it is about one per 150 births, while in Japan, the incidence appears to be as low as one per 5,000 births. Assuming that the disease does not develop in the births of first and second pregnancies, but only in the births of higher parity, it may be estimated that the reduction in the frequency of Rh-erythroblastosis in Japan amounts to 54 per cent from 1947 to 1960. Secondly, a decline in the proportion of births to older mothers should result in a reduction in the frequencies of such

Table 1. Some features of population trends in Japan (comparison of relevant data in 1947 with those in 1953 and 1960, based on vital statistics of the Ministry of Health and Welfare)

	1947	1953	1960
(1) Live birth rate per 1,000 population..	34.3	21.5	17.2
(2) Infant death rate per 1,000 live births	76.7	48.9	30.7
(3) Total number of live births ^a	2,678,792	1,868,040	1,606,041
(4) Total number of reported induced abortions	—	1,068,066	1,063,256
(5) Total number of reported sterilizations	—	32,552	38,722
(6) Number and percentage of live births by birth order: ^a			
1 to 3 birth order: number	1,716,073	1,401,910	1,450,229
percentage	64.1	75.1	90.3
More than 4 birth order:			
number	961,402	466,112	155,795
percentage	35.9	25.0	9.7
(7) Number and percentage of live births by age of mother: ^a			
Under 19 years old: number	61,223	31,796	19,739
percentage ..	2.3	1.7	1.2
20-29 years old: number	1,442,259	1,201,357	1,192,350
percentage	53.9	64.3	74.2
30-34 years old: number	645,329	409,333	300,684
percentage	24.1	21.9	18.7
Over 35 years old: number	528,690	225,539	93,263
percentage	19.8	12.1	5.8

^a The total number of live-births under (3) includes a small fraction of live-births of unknown birth order and those by mothers of unknown age, so that the sum under (6) and (7) is slightly less than the total number listed.

diseases as Down's syndrome, whose occurrence is known to depend upon advancing maternal age. The frequency of this anomaly has been given as 1.5 per 1,000 total births, but recent surveys have indicated higher figures, in some cases as high as 2.5 per 1,000. The increase with maternal age is rather slow until the mother reaches the age of 35 years, then it becomes rapid as the mother approaches the menopause. Compared with the over-all frequency, there is a two-to-fourfold increase for the age group thirty-five to thirty-nine, a five-to-tenfold increase for the age group forty to forty-four, and after the age of forty-five, a ten-to-twentyfold increase.¹ A similar rate of increase with rising maternal age has been observed also in Japan.² Considering the change in maternal age distribution in Japan from

1947 to 1960, it is assumed that the frequency of Down's syndrome has been reduced to about three-fifths during that period.

6. Another genetic consequence of decreasing family size is an indirect one, resulting from a drop in the frequency of consanguineous marriages. With smaller families, a person has fewer relatives, for example, fewer cousins, than was the case when the families were larger. This change, with the break-down of isolates, should lead to a reduction in the frequencies of consanguineous marriages due to mere chance. An example of such reduction is given in table 2, which was observed in our recent survey in Ohdate City, Akita Prefecture, located in the northern part of Honshu. Among various consanguineous marriages, first-cousin marriage is the most frequent in Japan. Since consanguineous marriages lead to increased risks of illness, premature death and congenital abnormality among the offspring, reduction in the frequency of such marriages should lead to a reduction in the expressed genetic burden of the society, at least for a long period of time.

¹ W. Lenz, "Der Einfluss des Alters der Eltern und der Geburtennummer auf angeborene pathologische Zustände beim Kind", Spezieller Teil, *Acta Genetica et Statistica Medica*, vol. IX (1959), pp. 249-283.

² E. Matsunaga, "Down's syndrome in Japan", *Annual Report of the National Institute of Genetics*, vol. XIV (1964), pp. 128-130.

Table 2. Secular change in the frequencies of consanguineous marriages among 3,427 couples in Ohdate City (with wife's age ranging from 30 to 40)^a

<i>Year of marriage</i>	<i>Before 1945</i>	<i>1946-1949</i>	<i>1950-1953</i>	<i>1954-1957</i>	<i>1958-1961</i>	<i>Total</i>
Number of couples examined.....	977	1,346	702	309	93	3,427
Consanguineous couples: Number	88	85	24	4	1	202
Per cent	9.01	6.32	3.42	1.29	1.08	5.89
Mean inbreeding coefficient.....	0.0033	0.0021	0.0010	0.0003	0.0003	0.0020

^a The mean age of wives at the date of marriage was 21.7 among unrelated couples, and 19.8 among consanguineous couples.

Table 3. Frequencies of a simple Mendelian recessive disease per million population when the birth of an affected child deters the parents from further reproduction

<i>Gene frequency</i>	<i>With selective limitation, family size</i>						<i>Without selective limitation</i>
	2	3	4	5	6	7	
0.002.....	3.5	3.1	2.7	2.4	2.2	2.0	4.0
0.005.....	22	19	17	15	14	12	25
0.01.....	86	76	67	60	54	49	98
0.02.....	336	296	263	235	211	191	384
0.05.....	1,986	1,751	1,555	1,388	1,248	1,128	2,268

7. The two points just mentioned are of rather minor significance as factors contributing to the reduction of our genetic burden. Perhaps the most important aspect concerning the genetic effect of various measures for birth control is that they readily could be used for eugenic purposes, especially in countries where family planning has been encouraged on a large scale. If the birth of a child with some hereditary disorder could deter the parents from further reproduction, this would reduce not only the absolute number, but also the relative frequency of the affected individuals in the population. This problem recently has been dealt with mathematically by Goodman³ in a general way. For a special case, table 3 shows that the frequency of a simple mendelian recessive disease decreases according to family size, when the birth of one affected child prevents the parents from further childbearing. If every parental couple had exactly three children unless an affected one is born, then the reduction in the frequency of the disease would be, irrespective of the gene frequency,

about 23 per cent as compared with the case without selective limitation.

8. A thought should be given to differential fertility introduced by the biased distribution of family planning practices. These practices usually spread more rapidly in some social strata than in others and more rapidly among persons who are well educated than among persons with less education. Table 4, for example, illustrates secular changes in the spread of "present contraceptors" among the Japanese during the period from 1950 to 1959. In fact, the distribution is biased by differences in husband's occupation or the couple's educational background. This may be reflected in fertility differences, but at present, it is difficult to evaluate the extent of dysgenic effect of these factors. The experiment in Japan indicates that the spread of contraceptive experience in the social stratum in which it was initially lowest experienced such a remarkable rise during a short period that the bias has been lessened considerably. This experience suggests that the problem of differential fertility introduced by biased distribution may be solved within a relatively short time if particular effort is made to enlighten people to whom it is difficult to introduce the practice of contraception.

³ L. A. Goodman, "Some possible effects of birth control on the incidence of disorders and on the influence of birth order", *Annals of Human Genetics*, vol. XXVII (1963), pp. 41-52.

Table 4. Spread of contraceptive practices in different strata in Japan from 1950 to 1959 (not including induced abortions)^a

		Percentages of "present contraceptors" in the years of				
		1950	1952	1955	1957	1959
1. By occupation of husbands						
Farmers and fishermen.....	} 11.5	17.0	23.9	25.4	30.5	34.9
Labourers				35.8	37.6	40.1
Commercial and industrial business men	} 25.9	24.7	36.9	37.4	39.0	40.4
Salaried men		35.2	39.7	41.0	49.1	50.7
Others ^b			47.0	47.0	—	—
2. By duration of education in years						
Husband:						
Less than 9 years.....		14.2	18.2	28.2	33.4	37.6
10-12 years		25.4	37.0	37.7	46.5	43.9
More than 13 years.....		37.3	47.0	48.8	52.5	54.0
Wife:						
Less than 9 years		13.0	20.1	28.2	33.3	35.0
10-12 years		32.4	38.7	46.1	48.4	51.6
More than 13 years ^b		36.0	59.1	47.8	53.2	51.9
3. Totals		19.5	26.3	33.6	39.2	42.5

^a Based on consecutive surveys by the Mainichi-Newspapers. In each survey approximately 3,000 couples from the whole country were sampled at random.

^b Sample size small.

9. Another solution for alleviating population pressure is to adjust the geographical distribution of the population. In countries with excess population, overseas emigration often is encouraged. Today, this policy generally is not feasible for a variety of reasons. On the other hand, policies for resettling or evacuating populations in over-crowded areas within a country are becoming of particular concern to Governments in many countries where streams of migrants pour into cities from countrysides to seek socio-economic opportunities. For example, the total population of Tokyo has grown from 5.0 million in 1947 to 10.5 million in 1963; of this increase, about 3.9 million was due to net migration. The Government has decided to take measures for evacuating some functional parts of the metropolitan city. Such policy of the Government will result in a change in the distribution of genes, affecting both the area of immigration and that of emigration, provided the emigrating group is genetically different in some respect. In the past, emigrants often were not extracted randomly from the general population, but from particular groups for political, social or religious reasons. Even if there is no obvious selection, emigrants likely have some genetically selective attributes in comparison with non-migrating groups. For instance, they may have a greater physical and mental strength which might be able to stand the hardships of the

new life. Such selective migration has, in fact, been demonstrated within countries.⁴

10. The break-down of isolates due to migration tends to equalize the frequencies of those alleles which were formerly different in the separate groups. The number of homozygous individuals in a mixed population is always smaller than the sum of the homozygous individuals in the original subgroups. The break-down of isolates leads to a reduction in the incidence of individuals affected with hereditary diseases due to recessive genes. This reduction should be especially large when considerable variability had been present among the original subgroups in the frequencies of the recessive genes. In addition, intermixing between different subgroups makes new genic combinations possible.

11. Most of the points made in this paper can be referred to as obviously "positive" aspects of the genetic consequences of measures affecting population trends. A question may arise whether there is possible dysgenic effect of the tendency towards smaller family size. A reduction in the number of children born as a result of policies encouraging family planning is usually accompanied by a reduction

⁴ R. Illsley, A. Finlayson and B. Thompson, "The motivation and characteristics of internal migrants", *Milbank Memorial Fund Quarterly*, vol. XLI (1963), pp. 115-144 and pp. 217-248.

in childhood mortality. As a result, a greater proportion of children survive and reach maturity than was formerly the case. This fact would result in relaxation of natural selection as far as viability is concerned, but not necessarily in relaxation of total selection intensity. This may be just as efficient in a population in which most of the children survive, if their number per family varies depending upon the genetic constitution of the parents.^{5,6} On the other hand, if the variance

in family size decreases faster than the mean number of children per family, then the genes adversely affecting fertility may gradually accumulate in the population. Table 5 represents some relevant data for Japan, indicating that the variance of the number of children has decreased relatively faster than the mean family size during the past thirty years. There is no doubt that this tendency becomes evident as various measures for birth control are becoming more widely used. Although the nature and extent of possible dysgenic effect of this trend cannot be predicted at present, some increase in our genetic burden of the component due to impairment of fertility might be considered innocuous in terms of social burden if this increase is not too large.

⁵ J. F. Crow, "Some possibilities for measuring selection intensities in man", *Human Biology*, vol. XXX (1958), pp. 1-13.

⁶ J. N. Spuhler, "Empirical studies on quantitative human genetics", *The Use of Vital and Health Statistics for Genetic and Radiation Studies* (United Nations publication, Sales No.: 61.XVII.8), pp. 241-252.

Table 5. Mean ($\bar{x}$) and variance (V) of number of children ever born to all 40-year-old and older women married at least once, based on 1960 census data in Japan^a

Variable	Age of married women								
	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+
$\bar{x}$	3.286	3.931	4.466	4.675	4.688	4.680	4.683	4.574	4.670
V	3.664	5.428	7.291	8.479	8.801	8.784	9.045	8.675	8.447
$V/\bar{x}^2$ ^b	0.339	0.351	0.366	0.388	0.400	0.401	0.412	0.415	0.387

^a The mean and variance are somewhat smaller than the true values because the census reports lumped together several classes for birth orders over 11.

^b $V/\bar{x}^2$ is the index of total selection intensity with respect to differential fertility defined by Crow.

Consanguinity studies in Japan

JAMES V. NEEL, TOSHIYUKI YANASE and WILLIAM J. SCHULL

1. For a number of reasons, Japan is a country unusually suitable for studies on the effects of consanguineous marriages. Until recently, a high rate of consanguineous marriages was made, ranging from approximately 4-7 per cent in the cities to 20-25 per cent or more in rural areas. Although the frequency of consanguineous marriage has diminished markedly in the past decade, it still remains relatively high by world-wide standards. The strong sense of family, the high literacy rate and the relatively long life expectancy in Japan result in an informed population, capable of providing accurate information. The complete vital statistics and the level of medical practice compare favourably with the best practices in other countries. The Family Record System, the *koseki*, provides the investigator with a set of open records of family relationships of high accuracy, much less subject to errors of recollection than the usual family history (Ohkura, 1960; Ohkura and Watanabe, 1961; Yanase, 1960, 1962a).^{1,2,3,4} In some parts of Japan, the belief in Catholicism is sufficiently prevalent to offer a third source of information regarding consanguinity that can be checked against the respondent's statement and the *koseki*.

2. The advantages just outlined have led to considerable studies of consanguinity effects in Japan in recent years. Many of these studies are still in progress. We will not undertake to review all studies relating to the frequency of consanguineous marriage in Japan (Schull

and Neel, 1965).⁵ Rather, the purpose of this paper will be to summarize the findings pertaining to the biological consequences of consanguineous marriages in Japan. The important questions of the manner in which consanguineous marriages may be ascertained, the impact on the data of various methods of ascertainment, the problem of the selection of suitable controls, and the various forms which the analysis may take, cannot be discussed within the scope of this paper. The ways in which those questions are met have very important implications for the data and make it timely to consider how comparable the findings of various investigations really are. While comparability is a perennial problem in population studies, it assumes special significance in this area, because data from the limited range of inbreeding coefficients encountered in human marriages have been subject to extrapolations which are sensitive to small biases and sampling errors.

3. At the outset, we should like to emphasize that while most of us find it difficult to divorce the study on consanguinity effects from thoughts concerning their interpretation, the fact is that while interpretations come and go an intrinsic value remains in knowledge of consanguinity effects in different human populations and the comparability of the data on man with that for other mammals. Should consanguinity effects be found to be similar not only among diverse human populations, but in a variety of mammalian species, including man, one would be justified in inferring, with all the necessary reservations, that certain basic similarities in genetic structure had persisted, despite long-standing evolutionary divergence.

I. THE DATA TO BE COLLECTED IN STUDIES ON CONSANGUINITY EFFECTS

4. The range of data which can be collected

⁵ W. J. Schull and J. V. Neel, *The Effects of Inbreeding in Japanese Children* (New York, Harper and Row, 1965).

¹ K. Ohkura, "Use of the family registration in the study of human genetics in Japan", *Japanese Journal of Human Genetics*, vol. V (1960), pp. 61-98.

² K. Ohkura and K. Watanabe, "Some problems in the study of consanguinity, with special reference to methodology", *Japanese Journal of Human Genetics*, vol. VI (1961), pp. 26-38.

³ T. Yanase, "The study of isolated populations, with special reference to methodology (1)", *Japanese Journal of Human Genetics*, vol. V (1960), pp. 25-45.

⁴ T. Yanase, "The use of the Japanese family register for genetic studies", *Seminar on the Use of Vital and Health Statistics for Genetic and Radiation Studies* (United Nations publication, Sales No.: 61.XVII.8), pp. 119-132.

on consanguinity effects can be organized under six headings, as follows:

(a) Mortality among the offspring of consanguineous marriage;

(b) Physical and intellectual development and morbidity among the offspring of consanguineous marriage;

(c) The fertility of consanguineous marriage;

(d) Mortality among the children of the individual who is the product of inbreeding (unrelated to spouse);

(e) Physical and intellectual development and morbidity among the children of the individual who is the product of inbreeding; and

(f) The fertility of the individual who is the produce of inbreeding.

5. The data to be collected have been listed in the order of their ease of collection, in Japan and in the world at large. As might be expected, the available data reflect this

seriation. The most common data in the literature are concerned with mortality. Acceptable data on the characteristics of inbred children or completed fertility are less common, while data of all three types concerned with the effect of parental inbreeding are almost non-existent, yet studies on inbreeding effects in other mammals, particularly swine, suggest that these effects may be of considerable magnitude (Dickerson and associates, 1954).⁶

II. RESULTS OF STUDIES ON CONSANGUINITY EFFECTS IN JAPAN

6. We shall summarize the results of the studies in Japan on consanguinity effects under the same headings and in the same sequence as listed in Section I.

⁶ G. E. Dickerson, C. T. Blunn, A. B. Chapman, R. M. Kottman, J. L. Krider, E. J. Warwick and J. A. Whatley, Jr., "Evaluation of selection in developing inbred lines of swine", *Missouri Research Bulletin*, No. 551 (1954).

Table 1. A summary of lethal equivalents as estimated for various contemporary Japanese populations

("Total" represents the sum of lethal equivalents manifesting themselves as still-births or deaths between parturition and maturity)

Region	Lethal equivalents			Total	B/A
	Still-births	Neo-natal death	Infantile and juvenile death		
Aizu	—	—	—	0.96 ^a	5.85
Kure	—	0.04 ^b	—	0.04	1.22
Kuroshima:					
Catholic	—	—	—	7.33	—
Buddhist	—	—	—	1.46	—
Hiroshima	0.14	0.29	0.63	1.06	6.08
Nagasaki	—0.02	0.20	0.15	0.33	1.08
Shizuoka	—	—	—	1.11 ^a	5.74
Hoshino	0.15	0.67	—	0.82	10.57
Mishima	0.26	—0.29	0.55	0.52	1.58

^a Inclusion of still-births uncertain.

^b Including still-births.

(a) Mortality among the offspring of consanguineous marriages

7. Table 1 presents certain analyses of these data. Table 2 summarizes the results of studies on mortality. In no sample does the information extend beyond the second decade of life expectancy. Both the data and the analyses differ greatly in information content (for an example, see Kishimoto, Masuda, Fujiki, Watanabe).^{7,8,9} Some samples are

twenty or more times the size of others, some investigations cover only a fraction of the pre-reproductive years, and some regressions involve only two points, others four points.

cil of Japan", *Eugenics Quarterly*, vol. IX (1962), pp. 5-13.

⁸ M. Masuda and N. Fujiki, unpublished observations.

⁹ M. Watanabe, "Racial hygienical studies on dwellers in a mountainous district. I. On the frequency of consanguineous marriage among villagers of Aizu, a mountainous district of Fukushima Prefecture", *Fukushima Igaku Zasshi*, vol. VI (1956), pp. 111-117.

⁷ K. Kishimoto, "Preliminary report of activities of the consanguinity study group of the Science Coun-

Table 2. Mortality in the offspring of consanguineous marriages in Japan

Investigator	Population surveyed	Level of inbreeding in population	Ascertainment of consanguineous marriage	Ascertainment of control marriage	Parental relationship	Number of sibships	Total number of children	Total number of deaths	Per cent mortality					
Watanabe, 1956.	Aizu, a mountainous district of Fukushima Prefecture	23.1% of all marriages consanguineous	Through a study of a junior high school population (at least one child in a sibship had to survive to this age)	Through a study of a junior high school population, with same ascertainment as for consanguineous population	Unrelated	2,674	14,867	1,258	8.46					
					Remote relat. . . .	288	1,579	124	7.85					
					Second cousins . . .	166	922	78	8.45					
					First cousins once removed	75	419	41	9.78					
					First cousins	277	1,674	192	11.47					
					TOTAL	3,480	19,461	1,693	8.70					
					(Age distribution of population at risk not defined — presumably ranges approximately from 1 to 20 years. Inclusion of still-births uncertain)									
					Schull, 1958. . . .	Kure	—	Through pregnancy registration	Through pregnancy registration	Unrelated	—	7,486	265	3.54
										Second cousins . .	—	139	7	5.04
										First cousins once removed	—	111	1	0.90
First cousins	—	314	13	4.14										
(Age limit of population at risk is one month)														
Schull, <i>et al.</i> , 1962	Kuroshima Buddhists and Catholics	Buddhist: F = 0.018 Catholic: F = 0.006	Through a study of <i>koseki</i> and Catholic church records	Through a study of <i>koseki</i> and Catholic church records	Buddhists:									
					Unrelated	21	101	11	10.89					
					Related	14	74	10	13.51					
					Catholics:									
					Unrelated	118	676	61	9.02					
Related	22	149	20	13.42										
(In both religious groups, the age limit of the population at risk is 20 years. The data represent the reproductive performances of all marriages contracted in three hamlets in the years 1920-1939)														
Schull and Neel, 1965	Hiroshima	—	Through pregnancy registration	Through pregnancy registration	Unrelated	—	1,970	162	8.22					
					Second cousins . .	—	390	42	10.77					
					First cousins once removed	—	356	32	8.99					
					First cousins	—	951	108	11.36					
					(Age limit of population at risk averages 8 years)									
Schull and Neel, 1965	Nagasaki	—	Through pregnancy registration	Through pregnancy registration	Unrelated	—	2,847	269	9.45					
					Second cousins . .	—	600	67	11.17					
					First cousins once removed	—	466	26	5.58					
					First cousins	—	1,542	161	10.44					
					(Age limit of population at risk averages 9 years)									

Tanaka, <i>et al.</i> , unpublished, see also Tanaka, 1962 and Kishimoto, 1962	Shizuoka City	—	Through a study of an elementary school population, i.e., at least one child in a sibship had to survive to this age	Through a study of an elementary school population (at least one child in a sibship had to survive to this age)	Unrelated	921	4,227	490	11.59
					Second cousins ..	131	573	78	13.61
					First cousins once removed	94	417	67	16.07
					First cousins	268	1,215	183	15.06
					TOTAL	1,414	6,432	818	12.72
			(Age limit of population at risk is 20 years)						
Yanase, <i>et al.</i> , unpublished, preliminary ..	Hoshino, an isolated district of Fukuoka Prefecture	22.27% of all marriages (F = 0.01088)	Through house-to-house survey, plus <i>koseki</i> records	Through house-to-house survey, plus <i>koseki</i> records	Unrelated	—	1,184	SB ^a 18 MO ^b 27	1.52 2.28
					First cousins ...	—	808	TOTAL 45 SB 16 MO 1 35	3.80 1.98 4.33
								TOTAL 51	6.31
Masuda and Fujiki, unpublished, preliminary ..	Mishima Island, 35 km. from coastal city of Hagi in Yamaguchi Prefecture	23.9% of all marriages consanguineous (F = 0.0115)	Examination of <i>koseki</i> records supplemented by interviews	Examination of <i>koseki</i> records supplemented by interviews	Unrelated	164	648	SB 4 MO 1 40 MO 2-24 20 MO 25-60 11 MO >60 20	0.62 6.17 3.09 1.70 3.09
					Consanguineous (F = 0.0524).	52	211	TOTAL 95 SB 3 MO 1 11 MO 2-24 7 MO 25-60 7 MO >60 6	14.66 1.42 5.21 3.32 3.32 2.84
								TOTAL 34	16.11
			(Age limit of population at risk not defined — presumably ranges approximately from 1 to 20 years)						

^a SB = still-birth.

^b MO = month.

Taken at face value, there is a threefold variation in the estimated number of lethal equivalents,¹⁰ and a tenfold variation in the estimated B/A ratios. Despite the possibility of varying socio-economic biases from group to group (which may even be operating in opposite directions in urban and rural populations) and despite the possibility of error in the determination of the coefficient of inbreeding, none of the regression coefficients upon which these calculations are based can be shown to differ significantly from any of the others. We conclude that it is an open question whether local variation exists in the effect of inbreeding on mortality during the pre-reproductive years in Japan. The number of lethal equivalents appears to be approximately one, and the B/A ratio about five.

(b) *Physical and intellectual development and morbidity among the offspring of consanguineous marriage*

8. The higher death rate of male infants compared with female infants, and the evidence that sex ratio at conception may be significantly higher than at birth, suggest that the increased homozygosity for semi-lethal genes to be expected from inbreeding might result in the death of proportionately more male infants than female infants *in utero*. This fact may be reflected in the sex ratio; however, none of the studies in Japan to date has revealed this to be the case (Schull, 1958; Tanaka, 1964).^{11, 12}

9. With respect to other physical differences between the inbred and the non-inbred child, five studies in particular deserve mention. Ichiba (1953, 1954) examined 2,829 children (190 of consanguineous marriage in grades one to six living in Itadori, Gifu Prefecture; Ina, Nagano Prefecture; Katagiri, Nagano Prefecture; Okisawa, Fukushima Prefecture;

and Sekihara, Tokyo-to).^{13, 14} Fourteen anthropometric measurements, strength of grip, time for the 50-metre run, performance on Tanaka Type B Intelligence Test, and appraisals of temperament were obtained. The effect of consanguinity was estimated by converting the observed measures on the 2,829 children to an adjusted, "standard" measurement and determining whether the measurements on the consanguineous group were uniformly distributed about zero. Regressions on degree of consanguinity were not performed. For all of the indicators, more than 50 per cent of the children born to consanguineous marriages exhibited measurements which were less than the average for the 2,829 children, but the differences were not striking. Ichiba summarized his data with the statement that the effects of consanguinity on the variables he studied must be small, if existent at all.

10. In a study of pre-school and school age children conducted in Kiyotake-mura, Miyazaki Prefecture, Shiroyama (1953) obtained birth weights, heights, weights, and chest circumferences of 121 children born to related parents and 858 children born to unrelated parents.¹⁵ No significant differences with respect to any measurements were found. In another study, Shiroyama and Shiroyama (1953) investigated the mental development of 374 children,¹⁶ forty-eight of whom were the offspring of related parents. A significant proportion of the children of related parents exhibited intelligence quotients of below 70, a proportion higher than that among the children of unrelated parents. For neither of those two studies were the data subjected to regression analysis, and for none of the three studies summarized are socio-economic data available.

11. In a study of stature in 1,896 members of 533 families residing in K. village, located in the southern portion of Fukuoka Prefecture, Furusho (1963) found that the mean value in the whole sample tends to decrease as *F* in-

¹⁰ A lethal equivalent is usually defined as "a group of mutant genes of such number that... they would cause on the average one death, e.g., one lethal mutant, or two mutants with 50 per cent probability of causing death, etc.". N. E. Morton, J. F. Crow and H. J. Muller, "An estimate of the mutational damage in man from data on consanguineous marriages", *Proceedings of the National Academy of Science*, vol. XLII (1956), pp. 855-863.

¹¹ W. J. Schull, "Empirical risks in consanguineous marriages: sex ratio, malformation and viability", *American Journal of Human Genetics*, vol. X (1958), pp. 294-343.

¹² K. Tanaka, "Preliminary report of studies on genetic effects of consanguineous marriages. Ascertainment and estimation of mortality—a consanguinity study in Shizuoka", *Proceedings of the Japanese Academy*, vol. XL (1964), pp. 285-290.

¹³ M. Ichiba, "Study on children born as the result of consanguineous marriage. II. On their physical and mental constitutions", *Nihon Ika Daigaku Zasshi*, vol. XX (1953), pp. 916-922.

¹⁴ M. Ichiba, "Study on children born as a result of consanguineous marriage. III. Fingerprints, blood and morphological characteristics", *Nihon Ika Daigaku Zasshi*, vol. XXI (1954), pp. 113-118.

¹⁵ E. Shiroyama, "On the relation of growth of new-born infants, sucklings and children to consanguineous marriage", *Taishitsu Igaku Kenkyusho Hokoku*, vol. III (1953), pp. 462-464.

¹⁶ E. Shiroyama and T. Shiroyama, "Constitutional studies on the intelligence quotient of pupils in an agricultural district", *Taishitsu Igaku Kenkyusho Hokoku*, vol. III (1953), pp. 465-470.

creases, although the regression coefficient did not differ significantly from zero.¹⁷ The mean values in the offspring of first cousins and second cousins were significantly smaller than the controls, whereas the means for the offspring of first cousins were significantly greater than the control values. The variance for the first cousin offspring was significantly larger than for controls; for second cousin offspring, it was significantly smaller. For the other groups, it was no different. These confusing findings need amplification.

12. Of the extensive data concerning physical characteristics recently collected by a large team of Japanese investigators in Shizuoka, only those pertaining to the anthropometrics have been described in preliminary fashion (Komai, 1963; Ito and Kudo, 1965).^{18, 19} The analysis based on the assumption that the inbreeding effects were the same in all schools sampled and that the various variance-covariance matrices, were homogeneous, reveals small but significant depressions in stature, weight, acromial breadth, chest circumference, head length, head breadth, and head circumference, but no significant depression in sitting height.

13. The most extensive published data on this aspect of consanguinity are those of Schull and Neel from Hiroshima and Nagasaki. Noteworthy facts among their findings will be explained briefly.

(i) Small but uniform depressions exist in the physical dimensions of inbred children. The vector of the regression coefficients associated with the coefficient of inbreeding differs significantly from zero. The findings of Furusho regarding stature suggest that these anthropometric differences may persist into adulthood, that is, the depression in childhood is not compensated by a prolongation of the growing period. Further data on this point are needed. Comparison of the measurements in the female children from the four different kinds of first cousin marriages (whose coefficients of inbreeding for sex-linked genes varies from zero for daughters born to spouses who are offspring of brothers to 3/16 for the daughters of first cousins related through two sisters) provided no evidence for sex-linked modifiers with ma-

nor effects on the traits under consideration (Schull and Neel, 1963);²⁰

(ii) A remarkable concordance exists in the inbreeding depression with respect to the school performance variables, on the one hand, and the psychometric variables, on the other hand. This concordance seems to imply that in Japan there is a high correlation between potential and achievement. Because retarded or conspicuously abnormal children are not included in either set of statistics, the correlation is not explicable in terms of a few intellectual "outliers" contributing to both sets of observations;

(iii) In these data, some 10 to 20 per cent of the "apparent" inbreeding depression is assignable to socio-economic variation. Of especial interest are the degrees to which the anthropometric and psychometric effects are inflated. The former are over-estimated by 15 per cent, and the latter by 18 per cent. These values suggest an equality of environmental plasticity which some might view as surprising; however, when we move from these observations to school performance, we find the latter to be inflated by 23 per cent, on the average, and the impact of the socioeconomic differences becomes clearer. It is patent that the more dependent the variable is upon "home environment", the greater the inflation of the inbreeding effect. Even for variables which might be viewed as highly dependent, such as school performance, a significant but modest inbreeding effect persists. The effect of inbreeding on morbidity appears to be essentially the same for diseases of infectious aetiology as for diseases of a congenital or "idiopathic" nature.

(c) *The fertility of consanguineous marriage*

14. The light in which one views the significance to the species of the mortality and morbidity data presented in the preceding sections will be influenced to a large extent by the reproductive potential of the consanguineous marriage. Were much marriages inherently more fertile—and in theory, they should result in a lessened "incompatibility load" (Crow and Morton, 1960)²¹—then this fact could partially or completely offset the increased mortality and morbidity described in the preceding sections. Conversely, a lessened reproductive potential would intensify the

¹⁷ T. Furusho, "Genetic effects of inbreeding on stature", *Japanese Journal of Human Genetics*, vol. VIII (1963), pp. 195-201.

¹⁸ T. Komai, "Preliminary reports of studies on genetic effects of consanguineous marriages. I. Anthropometric data", *Proceedings of the Japanese Academy*, vol. XXXIX (1963), pp. 380-384.

¹⁹ K. Ito and A. Kudo, "Certain multivariate problems arising in human genetics. II.", *Japanese Journal of Human Genetics*, vol. IX (1965).

²⁰ W. J. Schull and J. V. Neel, "Sex linkage, inbreeding, and growth in childhood", *American Journal of Human Genetics*, vol. XV (1963), pp. 106-114.

²¹ J. F. Crow and N. E. Morton, "The genetic load due to mother-child incompatibility", *American Naturalist*, vol. XCIV (1960), pp. 413-418.

effect. Unfortunately, human fertility is so subject to conscious and unconscious manipulation that the investigator is extremely wary of using this metric as an indicator of biological reproductive capacity. For studies on the relationship between consanguinity and fertility, populations reproducing at near peak capacity would seem to be particularly favourable objects of investigation. Rural Japanese populations of the era preceding the Second World War would seem to come near meeting this specification.

15. The very limited data available from Japan on this point are derived from the studies of Yanase (1962b, 1964) and Schull, Yanase and Nemoto (1962).^{22, 23, 24} Because a minimum of twenty years had elapsed since the contraction of the marriages whose fertility was evaluated, family size was virtually complete for most of these couples. In both sets of data, the reproductive rate tends to be high, exceeded in the summary of Spuhler (1962) only by the reproductive performance of the Hutterites.²⁵ Even so, the higher figure for Catholics than for Buddhists in the data of Schull, Yanase and Nemoto suggests a certain measure of population control in the Buddhists. These limited data fail to suggest a lessened fertility of consanguineous marriages and raise the possibility of an increased fertility level.

16. Because of the strong desire for children in rural Japan, the interval between the date of marriage and the birth of a first child might be as good an indicator of fertility potential as completed family size. No data from rural Japan are yet available on this point. For three urban populations, Hiroshima, Nagasaki and Kure, the interval between beginning of cohabitation and registration of first pregnancy for ration purposes was 12.2 months for unrelated parents and 13.6 months for first cousins, but this difference was not statistically significant.

²² T. Yanase, "The study of isolated populations: an estimation of endogamy", *Japanese Journal of Human Genetics*, vol. VII (1962b), pp. 20-29.

²³ T. Yanase, "Manifestation of congenital abnormalities in the unit of the individual, a kindred, and a population group", *Journal of Public Health*, vol. XXVIII (1964), pp. 61-69.

²⁴ W. J. Schull, T. Yanase and H. Nemoto, "Kuroshima: the impact of religion on an island's genetic heritage", *Human Biology*, vol. XXXIV (1962), pp. 271-298.

²⁵ J. N. Spuhler, "Empirical studies on quantitative human genetics", *Seminar on the Use of Vital and Health Statistics for Genetic and Radiation Studies* (United Nations publication, Sales No.: 61.XVII.8), pp. 241-250.

(d) *Mortality among the children of the individual who is the product of inbreeding*

17. Data on mortality of children born of individuals who are products of inbreeding are scanty. Limited though these data are, they suggest a small increase in early mortality with increasing maternal inbreeding (see Schull, 1959).²⁶ Clearly, further observations are needed on this effect.

(e) *Physical and intellectual development and morbidity among the children of the individual who is the product of inbreeding*

18. The Genetics Long Form employed in the study of the genetic effects of the atomic bomb (Neel and Schull, 1956) contained an item concerning consanguinity of the parents of both the father and the mother of the child.²⁷ Some children for whom Genetics Long Forms were completed were subsequently included (either as control or inbred children) in the sample of children seen in the course of the Schull-Neel study on consanguinity effects in Hiroshima and Nagasaki. In this manner, there was ascertained a sample of 151 children whose parents were themselves inbred. The findings in these children are most provocative (Schull, 1962).^{28, 29} With respect to anthropometrics, the children of inbred parents are larger in all dimensions, save one, than the controls. The changes are exactly opposite in sign to those produced by inbreeding in the child, although neither the individual regressions nor the multivariate vector differs significantly from zero. With respect to the limited psychometric and neuro-muscular data available, the picture is less consistent. The possible role of socio-economic factors has not been explored for these data.

(f) *The fertility of the individual who is the product of inbreeding*

19. Data on this point are quite limited. The most extensive observations are, perhaps, those of Tanaka, Yanase, and Furusho, on the villages of Hishino and Kurogi in Fukuoka

²⁶ W. J. Schull, "Inbreeding effects on man", *Eugenics Quarterly*, vol. VI (1959), pp. 102-109.

²⁷ J. V. Neel and W. J. Schull, "The effect of exposure to the atomic bombs on pregnancy termination in Hiroshima and Nagasaki", *National Academy of Sciences—National Research Council Publication*, No. 461 (1956), pp. xvi and 241.

²⁸ W. J. Schull, "Inbreeding and maternal effects in the Japanese", *Eugenics Quarterly*, vol. IX (1962), pp. 14-22.

²⁹ W. J. Schull and J. V. Neel, "The Child Health Survey: a genetic study in Japan", *Seminar on the Use of Vital and Health Statistics for Genetic and Radiation Studies* (United Nations publication, Sales No.: 61.XVII.8), pp. 171-193.

Prefecture.^{30, 31} These authors found seventy couples among 1,662 cohabiting for five years or more, where the wife had never been pregnant. Regression analysis of these data, based upon a model which assumes that the infertility rate is a function of the relationship between (a) the spouses; (b) the parents of the husband; and (c) the parents of the wife, revealed a significant decrease in infertility with increasing relationship between the spouses, and an increasing infertility rate with

³⁰ K. Tanaka, T. Yanase and T. Furusho, "Effects of inbreeding on sterility in man", *Proceedings of the Japanese Academy*, vol. XLI (in press, 1965).

³¹ K. Tanaka, "Consanguinity study on Japanese populations" in E. Goldschmidt, ed., *The Genetics of Migrant and Isolate Populations* (New York, Association for Aid to Crippled Children, 1963), pp. 169-176.

inbreeding in the wife, but no significant effect of paternal inbreeding. Concern over whether the group "spouses unrelated, and neither spouse inbred" was similar to the other groups led these investigators to fit the regression model previously described to the data, after the exclusion of the aforementioned group. A significant increase in infertility rate with maternal inbreeding remained, but now infertility increased, although not significantly, with relationship between the spouses. Clearly, further observations on this effect are necessary.

20. Several extensive studies are now under way in Japan by Yanase, Yamaguchi and their collaborators, and by Schull, Neel and their collaborators which should supply considerable data on the three aspects of consanguinity effects which we have just mentioned.

Use of vital statistics

HOWARD B. NEWCOMBE

1. Most genetic studies of human populations seek information concerning factors which operate either to modify the composition of the collective pool of genes, or to determine the manner in which a gene pool will be expressed in the phenotypes of the persons of a chosen population. Such studies will, in principle, be aided by using almost any record file in which have been systematically collected various facts concerning family relationships or the biological and social characteristics of individual members of the population. In practice, however, the magnitude of the use of a given record will depend on the quality, quantity and accessibility of the relevant information.

I. INFORMATION CONTENT OF THE VITAL RECORDS

2. In one respect, the information available from vital records is unique. For most industrial countries, the accumulated registrations of births, marriages and deaths include sufficiently unambiguous identifications of persons and of their near relatives to constitute a "family tree" of the population as a whole. This information is not only accurate and virtually complete for all recent events, but constantly is brought up to date. For many registration areas, the records include still births, presumptions of death, annulments, divorces, legitimations, adoptions, and for some populations, early foetal deaths. In the past, the accessibility of such pedigree information for scientific studies carried out on a statistical scale has been regarded as poor; however, there is now ample evidence that, with appropriately designed methods and modern electronic data processing facilities, vital records of family groupings can be established, and pedigree information can be extracted with extreme rapidity.^{1, 2, 3} The chief barriers to using pedi-

gree information are currently organizational, rather than technological.

3. Biological, medical, and social information contained in these records may be regarded correctly as less uniformly reliable than pedigree information; yet for certain population genetic studies, the uses of this information are perhaps greater than generally is recognized. In addition to the causes of death and of still birth, vital records systems commonly collect information on the order of birth, parental ages, birth weight, gestation, legitimacy, twins, race, residence, father's occupation at the time of a child's birth, and religions, occupations and residences of brides and bridegrooms. The vital records systems provide virtually universal recording of a small number of basic biological and social characteristics, which may be studied in relation to geographical settings and family groupings.

4. Sometimes records of biological and medical facts are treated as integral parts of the vital records system. For some registration areas, congenital malformations recognized at birth are entered by the physician either in the birth record or in a separate "physician's notice" of a live birth or a still birth. In localities such as the Canadian province of British Columbia, information concerning the delivery is contained in the physician's notice form. This information may include data regarding the physician's estimate of gestation (as distinct from the mother's estimate), induced *versus* spontaneous labour, operative procedures, anaesthetics or sedatives given, complications of pregnancy or labour, birth injuries, and needs for resuscitation of the child. Many of these facts would be useful in helping to disentangle the contributions of environment and heredity to the cause of conditions subsequently diagnosed as being of mixed origin.

5. In other localities, notably New York City, the ABO and Rh blood types of mothers,

¹ H. B. Newcombe, J. M. Kennedy, S. J. Axford and A. P. James, "Automatic linkage of vital records", *Science*, vol. CXXX (1959), pp. 954-959.

² J. M. Kennedy, "Linkage of birth and marriage records using a digital computer", *AECL Report No. 1258* (Chalk River, Ontario, Atomic Energy of Canada Limited, 1961).

³ H. B. Newcombe and J. M. Kennedy, "Record

linkage: making maximum use of the discriminating power of identifying information", *Communications of the Association for Computing Machinery*, vol. V (1962), pp. 563-566.

and sometimes of fathers, are entered in the birth records; and in at least one registration area (British Columbia), a register of handicap conditions of children and adults is treated as an integral part of the vital records system, with each registration linked to the birth record of the individual concerned. In British Columbia, hospital diagnoses of congenital malformations recently have been employed to increase the complete ascertainment of these conditions in a systematic fashion. Integration of a vital records system and another source of health information of potential genetic significance has taken place on a limited scale. The scale could be extended if there were sufficient demand for additional information.

6. The conventional vital statistics systems, namely, the tabulations relating to a year's events, are of very limited use for population genetic studies. These tap a minute part of the information which is inherent in the accumulated files and they tell little about the reproductive and health histories of individuals and families that are contained in the collected documentation. Examples will be given in this paper of the use of information from the vital records which does not appear in routine tabulations.

II. APPLICATIONS TO PROBLEMS OF POPULATION GENETICS

7. Population genetics seeks to identify the sources of genetic variability arising through mutation and through influx into a population of genes from other groups; to account for the phenotypic expressions of this genetic variability, as modified by deviations from random mating of individuals and by environmental variations; and to measure the extent and genetic consequences of the selective forces which act through differences in fertility and mortality among different phenotypes to modify the transmission of the genes which they carry and to determine the direction and magnitude of changes in the collective gene pool of the next generation.

8. In our experience, vital records have been particularly useful for studies of parental age correlations (of interest in indicating the possibility of elevated mutation rates in aging parents), of selection (observed as differences in maternal fertility following still-birth or birth of a living child later registered as handicapped or as having died), and of the increased risks to brothers and sisters of children who are registered as handicapped, dead or still-born from various causes (of interest for its bearing on the question of monomeric *versus* "quasi-continuous" polygenic inheritance).

9. Other genetic investigations of populations which are possible with the use of vital records relate to assortative mating, migration, miscegenation, twin concordance, selection in relation to continuously distributed traits, such as birth weight, and to monomeric traits, such as blood groupings, identification of cousin marriages, and detection of effects of the maternal, as compared with the foetal genotype, through examination of correlated risks in cousin sib-ships of the four different classifications. Perhaps more important are studies that are possible through using a variety of routinely recorded information of a biological and medical nature, in files other than the vital records, by combining them with the pedigree information that is inherent in the vital registration systems. A few examples of work actually completed will illustrate some of these uses.

III. PARENTAL AGE AND BIRTH ORDER CORRELATIONS

10. The possibility that the risk of some children to certain diseases may be associated with the ages of their parents has stimulated the hope of detecting the effects of increases in mutation rate as parents age.^{4,5} Because correlations can arise for other reasons, these interdependent causes must be identified if the study is to have value. In our studies, one condition which showed a strong correlation with advancing age of the father (when the effects of maternal age differences were removed) was the death of infants and children from pneumonia. Examination of the records indicated a disproportionate risk to children of North American Indians and a tendency for Indian fathers to be older than non-Indian fathers. This paternal age effect was shown to be a product of population heterogeneity, and disappeared when two population groups were treated separately. This example illustrates a need to use information on social characteristics contained in vital records and to employ the birth populations from which the cases were drawn.

11. The studies from which this example was taken were based on records of child handicaps and deaths, which had been linked by use of a computer to the birth registrations of the individuals to obtain necessary birth orders and parental ages. Linked files have been used to identify maternal age effects which are independent of birth order (such as cerebral

⁴ L. S. Penrose, "Parental age and mutation", *Lancet* (August 13, 1955), pp. 312-313.

⁵ T. M. Sonneborn, "Paternal age and stillbirth rate in man", *Records of The Genetics Society of America*, No. 25 (1956), p. 661.

palsy and congenital malformations of the central nervous system), birth order effects which are independent of maternal age (such as strabismus and certain congenital malformations of the nervous system and sense organs), and paternal age effects which are independent of maternal age (such as congenital malformations as a group and deaths from respiratory disease).^{6, 7, 8}

12. Evidence for the non-mutational origins of such correlations may, in some instances, be derived from apparent shifts in the magnitudes of particular parental age effects, as seen in data broken down by some other characteristic. This has been observed, for example, in the elevated risk of asphyxia of the new-born among offspring of older mothers, the maternal age effect being much greater for first and second births than for the higher birth order. Until a variety of such interactions can be explored, the approach will lack an essential element of refinement. To reach this refinement, one must use large numbers of ascertainties of causes of death and of handicap, with a full break-down of the data for cases and for the birth population from which they were drawn. These facts of social characteristics are already in the records of marriages, births, and deaths.

IV. PHENOTYPIC SELECTION

13. The vital records systems particularly are well suited to studies of selection, in that the accuracy and completeness of the family histories of fertility and mortality greatly exceed those of similar histories obtained by interview or questionnaire methods. The quantities of information that can be extracted by modern data processing methods from birth and marriage files is large in comparison with that which can be derived by interview, although studies using vital records initially will be limited to the use of family history extending over short periods of time.

14. In one selection study, a test was made for reproductive "compensation" on the part of mothers whose children had been still-born or had died from various causes, including

erythroblastosis.⁹ This compensation was found, but not quite in the expected form. Mothers of still-born children did tend to have more babies in the next year than would have been expected from their ages and parities, but such compensatory fertility was short-lived. In a four-year period, they proved to be less fertile than the average woman. Mothers whose children had died of erythroblastosis showed no compensation, although such an effect has been postulated for the continued prevalence of the Rh-negative gene in the population.

15. Studies of selection do not require complete ascertainment of all cases of the condition under study in order to achieve a high level of precision. The results are of interest whether the phenotypes are determined by a multiplicity of genes, as in birth weight and certain of the congenital malformations, or by single gene differences, as in the blood types. New York City and Hawaii, where substantial amounts of blood group information are registered and early foetal deaths are registered because of the law, would be ideal for certain selection studies using vital records.

V. EMPIRIC RISKS IN RELATIVES OF CASES

16. Knowledge of the mechanisms of inheritance is largely dependent upon empirical information about the risk of a condition appearing in more than one member of a family, for example, in a co-twin, a sibling, a parent, an offspring, a cousin (of one of the four possible kinds), of an affected person. Such information plays a large part in distinguishing monogenic from polygenic inheritance, in detecting a possible recessive component in the inheritance (whether of a major gene or of polygene alleles), and in distinguishing the so-called "quasi-continuous" variations from simple Mendelian traits with reduced penetrance or expressivity. Vital records have not been used extensively for such studies; however, mention should be made of the family groupings of cases of the central nervous system malformations spina bifida, meningocele, and anencephaly, uncovered by Milham,¹⁰ using birth records for the State of New York. In this instance, the work was done by laborious manual methods to link records. Milham's study has shown that in the doubly affected families there is no special tendency for

⁶ H. B. Newcombe, "Screening for effects of maternal age and birth order in a register of handicapped children", *Annals of Human Genetics*, vol. XXVII (1964), pp. 367-382.

⁷ H. B. Newcombe and O. G. Tavendale, "Maternal age and birth order correlations. Problems of distinguishing mutational from environmental components", *Mutation Research* (in press, 1965a).

⁸ H. B. Newcombe and O. G. Tavendale, "Effect of father's age on the risk of child handicap or death" (in preparation, 1965b).

⁹ H. B. Newcombe and P. O. W. Rhynas, "Child spacing following stillbirth and infant death", *Eugenics Quarterly*, vol. IX (1962), pp. 25-35.

¹⁰ S. Milham, "Random distribution of affected birth ranks in anencephalic and spina bifida subgroups with two affected cases," *Nature*, 200 (1963), pp. 480-481.

adjacent birth ranks to be involved. This observation minimizes the role of causative factors which are contagious or limited in time.

17. The variety of the potential uses of vital records systems for population genetic study greatly exceeds that of the actual cases which are illustrated in examples of current work. Potential utility will increase as other systems of records, such as handicap registers and records of hospital diagnoses, become inte-

grated with the registrations of births, marriages and deaths. Even the integrations of vital registrations with other administrative records, such as those for schemes of family allowance, social security and medical care, should help the potential value of the vital statistics system for study of population genetics. One must remember, however, that the degree to which files become organized for convenient use will depend upon the amount of interest shown in such studies.

The evidence for natural selection due to blood groups

T. EDWARD REED

1. The well-known blood group systems (for example, *ABO*, *Rh*, *MNSs*, *P*, *Kell*, *Duffy*, *Kidd*, *Lewis*, *Lutheran*, *Diego*, *Xg^a*) are "polymorphisms", as defined by E. B. Ford;¹ that is, two or more groups (phenotypes) in each system are each present in frequencies of about 1 per cent or more in one or more extensive populations or areas. Widespread polymorphisms, until recently, were very likely stable polymorphisms. Evidence for stability comes from consideration of spatial and temporal distributions. Considering spatial distribution, the *MNSs* system appears to be polymorphic in every population in every continent. The *Rh* system seems about equally polymorphic, while the *ABO* system is polymorphic in almost every original (non-immigrant) population outside South and Central America. Similar statements can be made about the other systems, while recognizing that some, like *Diego*, have relatively restricted distributions. Equally convincing statements about distributions in time are not possible, but it does seem unlikely that all the presently widespread polymorphisms should have arisen recently, that is, within the last 5,000 years. At least some of the systems, therefore, are likely stable polymorphisms.

2. All theoretically possible processes which can maintain stable polymorphism require differences between genotypes in natural selection values, that is, relative fitness. Fitness is measured by the contribution that a newborn individual will make, on the average, to the genes of the new-born of the next generation. The processes presently recognized are the following:

(a) Heterozygote most fit (two allele system, or modification for three allele system);^{2, 3}

(b) Different selective values in two dif-

ferent "ecological niches", either of which can be occupied;⁴

(c) Selective value of a genotype changes (properly) as its frequency changes;⁵

(d) Different (opposite) selective values in males and females;⁶

(e) Different (opposite) selective values in gametes and zygotes.⁷

The process listed in (a) is the best known possibility, but the other four add variety.

3. If, as seems probable, some of the blood group systems are (or were) stable polymorphisms and if, as seems likely, the only mechanisms for obtaining stable polymorphisms require selective differences between genotypes, then it follows that there are differences in fitness, expressed either in viability or fertility or both, between genotypes in some blood group systems.

I. REVIEW OF EVIDENCE FOR NATURAL SELECTION

4. *Gametes*. E. Matsunaga and Y. Hiraizumi suggested, from a study of *ABO* groups in Japanese family data, that group *O* sperm from *AO* men (heterozygotes with one *A* gene and one *O* gene) had some advantage over *A* sperm ("meiotic drive"),⁸ but this conclusion is uncertain for several reasons. The possible occurrence of selection for the *P* gene and *N* gene has been suggested by Hiraizumi.⁹ The same objections apply here. The known occur-

⁴ H. Levene, "Genetic equilibrium when more than one ecological niche is available", *American Naturalist*, vol. LXXXVII (1953), pp. 331-333.

⁵ R. C. Lewontin, "A general method for investigating the equilibrium of gene frequency in a population", *Genetics*, vol. XLIII (1958), pp. 419-434.

⁶ J. B. S. Haldane, "Conditions for stable polymorphism at an autosomal locus", *Nature*, vol. CXCIII (1962), p. 1,108.

⁷ Y. Hiraizumi, "Are the *MN* blood groups maintained by heterosis?", *American Journal of Human Genetics*, vol. XVI (1964a), pp. 375-379.

⁸ E. Matsunaga and Y. Hiraizumi, "Prezygotic selection in *ABO* blood groups", *Science*, vol. CXXXV (1962), pp. 432-434.

⁹ Y. Hiraizumi, "Prezygotic selection as a factor in the maintenance of variability", *Cold Spring Harbor Symposium on Quantitative Biology*, vol. XXIX (1964b).

¹ E. B. Ford, "Polymorphism and taxonomy", *The New Systematics* (Oxford, Oxford University Press, 1940).

² R. A. Fisher, *The Genetical Theory of Natural Selection*, (Oxford, Clarendon Press, 1930).

³ S. P. H. Mandel, "The stability of a multiple allelic system", *Heredity*, vol. XIII (1959), pp. 289-302.

rence of aberrant segregation ratios in mice,¹⁰ and probable occurrence in man,¹¹ make meiotic drive an interesting, but yet unproved possibility in blood group genetics.

5. *In utero selection.* Selection *in utero*, when present, may be detected by disturbed segregation ratios and by foetal deaths. Since disturbed ratios can also result from meiotic drive, additional information is required to attribute the disturbance to *in utero* selection. The principal cause of reported disturbed segregation ratios in the *ABO* system is maternal foetal incompatibility, but it is now clear that this effect is variable from population to population, ranging from reported deficiencies of 23 per cent of *A* children in the mating $A\delta \times \text{♀ } O$ in certain Japanese studies,¹² to no deficiencies of *A* children from this mating, or of *B* children from $B\delta \times \text{♀ } O$ matings, in a recent Japanese study.¹³ These Japanese results are especially interesting since the author, Y. Hiraizumi, has shown that in other Japanese studies, those done before 1945 show the deficiency of maternally-incompatible *A* and *B* children found by Matsunaga, but those done after 1949 did not, agreeing with Hiraizumi's negative result. These results are interpreted as showing the effect of recently improved environmental conditions. This newly found temporal effect makes the segregation interpretations of Chung, Matsunaga and Morton on pooled Japanese data somewhat less clear,¹⁴ they found definite, but variable incompatibility effects. *ABO* incompatibility in Caucasoids (used here for persons of European ancestry) has been studied by many workers. Chung and Morton,¹⁵ in their survey of published data, found significant incompatibility (*A* or *B*) in their pooled data. Considering segregation apart from incompatibility effects in the *ABO* system, the latter authors

in Caucasoid data, and Chung, Matsunaga and Morton in Japanese data,¹⁶ claim to find an excess of heterozygotes in compatible matings. It must be noted that the serological inability to distinguish *AA* from *AO* and *BB* from *BO* and that the assumptions used in their model (including the assumption that all three heterozygotes have equal fitness) must reduce the certainty of this conclusion.

6. Segregation proportions in the *MN* system have been studied often and an apparent excess of *MN* children from certain matings (one or both parents *MN*) has been noted. This is due to *MN* advantage and not to technical error, according to the studies of Morton and Chung,¹⁷ and Chung with Morton and Matsunaga.¹⁸ The importance, again, of the selection model tested in producing this conclusion is emphasized by Hiraizumi.¹⁹ He showed formally that a model without *MN* advantage, but with an abnormal meiotic segregation ratio (favouring *N* over *M* gametes) and a disadvantage of *N* persons, could explain the observed family segregation proportions and could lead to a stable polymorphism. It appears that there may be a real excess of *MN* children, which may be due to selection in one of several places in the life cycle.

7. Abnormal segregation has also been reported in the *Rh* system by Gershowitz.²⁰ Studying separate antigens *C*, *c*, *D*, *E*, and *e*, he found an excess of heterozygotes in the matings $Cc \times cc$, $Dd \times dd$, and $Ee \times ee$, the excess from the first mating being significant at the 0.001 level. His families were selected for the presence of a child with a severe disease, which may explain why this phenomenon has not been found previously. These results suggest that there is *Rh* selection at some early stage, either meiotic, gametic, or zygotic.

8. Data on six blood group systems and foetal deaths (abortions and still births) are now available. The extensive *ABO* data from Japan on normal couples, again, give interesting re-

¹⁰ L. C. Dunn, "Variations in the segregation ratio as causes of variations of gene frequency", *Acta Genetica et Statistica Medica*, vol. IV (1953), pp. 139-147.

¹¹ M. W. Shaw, H. F. Falls and J. V. Neel, "Congenital aniridia", *American Journal of Human Genetics*, vol. XII (1960), pp. 389-415.

¹² E. Matsunaga, "Intra-uterine selection by the *ABO* incompatibility of mother and foetus", *American Journal of Human Genetics*, vol. VII (1955), pp. 66-71.

¹³ Y. Hiraizumi, "Prezygotic selection as a factor in the maintenance of variability", *Cold Spring Harbor Symposium on Quantitative Biology*, vol. XXIX (1964b).

¹⁴ C. S. Chung, E. Matsunaga and N. E. Morton, "The *ABO* polymorphism in Japan", *Japanese Journal of Human Genetics*, vol. V (1960), pp. 124-134.

¹⁵ C. S. Chung and N. E. Morton, "Selection at the *ABO* locus", *American Journal of Human Genetics*, vol. XIII (1961), pp. 19-27.

¹⁶ C. S. Chung, E. Matsunaga, N. E. Morton, op. cit.

¹⁷ N. E. Morton and C. S. Chung, "Are the *MN* blood groups maintained by selection?", *American Journal of Human Genetics*, vol. XI (1959), pp. 237-251.

¹⁸ C. S. Chung, E. Matsunaga and N. E. Morton, "The *MN* polymorphism in Japan", *Japanese Journal of Human Genetics*, vol. VI (1961), pp. 1-11.

¹⁹ Y. Hiraizumi, "Are the *MN* blood groups maintained by heterosis?", *American Journal of Human Genetics*, vol. XVI (1964a), pp. 375-379.

²⁰ H. Gershowitz, "Segregation distortion in the *Rh* system", *Annual meeting, American Society of Human Genetics* (1963).

sults. Two large studies, those of Matsunaga and Itoh,²¹ and those of Haga,²² agree in showing a significantly higher frequency of abortions to incompatible couples than to compatible couples, but the recent study of Hiraizumi showed no difference.²³ One study of Caucasoids selected for habitual abortion showed an increased proportion of *ABO* incompatible couples,²⁴ while another showed a similar increase for late foetal deaths.²⁵ In contrast, one study on normal Caucasoid (American) couples found no effect of *ABO* groups on abortion or still births.²⁶ Another study on American couples found that *ABO* incompatible couples had more children than compatible couples.²⁷ In the *Rh* system, the clinical effects of hemolytic disease of the new-born (mainly due to anti-*D* antibody) are well known. In spite of this, Grubb and Sjöstedt found no *Rh* frequency differences in couple with abortions.²⁸ Reed and his associates found differences between mating types in abortion frequencies (but not still births), but these were not due to *D* antigen incompatibility. This latter study found no mating type differences in foetal deaths in the *MN* or *P* systems, nor did Matsunaga and Itoh.²⁹ Reed found no clear-cut effects on foetal deaths of the *Kell*, *Duffy*, or *ABH* secretor status.³⁰ (Note. Because of the large number of significance tests performed,

the significance level used for the study by Reed and his associates is 0.01, not 0.05.)

9. *Post-natal selection.* Selection after birth can be shown either by studying the blood groups of deceased individuals or by change in blood group frequency with age. In the *ABO* system two studies, that of Reed and that of Bennett and Walker,^{31,32} have shown that the children of group *O* fathers (*O*, *Rh*+) in the latter study) are more likely to die in childhood than are other children. Several studies have suggested that old people differ from young people in frequencies, but these claims are not consistent,^{33,34} and the large study of blood donors by Roberts did not confirm this.³⁵ The now well known associations of group *O* or group *A* with certain diseases must be mentioned here. (For a review, see Race and Sanger.)³⁶ It is important to note that all of the well established associations (for example, *O*-ulcer, *A*-cancer of the stomach, *A*-pernicious anæmia, and *A*-diabetes mellitus) involve diseases which have a late onset, usually after reproduction is completed, and therefore have relatively little effect on genetic fitness. For the United States (Caucasoid) population in 1955, Reed calculated that, of the total reproductively important part of the population (under forty-five years old), only 2×10^{-5} of it dies each year from these five diseases together.³⁷ Association of *ABO* antigens with infectious diseases, in contrast, could, in theory, have important selective effects. The reported serological association between *A* or *O*(*H*) antigens and the organisms causing plague and smallpox, which could cause differential susceptibility to these diseases, has been challenged and is a matter for experts.^{38,39}

³¹ *Ibid.*

³² J. H. Bennett and C. B. V. Walker, "Fertility and blood groups of some East Anglian blood donors", *Annals of Human Genetics*, vol. XX (1956), pp. 299-308.

³³ S. Murray, "*ABO* groups and *Rh* genotypes in the elderly", *British Medical Journal*, vol. II (1961), pp. 1,472-1,474.

³⁴ T. E. Reed, "Polymorphism and natural selection in blood groups", in B. S. Blumberg, ed., *Proceedings of the Conference on Genetic Polymorphisms and Geographic Variations in Disease* (New York, Grune and Stratton, 1961).

³⁵ J. A. F. Roberts, "The frequencies of the *ABO* blood groups in South-western England", *Annals of Eugenics*, vol. XIV (London, 1948), pp. 109-116.

³⁶ R. R. Race and R. Sanger, *Blood Groups in Man*, 4th ed. (Oxford, Blackwell, 1962).

³⁷ T. E. Reed, "Polymorphism and natural selection in blood groups", in B. S. Blumberg, ed., *Proceedings of the Conference on Genetic Polymorphisms and Geographic Variations in Disease* (New York, Grune and Stratton, 1961).

³⁸ G. F. Springer, A. S. Wiener, H. J. Pettenkofer, B. Stöss, W. Helmbold and F. Vogel, "Alleged causes of the present-day world distribution of the

(foot-notes continued on page 501)

²¹ E. Matsunaga and S. Itoh, "Blood groups and fertility in a Japanese population, with special reference to intra-uterine selection due to maternal-foetal incompatibility", *Annals of Human Genetics*, vol. XXII (1958), pp. 111-131.

²² H. Haga, "Studies on natural selection in *ABO* blood groups with special reference to the influence of environmental changes upon the selective pressure due to maternal-foetal incompatibility", *Japanese Journal of Human Genetics*, vol. IV (1959), p. 120.

²³ Y. Hiraizumi, "Prezygotic selection as a factor in maintenance of variability", *Cold Spring Harbor Symposium on Quantitative Biology*, vol. XXIX (1964b).

²⁴ C. McNeil, L. C. Warenski, C. D. Fullmer and E. F. Trentleman, "A study of the blood groups in habitual abortion", *American Journal of Clinical Pathology*, vol. XXIV (1954), pp. 767-773.

²⁵ R. Grubb and Sjöstedt, "Blood groups in abortion and sterility", *Annals of Human Genetics*, vol. XIX (1955), pp. 183-195.

²⁶ T. E. Reed, H. Gershowitz, A. Soni and J. Napier, "A search for natural selection in six blood group systems and *ABH* secretion", *American Journal of Human Genetics*, vol. XVI (1964), pp. 161-179.

²⁷ T. E. Reed and J. H. Aronheim, "An association between *ABO* blood groups and fertility in a normal American population", *Nature*, vol. CLXXXIV (1959), pp. 611-612.

²⁸ R. Grubb and Sjöstedt, *op. cit.*

²⁹ E. Matsunaga and S. Itoh, *op. cit.*

³⁰ T. E. Reed, H. Gershowitz, A. Soni and J. Napier, "A search for natural selection in six blood group systems and *ABH* secretion", *American Journal of Human Genetics*, vol. XVI (1964), pp. 161-179.

10. For the *Rh* groups, the only claim for genetically effective selection is that of Bennett and Walker,⁴⁰ finding an increased mortality rate under ten years of children of *O*, *Rh* positive fathers. Reed found no effect on childhood mortality under five years.⁴¹ Murray reported an increase in *Rh D/D* homozygotes in healthy English persons more than sixty-four years of age.⁴² For the *P* system, Reed found an increase in the mortality among children of *P* negative mothers.⁴³ There appear to be no other studies on this point. Other systems studied by Reed and found to have no significant effects include *MN*, *Kell*, *Duffy* and *ABH* secretion.

11. *Primary fertility effects.* The possible primary effects (theoretically measured by the number of fertilized eggs) of blood groups on fertility can, for convenience, be considered as acting in two ways, either causing (or increasing the tendency toward) sterility or affecting the number of pregnancies among the fertile.

12. Six studies have been reviewed for sterility,^{44, 45, 46, 47, 48, 49} and three have been reviewed for number of pregnancies.^{50, 51, 52}

human *ABO* blood groups", *Nature*, vol. CXCI (1962), pp. 444-446.

³⁹ R. Harris, G. A. Harrison and C. J. M. Randle, "Vaccina and human blood group A substance", *Lancet*, vol. I (1962), p. 622.

⁴⁰ J. H. Bennett and C. B. V. Walker, "Fertility and blood groups of some East Anglian blood donors", *Annals of Human Genetics*, vol. XX (1956), pp. 299-308.

⁴¹ T. E. Reed, H. Gershowitz, A. Soni and J. Napier, "A search for natural selection in six blood group systems and *ABH* secretion", *American Journal of Human Genetics*, vol. XVI (1964), pp. 161-179.

⁴² S. Murray, "*ABO* groups and *Rh* genotypes in the elderly", *British Medical Journal*, vol. II (1961), pp. 1,472-1,474.

⁴³ T. E. Reed, H. Gershowitz, A. Soni and J. Napier, *op. cit.*

⁴⁴ S. J. Behrman, J. Buettner-Janusch, R. Heglar, H. Gershowitz and W. L. Tew, "*ABO(H)* blood incompatibility as a cause of infertility: a new concept", *American Journal of Obstetrics and Gynecology*, vol. LXXIX (1960), pp. 847-855.

⁴⁵ R. Grubb and Sjöstedt, "Blood groups in abortion and sterility", *Annals of Human Genetics*, vol. XIX (1955), pp. 183-195.

⁴⁶ H. Haga, "Studies on natural selection in *ABO* blood groups, with special reference to the influence

II. OBSERVED RESULTS

13. The table summarizes and evaluates the results presented. The evaluation is necessarily somewhat arbitrary and personal, but still it should have some merit. It should be stressed that the numerous negative findings are not particularly meaningful. Each can be criticized on various grounds, such as size and composition of the population studied. None of the reported effects can be related unequivocally to the five genetic mechanisms listed as capable of maintaining balanced polymorphism. This is mainly because the effects are for only a small part of the life cycle and we are unable to relate them to selection elsewhere in the cycle or to selection over the whole cycle. In particular, we cannot show a definite example of heterozygote advantage maintaining a blood group polymorphism. The statements of Chung, Matsunaga and Morton and of Chung and Morton in the *ABO* system for heterozygote advantages for compatible zygotes are qualified and are derived from the particular model tested. At the same time, heterozygote advantage, over-all or in one part of the life cycle, may very well be present, but still undetected. Many geneticists think the necessity for some mechanism of the types described is convincing. They think it is a matter of time and labour until these mechanisms are understood. The writer shares this view.

of environmental changes upon the selective pressure due to maternal-fœtal incompatibility", *Japanese Journal of Human Genetics*, vol. IV (1959), pp. 1-20.

⁴⁷ Y. Hiraizumi, "Prezygotic selection as a factor in the maintenance of variability", *Cold Spring Harbor Symposium on Quantitative Biology*, vol. XXIX (1964b).

⁴⁸ E. Matsunaga and S. Itoh, "Blood groups and fertility in a Japanese population, with special reference to intra-uterine selection due to maternal-fœtal incompatibility", *Annals of Human Genetics*, vol. XXII (1958), pp. 111-131.

⁴⁹ T. E. Reed, H. Gershowitz, A. Soni and J. Napier, "A search for natural selection in six blood group systems and *ABH* secretion", *American Journal of Human Genetics*, vol. XVI (1964), pp. 161-179.

⁵⁰ Y. Hiraizumi, *op. cit.*

⁵¹ E. Matsunaga and S. Itoh, *op. cit.*

⁵² T. E. Reed, H. Gershowitz, A. Soni and J. Napier, *op. cit.*

Summary and evaluation of reported natural selection due to blood groups
(magnitude ignored; may not be constant in time and place)

Blood group system	Viability selection						Overall evaluation
	Gametes (or meiotic drive)	In utero and peri-natal		Post-natal	Fertility selection ^a		
		Fatal death data	Segregation data ^b		Sterility	Number of pregnancies	
ABO	*	***	**	***	*	0	***
Rh	—	***	**	*	0	0	***
MN	*	0	*	0	*	0	**
P	*	0	0	*	0	0	*
Kell	—	0	0	0	0	**	**
Duffy	—	0	0	0	0	0	0
ABH secretion	—	0	0	0	0	0	0

^a "Primary" selection, before *in utero* selection is known to act.

^b May be confused with meiotic drive.

Evaluation of evidence:

*** Definite;

** Probable (including single reports if $P < .001$);

* Possible (conflicting or disputed evidence, or single report only if $P > .001$);

0 Tested for, but no effect at the 0.05: level (0.01 level in Reed, *et al.*, 1964). Rare maternal-fetal incompatibility ignored.

— No data.

Inbreeding in India

L. D. SANGHVI

1. In order to understand the pattern of consanguineous marriages in India, it is necessary to know three important marriage rules. The first one is the rule of endogamy (marrying within a group), which defines a caste and which remains its most persistent feature even today. The second one is the *gotra* rule, which prohibits marriages between individuals who belong to the same *gotra*. *Gotras*, which are usually small in number (fifteen to twenty-five for Brahmans), divide a caste into exogamous (marrying-out) sections. They are also known by other names in different castes and tribes and are transmitted in the male line. One of the important consequences of this rule, as far as inbreeding is concerned, is to prohibit marriages between children of two brothers. The third one is the *sapinda* rule, which requires that no marriage should take place among cousins through the fifth cousins on the mother's side and the seventh cousins on the father's side. This rule produces almost no inbreeding in a genetic sense. A rigorous enforcement of this third rule requires maintenance of pedigree records over a long period of time. There is evidence that, in some Brahman castes, records were kept with great care.

2. The population of India is divided into numerous castes or endogamous groups, not only among followers of the Hindu religion, but also among the followers of Islam and of Christianity. The *gotra* rule or the rule of exogamy is followed by the Hindus throughout India and its influence also is seen in Moslems and Christians in certain regions of the country. As far as the *sapinda* rule is concerned, the country is divided into two distinct geographical zones (see map). In north India, where this rule is enforced, the inbreeding levels would be even lower than the current levels in western European countries. In south India, however, not only is this rule relaxed, but a high preference is given to certain consanguineous marriages. The most common of these is the marriage of matrilinear cross-cousins (a boy to his maternal uncle's daughter).

3. *Data on inbreeding in India.* At the World Population Conference in 1954, I pre-

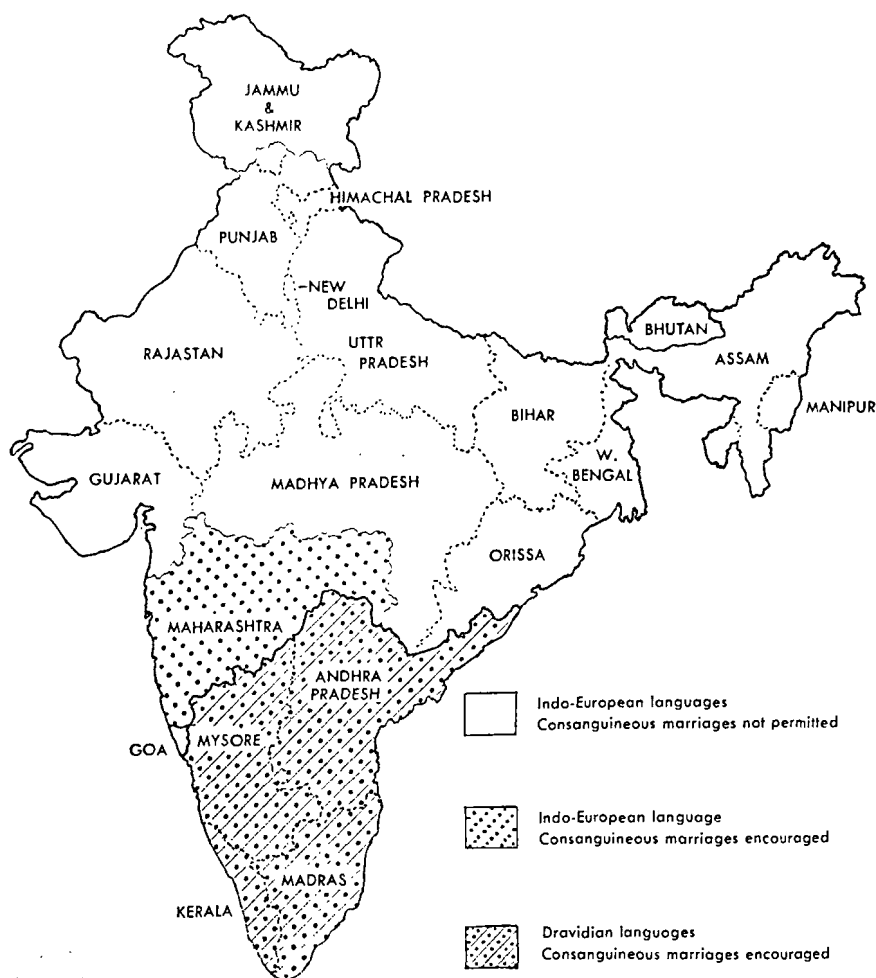
sented for the first time quantitative data on consanguineous marriages from India.¹ After this study and its presentation, we made our study of inbreeding in twelve endogamous groups in Bombay, based on a sample of 6,597 marriages.² An opportunity was presented to us later to carry out a consanguinity survey of rural areas of Andhra Pradesh during 1957-1958. A sample of 6,945 marriages was collected from thirty-nine villages spread over fourteen districts. Dronamraju and Meera Khan have also published some data on inbreeding from an urban centre in Andhra Pradesh. To complete this picture, data on consanguineous marriages have been collected from 500 villages spread over the country along with the 1961 census operation. These data are expected to be published shortly by the Registrar General of India.

4. *Inbreeding in Bombay.* Seven of the twelve groups studied in Bombay belonged to the Hindu community. There were two castes of Brahmans, two castes of writers, a large agricultural caste, a caste of salt workers and a caste of Harijans (formerly untouchables). Rates of consanguineous marriages were low among the Brahman and the writer castes, giving the coefficient of inbreeding varying from 0.001 to 0.003.³ In the other three castes, it varied from 0.005 to 0.007. Among these seven castes, the consanguineous type that contributed mainly to inbreeding was the matrilinear cross-cousin. In addition, there were three Moslem groups, one group of Parsi and one Christian group. The coefficient of inbreeding among the Moslems and the Parsis was high, varying from 0.006 to 0.013. The Christians who were Roman Catholics gave a value of 0.001. In all these non-Hindu commu-

¹ L. D. Sanghvi, "Genetic diversity in the people of western India", *Eugenics Quarterly*, vol. I (1954), pp. 235-239.

² L. D. Sanghvi, D. S. Varde and H. R. Master, "Frequency of consanguineous marriages in twelve endogamous groups in Bombay", *Acta Genetica et Statistica Medica*, vol. VI (1956), pp. 44-99.

³ Coefficient of inbreeding is defined as the probability that a pair of genes at any particular locus in an offspring is derived from a single gene present in one of the ancestors common to both the parents.



Languages and pattern of consanguineous marriages in India

nities, the marriages of first cousins represented all the four possible types. There was evidence of decline of inbreeding in the Parsis in the last twenty-five years, but not in any other group.

I. INBREEDING IN ANDHRA PRADESH

5. Our study of inbreeding in the rural areas of Andhra Pradesh was a part of a survey of smoking and chewing habits in relation to oral cancer. Three interviewers selected from Andhra Pradesh were specially trained for this purpose in Bombay. The work was carried out under supervision and independent checks were made for accuracy of information. A total of 7,249 men more than thirty years old were interviewed during the course of this survey. Of these, 227 were bachelors and information on consanguinity was not elicited in

seventy-seven cases, leaving a sample of 6,945 marriages for this study. During a preliminary run in this area, a high proportion of maternal uncle-niece marriages was found, in addition to cross-cousin marriages. Information other than these facts was not very reliable. On the other hand, sample checks showed that a small proportion of marriages reported as first cousin marriages were actually of second cousins. On the whole, these errors on either side appeared to balance each other and the co-efficients of inbreeding reported below may be taken as reliable for the rural areas of Andhra Pradesh.

6. The main feature of the data was the high proportion of uncle-niece and matrilineal cross-cousin types, which accounted for two of every five marriages. Only 2.13 per cent of marriages were of patrilineal cross-cousins. Two marriages in the series were recorded as

between children of two sisters. Further inquiry indicated they were exceptions that were not tolerated in the community. In other words, the *gotra* rule, which prevented marriages of paternal cousins among Hindus in all the country, seems to extend also to maternal cousins in Andhra Pradesh. The coefficient of inbreeding was 0.032 for autosomal genes and 0.051 for sex-linked genes. These rates, which are exceedingly high for any large human population, may be compared with some theoretical values. If, for instance, a population were perpetuated entirely by first cousin marriages, the coefficient of inbreeding would be 0.0625. If it were continued by marriages only of first cousins once removed, the coefficient would be 0.0313. The figures for Andhra Pradesh lie between these values.

7. Data analysed according to districts showed that the highest concentration of inbreeding was in the coastal areas of Vishakhapatnam and East Godvari (0.048 and 0.045).⁴ Inbreeding gradually diminished in the interior districts. In the districts of Karimnagar and Nizamabad, uncle-niece marriages were almost non-existent (0.023 and 0.015). Data analysed according to occupational caste groups showed that the inbreeding levels were lowest among the Brahmans (0.019) and highest among the shepherds (0.038) and fishermen (0.047). One of the interesting features that the study revealed was the pattern of consanguinity among the Moslems and the Christians. Like the Hindus in this region, these two communities practised uncle-niece and cross-cousin marriages, but did not resort to the other two types of parallel cousin marriages. This was in contrast to the custom among the Moslems and Christians in Bombay where they practised all four types of first cousin marriages. The local custom of consanguineous marriages in Andhra Pradesh had deeper roots than could be modified by religious influence, which came there at a later stage. The data from rural areas of Andhra Pradesh, with detailed discussion, are being published elsewhere.

8. Dronamraju and Meera Khan reported data collected from married in-patients of King George Hospital,^{5,6} and from parents of school children in Visakhapatnam. The coefficient of

inbreeding for the patients was 0.028, and for parents of school children was 0.019. Their data further showed that inbreeding levels were higher in persons with rural background, in conformity with the findings reported above. The authors have further analysed their data with respect to caste, literacy and bridal age.

II. GENETIC EFFECTS OF INBREEDING

9. Consanguineous marriages reduce the frequency of heterozygotes in the population and distribute them equally to the two homozygotes. The homozygote, which is rare, has a proportionately bigger gain. If the frequency of two alleles at a locus is equal, inbreeding has equal effect on both homozygotes. This balance changes progressively as the frequency of one of the alleles gets smaller and smaller. The inbreeding effect is most pronounced on homozygotes determined by very rare genes.⁷ For instance, phenylketonuria (a severe mental defect), which has an incidence of about one in 40,000 offspring of unrelated marriages, rises thirteen times in the children of first cousin marriages. Similar observations have been recorded for albinism, *ichthyosis congenita*, amaurotic idiocy and several other conditions.

10. Unfortunately, our knowledge of the role of heredity and, in particular, of genes, which, when homozygous, contribute to morbidity and mortality, is woefully inadequate. In order to overcome this difficulty, a number of empirical studies have been carried out, comparing the effects in children of unrelated and consanguineous parents. The most extensive of these studies is the one carried out in Japan, in which observations were made on children from birth to the age of eight years.⁸ There was no significant effect of inbreeding on still births. In infants, during the first nine months, mortality increased from 4.7 per cent in the offspring of unrelated parents to 6.6 per cent in those of first cousins. Between one and eight years of age, the corresponding increase in mortality was from 1.5 per cent to 4.6 per cent. In a large series of 63,796 pregnancy terminations, malformations were observed in 1.02 per cent of infants at birth in the unrelated series, as compared to 1.69 per cent in the inbred series. Other studies also show similar harmful effects in children of consanguineous marriages. From these observations, it has been estimated that

⁴ The values in parentheses in this paragraph refer to the coefficient of inbreeding for autosomal genes.

⁵ Dronamraju and Meera Khan, "Inbreeding in Andhra Pradesh", *Proceedings of the Second International Congress on Human Genetics*, vol. I (1961), pp. 126-130.

⁶ Dronamraju and Meera Khan, "A study of Andhra marriages: consanguinity, caste, illiteracy and bridal age", *Acta Genetica et Statistica Medica*, vol. XIII (Basel, 1963), pp. 21-29.

⁷ L. D. Sanghvi, "The concept of genetic load: a critique", *American Journal of Human Genetics*, vol. XV (1963), pp. 298-309.

⁸ W. J. Schull, "Empirical risks in consanguineous marriages: sex ratio, malformation and viability", *American Journal of Human Genetics*, vol. X (1958), pp. 294-343.

individuals in these populations carry, on an average, 2-4 lethal genes (or their equivalents) which cause death and 2-4 detrimental genes (or their equivalents) which cause malformations, mental defects and other serious anomalies.⁹

11. The study of inbreeding in Andhra Pradesh has revealed a somewhat complex problem. Not only are the inbreeding levels exceedingly high for a population of approximately 30 million (and this high level may be true even of the populations of Madras, Mysore and Kerala States of south India), but there is evidence to suggest that this practice was prevalent at the beginning of the Christian era and perhaps earlier.¹⁰ If so, there would have been a considerable decline in the frequency of deleterious and lethal genes and theoretically, the population should have an excellent gene pool, the fruits of which can be harnessed by a change in their marriage pattern.

⁹ United Nations, *Report of the United Nations Scientific Committee on the Effects of Atomic Radiation*, Seventeenth Session, Supplement No. 16 (A/5216) (New York, United Nations, 1962).

¹⁰ K. A. N. Sastri, *A History of South India from prehistoric times to the fall of Vijayanagar* (Madras, Oxford University Press, 1955).

12. The consequences would be different for the genes which are maintained by mutation and those which are maintained by selective advantage of the heterozyte. My preliminary calculations show that a condition such as phenylketonuria, with a frequency of one in 40,000 without inbreeding, will rise in frequency to eleven cases in 40,000 in a population with a coefficient of inbreeding of 0.05. If the gene was maintained by mutation, the frequency will decline gradually to one case in 37,000 in one hundred generations, and will revert to one case in 40,000 in approximately two hundred generations. Thereafter it will remain stationary at this frequency if there is no change in marriage pattern. On the other hand, if the gene was maintained by selection, the frequency will decline more rapidly. There will be one case in 250,000 in one hundred generations, and one case in a million in 133 generations. In two hundred generations, the frequency would have gone down to one case in 20 million people. An observational study of recognizable recessive genes in Andhra Pradesh would provide definite evidence as to which genes are maintained by mutation and which are maintained by selection.

Population genetics of haemoglobin variants, thalassaemia and *G6PD*-deficiency, with particular reference to the malaria hypothesis

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S. PIOMELLI and M. RATTAZZI

1. The idea that not all individuals were equally liable to malarial infection was first put forward by J. B. S. Haldane, in 1949, to explain the preponderance of thalassaemia in the Mediterranean basin. A few years later, Allison, in 1954, reported to everybody's excitement that people carrying the sickle-cell trait indeed were more resistant to sub-tertian malaria. This claim, though disputed in a few instances, is now supported by an overwhelming body of data, including three types of evidence:

(a) The direct demonstration in areas where malignant malaria is still endemic that young children heterozygous for the sickle-cell gene have lower *Plasmodium falciparum* parasite counts than non-sickling children;

(b) The low incidence of sickling carriers among the cases of fatal malarial infections observed in the same areas;

(c) The overlapping between the world distribution of the sickle-cell trait and that of malignant malaria.

2. For various reasons the only evidence supporting the relationship between malaria, thalassaemia and *G6PD*-deficiency comes exclusively from population studies showing a positive correlation between the incidence of these genes and malarial morbidity. Even these studies present difficulties and require ethnical homogeneity among the "genetical isolates" chosen for study, accurate historical data on malarial morbidity and a "control" population.

3. The island of Sardinia was an ideal place for these population studies. The degree of isolation is still high for most of its villages and its geography is such that within a few hundred square miles one can easily find isolated settlements that have had a very high malarial morbidity in the past and other settlements that always have been practically free from malaria. Furthermore, one can reasonably assume that the population of Sardinian villages must have remained free from external admixtures over a long period of time.

I. SUMMARY OF SARDINIAN POPULATION DATA

4. Samples from fifty-two villages and more than 6,000 persons were examined. There is a positive correlation between the incidence of thalassaemia and *G6PD*-deficiency, with a straight regression line to the level of about 24 per cent. Above that frequency the correlation disappears, probably because the gene for thalassaemia, lethal in the homozygous condition, can never reach equilibrium levels as high as ones possible for the unfavourable gene for the enzyme deficiency.

5. Simple considerations of population genetics make the following facts clear:

(a) Levels of gene frequency as those reported for the villages in the Sardinian plains could not be explained without the assumption of a higher fitness of the heterozygous genotype for thalassaemia and of the heterozygous and perhaps the hemizygous and homozygous genotypes for the enzyme deficiency;

(b) A "migration" hypothesis, in particular, is grossly inadequate to account for the very high frequencies found in the plains, since these frequencies could not be expected even if one assumes — against all historical evidence — that the autochthonous populations had been replaced totally by equally numerous groups of immigrants, all carriers of thalassaemia and enzyme-deficiency or both of these;

(c) If the genetical heterogeneity between the low-land and the high mountain villages has been due to a different fitness value of the carrier genotypes, malignant malaria is the obvious ultimate factor to suspect because the two ecological environments are known to have differed from each other through centuries and almost exclusively in respect to malarial morbidity and mortality. This situation changed only twenty years ago.

6. There is a negative correlation with altitude, but the correlation must turn out to be a positive one when the gene frequencies are compared with the relative incidence of malaria. We have shown this previously in a study

group of villages for which direct estimates of past malarial morbidity are available.

7. A few villages require special mention. Carloforte is the only village on the island of San Pietro, which is next to the very malari-ous plains of the South West Sardinian coast. From the time of the first settlement, about 1700, until recently the population of 7,000 has remained very isolated from the rest of Sardinia. In spite of heavy malarial morbidity in the past, only a few genes for thalassaemia or *G6PD*-deficiency are present in the population. Genealogical studies show that these have been derived from Sardinian ancestry.

8. Usini is a village not far from the North West coast of Sardinia, where settlements of Spanish and Genovese origin are found. Here the intermixtures with the inland population has presumably been massive and frequent, and thus the intermediate values of gene frequencies found nowadays are an obvious consequence.

9. Lodé and Alá dei Sardi are two villages particularly meaningful for stressing the relationship between the high gene frequencies and the past malarial prevalence. Beyond any doubt the date of formation of these villages is very remote. Their isolation has been extremely strict until a few years ago. Fermi, in 1938, reported an intense malarial morbidity for both these villages, in spite of the relatively high altitude of one of them, Alá. In these villages the gene frequencies for both thalassaemia and *G6PD*-deficiency are particularly high. Unlike them an almost neighbouring village, Batti, was reported by Fermi as relatively free from malaria. The situation in these villages, together with the others from the interior plains, are again an obvious indication that the argument of ethnical heterogeneity as possibly the main cause of differences in gene frequencies is certainly not a strong one. Moreover, the blood group distribution of the interior, coastal and mountain villages is remarkably similar. All show an unusually high incidence of the *M* gene and a very low frequency of RH-negative individuals. This feature seems to be unique among the Sardinian population when compared to the remaining European populations.

II. INTERACTION BETWEEN *G6PD*-DEFICIENCY AND THALASSAEMIA

10. Reasons exist for believing that the association of the two defects of *G6PD* and thalassaemia in the same person may lead to a higher biological fitness of the individuals concerned. We have reported previously that the incidence of severe hæmolytic crises from expo-

sure to Fava beans (clinical favism) is lower among carriers of enzyme-deficiency and thalassaemia than among carriers of enzyme-deficiency alone. Since the *G6PD*-activity is always increased in thalassaemia carriers, one supposed there could be compensation of the enzyme deficiency in the presence of thalassaemia. The likelihood of a higher fitness of the carriers of both these genes is strengthened by finding that their number in the general population seems to exceed the expected one calculated from the estimates of gene frequencies of the two traits per each village. This slight excess is not significant within each village, but becomes clearly significant when the data of twenty-one villages studied for that purpose are brought together.

III. HAEMOGLOBIN VARIANTS AND OTHER FORMS OF THALASSAEMIA IN SARDINIA

11. A study of 1,200 random blood samples from villages in the South Sardinian plains failed to reveal a single case of hæmoglobin variants or high foetal hæmoglobin (a probable α chain variant similar to *Hb* "Mexico" has been reported recently). Examination of a random sample of carriers of the thalassaemia-like picture in an area with an incidence of about 30 per cent revealed normal A_2 levels in about 4 per cent of cases. Further studies suggested that these persons were probably cases of α -thalassaemia.

12. The absence of the sickling-trait in Sardinia is particularly noteworthy in view of its appreciable frequency in neighbouring Mediterranean areas; however, the incidence of *Hb S* tends to be inversely correlated with that of β -thalassaemia, possibly because of the low fitness of the combined genotype, *Hb S*-thalassaemia. The absence of *Hb S* in Sardinia may be due to the fact that either the island had low frequency in the original population and has been eliminated while the thalassaemia and *G6PD*-deficiency genes successfully established themselves, or the absence may be due to the original population settled in Sardinia before the *Hb S* gene entered the Mediterranean gene pool but not before the other two genes were present.

IV. POPULATION DYNAMICS OF *G6PD*-DEFICIENCY AND THALASSAEMIA

13. It seems irrelevant to establish whether a set of genes found in a given area arose by mutation or migration, once it is made clear that their maintenance within an appreciably long interval of time could not be possible without the intervention of selective mechanisms.

Livingstone recently has discussed the population dynamics of the genes for thalassæmia, hæmoglobin variants and *G6PD*-deficiency and has given the general equations for calculating the time required to attain genetical equilibrium under different selective models. To arrive at these equations he needed to make some estimates of the various genotypes for each of the genetical systems under consideration. These estimates probably are not far from reality for the hæmoglobin *S* and the beta-thalassæmia genes, but we cannot agree with those proposed for the *G6PD*-deficiency gene which he supposed to have had a positive adaptive value in malarial time only in the female heterozygous. While it is indeed the obvious conclusion if the gene frequencies observed today are considered "equilibrium frequencies", no strong reasons can be given for assuming that this is necessarily true.

14. We assume that the male homozygous and the female homozygous, in spite of the slight risk of disease due to the enzyme-deficiency itself, might have been the fittest of all the genotype when malaria was killing about half the population before the age of reproduction. In the present case, it is possible that the

greater fitness of the combined genotype *Gd*(—)*Th*(+), to which we have referred and the total absence of the hæmoglobin *S* gene from Sardinia undoubtedly must have had their weight in influencing the gene frequencies distribution. Though there is adequate ground for believing that malaria was the major ecological factor responsible for the selection of these genes, the possible existence of other genetical and environmental factors of selection should not be disregarded. Consanguinity, for instance, must have been an important counteracting selective agent for the accumulation of thalassæmia in Sardinian isolates, because increased homozygosity which follows close inbreeding undoubtedly would help natural selection in the elimination of lethal genes. Instead, the effects of consanguinity on *G6PD*-deficiency must have been quite the opposite in the presence of malaria if the fitness estimates reported are correct. To avoid the disturbing effects of consanguinity, we deliberately omitted the inclusion in our study of villages that were of great difference in size because they would be likely to involve significant differences in inbreeding coefficients known to be quite constant in Sardinian villages of ancient formation and longstanding genetical isolation.

SUMMARY OF PAPER

Intensive study on the population of an isolated country in the Latium region (Fumone) — progress report

L. GEDDA, P. PARISI and D. P. PACE

An extensive research has been carried out on the population of a little country in the Latium region (Italy). The aim was to study the role of consanguinity in the evolution of various demographic and medical parameters.

Data have been collected, mainly from parish records, concerning natality, mortality, mar-

riages and consanguineous marriages, from 1911 through 1960, while, at the same time, general data concerning the present population and its social conditions have also been gathered by a local analysis and by previously published data.

All the data are now being worked out, and the results will appear in further publications. However, already by now, infant mortality would seem to be relevant, which might — even partly — be due to the rather high consanguinity coefficients detectable in the population under study until a few decades ago.

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