The Population Bulletin of the Economic Commission for Western Asia (ECWA) is a periodical issued twice a year in January and July and covers the activities in this region on population matters.

Suggestions are welcome as to further ways in which the Population Bulletin of ECWA can be utilized to provide the best service to the countries of the region.

To obtain copies of the Population Bulletin of ECWA, requests may be addressed to the Population Division of ECWA, P. O. Box 35099, Amman, Jordan.

Table of Contents

FINAL REPORT OF THE REGIONAL SEMINAR ON TECHNIQUES OF COLLECTING, EVALUATING AND ESTIMATING DEMOGRAPHIC PARAMETERS*

1. Organization Of The Seminar

Introduction

1. The Seminar on Techniques of Collecting, Evaluating and Estimating Demographic Parameters was organized by the United Nations Economic Commission for Western Asia (ECWA) in cooperation with the Government of Jordan, and was held in Amman, Jordan, from 27 to 31 January 1976.

2. The Seminar was complementary to previous regional meetings that were held under the auspices of ECWA and in response to the requests of the countries of the region. Such requests were made in the various conferences and, in particular, in the Regional Consultation Meeting, which was held in Doha, Qatar, from 24 to 25 March 1975 and in Beirut,Lebanon, from 1 to 2 May of the same year.

Purpose of the Seminar

3. The purposes of the Seminar may be summarized in the following points :

— To review methods and problems related to the collection and evaluation of population and related socio - economic data and the identification of conceptual and empirical methods that may be used to improve them and to deal with common problems in this field.

— To review methods used in analyzing data and undertaking population projections in view of the fact that a good portion of available data in the region has still not been analyzed and is, therefore, of limited present use.

— To study recent methods of estimating population parameters from defective data which have special significance because of the urgent need for these parameters.

Participants

4. Representatives of the following governments participated in the Seminar : Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, People's Democratic Republic of Yemen, Saudi Arabia, Syrian Arab Republic and the Yemen Arab Republic. The Seminar was also attended by represent - atives of the Palestine Liberation Organization, WHO, UNICEF, the Population Council, the Statistical Office and Population Division of United Nations Headquarters, a representative of Abu Dhabi Fund as well as representatives of the Family Planning Organization of Jordan, the Jordanian Women's Union and the Arab College of Amman. Also attending the Seminar was a number of local and international experts who contributed in an effective way to all its activities and enriched its discussions with their wide expertise and practical intensive ex- pertise and practical and intensive experience. A list of participants is attached (Annex I).

* Meeting document E/ECWA/POP/WG. 5/21.

Election of Officers

5. Mr. Shuja' Al-Asad, Director-General of the Department of Statistics of Jordan, was elected chairman of the Seminar; Mr. Mohamed Al-Fayez, Census Director in the Central Bureau of Statistics in Saudi Arabia and Dr. Farid Bustani, Deputy Director, Central Bureau of Statistics in Syria, were elected vice-chairman, and Mr. Tahseen Mustafa, Director, Population Studies Board, Central Statistical Organization in Iraq, was elected rapporteur.

Opening of the Seminar

6. The Seminar was opened by Mr. Shuja' Al-Asad in his capacity as chairman of the delegation of the host country, who welcomed the participants and thanked the Economic Commission for Western Asia for holding the Seminar in Jordan. He then explained the specific characteristics of population policies that have begun to emerge since the population conference in Bucharest in 1974 and the contribution of the regional meetings in clarifying them. He indicated that an accurate and comprehensive data base is the corner-stone for population policies and explained the relationship between population conditions and social and economic planning. Mr. Al-Asad referred to the Seminar on Population Policies and their relation to Development, which was held in Amman three years ago under the auspices of the United Nations, and showed the close relationship between it and the present Seminar. He then dealt with the problems faced by the statistical offices of the region in the field of population data collection, the improvement of inaccurate information and the estimation of population parameters. He then discussed questions of population analysis and the need for making demographic information readily available. Mr. Al-Asad concluded his statement by referring to the negative consequences of Israeli aggression in the region with regard to forced migration in occupied territories. He then expressed the hope that this important Seminar will conclude with clear and implementable recommendations which would lead to the greater availability of comprehensive and accurate data on population and its various characteristics.

7. Dr. Riad Tabbarah, Chief of the Population Division of the United Nations Economic Commission for Western Asia, then addressed the meeting and expressed thanks to the Government of Jordan for hosting the Seminar. He showed the importance of the availability of population statistics in a way commensurate with the rapid social and economic development that this region is experiencing. He then referred to the special attention given by the United Nations and its Specialized Agencies to these subjects pointing out the recommendations of previous regional and international conferences, in particular those of the World Population Conference in Bucharest and the regional consultations which followed. He then explained the significant development on the administrative and substantive levels of the population activities of the Economic Commission for Western Asia which was undertaken to respond to the increasing needs of the region in this field. He emphasized the importance of the Seminar and its purposes, pointing out the fact that the preparations for it were made during the painful events that took place in Lebanon, and that was made successful to a large extent by the valuable cooperation offered by the Department of Statistics of Jordan. Dr. Tabbarah concluded his statement by thanking the Government of Jordan and expressing his wishes for the success of the Seminar.

8. The schedule of meetings and documentation of the Seminar was then adopted (Annex II).

II. Discussions

9. The Seminar discussions began with the documents presented by country delegations. These documents dealt in particlar with issues and problems of population data collection in each country and with present and future statistical projects in the field of population. During these discussions, common characteristics became apparent with regard to both present and future questions .

10. On the national level, a common characteristic is the inadequacy of population data in most countries of the region and their limited coverage. Some of the reasons for this are the absence of comprehensive and regular population surveys as well as the necessary institutions for the collection and presentation of population data in the requisite forms. Other reasons are the shortage statistical cadres and the continuous losses from them, the difficulties of data collection in some parts of the region because of the nature of these areas, their low density or the continous movement of their populations (nomads) . Finally, the lack of statistical awareness among some people in the region, particularly the illiterates, and financial difficulties that are being experiened by some countries inspite of the financial capabilities of the region as a whole are also hindrance to the availability of necessary data.

11. On the regional level, common problems may be summarized in the limited cooperation and coordination among the countries of the region with regard to the needs and results of statistical activities, in particular, the lack of coordination of different population surveys and studies and the limited exchange of expertise and knowledge in the field of population.

12. Therefore, discussion of country papers concentrated on the methods needed for improving the comprehensiveness and accuracy of population data at the country level and on the importance of increasing cooperation and coordination at the regional level among the countries of the region. It also concentrated on the necessity for benefiting from international expertise in this regard as well as from financial and technical assitance offered by the United Nations and its Specialized Agencies. The participants emphasized the necessity that the Economic Commission for Western Asia undertake particular statistical projects which no given country could undertake alone such as, for example, the survey of Palestinians residing inside and outside the region, the survey of nomads, the measurement and monitoring of intra-regional migration, the survey of Arab experts inside and outside the region and other such surveys and population studies.

13. Following the discussion of country papers, working papers were presented. These papers contained valuable information on methods needed for solving problems of data collection in the region, on scientific and recent methods for evaluating and analyzing population data and on methods for estimating popluation parameters from available, in particular defective, data. The discussion of these papers concentrated on the necessity of expanding population data coll-

ection operations on scientific bases and the standardization of definitions and concepts used in such a way that they would be compatible with international standards but also take into account the conditions of the countries of the region. The need for coordinating the timing of data collection activities among the countries of the region was also emphasized.

14. Discussion of working papers also emphasized the need for intensifying activities dealing with the evaluation and correction of available population data and for expanding activities of data analysis on the basis of recent scientific methods and with a view to making them more useful on regional and international levels. Estimating population parameters from defective data received a great deal of attention particularly since much of available population data in the region may be considered more or less defective.

III. Recommendations

At the conclusion of its sessions the Seminar reached the following recommendations :

1. To support national statistical offices by assisting them in expanding their field and research operations in accordance with the needs of each country and in such a way as to present a comprehensive and accurate picture of the various aspects of the economic and social life in these countries. In this respect, special attention should be given to the less developed countries of the region.

2. To make special efforts to establish and support civil registration systems and to enact appropriate laws.

3. To undertake specialized population surveys in the region, in particular surveys dealing with nutrition, the family and infant mortality.

4. To consider the document prepared by the Population Division of ECWA (E/ECWA/ POP/WG.5/2) which contained demographic socio - economic parameters, a leading project which must be completed and emphasized in the future work of the Commission.

5. The Economic Commission for Western Asia, in implementation of recommendations of previous meetings particularly the regional consultation meeting that was convened in Doha and Beirut in 1975, should undertake a comprehensive survey of the Palestinian people in cooperation with the Arab countries concerned and the Palestine Liberation Organization. Therfore, the Arab countries are urged to rapidly finance this survey in the requisite manner.

6. Countries of the region and regional and international organizations should give fin - ancial and moral assistance to the Palestine Liberation Organization to establish a statistical centre and to undertake studies and statistical research aimed at improving knowledge regarding the social and economic characteristics of the Palestinian people.

7. To take into consideration applicability and simplicity in designing the various question- naires for censuses and demographic and statistical surveys and to attempt to restrict these

questionnaires to what is needed for achieving the purposes of the statistical project. Also clear and precise definitions and concepts should be used which are commensurate with national and regional conditions and which are compatible with international concepts.

8. The importance of practical field training during the preperations for censuses and surveys is emphasized and, in particular, training in the work areas so that conditions and problems that the field workers face become known and avoided. The choice of field workers should be made according to practical bases taking into account levels of competence and prevailing customs.

9. Coordination between the various statistical offices should be emphasized in order to avoid duplication in the work. It would be desirable to establish a centralized focal point to undertake such coordination.

10. It is recommended that regional coordination between the countries should be undertaken in accordance with their needs and that the Economic Commission for Western Asia should play a principle role to achieve this in particular with respect to the following subjects :

— The unification of definitions, concepts and questionnaires including the classifications of occupation and economic activity in accordance with national and regional conditions, and the holding of seminars for which the necessary studies are prepared by ECWA.

— The coordination of the timing of execution of censuses and survey so as to benefit fully from regional skills and expertise.

— The exchange of information, statistics and studies dealing with the various aspects and results of statistical and population work.

— The design of model questionnaires in which a minimum of statistical and population information is contained and which the countries of the region are able to use.

11. The evaluation and analysis of data as well as training should be considered basic activities in all statistical and population projects and should be part of censuses and survey projects.

12. Projects for making available population statistics must be considered part of development project and must, therefore, be budgeted as part of the development budgets.

13. Efforts should be made to make available and to translate recent scientific methods dealing with the estimation of population parameters from defective data and to incorporate these methods in the national and regional training programmes.

14. The Economic Commission for Western Asia should coordinate the efforts of the various UN agencies with regard to training in the fields of collection, evaluation and estimation of population parameters in the region so as to ensure a consistent and complete training programme.

15. The Economic Commission for Western Asia is urged to undertake measures for training middle and high level persons working in the fields of population and statistics. This training should be undertaken as much as possible in the Arabic language and be based on the national and regional conditions. It should also attempt to establish a centre under its auspices for this purpose.

16. The Economic Commission for Western Asia is urged to undertake, in cooperation with countries of the region, surveys that these countries are unable to undertake because of their regional nature such as the survey of Palestinians, the survey for measuring and monitoring the characteristics of intra-regional migration,the survey of Arab skills within and outside of the region, the survey of Bedouins and others.

17. In giving assistance to the countries of the region, regional and international institutions are requested to consider the regional programme of ECWA an extention of the national programmes of the countries in the fields of population and statistics and a basic factor in the success of these national programmes.

18. Countries of the region are requested to make available to ECWA documents projects and studies dealing with statistics and population so as to enable the Commission to utilize them and to spread their usefulness at the regional level.

19. The Seminar addressed its thanks to the Economic Commission for the efforts it has expanded in preparing for this Seminar inspite of the difficult circumstances that arose from the painful events in Lebanon. It also extended its thanks to the Government of the Hashemite Kingdom of Jordan for hosting the Seminar and for the great efforts that were made by the employees of the department of statistics for the success of its work.

ANNEX 1

LIST OF PARTICIPANTS

1. COUNTRY PARTICIPANTS

BAHRAIN

1.	Mr. Habib Hassan	Engineer, Ministry of Housing
2.	Mr. Abdulla Abdulghaffar	Engineer, Ministry of Housing

IRAQ

1.	Mr. Tahseen Mustafa	Director, Population Studies Board Central Statistical Organization
2.	Mr. Mouzahem Alnoorachi	Researcher, Educational and Social Department Ministry of Planning

JORDAN

1.	Mr. Shuja' Al-Asad	Director-General, Department of Statistics
2.	Mr. Suleiman Abdel Ati	Prof. of Statistics, Jordan University
3.	Mr. Saleh Khasauna	Assist. Prof. of Statistics and Economics
4.	Mr. Abdul Rahim Muaitah	Head of Statistical Section Ministry of Health
5.	Mr. Derwass Al-Khass	National Planning Council
6.	Mr. Fahd Al-Hiari	Department of Statistics
7.	Mr. Abdul Mon'em Abu Nawar	Department of Statistics
8.	Mr. Mohamed Hasan Ismail	Department of Statistics
9.	Mr. Abdel Wahab Sraihin	Department of Statistics
10.	Mr. Mohamed Ali Al-Halabi	Department of Statistics

KUWAIT

1.	Mr. Ibrahim Abdullah El-Khamis	Head, Research Division Central Statistical Office

LEBANON

1.	Mr. Hussein Hamdan	Population Expert, Ministry of Planning
2.	Mr. Roger El-Hage	Statistical Expert, Ministry of Planning

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

1.	Mr. Ayash Ali Saleh	Head, Social and Population Statistics Unit
2.	Mr. Abdel-Wakil G. Ahmed	Central Statistical Office

SAUDI ARABIA

1.	Mr. Muhamed Al-Fayez	Director, Population Census Central Department of Statistics
2.	Mr. Abdel Rahman Al-Madani	Director, National Income Accounts Central Department of Statistics

SULTANATE OF OMAN

1.	Mr. Hilal A. Al-Kuymi	National Statistical Department

SYRIAN ARAB REPUBLIC

1.	Mr. Farid Bustani	Deputy Director, Central Bureau of Statistics
2.	Mr. Mohamed Kallas	Director, Demographic Studies and Research Centre, Central Bureau of Statistics

YEMEN ARAB REPUBLIC

1.	Mr. Ali Kaed Al-Adashi	Head, National Account Section, Statistics Department Central Planning Organization
2.	Mr. Abdo Saleh Saif	Head, Social Statistics Section Statistics Department Central Planning Organization

11. CONSULTANTS

1.	Mr. William Brass	Professor of Medical Demography London School of Hygiene and Tropical Medicine
2.	Mr. James Trussel	Office of Population Research Princeton University
3.	Mr. Mohamed Al-Khodary	U. N. Census Adviser in Kuwait
4.	Mr. Allan Hill	Regional Representative and Demographic Adviser, The Population Council
5.	Mr. Atef Khalifeh	U.N. Demographic Adviser in Jordan
6.	Mr. Hanna Rizk	U.N. Demographic Adviser in Jordan

III. UNITED NATIONS

POPULATION DIVISION (HEADQUARTERS)

1.	Mr. Shunichi Inoue	Estimates and Projections Section

STATISTICAL OFFICE (HEADQUARTERS)

1.	Mr. Roque Garcia - Frias	Consultant

ECONOMIC COMMISSION FOR WESTERN ASIA

1.	Mr. Riad Tabbarah	Chief, Population Division
2.	Mr. Nabil Khoury	Population Affairs Officer Secretary of the Seminar
3.	Mr. Muhi Al-Dean Mamish	Population Affairs Officer
4.	Ms. Thèa Filiangouridis	Secretary
5.	Ms. Hadia Hammour Afra	Secretary
6.	Mr. Sami Abiad	Conference Section

WORLD HEALTH ORGANIZATION

1.	Dr. Esmat Hammoud	Regional Advisor on Vital and Health Statistics Regional Office, Alexandria

UNICEF

1.	Mr. Zuhni R. Quebeiweh	Liaison-Officer, Amman
2.	Mr. Michael Scheye	

IV. OTHER ORGANIZATIONS

PALESTINE LIBERATION ORGANIZATION

1.	Mr. Youssef Choueiri	Beirut Office
2.	Mr. Antoine Mansour	Beirut Office
3.	Mr. Abdul Rahman Jibara	Amman Office
4.	Mr. Mustafa Melhem	Amman Office

ABU DHABI FUND

1. Ms. Maha El-Shawa

THE POPULATION COUNCIL

1.	Mr. Allan Hill	Regional Representative and Demographic Adviser

FAMILY PLANNING ORGANIZATION

1. Ms. Bassima Adnan

WOMEN'S UNION

1. Ms. Daad Maaz
2. Ms. Salwa Ziadin

THE ARAB COLLEGE - AMMAN

1. Mr. Yourib I. Abdel-Haq

ANNEX II

SCHEDULE OF MEETINGS AND DOCUMENTATION

Tuesday 27 January 1976

08:00 — 10:00	Registration
10:00 — 10:30	Opening ceremony
10:30 — 11:00	Coffee break
11:00 — 11:15	Election of officers
11:15 — 11:30	Adoption of the Agenda
11:30 — 13:30	Agenda item I : **Data Collection and Appraisal — presentation of country papers** (E/ECWA/POP/WG. 5/10, 11, 12,...)
15:30 — 17:30	Continuation of Agenda item I - **presentation of country papers**
19:00 — 21:00	Reception offered by the Director General, Department of Statistics.

Wednesday 28 January 1976

09:00 — 11:00 Continuation of Agenda item I : **presentation and discussion of working papers**

— **Available Demographic Socio — Economic Data for Countries of the ECWA Region, prepared by the Population Division of ECWA** (E/ECWA/POP/WG. 5/2).
This paper presents the existing demographic, socio - economic data which have been compiled and evaluated by the Population Division of ECWA.

— **Methods of data Collection, with special reference to West Asian Regional conditions, prepared by Mr. S. - El-Asad and Dr. H. Rizk** (E/ECWA/POP/WG. 5/5).
This paper will include a brief discussion of methods of collection (censuses, surveys, vital registration, etc...). Their respective relevance to conditions in the region and their complementary and substitut - ability. It will also include discussion of problems of data collection and related preoccupations in the region (nomads, refugees, scholars, remote areas, illiterate, etc...).

11:00 — 11:30 Coffee break

11:30 — 13:30 Continuation of Agenda item I : **presentation and discussion of working papers.**

— **Proplems of demographic data collection in the Arab World, prepared by Mr. M. S. El-Khodary** (E/ECWA/POP/WG. 5/7).
This paper will draw on the field experience of several Arab countries with a view to pointing out in empirical terms some of the major difficulties encountered in data collection in conditions of this region.

16:00 — 18:00 Agenda item II : **Methods of Data Evaluation and Analysis — presentation and discussion of working papers**

— **Summary of methods of evaluating and adjusting demographic data, Prepared by Dr. A. Khalifa** (E/ECWA/POP/WG. 5/6).
This paper is a state-of-the-art paper in which will be reviewed methods for evaluating the quality of available demographic data and for adjusting these data. Examples will be largely drawn from data of the countries of the region.

— **Methods of population projections for development planning, prepared by Dr. A. Hill** (E/ECWA/POP/WG. 5/3) .
This paper will include, in addition to a brief description of " conventional" methods of population projections, discussion of projection methods from limited data and those relating population to other socio-economic variables.

Thursday 29 January 1976

09:00 — 11:00 Agenda item III : **Indirect Methods of Estimating Demographic Parameters — presentation and discussion of working papers.**

— **Demographic models and reality : A critical review of indirect methods for estimating demographic parameters from defective data, prepared by Dr. A. Hill** (E/ECWA/POP/WG. 5/4).
This paper will summarize, in a tabular and simplified form, indirect methods of estimating demographic variables together with brief comments on their potential deficiencies and pitfalls particularly in their applicability to the conditions of the ECWA region.

— **Model Fertility Schedules and their Use in Estimating Measures of Fertility, prepared by Prof. T. J. Trussell** (E/ECWA/POP/WG. 5/8) .
This paper will include a simplified but indepth discussion of fertility schedules and their value in estimating fertility variables from defective demographic data.

11:00 — 11:30 Coffee break

11:30 — 13:30 Continuation of Agenda item III : **presentation and discussion of working papers.**

— **Contribution to the methodology of estimating mortality from defective data, prepared by Prof. W. Brass** (E/ECWA/POP/WG.5/9).

In this paper, a simplified but indepth discussion will be undertaken of selected methods of estimating mortality variables from defective data drawing on examples from the region.

Free afternoon

Friday 30 January 1976

Free day - trip to the Dead Sea
Lunch offered by ECWA

Saturday 31 January 1976

10:00 — 12:00 Adoption of the final report.

AVAILABLE DEMOGRAPHIC SOCIO - ECONOMIC DATA FOR COUNTRIES OF THE ECWA REGION *

Prepared by the Population Division of ECWA

The purpose of this document is to present some recent reliable data on a set of important demographic and socio-economic variables for the twelve Arab countries of Asia that are covered by ECWA, namely, Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, People's Democratic Republic of Yemen, Qatar, Saudi Arabia, Syria, Yemen Arab Republic and the United Arab Emirates. The set of country tables and the summary table following them are based mainly on official sources such as censuses, civil registration reports and sample surveys. The sizeable gaps in these tables demonstrate the shortage of reliable statistical data.

During the last two decades or so, a major effort has been made in many countries of the region to undertake population censuses and related surveys. Nevertheless, it must be noted that almost half of the countries of the region have not undertaken national population censuses during this period or have not published the results of these censuses. It is expected that all countries of the region would have taken at least one census by the end of the 1980 round of censuses and this will require significant complementary activities on the part of the United Nations in this region.

With regard to civil registration systems in which population events such as marriages, divorces, births and deaths are recorded. the need for improvement is even greater than that related to population censuses. Civil registration systems generally consist of a continuous operation rather than an **ad hoc** one and thus require the services of qualified personnel on a permanent basis. The shortage of such personnel in many countries of the region is perhaps the major barrier in establishing such systems and major cause of the low quality of data emanating from some existing systems. It must be noted, however, that some countries of the region are working hard to improve civil registration. Iraq, for example, has in January 1973 initiated a national programme of vital registation which will be permanent but based on a national sample. Syria too has begun a multi-round survey aimed specifically at improving vital registration at the national level.

Multi-purpose sample surveys are increasingly being used for supplementing census and civil registration information but are still at an early stage of their development in the region. In addition, a number of specialized surveys dealing with fertility, mortality or international migration have been conducted.

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* Meeting document E/ECWA/POP/WG. 5/2.

A number of principles were followed in the choice of data to be incorporated in the national tables of this document. First, only data believed to be fairly reliable was incorporated and priority was given to those relating to the period since 1960. Furthermore, in most cases, official sources were used and only complemented by private sources. Official sources included not only national sources but also those of the United Nations, its specialized agencies and, of course, ECWA. The tables are believed to have a double usefulness : they form the statistical basis for a number of national comparative studies of the demographic socio-economic situation in the countries of the region and they show the gaps and deficiencies in statistics and, therefore, the areas for demographic analysis that must urgently be covered by national demographic programmes and the regional demographic programme of ECWA.

		Year
Selected Demographic Indicators		1971
Total Population (thousands)		C
Foreign Population (%)		216
Urban Population (%)		17.5
Population of the Capital agglomeration (%)		78.1
Population in localities by size of locality	Number of localities	41.1
	Localities of 10.000 inhabitants	65
	Population of localities of 10.000 inhabitants (%)	4
Population under 15 years (%)		68.7
Population 65 years and over (%)		44.3
Sex ratio		2.7
Dependency ratio		116.6
Density (inh / km^2)		88.7
Crude birth rate (o/oo)		361.0
Crude death rate (o/oo)		42.8 1/
Natural increase rate (o/oo)		8.0 1/
Rate of growth (%)		34.8 1/
Life expectancy at birth (years)		2.9 a/
Infant mortality rate (o/oo)		63.2 1/
Total fertility rate		63.0 1/
General fertility rate		6.7 1/ b/
Gross reproduction rate		244 1/ b/
Net reproduction rate		2.5 1/ b/
Celibacy rate at 50 years (%)		...
	M	6.3
	F	1.5
Mean age at marriage	M	26.3
	F	20.3
Selected Educational Indicators		
Illiteracy rate of the population aged 15 years and over (%)	M	50.8
	F	71.5
Illiteracy rate of the population aged 15 - 24 years (%)	M	22.8
	F	45.4
Population aged 25 years and over by educational attainment	pre-school	77.2
	first level	11.4
	second level	7.4
	third level	4.0
Enrolment ratio	first level	108.4
	second level	21.0
	third level	3.0
Students of the third level by field of study (%)	Human, Law and Social Sciences	100.0
	Natural Sciences and Applied Sciences	-
	Not specialized	-
Selected Economic Indicators		
Economically active population (thousands)		60
Economically active population in per cent of the total population		27.9
Activity rate of the population aged 15 years and over	M	83.3
	F	6.2
Relative distribution of employment by economic sector (%)	primary	6.7
	secondary	34.6
	tertiary	58.7
Highly qualified active population	% of active population	10.0
	% with university degree	...
% of employees		80.0
Unemployment rate (%)		3.0
% of females in the total active population		5.4
% of females in agriculture in the total active female population		0.1

Sources

C: Bahrain, Ministry of Finance and National Economy, Statistical Bureau, Statistics of the Population Census, 1971

1/ A. Kjurciev and Y. Courbage, "Alternative population projections and analysis of the essential data in Bahrain", published in Population Bulletin of the United Nations ECWA issue No. 6 January 1974

Notes

a/ For 1965 - 1971, inter-census period

b/ A national Document: "Fertility levels and trends in Bahrain, ESOB/DEM/F/C.P.6 provides the following data:

total fertility rate : 7.4

general fertility rate : 224

gross reproduction rate : 3.8

... Data not available

K U W A I T

Selected Demographic Indicators		Years 1970	1975
		C	C
Total Population (thousands)		738	991.3 5/
Foreign Population (%)		53.0	52.6 5/
Urban Population (%)		85.8	85.9 5/
Population of the Capital agglomeration (%)		29.5	27.8 5/
Population in localities by size of locality	Number of localities	54	...
	Localities of 10.000 inhabitants	20	...
	Population of localities of 10.000 inhabitants (%)	73.4	...
Population under 15 years (%)		43.2	...
Population 65 years and over (%)		1.7	...
Sex ratio		131.7	120.8 5/
Dependency ratio		81.5	...
Density (inh/km^2)		43.6	55.6 5/
Crude birth rate (o/oo)		46.0	...
Crude death rate (o/oo)		5.0	...
Natural increase rate (o/oo)		41.0	...
Rate of growth (%)		9.6 a/	6.1 5/ c/
Life expectancy at birth (years)		66 b/	...
Infant mortality rate (o/oo)		41.8 1/	...
Total fertility rate		6.9 2/	...
General fertility rate		190 2/	...
Gross reproduction rate		3.4 2/	...
Net reproduction rate		3.1 2/	...
Celibacy rate at 50 years (%)	M	3.8	...
	F	2.7	...
Mean age at marriage	M	26.5	...
	F	19.5	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over (%)	M	36.6	...
	F	58.1	...
Illiteracy rate of the population aged 15 - 24 years (%)	M	28.5	...
	F	39.9	...
Population aged 25 years and over by educational attainment	Pre-school	72.3	...
	First level	10.9	...
	Second level	12.3	...
	Third level	4.5	...
Enrolment ratio	First level	90.0 3/	...
	Second level	69.0 3/	...
	Third level	2.4 3/	...
Students of the third level by field of study (%)	Human.,Law and Social Sciences	84.2 4/	...
	Natural Sciences and Applied Sciences	15.8 4/	...
	Not specialized	-	...
Selected Economic Indicators			
Economically active population (thousands)		242.5	...
Economically active population in percent of the total population		32.9	...
Activity rate of the population aged 15 years and over	M	87.4	...
	F	10.0	...
Relative distribution of employment by economic sector (%)	Primary	1.7	...
	Secondary	34.3	...
	Tertiary	64.0	...
Highly qualified active population	% of active population	11.6	...
	% with university degree	41.0	...
% of employees		79.0	...
Unemployment rate (%)		3.4	...
% of females in the total active population		6.9	...
% of females in agriculture in the total active female population		0.05	...

Sources

C Kuwait, The Planning Board, Central Statistical Office, Population Census 1970, Kuwait, October 1972

1/ K.E. Vaidyanathan, A Study of Infant and Child Mortality in Arab Countries Doc. CDC/S75/12

2/ Kuwait, Central Statistical Office, Planning Board, Fertility Situation in Kuwait, ESOB/DM/F/C.P.5

3/ UNESCO, Statistical Yearbook 1971 and 1972

4/ Kuwait, Central Statistical Office, Planning Board, Statistical Abstract 1973

5/ Preliminary results from U.N. files

Notes

a/ for 1965 - 1970, intercensus period

b/ for Kuwaitis only

c/ for 1970 - 1975, intercensus period

... Data not available

Selected Demographic Indicators		Years 1970	1975
		S	
Total Population (thousands)		2,314 a/ b/	2,869 3/
Foreign Population (%)		9.3 b/ c/	...
Urban Population (%)		61.2	59.8 3/
Population of the Capital agglomeration (%)		44.1	...
Population in localities by size of locality	Number of localities	1,479	...
	Localities of 10.000 inhabitants	31	...
	Population of localities of 10.000 inhabitants (%)	58.0	...
Population under 15 years (%)		43.9	43.2 3/
Population 65 years and over (%)		4.9	4.8 3/
Sex ratio		101.2	101.4 3/
Dependency ratio		95.3	92.4 3/
Density (inh/km^2)		209.1	276 3/
Crude birth rate (o/oo)		34.4 1/	40.1 3/
Crude death rate (o/oo)		9.1 1/	9.3 3/
Natural increase rate (o/oo)		25.3 1/	30.8 3/
Rate of growth (%)		2.5 1/	3.1 3/
Life expectancy at birth (years)		64.0 1/	64.2 3/
Infant mortality rate (o/oo)		65.0 1/	...
Total fertility rate		5.5 1/	6.2 3/
General fertility rate		171 1/	183.9 3/
Gross reproduction rate		3.1	3.0 3/
Net reproduction rate		...	2.6 3/
Celibacy rate at 50 years (%)	M	6.1	...
	F	7.1	...
Mean age at marriage	M	28.5	...
	F	23.2	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over (%)	M	25.1	...
	F	47.9	...
Illiteracy rate of the population aged 15 - 24 years (%)	M	9.6	...
	F	24.1	...
Population aged 25 years and over by educational attainment	Pre-school	74.3	...
	First level	10.7	...
	Second level	11.9	...
	Third level	3.1	...
Enrolment ratio	First level	111.0 2/ d/	...
	Second level	40.0 2/	...
	Third level	16.1 2/ e/	...
Students of the third level by field of study (%)	Human.,Law and Social Sciences	51.9	...
	Natural Sciences and Applied Sciences	36.1	...
	Not specialized	12.0	...
Selected Economic Indicators			
Economically active population (thousands)		571.8	...
Economically active population in percent of the total population		26.9	...
Activity rate of the population aged 15 years and over	M	75.2	...
	F	14.8	...
Relative distribution of employment by economic sector (%)	Primary	19.0	...
	Secondary	25.4	...
	Tertiary	55.6	...
Highly qualified active population	% of active population	12.1	...
	% with university degree	28.6	...
% of employees		59.7	...
Unemployment rate (%)		5.8	...
% of females in the total active population		17.3	...
% of females in agriculture in the total active female population		22.6	...

Sources

S Liban, Ministère du Plan, Direction Centrale de la Statistique, L'enquête par sondage sur la Population Active au Liban - Nov. 1970, Fascicules No. 3, 4 et 5.

1/ Youssef Courbage et Philippe Fargues, La situation démographique au Liban, Publication de l'Université Libanaise, Librairie Orientale, Beyrouth

2/ UNESCO, Statistical Yearbook 1971 and 1972

3/ UN, Population Division Department of Economic and Social Affairs of the United Nations Secretariat, Selected World Demographic Indicators by countries 1950 - 2000 ESA/P/W.B/55

Notes

a/ Unadjusted figure given by 1970 Survey is 2,126

b/ including Palestinian population living outside camps but excluding Palestinian population living in camps

c/ if Palestinians inside camps were included, this figure would be 13.7.

d/ Including UNRWA schools

e/ for 1969

... Data not available

		Years 1971	1975
Selected Demographic Indicators			
Total Population (thousands)		675 1/	766 2/
Foreign Population (%)		...	...
Urban Population (%)		...	...
Population of the Capital agglomeration (%)		...	...
Population in localities by size of locality	Number of localities	...	...
	Localities of 10.000 inhabitants	...	...
	Population of localities of 10.000 inhabitants (%)	...	...
Population under 15 years (%)		44.9 2/	...
Population 65 years and over (%)		2.5 2/	...
Sex ratio		...	...
Dependency ratio		90.1 2/	...
Density (inh/km^2)		3.5 1/	3.6 2/
Crude birth rate (o/oo)		50.0 3/	...
Crude death rate (o/oo)		...	...
Natural increase rate (o/oo)		...	...
Rate of growth (%)		3.2 a/ 4/	...
Life expectancy at birth (years)		...	...
Infant mortality rate (o/oo)		...	...
Total fertility rate		...	...
General fertility rate		...	...
Gross reproduction rate		3.5 1/	...
Net reproduction rate		...	...
Celibacy rate at 50 years (%)	M	...	...
	F	...	...
Mean age at marriage	M	...	...
	F	...	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over (%)	M	...	...
	F	...	...
Illiteracy rate of the population aged 15 - 24 years (%)	M	...	...
	F	...	...
Population aged 25 years and over by educational attainment	Pre-school	...	...
	First level	...	...
	Second level	...	...
	Third level	...	...
Enrolment ratio	First level	...	...
	Second level	...	...
	Third level	...	...
Students of the third level by field of study (%)	Human., Law and Social Sciences	...	...
	Natural Sciences and Applied Sciences	...	...
	Not specialized	...	...
Selected Economic Indicators			
Economically active population (thousands)		300 1/	...
Economically active population in percent of the total population		44.1 1/	...
Activity rate of the population aged 15 years and over	M	...	...
	F	...	...
Relative distribution of employment by economic sector (%)	Primary	82.7 1/ b/	...
	Secondary	17.3 1/ b/	...
	Tertiary		
Highly qualified active population	% of active population	...	...
	% with university degree	...	...
% of employees		...	...
Unemployment rate (%)		...	...
% of females in the total active population		...	...
% of females in agriculture in the total active female population		...	...

Sources

1/ Data computed by ILO in October 1973 at Beirut on the basis of IBRD, Report of Mission to Oman, September 1972 (IBRD-EMA-55a)

2/ Data computed by the Population Division of United Nations, New York, in 1965 for projections

3/ US Bureau of the Census , Washington

4/ UN Demographic Yearbook 1973 Sales No. E/F.1974.XIII.1

Notes

a/ for 1970 - 1975

b/ The distribution by industry is done over a total of 150,000 gainfully employed. For the total active population it appears to exceed 90 % in agriculture

... Data not available

		Years	
		1970	1973
Selected Demographic Indicators			C
Total Population (thousands)		1,436 1/	1,590
Foreign Population (%)		...	...
Urban Population (%)		25.7 1/	...
Population of the Capital agglomeration (%)		...	18.3
Population in localities by size of locality	Number of localities	...	88
	Localities of 10.000 inhabitants	...	59
	Population in localities of 10.000 inhabitants (%)	...	88.4
Population under 15 years (%)		44.1 1/	...
Population 65 years and over (%)		2.7 1/	...
Sex ratio		102.5 1/	98.0
Dependency ratio		88.0 1/	...
Density (inh/km^2)		5 1/	5.5
Crude birth rate (o/oo)		49.8 1/	...
Crude death rate (o/oo)		21.6 1/	...
Natural increase rate (o/oo)		28.2 1/	...
Rate of growth (%)		2.8 1/	...
Life expectancy at birth (years)		44.8 1/	...
Infant mortality rate (o/oo)		...	...
Total fertility rate		7.2 1/	...
General fertility rate		220.7 1/	...
Gross reproduction rate		3.5 1/	...
Net reproduction rate		2.3 1/	...
Celibacy rate at 50 years (%)	M	...	...
	F	...	...
Mean age at marriage	M	...	...
	F	...	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over	M	...	...
	F	...	...
Illiteracy rate of the population aged 15-24 years (%)	M	...	...
	F	...	...
Population aged 25 years and over by educational attainment	Pre-school	...	...
	First level	...	...
	Second level	...	...
	Third level	...	...
Enrolment ratio	First level	68 2/	75 2/ a/
	Second level	11 2/	15 2/ a/
	Third level	0.1 2/	...
Students of the third level by field of study (%)	Human., Law and Social Sciences	100.0 2/	...
	Natural Sciences and Applied Sciences	-	...
	Not specialized	-	...
Selected Economic Indicators			
Economically active population (thousands)		...	409.7 3/
Economically active population in percent of the total population		...	25.8 3/
Activity rate of the population aged 15 years and over	M	...	...
	F	...	...
Relative distribution of employment by economic sector (%)	Primary	...	...
	Secondary	...	...
	Tertiary	...	...
Highly qualified active population	% of active population	...	...
	% with university degree	...	...
% of employees		...	...
Unemployment rate (%)		...	...
% of females in the total active population		...	18.5 3/
% of females in agriculture in the total active female population		...	...

Sources

C P. D. R. of Yemen, Central Planning Commission, Central Statistical Office, Preliminary Figures for 1973, Population and Establishment Censuses, January 1974

1/ UN, Population Division, Department of Economic and Social Affairs of the United Nations Secretariat Selected World Demographic Indicators by Countries 1950-2000 ESA/P/W.R/55

2/ UNESCO, Statistical Yearbook 1974

3/ ILO Yearbook of Labour Statistics 1975, Geneva

Notes

a/ for 1972

... Data not available

Q A T A R

		Years	
		1970	1975
Selected Demographic Indicators			
Total Population (thousands)		111 1/ a/	170 6/ a/
Foreign Population (%)		59 1/	...
Urban Population (%)		...	...
Population of the Capital agglomeration (%)		80 1/	...
Population in localities by size of locality	Number of localities	...	...
	Localities of 10.000 inhabitants	...	...
	Population in localities of 10.000 inhabitants (%)	...	...
Population under 15 years (%)		44.9 2/	...
Population 65 years and over (%)		2.5 2/	...
Sex ratio		181.9 1/	...
Dependency ratio		90.1 2/	...
Density (inh/km^2)		5.0 1/	7.7 6/
Crude birth rate (o/oo)		50.0 3/	...
Crude death rate (o/oo)		...	...
Natural increase rate (o/oo)		...	...
Rate of growth (%)		...	8.5 c/
Life expectancy at birth (years)		...	...
Infant mortality rate (o/oo)		...	...
Total fertility rate		...	...
General fertility rate		...	...
Gross reproduction rate		3.5 4/	...
Net reproduction rate		...	...
Celibacy rate at 50 years (%)	M	...	...
	F	...	...
Mean age at marriage	M	...	...
	F	...	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over (%)	M	...	...
	F	...	...
Illiteracy rate of the population aged 15-24 years (%)	M	...	...
	F	...	...
Population aged 25 years and over by educational attainment	Pre-school	...	...
	First level	...	...
	Second level	...	...
	Third level	...	...
Enrolment ratio	First level	96 5/b/	...
	Second level	24 5/b/	...
	Third level	...	...
Students of the third level by field of study (%)	Human, Law and Social Sciences	64.0 1/	...
	Natural Sciences and Applied Sciences	36.0 1/	...
	Not specialized	-	...
Selected Economic Indicators			
Economically active population (thousands)		48.4 1/	80.3 6/
Economically active population in percent of the total population		43.2 1/	47.2 6/
Activity rate of the population aged 15 years and over	M	...	...
	F	...	...
Relative distribution of employment by economic sector (%)	Primary	4.3 1/	...
	Secondary	31.5 1/	...
	Tertiary	64.2 1/	...
Highly qualified active population	% of active population	6.9 1/	...
	% with university degree	34.9 1/	...
% of employees		...	...
Unemployment rate (%)		...	...
% of females in the total active population		3.0 1/	2.2 6/
% of females in agriculture in the total active female population		34.9 1/	...

Sources

1/ UNESOB, UN Interdisciplinary Reconnaissance Mission Vol. 2: Qatar July 1972, ESOB/D/72/23

2/ Data computed by the Population Division of the United Nations, New York, in 1965 for projection

3/ US Bureau of the Census, Washington

4/ U.N. World Population situation in 1970-75 and its long range implications, 1974. Sales No. E/74/XIII.4

5/ UNESCO, L'éducation dans les Pays Arabes à la lumière de la Conférence de Marrakech, 1970. Etudes et documents d'Education No. 1

6/ ILO, Yearbook of Labour Statistics 1975, Geneva

Notes

a/ Official U.N. estimates for 1970 and 1975 are 79 and 92 respectively. The corresponding rate of growth is 3.0 % : U.N. Single-year population estimates and projections ... ESA/P/WP.56

b/ for 1967

c/ for 1970-1975

... Data not available

	Years		
	1962	1966	1970
Selected Demographic Indicators			
Total Population (thousands)	6,416 1/	...	7,740 2/b/
Foreign Population (%)	...	...	...
Urban Population (%)	13.5 2/	...	17.8 2/
Population of the Capital agglomeration (%)	...	...	...
Population in localities by size of locality: Number of localities	6,115 1/	...	...
Population in localities by size of locality: Localities of 10.000 inhabitants	22 1/	...	...
Population in localities by size of locality: Population in localities of 10.000 inhabitants (%)	...	...	...
Population under 15 years (%)	...	...	44.1 2/
Population 65 years and over (%)	...	...	2.7 2/
Sex ratio	...	...	102.4 2/
Dependency ratio	...	...	88.2 2/
Density (inh/km^2)	3.0 1/	...	4 2/
Crude birth rate (o/oo)	...	...	49.7 2/
Crude death rate (o/oo)	...	...	21.4 2/
Natural increase rate (o/oo)	...	...	28.3 2/
Rate of growth (%)	...	...	2.8 2/
Life expectancy at birth (years)	39.7 2/	42.3 2/a/	43.8 2/
Infant mortality rate (o/oo)	...	...	...
Total fertility rate	...	...	7.2 2/
General fertility rate	...	...	220.8 2/
Gross reproduction rate	...	...	3.5 2/
Net reproduction rate	...	...	2.3 2/
Celibacy rate at 50 years (%): M	...	...	...
Celibacy rate at 50 years (%): F	...	...	...
Mean age at marriage: M	...	...	...
Mean age at marriage: F	...	...	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over (%): M	...	...	...
Illiteracy rate of the population aged 15 years and over (%): F	...	...	...
Illiteracy rate of the population aged 15-24 years (%): M	91.0 3/	...	...
Illiteracy rate of the population aged 15-24 years (%): F	99.0 3/	...	...
Population aged 25 years and over by educational attainment: Pre-school	...	...	...
Population aged 25 years and over by educational attainment: First level	...	...	...
Population aged 25 years and over by educational attainment: Second level	...	...	...
Population aged 25 years and over by educational attainment: Third level	...	...	...
Enrolment ratio: First level	...	24 5/	34 5/
Enrolment ratio: **Second level**	...	4 5/	9 5/
Enrolment ratio: Third level	...	0.6 5/	1.3 5/
Students of the third level by field of study (%): Human, Law and Social Sciences	...	...	78.0 5/
Students of the third level by field of study (%): Natural Sciences and Applied Sciences	...	...	22.0 5/
Students of the third level by field of study (%): Not specialized	...	...	-
Selected Economic Indicators			
Economically active population (thousands)	...	1,006.6 4/	1,180.7 4/c/
Economically active population in percent of the total population	...	...	15.2 4/
Activity rate of the population aged 15 years and over: M	...	...	...
Activity rate of the population aged 15 years and over: F	...	...	...
Relative distribution of employment by economic sector (%): Primary	...	46.2 4/	45.8 4/d/
Relative distribution of employment by economic sector (%): Secondary	...	16.9 4/	22.5 4/d/
Relative distribution of employment by economic sector (%): Tertiary	...	36.9 4/	31.7 4/d/
Highly qualified active population: % of active population	...	...	...
Highly qualified active population: % with university degree	...	...	...
% of employees	...	...	...
Unemployment rate (%)	...	7.0 4/	...
% of females in the total active population	...	1.1 4/	...
% of females in agriculture in the total active female population	...	...	...

Sources

1/ UN estimation

2/ UN, Population Division, Department of Economic and Social Affairs of the United Nations Secretariat, Selected World Demographic Indicators by Countries 1950-2000 ESA/P/W.R/55

3/ UNESCO, Office of Statistics, Comparative Statistical data on Education in the Arab States (an analysis 1960-61, 1967-68) Conference of Ministers for Economic Planning in the Arab States, Marrakech, 12-22 January 1972

4/ ILO, UNDP, Technical assistance Sector, Report to the Government of the Kingdom of Saudi Arabia on manpower assessment and planning, Geneva 1971 ILO/TAP/Saudi Arabia/R.7

5/ UNESCO, Statistical Yearbook 1971, 1972 and 1973

Notes

a/ for 1965 - 1970

b/ 1974 Census results have not yet officially been published nevertheless total population was unofficially quoted at slightly over 5,000,000

c/ volume required noted in the plan

d/ Private sector only, which represents 896,200 active population in 1966 and 1,040,600 in 1970

... Data not available

		Years	
		1970	1973
Selected Demographic Indicators		C	
Total Population (thousands)		6,305	6,949.6 4/
Foreign Population (%)		3.3	...
Urban Population (%)		43.5	...
Population of the Capital agglomeration (%)		13.3	...
Population in localities by size of locality	Number of localities	6,327	...
	Localities of 10.000 inhabitants	46	...
	Population of localities of 10.000 inhabitants (%)	44.3	...
Population under 15 years (%)		49.3	...
Population 65 years and over (%)		4.4	...
Sex ratio		105.2	...
Dependency ratio		115.7	...
Density (inh/km^2)		34.0	37.5 4/
Crude birth rate (o/oo)		47.8	...
Crude death rate (o/oo)		15.5	...
Natural increase rate		32.3	...
Rate of growth (%)		3.3 a/	3.0 c/
Life expectancy at birth (years)		54.6	...
Infant mortality rate (o/oo)		123	...
Total fertility rate		7.6 1/	...
General fertility rate		159 1/	...
Gross reproduction rate		3.7 1/	...
Net reproduction rate		...	...
Celibacy rate at 50 years (%)	M	2.7	...
	F	2.5	...
Mean age at marriage	M	25.9	...
	F	20.7	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over (%)	M	40.4 b/	...
	F	80.0 b/	...
Illiteracy rate of the population aged 15-24 years (%)	M	22.0 b/	...
	F	64.5 b/	...
Population aged 25 years and over by educational attainment	Pre-school	87.9	...
	First level	8.3	...
	Second level	2.5	...
	Third level	1.3	...
Enrolment ratio	First level	88 2/	98 d/
	Second level	39 2/	45 d/
	Third level	8.0 2/	9.4 d/
Students of the third level by field of study (%)	Human., Law and Social Sciences	69.1 3/	...
	Natural Sciences and Applied Sciences	30.9 3/	...
	Not specialized	-	...
Selected Economic Indicators			
Economically active population (thousands)		1,570.7	1,688.5 4/
Economically active population in percent of the total population		24.9	24.3 4/
Activity rate of the population aged 15 years and over	M	82.0 b/	72.5 4/
	F	8.6 b/	15.9 4/
Relative distribution of employment by economic sector	Primary	49.9	52.7 4/
	Secondary	21.4	16.8 4/
	Tertiary	28.7	30.5 4/
Highly qualified active population	% of active population	5.2	4.6 4/
	% with university degree	25.0 b/	...
% of employees		43.4	36.6 4/
Unemployment rate (%)		6.4	4.5 4/
% of females in the total active population		10.7	20.4 4/
% of females in agriculture in the total active female population		65.2 b/	82.9 4/

Sources

C Syria, Office of the Prime Minister, Central Bureau of Statistics, Population Census in Syrian Arab Republic 1970, Vol. 1

1/ Syria, Central Bureau of Statistics, Office of the Prime Minister, Current Situation of Fertility in Syria ESOB/DM/F.CP.2

2/ UNESCO, Regional Office for Education in the Arab States, Population Dynamics and Educational Development in Syria Analysis and Perspectives, Beirut, 1974

3/ Syria, Central Bureau of Statistics, Statistical Abstract 1971

4/ Syria Central Bureau of Statistics, Statistical Abstract 1973

Notes

a/ for 1960-1970, intercensus period

b/ Syrians only

c/ for 1970-1975

d/ for 1972

... Data not available

YEMEN ARAB REPUBLIC

	Years		
	1970	1972	1975
			C
Selected Demographic Indicators			
Total Population (thousands)	5,767 1/	6,062 5/	4,526 c/
Foreign Population (%)	...	...	...
Urban Population (%)	7.0 1/	...	...
Population of the Capital agglomeration (%)	2.0 2/	1.5 5/	17.3
Population in localities by size of locality — Number of localities	...	...	...
Population in localities by size of locality — Localities of 10.000 inhabitants	...	...	...
Population in localities by size of locality — Population in localities of 10.000 inhabitants (%)	...	...	...
Population under 15 years (%)	44.1 1/	...	46.7
Population 65 years and over (%)	2.7 1/	...	3.7
Sex ratio	102.5 1/	111 2/	90.9
Dependency ratio	88.0 1/	...	102.0
Density (inh/km^2)	30 1/	31 5/	23.2
Crude birth rate (o/oo)	49.9 1/	...	...
Crude death rate (o/oo)	21.5 1/	...	...
Natural increase rate (o/oo)	28.4 1/	...	...
Rate of growth (%)	2.8 1/	...	...
Life expectancy at birth (years)	43.5 1/	...	...
Infant mortality rate (o/oo)	...	...	...
Total fertility rate	7.2 1/	...	...
General fertility rate	221.4 1/	...	...
Gross reproduction rate	3.5 1/	...	...
Net reproduction rate	2.3 1/	...	...
Celibacy rate at 50 years (%) — M	...	...	1.5
Celibacy rate at 50 years (%) — F	...	...	2.0
Mean age at marriage — M	...	...	22.0
Mean age at marriage — F	...	...	18.3
Selected Educational Indicators			
Illiteracy rate of the Population aged 15 years and over (%) — M	...	...	64.7
Illiteracy rate of the Population aged 15 years and over (%) — F	...	...	97.7
Illiteracy rate of the Population aged 15-24 years (%) — M	89.0 3/a/	...	60.9
Illiteracy rate of the Population aged 15-24 years (%) — F	99.0 3/a/	...	95.6
Population aged 25 years and over by educational attainment — Pre-school	...	...	99.1
Population aged 25 years and over by educational attainment — First level	...	...	0.1
Population aged 25 years and over by educational attainment — Second level	...	...	0.5
Population aged 25 years and over by educational attainment — Third level	...	...	0.3
Enrolment ratio — First level	10 4/	16 4/	...
Enrolment ratio — Second level	1 4/	1 4/	...
Enrolment ratio — Third level	0.01 4/	...	...
Students of the third level by field of study (%) — Human., Law and Social Sciences	100.0	...	...
Students of the third level by field of study (%) — Natural Sciences and Applied Sciences	-	...	...
Students of the third level by field of study (%) — Not specialized	-	...	...
Selected Economic Indicators			
Economically active population (thousands)	...	26.6 5/b/	1,135.7
Economically active population in percent of the total population	...	29.0 5/b/	25.1
Activity rate of the population aged 15 years and over — M	...	...	73.8 d/
Activity rate of the population aged 15 years and over — F	...	...	86.2 d/
Relative distribution of employment by economic sector (%) — Primary	...	8.3 5/b/	...
Relative distribution of employment by economic sector (%) — Secondary	...	5.0 5/b/	...
Relative distribution of employment by economic sector (%) — Tertiary	...	86.7 5/b/	...
Highly qualified active population — % of active population	...	...	2.1
Highly qualified active population — % with university degree	...	...	...
% of employees	...	71.1 5/b/	33.3
Unemployment rate (%)	...	3.5 5/b/	2.2
% of females in the total active population	...	...	12.1
% of females in agriculture in the total active female population	...	...	...

Sources

C Yemen Arab Republic, Prime Minister's Office, Central Planning Organization, The Housing and Population Census, Feb. 1975, Preliminary results.

1/ UN, Population Division, Department of Economic and Social Affairs of the United Nations Secretariat, Selected World Demographic Indicators by Countries 1950-2000 ESA/P/W.R/55

2/ Governmental Estimates

3/ UNESCO, Office of Statistics, Comparative Statistical data on Education in the Arab States (an analysis 1960-61, 1967-68) Conference of Ministers for Economic Planning in the Arab States, Marrakech, 12-22 January 1972

4/ UNESCO, Statistical Yearbook 1974

5/ Yemen Arab Republic, Central Planning Organization, Statistics Department, Statistical Yearbook 1974-75

Notes

a/ for 1962

b/ Sana'a City only

c/ 1975 figure for total population is for de facto population, the difference with previous estimates might be partly due to inclusion of emigrants in these estimates

d/ for 10 years and over

... Data not available

		Years	
		1968	1973
Selected Demographic Indicators		C	
Total Population (thousands)		180	320 5/
Foreign Population (%)		...	...
Urban Population (%)		...	...
Population of the Capital agglomeration (%)		25.7	...
Population in localities by size of locality	Number of localities	...	...
	Localities of 10.000 inhabitants	...	...
	Population of localities of 10.000 inhabitants (%)	...	...
Population under 15 years (%)		44.9 1/	...
Population 65 years and over (%)		2.5 1/	...
Sex ratio		163.8	166.7 5/
Dependency ratio		90.1	...
Density (inh/km^2)		2.1	3.8 5/
Crude birth rate (o/oo)		50.0 2/	...
Crude death rate (o/oo)		...	...
Natural increase rate (o/oo)		...	...
Rate of growth (%)		...	11.1 3/ c/
Life expectancy at birth (years)		...	...
Infant mortality rate (o/oo)		...	...
Total fertility rate		...	...
General fertility rate		...	...
Gross reproduction rate		3.5 4/	3.5 4/ b/
Net reproduction rate		...	...
Celibacy rate at 50 years (%)	M	...	...
	F	...	...
Mean age at marriage	M	...	...
	F	...	...
Selected Educational Indicators			
Illiteracy rate of the population aged 15 years and over (%)	M	73.0	...
	F	91.1	...
Illiteracy rate of the population aged 15-24 years (%)	M	65.5 a/	...
	F	83.8 a/	...
Population aged 25 years and over by educational attainment	Pre-school	...	...
	First level	...	...
	Second level	...	...
	Third level	...	...
Enrolment ratio	First level	...	...
	Second level	...	...
	Third level	...	...
Students of the third level by field of study (%)	Human., Law and Social Sciences	...	...
	Natural Sciences and Applied Sciences	...	...
	Not specialized	...	...
Selected Economic Indicators			
Economically active population (thousands)		78.1	114.5 5/
Economically active population in percent of the total population		43.3	35.6
Activity rate of the population aged 15 years and over	M	...	...
	F	...	...
Relative distribution of employment by economic sector	Primary	17.4	15.0 5/
	Secondary	33.2	31.4 5/
	Tertiary	49.4	53.6 5/
Highly qualified active population	% of active population	10.3	...
	% with university degree	...	...
% of employees		73.4	...
Unemployment rate (%)		3.4	...
% of females in the total active population		1.8	...
of females in agriculture in the total active female population		...	...

Sources

1/ Data computed by the Population Division of United Nations, New York, in 1965 for projection

2/ U.S. Bureau of the Census, Washington

3/ Emirate of Abu Dhabi, Dept. of Plan., Statistical Abstract 1974

4/ UN World Population Situation in 1970-1975 and its long range implications, 1974 Sales No. E/74/XIII.4

5/ U.A.E. Department of Planning Population Statistics of the United Arab Emirates, ECWA/POP. CON.I/CP/14

Notes

a/ for 15 - 20 years

b/ for 1970

c/ for 1968 - 1974

... Data not available

METHODS OF POPULATION PROJECTION FOR DEVELOPMENT PLANNING

by

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INTRODUCTION

The arithmetic of population projection is straightforward and fully described in the literature (UN, 1956 ; Shryock et al., 1973, pp. 771-809 ; Keyfitz and Flieger, 1968). The usual technique (the cohort component method) is to apply a series of survival factors (p_x) and a series of age-specific fertility rates (f_x) to an initial age distribution vector. This process can be reduced to a matrix operation (keyfitz, 1964 & 1968 ; Rogers, 1966) and this is probably the mathematically simplest way of carrying forward a population projection.

Apart from the problems associated with estimating the original census age distribution and the initial level of fertility and mortality, there is one so far unresolved conceptual problem in population projection which is that cohort and period effects are confounded during the projection process. Ryder has done a great deal to establish the importance of cohort fertility measures and there is some evidence that mortality and morbidity experience early in the life span affects the subsequent pattern of mortality (UN, 1962). While in the ECWA region we should be aware of these problems, as yet the data for estimating say, period total fertility from cohort fertiliy (complete and incomplete) are simply not available. Using the projection techniques described below, one is in effect employing a kind of generation life table even though the data and the results are for periods only.

THE INITIAL AGE DISTRIBUTION

Since age misreporting (net transfers across certain age boundaries and digital preference or age heaping) distorts all the reported census age distributions in the ECWA region, some corrections are necessary prior to making a projection. The revisions suggested in my second paper, replacing the reported age distribution with an appropriate stable or quasi-stable model age distribution, are preferable to hand smoothing or smoothing with some polynomial function.

SELECTING AN APROPRIATE LIFE TABLE

In some instances, it may be possible to construct an observed life table as a starting point for the projection. If not, a model life table, preferably one drawn from the Princeton model life table set, will have to be used. Methods for estimating the approximate level of mortality and for selecting the appropriate model life table are described in my second paper and in the UN Manual IV. Where a life table can be constructed from observed mortality

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* Meeting document E/ECWA/POP/WG. 5/3.

statistics, it is possible to test the fit of the observed life table with one of the regional model life tables from the Princeton set and hence to select additional life tables with lower mortality for realistic projections of future mortality. Alternatively, it may be preferable to fit, say, a two - parameter model to the observed q_x values in the manner described by Brass and to generate additional life tables with lower mortality by making separate assumptions about the future course of each of the two parameters.

Both methods are an improvement on earlier and simpler methods which involved linear extrapolation of some q_x functions. In both instances, the problem of estimating the future pace and pattern of mortality decline remains. One practical solution is as follows :

1. examine the rate at which mortality has declined in the past in the population under study, or if no historical data are available, in a similar country nearby;

2. estimate the annual increase in the value of $\overset{o}{e_o}$ in the years prior to the starting point of the projection ;

3. make an assumption about the highest value of $\overset{o}{e_o}$ likely to be attained in the forseeable future and about the lowest value of $\overset{o}{e_o}$ prevailing in the distant past. In most in - stances, these limits can be taken as 77.5 and 30 years respectively ;

4. fit a logistic growth curve to the observed or estimated values of $\overset{o}{e_o}$ and generate new values of $\overset{o}{e_o}$ at selected times in the future. Shryock et al (1973, pp. 377 - 386) describe how to do this formula is :

$$\overset{o}{e_e} = \frac{i}{(Ce^{-rt}) + K/r} \qquad (1)$$

and

$$K = \frac{(e_y - e_x)/(t_y - t_x) \cdot (1/e_c)}{e_b - e_c} \qquad (2)$$

$$C = 1/e_a - 1/e_b \qquad (3)$$

$$r = e_b \cdot K \qquad (4)$$

where t_x = first data at which $\overset{o}{e_o}$ is estimated ;

t_y = second data at which $\overset{o}{e_o}$ is estimated ;

e_x = first value of $\overset{o}{e_o}$ at t_x;

e_y = second value of $\overset{o}{e_o}$ at t_y;

e_a = lowest value of $\overset{o}{e_o}$ assumed

e_b = highest value of $\overset{o}{e_o}$ assumed

$e_c = (e_y - e_x)/2$

ESTIMATING THE FUTURE COURSE OF FERTILITY

In most ECWA countries, it is possible to estimate by direct or indirect methods a proportional age specific fertility schedule and to obtain an estimate of total fertility. It is extremely difficult to produce realistic future fertility schedules without a great degree of arbitrariness. The model fertility schedules produced by Coale and Trussell (1974) are some help in population projection since they force the user to make separate assumptions about the factors underlying the age-specific fertility schedule. These factors are the age at which marriage begins for women(a_0) , the rate of entry into marriage (k), and the extent of the departure from a model natural fertility schedule (m). Unfortunately, the model fertility schedules are difficult to match with observed schedules which are changing significantly (e.g. rising mean age of first marriage or increasing use of contraception) since many of these changes are first felt as cohort effects and not across the whole age span for a single period. In addition, the values of a_0 , k and m often have no intuitive significance and cannot be readily derived by fitting a model to the observed schedule by least squares methods. However, the ability to generate one or two sets of model fertility schedules from incomplete data is a valuable contribution to making more realistic projections and in many instances, the model fertility schedules will be a substantial improvement on accurately reported fertility schedules.

MIGRATION

While in certain exceptional circumstances it may be possible to predict the direction, composition and volume of future migration streams using econometric models, the movement of migrant workers and their dependents remains much more volatile and sensitive to political as well as economic factors than the course of fertility and mortality. In the ECWA region, the published statistics on international migration are inadequate for making predictions for a number of reasons. First, most countries do not publish arrival and departure statistics tabulated by sex, age and nationality, let alone the more detailed breakdown by education and economic status. Second, for population projection it is important to distinguish between the transient population (tourists, businessmen, pilgrims etc.) and those intending to migrate for longer periods. A tabulation of the age-sex characteristics of the migrants intending to stay, say, six months or more in the country concerned would be of great value for population projection, especially in the smaller Gulf states of eastern Arabia.

THE POPULATION COUNCIL PROJECTION PACKAGE

F. C. Shorter has produced computer program written in FORTRAN which can be used on all machines with a FORTRAN compiler and 64 K of storage space for making population projections. The program and an explanatory manual are freely available to organizations wanting to use the package. It is versatile and easy to use.

Its main attributes are the following :

a. mortality levels are specified by referring to a selected value of $_{e0}^{o}$ or to level in the

Princeton regional model life tables; all four regional model sets are provided as part of the package but users can provide their own life table sets if required.

b. fertility is specified as total fertility or the net reproduction rate plus an observed or model proportional age distribution of fertility.

c. if necessary, migrants are added during each projection cycle by specifying their age-sex distribution and their numbers. Thereafter they are subject to the mortality and fertility regime of the host population.

d. the date of the initial population can be shifted as required before the projection begins.

e. the stable or quasi-stable age distribution for use as the initial age distribution in the projection can be derived using a part of the computer routine.

f. single year projections can be produced or projections for selected sections of the population (e. g. the labour force, school age population).

g. if required the routine can be used to determine the volume of migration necessary to achieve the specified demographic targets.

More details are contained in the manual. The most valuable feature of the projection package is that it releases the projectionist from almost all the laborious tasks associated with population projection so that the main focus of effort can be directed towards measuring the initial estimates of mortality and fertility and estimates of future trends. This part of population projection remains an inexact science but short term projections (five to ten years forward) made with the package and using indirect estimation for incomplete data are almost certainly more useful for planning purposes than no projection data at all.

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A REVIEW OF INDIRECT METHODS FOR ESTIMATING DEMOGRAPHIC PARAMETERS FROM DEFECTIVE DATA

by

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I. INTRODUCTION

This paper is an annotated guide to the now large and widely dispersed literature on evaluating, adjusting and analysing demographic data. Some of the references may be difficult to locate in the Middle East so some notes on sources of information are included (Appendix 1). In fact, most needs can be met from four or five readily available books listed in the Appendix.

II. CHECKING AND CORRECTING AN AGE DISTRIBUTION

The proportional age distribution is the most valuable piece of information available from censuses and surveys for two main reasons. First, the number of people in each age group (usually tabulated in 5-year age intervals) is the usual denominator in the calculation of age-specific rates and ratios which are the starting point of all demographic analysis. Second, the age distribution of a closed population, since it is a function of fertility and mortality in the recent past (Coale, 1957 and 1972), is extensively used to estimate the basic demographic parameters by indirect methods (see below).

Two sources of error commonly distort many reported age distributions. On the one hand, the way the data are collected and tabulated can influence the accuracy of the age distribution. Spreading the census over several weeks without a clearly understood census night or allowing very young or very old persons to respond on behalf of the entire household are just two examples of the way in which imperfect procedures can affect the reported age distribution. On the other hand, despite sound census procedures, it is very difficult to extract accurate responses from a population with no written records of the vital events and a poor appreciation of the value of this information. These response errors fall into two categories :

1. Age misreporting

Whether asked for their date of birth or their age, people without accurate knowledge of their age tend to round up or to round down to the nearest preferred number. This digital preference is well described in the literature (Barclay, 1958, pp. 65-70; Carrier, 1959; Van de Walle, 1966) and there are a wide variety of methods for measuring and correcting these tendencies (Brass et al., 1968, pp. 13-52; Carrier and Farrag, 1959; Goldwell, 1966; Spiegelman,

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*Meeting document E/ECWA/POP/WG. 5/4.

1968, pp. 68-77; Shryock et al., 1973, chapter 8; U N, 1955, chapter 3). One of the most effective methods is simply to graph the single-year age distribution (see Barclay, 1958, p. 67 for illustration). In most of the Middle East countries, preferred numbers include 6, 10, 12, 18, 20 and all the numbers ending in O or 5.

In practice, this digital preference is less important for demographers (who generally work with 5-years age groups) than net transfers across an age boundary as a result of age misreporting. For example, the upward transferof teenagers across age 20 is widespread in the Middle East, perhaps because respondents and enumerators overestimate the ages of young married couples with children since the mean age of marriage for girls is still quite low in the regions. It is important to detect these transfers which commonly follow systematic patterns (U N, 1967, pp. 17-22) since the proportional age structure is frequently used for indirect estimation of fertility and mortality. Once again, graphing the proportional age structure against the age structure of an appropriate stable model remains the most satisfactory way of detecting these patterns although in countries like Lebanon and Kuwait one has to be aware of the effect of migration on the age structure. A full description of the method appears in UN (1967).

2. Omissions

Procedural and response errors can result in the omission of whole sections of the population usually for some special reason. Young black males are difficult to enumerate completely in the USA, and in the Gulf states, the largely male migrant workers from Iran and a number of other countries are difficult to count because of their mobility and the often crowded and inaccessible conditions in which they live. In all the censuses of the region, the very young and the very old are poorly enumerated. Some of the deficit of infants (under 1 year) is due to overestimation of age but even when a stream of births for the years preceding the census is available, the census often fails to count the total number of young children who should be alive. There must be good reasons for this failure : it may be that mothers with young children were away from home at the time of the census or there may have been a reluctance to admit the presence of a new child to a stranger for superstitious reasons. In any case, these reasons are worth discovering if the accuracy of the recording of such an important part of the population is to be improved.

3. Correction of errors and omissions

Whilst many of the methods for estimating the basic demographic parameters by indirect methods from the age structure and some additional information were developed with some knowledge of the distortions introduced by age misreporting, a corrected age distribution is often required to calculate a life table or as a preliminary to population projection. There is a large literature on smoothing or graduation techniques (e. g. Barclay, 1958, pp. 120 - 122; Shryock et. al., 1973, pp. 681 - 702; Keyfitz, 1968, chapter 10, Carrier and Farrag, 1959) but

the use of these polynomial functions to fit observed age distributions is not recommended. In most instances, it is much better to correct the observed age distribution in the following way : -

a) Determine whether the population is close to stability (stable or quasi-stable). If it is approximately stable, find the current level of mortality and fertility by direct or indirect methods, and, if appropriate, estimate the speed of the recent mortality decline.

b) Find the model stable population with the corresponding birth and death rates by interpolation in the Princeton Model Life Tables (Coale and Demeny, 1966; U N, 1967).

c) By interpolation, derive proportional age distribution for each sex from the model stable population selected.

d) Make any adjustments necessary to allow for changing mortality (Coale, 1971).

e) Divide up the reported total population of each sex in the proportions found in the model stable or quasi-stable population.

f) Special care is needed for the population under age 5 since omission of infants and young children from the total may be significant. It may be necessary to derive the numbers under age 5 examining the reported births in the six years to the census and applying some appropriate survival factors possibly drawn from a model life table.

The procedure sounds laborious but it is more logical than hand-smoothing or curve fitting. There is an alternative method for achieving the same end by population projection described in the Population Council Manual (Shorter, 1974) but in most instances, the quite detailed fertility information (i. e. an age-specific fertility schedule and some knowledge of total fertility) is a deterent to its use for this purpose. All the procedures have been programmed however, and those countries with a Fortran compiler and at least 64k storage space on their computers are welcome to try the program.

Another method for correcting the age distribution in a census or survey has recently been worked out by Valaoras (1972, especially pp. 14 - 22). The method depends on the existence of a series of at least two censuses at intervals of five or ten years. Basically, the track of each five or ten - year cohort is followed through each of the censuses with due allowance for mortality. Corrections are made on the basis of irregularities in the size of the cohorts as they age.

It must be noted that estimation of the basic demographic parameters must proceed correction of the age structure otherwise the whole process of finding mortality and fertility levels becomes circular.

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III. MORTALITY ESTIMATION

1. Model life tables

The most widely used set of model life tables are the Princeton series (Coale and Demeny, 1966) which include four " regional " patterns involving relationships between the force of mortality at different ages. Their derivation is fully described elsewhere (Coale and Demeny, 1966) and their applications are illustrated in the UN Manual (1967) . Some care is needed to ensure that the age pattern of mortality in the model set is in fact close to the pattern observed (however incompletely) since often substantially different indirect estimates of fertility and mortality can result from assuming one pattern of mortality rather than another. For most of the ECWA countries, it seems that the South pattern (characterized by relatively high infant mortality) is most appropriate but this is not an invariable rule; it seems that the efforts of UNRWA, for example, have resulted in low infant mortality levels to adult mortality amongst the camp population. A critical review of the value of the model life tables is provided by Adlakha (1972).

The Princeton model life tables superceded the older UN model life tables (1955) which were based on parabolic regressions indicating the relationships between pairs of ${}_nq_x$ values - a simpler system than was used to derive the Princeton tables and without the advantage of the four regional patterns. The Princeton tables are thus preferable to the UN and have the added attraction of providing more detail and of being more widely used by demographers all over the world.

Brass has developed a two-parameter system for producing a model life tables series using logits (Brass, 1973). One of the parameters describes the decline of mortality with age (the slope of the q_x function) and the other describes the intensity of mortality at a particular age (the value of q_x). With incomplete information on the observed pattern of mortality (perhaps some age-specific mortality rates based on incompletely recorded deaths), it is possible to construct a life table using the Brass method if the incomplete information allows the two parameters necessary for the application of the model to be estimated.

A good introduction to the use of model life tables is provided in Shryock et. al., 1973, pp. 812-821.

2. Stable population models

The best exposition of the value and use of stable and quasi-stable models for indirect estimation of demographic parameters is contained in UN (1967). Some worked examples and additional references can be found in Shryock et. al. (1973, chapter 25). What follows is simply a tabular summary of most of the methods which depend on the use of stable models and some notes which are meant to supplement parts of the UN manual. While the

TABLE 1 : MORTALITY ESTIMATION BY INDIRECT METHODS

DATA REQUIREMENTS	METHOD	PARAMETERS ESTIMATED	REFERENCES AND NOTES
1. Age distribution Rate of growth	Interpolation in stable models	CBR : CDR : GRR and life table measures	U.N. (1967) , pp. 61 - 72
2. Two separate age dis - tributions, preferably 5 or 10 years apart.	Census survival estimates and inter - polation in stable models	,,	U.N. (1967), pp. 39-40 and pp. 57-61 Shryock et. al., (1973), pp. 821-824 Addition to U.N. Manual, p. 60 : calculate the mortality indices for ages 10 + to55 + and select the median value from this range.
3. Proportion dead of children ever born by age of mother or by duration of marriage.	Brass method	$x\,q_o$	Brass et. al., (1968), chapter 3 U.N. (1967), pp. 74-5 Sullivan (1972) Trussell (1975)
4. Age distribution and childhood survival estimates from (3) above.	Interpolation in stable models	CBR : CDR : GRR and life table measures	U.N. (1967), pp. 38-39 and pp. 74-75 C (15) gives more reliable estimates than C (35) . It may be worth combining both sexes. Watch for the effect of migration.
5. Two or more age distributions and child - hood survival estimates from (3) above.	,,	,, plus separate mortality estimates for children and adults.	U.N. (1967), pp. 39 - 40
6. Age distribution, child - hood survival estimates and / or model life tables.	Reverse projection	CBR : CDR : life table measures	U.N. (1967) , pp. 37 - 33
7. Proportion of mothers and fathers surviving for each age group of children.	Probabilities of orphanhood	Adult mortality	Brass and Hill (1973)
8. Widows and widowers tabulated by age	Calculation of joint survival probabilities	Adult mortality	Brass (1973a and b)

References at end of Section III.

methods are primarily for the estimation of mortality, it must be remembered that in making indirect estimates of fertility and mortality, one has to constantly cross-check the derived rates for consistency and this may mean estimating fertility en route to the estimation of mortality. It is impossible to prescribe a standardized approach to the estimation problem since in each situation the accurancy and the completeness of the data will be different from all others. The essential point is to remain sceptical of the results obtained until two or more independent sources and methods give approximately the same results.

3. Appraisal of vital statistics

As Courbage and Fargues (1973) pointed out in their monograph on the Lebanese population, the value of incompletely recorded vital statistics is often neglected. By making certain assumptions, for example,that the extent of under-reporting of deaths is about the same at all ages between 15 and 60, Brass (1973) evolved a method which yields an estimate of the extent of under-registration. The method was described at an earlier ECWA conference and it seems to be fairly robust in a wide range of situations. The problem estimating child-hood mortality remains and so far the best solution to this problem is to use another Brass method(Brass et al., 1968; UN, 1967, pp. 34-36).

With an observed distribution of deaths by age and an age distribution, it is possible to estimate the mortality level using model life tables or some life tables assumed to be similar in form. The procedure, developed by Courbage and Fargues (1973, pp. 12-34), uses the proportion of deaths recorded above and below selected ages and compares these proportions with those observed in stable populations to derive separate mortality levels for infants and adults. The methods yields a life table and some estimates of the amount of under-registration by sex and age.

4. Surveys and other checks

There are a wide variety of survey methods which can be used to produce accurate estimates of mortality in favourable circumstances. In the ECWA region, there is comparatively little experience with these methods although the mortality modules offered by the World Fertility Survey for use by the participating countries (Jordan, Syria, Iraq and Kuwait so far) will provide a good introduction to the value of a retrospective, single-round survey (WFS, 1975). For the estimating of general mortality, the single-round survey has proved entirely in - adequate : the reported deaths are subjects to errors resulting from misinterpretation of the reference period, omissions and multiple reporting of the same event. Unfortunately, these errors cannot be easily corrected since there is no well-established and consistant pattern of misreporting as there is with age reporting.

Thus, there are three principal ways of collecting mortality information from sample surveys; the use of multiple-round surveys; the introduction of a dual record system on a sample basis; and the establishment of a population register using a continuous record system.

a) Multi-round surveys

One of the disturbing facets of all survey research is the inconsistency of responses at different survey dates (Westoff et. al., 1961; Stoeckel et. al., 1969). For analytical purposes, it is therefore worth keeping the sample as small as possible in an attempt to maintain the quality of the data. The experiences of Tunisia (Vallin and Paulet, 1969), Algeria (Boukhobze and von Allman, 1969) and the Turkish Demographic Survey in running multi-round surveys are relevant to the problems faced in the ECWA contries. The methods are summarized by Cantrelle (1974) and a good critique of the various approaches is available (Sabbagh and Scott, 1967). The World Fertility Survey has published an inventory of surveys by major regions (Baum et. al., 1974) and a selected bibliography of works on fertility which contains references to a number of multi-round surveys whose methodology may be of interest to ECWA countries (Acsadi, 1974). Certainly, a good deal is now known about the likely response errors which enter these studies and about ways to minimize these errors by changing the design of the survey or the way in which the questions are asked.

b) The dual record system

The now classic paper on this topic was written by Chandra Sekar and Deming (1949). The principles of the method are described in Shryock et. al., 1973, pp. 834-836. An analysis of the effects of matching errors and of the violation of the independence of the two collection methods on the estimated parameters is provided by Seltzer and Adlakha (1974). Other references worth consulting are Mauldin (1966) and Coale (1961).

c) The population register

A few developed countries, mostly those with small populations, successfully run continuous record systems. Only a small fractionof the information contained in the system can ever be analysed so that there have to be very good reasons for running such a high cost and in one sense extremely wasteful data collection system. The successful operation of the procedures depends on perfect or near perfect reporting of all vital events and of changes of address. For developing countries, such a system is plainly unsuitable since omissions and inaccuracies quickly render the whole scheme useless, as anyone who has tried working with the existing Etat Civil records in the ECWA region must already know.

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IV. FERTILITY ESTIMATION

1. Measures based on reported parities

There are two methods which make no assumptions about the population being closed, stable or quasi-stable and which are therefore suitable for application to sub-areas or districts. A recently completed Ph.D. thesis at Princeton by Nazek Nosseir made good use of the second of the two methods to esimate geographic variations in fertility in Egypt from the 1937,1947 and 1960 censuses.

a) Correction of average parities to give age - specific fertility

This method, first described in Brass et. al., (1968), chapter 3 and later described in more detail in UN (1967), (pp. 31-34 and pp. 73-4), requires a table of average parities by age of mother and an observed age-specific fertility schedule which could be taken from a retrospective survey of births occurring in the year before the census or survey if no vital statistics are available. The method assumed that the average parities for women aged 20-24 and 25-29 are approximately correct and uses the ratios of these parities to cumulated fertility to correct the reported age-specific fertility rates. Apart from omissions, the method is sensitive to the effects of age misreporting (van de Walle, 1968).

b) Use of average parities by duration of marriage to yield a corrected age-specific fertility schedule

This new method was designed to overcome some of the difficulties of using the preceding method and other techniques described below where accuracy was considerably affected by severe age misreporting. It depends on some important assumptions : that fertility has been almost constant in the recent past, that control of fertility is very small and that almost all the births occur to married couples (Coale, Hill and Trussell, 1975). It is simple to apply and has given what seem to be reliable results in four Middle Eastern examples. All that is needed is a tabulation of average parities by duration of marriage and estimate of the mean age of marriage for girls and of the age at which marriage first takes place. Care is needed in situations where non-response to either the duration or the parity question appears to be high: the original parities may need correcting on the lines of the method suggested by El Badry (1961).

2. Measures based on the Proportionate distribution and some other information

A number of methods are listed in Table 2 and of course many of them are also listed in Table 1 since all the methods are applied by estimating one unkown from the triangle of values (the rate of growth, the age distribution and the level mortality) which characterize a closed population.

TABLE 2 : INDIRECT WAYS OF ESTIMATING FERTILITY

DATA NEEDS	REFERENCES
1. $\frac{o}{eo}$ or r and a proportional age distribution	UN (1967) pp. 29-30
2. childhood survival, age distribution	UN (1967) pp. 37-8 uses reverse projection
3. "	UN (1967) pp. 38-9, 76-7 Interpolation in stable model
4. child survival, two or more age distributions	UN (1967) pp. 39-40
5. two age distributions	UN (1967) pp. 57-61 Census survival procedure

3. Survey and vital statistics measures

The more detail available about registered births (age of mother, birth order, marriage duration, etc.), the better are the chances of developing some correction procedure. One method (Brass, 1969) uses the birth orders to estimate completeness of registration. Survey data on fertility can prove invaluable and there are references in Section III to the methodology and reliability of this approach. Caldwell (1974) has produced a useful synopsis of experience in tropical Africa. The reports on the first world Fertility Survey project in Fiji (Sahib et. al., 1975) are also worth consulting since they contain a good deal of valuable field experiences.

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V. CONCLUSION

For indirect estimation of mortality and fertility, the following tabulations are valuable :

1. single and five-year age distributions for each sex;

2. marital status by age and sex;

3. average parity by current age of mother, including parity or age not stated columns. Special care is needed to distinguish zero parities from non-responses.

4. average parity by duration of marriage - see notes above;

5. births reported during the 12 months preceding the census tabulated by sex of birth and current age of mother ;

6. as above but tabulated by duration of marriage (0-4, 5-9, 10-14);

7. numbers of children everborn tabulated by current age of mother and preferably for each sex;

8. as above but by marriage duration ;

9. numbers of children surviving tabulated by current age of mother and preferably for each sex;

10. as above but by marriage duration ;

11. in addition to the usual tabulations of vital statistics, a table showing registered births by birth order is valuable.

Several other tables are useful and clearly it is not necessary to produce all the tables listed above. It is worth remembering, however, that the cost of producing an extra table or two, especially if the data are computerized, is usually slight in proportion to the costs of a national census or the costs of running a vital registration system. In most instances, the information for the tables is already being collected on a regular basis by the census and survey systems running in the ECWA region.

APPENDIX 1

A few notes on sources of information on demographic estimation may be valuable with particulars of how to obtain the books and manuals.

1. U.N. (1967) **Methods of estimating basic demographic parameters from incomplete data,** population Studies Series No. 42,ST/SOA/Series A/42, Sales No. E.67. XIII.2. Price $ 2.00 from UN Publication Section, UN Plaza, New York, N.Y. 10017, USA.

2. A.J. Coale and P. Demeny (1966) **Regional model life tables and stable populations,** Princeton University Press, Alexander Street, Princeton N. J. 08540, USA.

3. Henry S. Shryock et. al., (1973) **The methods and materials of demography,** 2 volumes, $ 8.50 from the Superintendant of Documents, US Government Printing Office, Washington D.C. 20402, USA.

4. William Seltzer (1973) **Demographic data collection : a summary of experience,** The Population Council, 245 Park Avenue, New York, N.Y. 10017.

5. Eli S. Marks et al. (1974) **Population growth estimation : a handbook of vital statistics measurement,** The Population Council, 245 Park Avenue, New York, N. Y. , 10017, USA.

6. N.H. Carrier and J. Hobcraft (1971) **Demographic estimation for developing societies.**

7. World Fertility Survey (continuing), Occasional Papers Series and Basic documentation available from WFS, 35-37 Grosvenor Gardens,London SW1 OBS, England.

8. The POPLAB program of the University of North Carolina publishes a large number of papers and reprints which are available on application to : International Population Center, University of North Carolina, Chapel Hill North Carolina 27514, USA.

METHODS OF DEMOGRAPHIC DATA COLLECTION, WITH SPECIAL REFERENCE TO WEST ASIAN REGIONAL CONDITIONS *

by

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The process of collecting demographic data and related economic or social data consists of many stages whether the data are being collected as part of a complete census or in the form of a sample survey. Most of these stages precede the commencement of the collection stage by a long period, sometimes exceeding one year. They are a series of operations which affect data collection and which make it either easy or else difficult and complicated.

A census or survey requires plannning and preparation, including geographical operations such as the drawing up of maps, the demarcation of statistical sectors, the preparation of lists of names of the places where desired data to be gathered, whether required by the Government for planning and other purposes, those with which employers are concerned of those relating to employment or other public objectives such as education and health and social services. Next comes the stage of formulation of the questions to be contained in the census form or survey questionnaire, preparation of the tabulation programme and establishment of the technique to be followed for obtaining the required data. Then comes the stage of designing the questionnaire, testing it by a pilot survey and then adjusting it in the light of the test so that it does not conflict with popular attitudes or values and in order to fill in any gaps and clarify questions which prove too vague. The investigation, whether census or survey, requires the preparation of a broad publicity programme to make clear its advantages for the common good and to stress the confidentiality of the data collected from citizens. This confidentiality is stressed in the United Nations census recommendations of 1970, which state that clear emphasis should be placed on methods of ensuring the fullest possible confidentiality of data obtained from individuals and an act promulgated to guarantee this confidentiality in order to facilitate the establishment of a relationship of trust and co - operation between the public and the data collectors.

The initial stages of preparation for a census or survey include measures to be taken for evaluation of the results, so that these measures can be applied at the specified stages, such as field work and data processing, the drafting of a time schedule for the census or survey operations and the selection and thorough training of staff to participate in the various operations.

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Each of these stages has details which affect the degree of accuracy, comprehensiveness and non-duplication of the data collected, as we shall explain below.

Census and sample survey

Methods of data collecting and the problems relating thereto are different in the case of a census and a survey. The purpose of this paper is to give an exposé of the methods used and the difficulties encountered in each of the two operations. There is really no strict dividing line between a census and a survey, although each has its own specific characteristics and objectives. Any official general investigation of a specific environment may by considered a census and any investigation based on a sample may be regarded as a survey. Of course, the basic purpose of a census is to find out the number, distribution and composition of the population, while this is rarely the purpose of a sample survey. The United Nations defined a population census as the whole set of measures taken for the operations of collection, classifying and publishing demographic, economic and social data on all individuals in the state, or certain parts of it, at a specific time.

Those states which do not possess complete machinary for the registration of vital events resort in their census or surveys to the addition of questions on the births and deaths that have occurred in a family durring a specified time period (usually one year) prior to the date of the census or survey. Even in those States which possess reliable vital statistics, we find that a census or survey may contain questions on each matter as fertility (live births), surviving children and the date of birth of each child, because birth certificates are insuf - ficient for a breakdown of females on the basis of the number of live births or ,the intervals between successive confinements.

Although the basic objective of a census and a sample survey is one and the same for demographic purposes, we find that the sample survey has certain advantages and certain drawbacks.

One of the advantages of a sample survey is the possibility of conducting experiments by introducing new questions in the questionnaire when the survey is carried out for the second time, since a survey is usually phased at close intervals. In a census, on the other hand, error cannot be rectified until after the elapse of five or ten years.

Since a national population census serves a multitude of purposes and covers a variety of topics, it is difficult to treat any one topic in depth. In a survey, however, supplements or extra runs can be added and the questions expanded to get to the roots of a specific phenomenon without incurring heavy additional expenses. One of the advantages of sample survey is that the number of data collectors is limited, so that it is easy to select persons with the desired characteristics and abilities and ensure that they are properly trained and super - vised.

One of the principal drawbacks of a sample survey is the sample error. However, this difficulty can be overcome by calculating the sample error for estimates of various sizes, thus making it possible to define the extent of accuracy of the investigation. Sometimes a survey suffers from bias in the sample, which usually arises from the survey design or failure to implement the design accurately.

Nevertheless, a census serves the purposes of a survey, inasmuch as a census may be regarded as a framework for the selection of investigation units in a survey. Through censuses, specific group can be selected for study by survey, e.g. occupational groups or a specific class of property owners or age groups.

In international usage, a census is not regarded as complete until its results have been published in a form which enables the bodies concerned and the researchers to utilize it. In some countries, it may happen that the results of a census are discarded, either because of lacunae in it or for political reasons, or all the tables may not be published, either owing to deficiency in reporting or because of errors in the data on a specific topic.

Factors directly affecting the quality of the data

We have already referred to the preparatory stages which precede the collection of data for a census or sample survey, and will now indicate the degree to which these stages affect the comprehensiveness and accuracy of the data and non-duplication in the units falling within the survey sample.

The census form or survey questionnaire comprises the information necessary for tabulation, and it is therefore necessary for the designing of the form or questionnaire to commence at the same time as the tabulation programme is being prepared. Each requires the greatest care with regard to the designing of the form, size and contents of the questionnaire, the logical sequence of the questions and the instructions relating to it, and the way in which the replies to the questions are to be recorded must also be clearly indicated, because difficulties arising from fauly design of the questionnaire cannot be overcome after the field work is completed. The accuracy of census or survey data depends to a large degree on the type and clarity of the questionnaire. It is an accepted fact that the results of the investigation cannot be better than the questionnaire used for it.

In the designing of the questionnaire, account must be taken of the data collecting technique to be followed and the type questionnaire that is to be used in the data collection, since there are four kinds of forms or questionnaire.

1. Individual questionnaire. This is designed to contain data on one person. It may be noted that the percentage of error in this type of questionnaires is less than in other forms, because there is no risk of data being recorded in the wrong column or on the wrong line.

2. Questionnaire for one family or one residential unit (whichever is the unit of investigation). This type of questionnaire is designed for the recording of the data required of a family. The detection of error in this type of form is easier because it is possible to check the relationship of the individual to the head of the family. It also facilitates the mechanical processing operations. It is the type most commonly used.

3. Questionnaire for a number of families or residential units. This is designed to contain information on the greatest possible number of families or residential units. Although this type effects savings in the cost of paper and printing and reduces the risk of questionnaires getting lost, it increases the number of errors arising from the recording of data in the wrong place, because there are so many lines on each page.

4. Questionnaire for collective enummeration. This is designed to comprise overall data on the members of specific communities such as the tribe or a branch thereof or an inter-related group of families taken as the unit of enumeration. We shall mention this type when speaking of the problems of the enumeration of nomadic tribes or inhabitants of remote regions which are for the data collector to reach.

In view of the fundamental importance of the questionnaire, those states concerned with the conducting of censuses or surveys have taken to consulting the opinion of government authorities, national institutions and scientific bodies on the contents of the questionnaire and the draft questionnaire is prepared in the light of the proposals made. The draft questionnaire is then shown to the bodies concerned and the potential users of the results of the census or survey so that they may express an opinion on it. It is then amended, wherever possible, to meet the requirements of the abovementioned bodies and individuals.

In every type of questionnaire the following points are observed :

1. The questionnaire must be clear and satisfactory as to form.

2. The questionnaire must not be longer than necessary, for the person replying to the questionnaire is more likely to be co-operative if the questionnaire is not too long.

3. A space should be left in the questionnaire for the data collector to record his comments.

4. The questionnaire should be printed on glossy hard-finish paper to withstand handling by many people during the interviewing and the subsequent checking and processing.

Pilot survey

While the views of the potential users of the results of the survey or census are valuable, the questionnaire must be tested in the field on a limited scale in order to detect any deficiency or lack of clarity in the questions or the instructions and to see the extent of the public's

receptivity to it. It is on the basis of the results of the pilot experiment that the necessary decisions are taken for the work of the subsequent stages of planning the census or survey project.

Although the pilot experiment is more important in the case of censuses, the United Nations recommends the conducting of a trial run in the case of every questionnaire prepared for data collection. The questionnaire should cover all the elements to be covered by the survey, because the trial run will show up the difficulties hindering the obtaining of some data and any errors in data collection procedures. It will also give a clear idea of the time required for the collection of the desired data from the survey unit, thus indicating the number of data collectors needed and an estimate of the time needed for field work. States have therefore endeavoured to test questionnaire in the field at a number of the preparatory phases.

Contest of the questionnaire

The questions in the questionnaire must be free from ambiguity and not liable to arouse any objection. There are three kinds of question. The first is where the reply is one of two possibilities such as "yes" or "no", "male" or " female ". Characteristics involving a reply limited to one of two alternatives are few. In the case of the second kind of question, the reply is one of a limited number of possibilities, and the anticipated responses are listed, with a space left for " other " where all cases cannot be covered. With this type of question, care is taken to make the alternatives realistic and unambiguous. The third kind of question is where the reply covers numerous possibilities. A blank is therefore left for the reply. " Occupation " is one example. The reply must be written in full and sample replies given in the instructions, so that occupations, for example, can be classified in a meaninful way.

In the case of all three kinds, the question must be clear, brief and not admitting of any interpretation other than that intended. Some questions may require definitions and explanations if a correct and accurate answer is to be obtained.

In the presentation of the questions, the data collector should read out each one literally as it stands in the questionnaire and then explain in his own words any questions which the person replying may find difficult to understand.

The data collector : characteristics and training

The process of data collecting in the field requires special characteristics in the staff, which must be taken into account when the latter are selected. These include an ability to appraise people and situations accurately and quickly, power of observation, attention to detail, perseverance and accuracy. A data collector should have the qualities of sympathy and interest in people, conscientiousess, trustworthiness, critical discernment and a good memory. His appearance should inspire respect, esteem and confidence, and he should be unbiased in his observations and capable of recording facts and views with complete accuracy.

Once the data collectors have been selected, attention must be given to giving them proper training in every area of their responsibilities. The training may take one or two weeks and must comprise a detailed briefing on the background of the envisaged study, including its purpose, the allocation of responsibilities, the scope of the study, the data collecting techniques and the information sought from the exercise generally. The data collectors must be given an idea of how the sample is selected and the methods used for delimiting it, and emphasis must be placed on the necessity of establishing good relations with the public and the need to complete the survey by a specified deadline. The instructions must also be discussed with them.

Instructions

The instructions are prepared for the data collectors and given to them in writing to study and refer back to whenever necessary. It is preferable to have the instructions ready for distribution before the commencement of training and to make them the starting point. Although the instructions will differ according to the data sought, there are certain basic points which should be incorporated. Among them are the following :

1. The data collector must acquaint himself thoroughly with the aims of the investigation.

2. He must observe the time schedule set for the work.

3. It must be made clear who is the person directly responsible for the data collector's work, so that he can consult him whenever necessary.

4. The data collector should not distribute copies of the questionnaire to persons not covered by the investigation without the permission of the supervisor.

5. The data collector should work full time on his task and not be prevented by other work from carrying out his responsibilities.

6. The data collector should write out the replies to the questions himself.

7. The data collector must follow the method of data collection laid down.

8. The data collector must carry his identity card and a letter from the supervisory authority of the exercise establishing that he is authorized to obtain the data in question. This letter should include a request to the subjects of the enquiry to co-operate with the data collector.

9. Stress should be placed on the confidentiality of the information obtained by the data collector.

Even though each data collector should have a complete copy of the instructions, it is essential that his work be carefully supervised so as to ensure that they are applied accurately and reliably.

Supervision of data collectors

A census or survey needs efficient supervision at every stage, especially at the data collection stages. Accordingly, a number of supervisors are appointed and trained in a way

similar to the data collectors, except that the training includes supervision techniques to ensure the accurate and faithful application of the instructions. While the details of the instructions for supervisors differ according to the objectives of the exercise, they generally cover the following points :

1. They explain how responsibilities should be distributed among the data collectors.

2. The supervisor must give guidance to the data collectors whenever they encounter any problem in applying the instructions or understanding the questions.

3. The supervisor must make a daily check of the completed questionnaires.

4. He must sometimes repeat an investigation in order to check the data collectors' competence and their careful completion of all items in the questionnaire.

5. It is the supervisor's job to rectify any deficiency or distortion in the field work.

6. The supervisor must determine the problems which the data collector can cope with himself, those which he should refer to the supervisor and those which the latter should, in turn, refer to his superior.

7. However carefully the details of the census are planned, unforeseen problems may nevertheless arise in the course of work. The data collector must therefore be given facilities to enable him to contact his supervisor without delay as soon as such problem emerge.

8. The supervisor must make a periodic field check on data collectors, in order to evaluate their work.

9. In order to ensure effective supervision, the number of data collectors working under one supervisor must not exceed a set limit. The less training the data collectors have, the more essential it is for the supervisor to be close to them.

10. Supervision and inspection of the data collectors' work with the first phase of the field work, in order to avoid errors right from the start and so that the supervisors know where they will have to concentrate their efforts.

Methods of data collection

There are three classic methods of collecting data for a census or for surveys conducted for various purposes.

Method I

This is the "canvasser method", which is the one most widely used, particularly in periodic surveys. With this method, the data collector or enumerator pays a visit to a designated family or residential unit and, after briefly introducing himself to the family and telling them the purpose of his visit, proceeds to put the questions in the questionnaire to a responsible member of the family-usually the head of the household-and fills in the replies on the form, in accord-

ance with the instructions. In some types of investigation the data collector is required to keep strictly to the literal wording of the questions as set forth in the questionnaire, and if the question is not understood the first time, it is repeated one or more times. In the case of some questions, adherence to the literal wording may not be required, and it is then essential that the data collector understand the basic intent of the question, so that he can convey the meaning which the drafter had in mind. For this he uses explanatory expressions or synonyms that may be better suited to the educational level of the subject.

Method II

This is the " householder or self-enumerator method". Briefly, it means the questionnaire is given to one member of the family-usually the head of the household-to fill in the data and reply to the questions in accordance with the attached instructions. He assumes respons ibility for this, and the data collector returns a few days later to collect the questionnaire and check that the data required have been entered accurately and in full. He is responsible for correcting any errors in the entries.

Method III

Here methods I and II are used in combination. Some states prefer to combine the two methods in the case of censuses and surveys alike. The self-enumerator method is used in some environments (usually urban ones) while the canvasser method is used in some environ - ments (usually rural ones); and sometimes both methods are used in the same environment according to the educational level.

Sometimes the head of the household is asked to fill in the replies to some of the questions (those relating to the names of family members, their relationship to the head of the household, age, sex, marital status, educational level and nationality), and the data collector fills in the replies to the other questions when he comes to collect the partially filled in form.

Besides these three methods, there are other non-traditional methods of collecting demog- raphic data and related material. This is due to circumstances imposed by the nature of certain environments, and we shall refer to them when dealing with the problems of data collection in the countries of the region.

Advantages and drawbacks of the canvasser and the self-enumerator methods

Supporters of the canvasser method for use in a census or survey prefer it to the self- enumerator method because the data collector, if properly selected and trained, can explain the questions and instructions so as to ensure the accuracy, congruity and logical sequence of the data.

This method averts the difficulties which arise from illiteracy or ignorance and the embarrasment which may affect the half-educated when they hesitate to admit their inability to provide the data required or to reply to the set questions, for this can cause many errors.

Data collectors should, naturally, pay the greatest attention to the precision of the data collecting processes. Good publicity can help to promote confidence in the data collectors and a willingness to reply to their questions reliably and accurately.

Supporters of the self-enumerator method say that it is less expensive, since it requires fewer trained data collectors, and they consider that self-enumerator method, by allowing the head of the household free scope in answering the questions, reduces the errors which may arise from haste or lack of reflection or from the lack of the necessary knowledge of the required data on the members of the household. They postulate that this method is better for preserving the confidentiality of the data, as the head of a household may hesitate to mention personal information about members of his family to a data collector, who may be from his own neighbourhood or a nearby one, and they believe that to give the head of the household the responsibility for entering the data on the form will stimulate the community's interest and its sense of responsibility. They consider that without such an attitude on the part of the public, the data collector's proficiency will not suffice to obtain good results.

We have mentioned that the canvasser method is the most commonly used. Indeed, is is essential in those countries where illiteracy is widespread and the head of the household is unable to enter the necessary replies on the form. In this method the data collector's work, after his training, is divided into three stages.

Stage I

This precedes the data collection day. The data collector must visit the area assigned to him, acquaint himself with it generally, get to know its boundaries and decide upon the routes to be followed in order to gain access to the enquiry units, if it is proposed to carry out an enquiry, or ensure that he will not get the roads confused if a comprehensive enumeration is envisaged. He must mark the road or roads he is to follow in sequence on the map provided for him by the census department, correlate the map to the terrain and correct the map as necessary. If he has no map he must draw a sketch of the sector to show the residential units and, in the event of a survey being conducted, the data collector must at this stage correlate the list of residential units included in the sample with the actual dwellings in order to make certain that the list comprises all the dwellings. If the dwellings have been numbered for purposes of the census he must ascertain that the numbering is comprehensive, clear and correct. In some countries the data collector distributes pamphlets during his visit explaining the census operation and stating the information which will be required so that the householder can prepare his replies.

Stage II

This is the data collecting stage when the collector visit the families or residential units from which data is required and conducts the interview with the head of the family during which he completes the questionnaire. Although one visit to the family is sufficient to carry out this task, if the respondent is unable to supply full details on each member of his family

the data collector can pay a second visit at a later specified time to complete the questionnair. The data collector must check off each unit in which his work is completed on his control list in order to avoid omission or duplication of any residential units.

Stage III

This is the period following the completion of data collection during which the data collector makes out his progress report containing his general comments and revisits those families in whose data he discovers an inconsistency in order to rectify the errors and repeat the interview procedure in the case of any questionnaire the answers to which he has reason to doubt after checking the questionnaire in the central office.

Problems of collecting census or survey data in the region

In the previous section we summarized the stages preceding data collection in the census or survey and pointed out that each of them is of consequence to the data collection process. We went on to mention the various methods and techniques which can be followed in data collection. A realistic look at the demographic data and socio-economic characteristics which have been gathered in most countries of Western Asia is sufficient to show that there is more than a little scope for the raising of standards to a level of comprehensiveness and accuracy that can be relied on when analyzing data and formulating and utilizing conclusions in various spheres of national planning.

Before giving example of specific problems we will make reference to certain environmental and social factors which impede the acquisition of accurate data and leave gaps in the demographic picture of the community. Some of these factors can be summarized as follows :

1. Illiteracy is still widespread in a sizeable proportion of the population in the middle and advanced age groups, and even in the younger generation, since these have not been given opportunities for education during school age. These two age groups comprise most of the heads of families who supply the data collector with the required information. This factor is especially relevant in the case of females among whom the illiteracy rate is higher than among males.

2. Sizeable groups in the region's communities still do not realize the value of the censuses and surveys being carried out. On the contrary, they consider them to be an interference in their private affairs and some even fear that the information they disclose may be used to their detriment, whether in the form of taxation or other burdens. They are, therefore, reluctant to impart accurate, factual information.

3. Most of the region's population lives in small towns, villages or settlements where they occupy unnumbered dwellings which have not been constructed in an orderly fashion likely to facilitate the numbering process. Therefore, the census or survey faces more than a little diffi culty in numbering these residential units and complete and comprehensive numbering is rare ly achieved.

4. There are also population groups in the region living in isolation from organized society, such as nomadic tribes who wander the desert wastes or the inhabitants of geographically remote places without regular means of communication with the more heavily populated centres and which can only be reached by way of rough and insecure tracks.

5. Most of the developed countries endeavour to maintain a permanent establishment for statistical activities with a nucleus of personnel trained to undertake and supervise data collection, select samples and avoid errors. When these countries decide to cary out a census or survey they have the advantage of being able to draw on the experience of this professional nucleus for the necessary preparation, training, implemention, supervision and data analysis. The majority of countries in the region, however, either still lack this permanent apparatus or are unable to fill existing gaps therein, especially with regard to the availability of technicians and specialists.

6. It is not easy to find a group of young men and women ready to accept temporary work for two or three months as data collectors and yet carry out their task with absolute integrity, attention to accuracy and concern for detail. Similarly those in charge of carrying out the census or survey may face the same problem when staff from government departments or private institutions are assigned.

These are some of the problems of demographic data collection. We will now turn to their effects with regard to the difficulty of obtaining reliable data and the attempts of the data collector to overcome them.

1. The ascertaining of age or data of birth

The classification of males and females by age group is one of the most widely used methods for purposes of demographic analysis. If classification is correct, it forms indispensable basis for forecasting future resources of manpower and their requirements with regard to schooling, services, housing, employment and food. Such data can also be used in computing the basic yardsticks of population growth such as fertility and mortality rates in the various age groups.

However, the accurate ascertaining of individual ages is one of the most complex problems faced by the data collector. The majority of the population do not know their dates of birth nor their ages and for some reason there is a general tendency to quote ages ending with the digits O, 2, 5, or 8 and in some cases respondents deliberately understate their ages. Since one person normally provides the information about the rest of the family, it may be defficult for him to remember the date of birth of every individual and he will, therefore, only give their approximate ages. Various methods are thus required to obtain more accurate information on ages. The data collector must, for example, familiarize himself with customary methods of measuring ages in certain communities since age is calculated in some societies from the New Year in either the Hegira or theGregorian calendar so that the new born child is considered to be one year old and becomes 2 at the beginning of the new year, gaining

one further year each new year. If the data collector does not ascertain the data of birth according to the solar year age estimates may exhibit an average bias of not less than one and a half years in the age of each person.

An attempt can be made to overcome certain problem of age estimation by the data collector asking for the ages of children in months instead of years, especially in the case of those whose age is either under or just over one year. The data collector may refer to the dates of important events such as a fire, blight or natural disaster, the construction of a dam or a bridge or the outbreak of a revolution or any political upheaval and then relate ages to these events by adding or deducting the number of years prior or subsequent to their occurrence. In age estimation it is also possible to relate the age of the family by comparing the ages of family members in close relationship to person whose age is unknown.

2. The number of live births

This data is important for the calculation of both the overall and the sex specific birth and fertility rates and is also useful in estimating current and future rates of population growth and their influence in generating socio-economic changes. In view of the significance of this data, great efforts are made to obtain the required information by means of sample surveys to measure the accuracy of the data obtained by comparing it with data from the Public Records Office.

The number of live births is frequently understated but may, on occasion, be overstated and it is, therefore, necessary to compare these figures with various other sources such as the Bureau of Vital Statistics or the results of a periodic survey. The data collector should ask several questions about surviving children such as the number of surviving children presently living with the family, those living away from home and the number of those who have died. This breakdown may be an aid to memory and help in rectifying errors.

3. Current fertility

The simplest way of establishing the number of live births among the members of a family is by asking a direct question. " How many children were live-born to the women living in the family during the past twelve months. How many were male and how many female. How many are still alive ? " The reply should include all live births to women living in the family wherever these births occurred and should comprise women who temporarily returned to their parents' home for their confinements.

Replies to this type of question are subject to a great many errors since they are dependent, in the first place, on the respondent's desire to answer accurately and, in the second, on the extent of his knowledge of the full facts and his ability to remember the time and place at which events occurred. It is, therefore, preferable for the question to be put to every

woman in the family who either is or has been married and then put the same question to the head of the family in order to compare the replies and rectify errors.

It is obvious from surveys carried out in India that the tendency to understate the number of births increases with the passage of time subsequent to their occurrence. For instance, when the question related to the previous year's births it was found that the live birth rate based on the replies was 34 per thousand of the population but when the question was restricted to births in the past three months the live birth rate was found to be 42 per thousand of the population.

Sometimes an error may arise in the specification of the time period since mothers are inclined to consider all their children who are either still being breast fed or who cannot walk as being under one year old with the result that the birth rate for a particular period may be higher than it actually should be.

For this reason it is recommended that the period in respect of which enquiries are made about the number of births should be kept as short as possible in order to minimize the likelihood of error with all its attendant drawbacks, chief of which is the need to repeat the survey at frequent intervals.

It may prove less difficult to determine the time of occurrance of vital events if the enquiry pertains to a twelve month period of particular significance to the peole i. e. immediately following an important incident such as a fire or after a religious or national holiday.

It is noticeable that children who die shortly after birth are the ones usually overlooked. A possible way to remedy this omission would be to put the question concerning births to each female of child bearing age separately, especially if the question is coupled to another such as "Is the child still alive?" Similarly, a question on the child's order of birth might produce more satisfactory answers.

4. Total fertility

Another question is normally asked to obtain information on total fertility up to the data of the survey as follows : (1) total number of children born alive to the respondent throughout her life up to the survey. (2) how many of these are still alive. (3) were any of them born during the past twelve months ? The reply to this question must include all live births to women irrespective of whether or not they are past child bearing age or whether the children born to them are from their present marriage or previous marriages and a distinction must be made between male and female births when recording the data.

This data is collected from all married, divorced, widowed or separated women and in certain communities it is preferable that the collector of this type of data should be a woman since it is difficult for men to obtain this data with any accuracy.

If accurate information can be obtained from this question it is possible to deduce various fertility measures such as the gross fertility rate, the net reproduction rate, the gross and the net averages of fertility in various age groups, the average number of live births to mothers who have reached the end of their child bearing life and the average number of children born to each woman.

The difficulties of obtaining this data far surpass the problems met with in questions pertaining to the number of births in the period of the past twelve months, such as lack of enthusiasm to reveal the facts, ignorance of the true state of affairs or weakness of memory.

The problem becomes more complicated when the questions are put to the aged since it is not easy for them to remember events that happened many years ago. There is a danger that children who died in infancy may be overlooked and if the respondent is not herself the mother she may not be able to supply all the information accurately.

In countries of the region, as in other developing countries, children who die before being named or before the traditional formalities can be carried out may be overlooked since, in the customary view of certain communities, they never existed. Some mothers may cite their children by adoption, especially if the adoption took place a long time ago or may mention still births as though they were live births.

Hence care must be taken to formulate the question in such a way as to make it as easy as possible to obtain correct information. Additional questions may be posed and then the number of live births should be compared to the list of members of the family. If the data does not correspond, the reason for this must be looked into and the error rectified.

5. Mortality

The part played by mortality statistics in the planning and implementation of public health programmes and in the analysis and projection of population trends required by demographic policy makers emphasizes the importance of obtaining an estimate of the mortality rate among the population. The annual gross mortality rate is the second element to be taken into account when calculating the rate of natural increase and is also a direct indicator of the standard of general health. It is, therefore, a matter of concern to governments to obtain accurate information on deaths and mortality rates.

The problem of overlooking the deaths of young children presents one of the difficulties of obtaining exact information on mortality since it is hard for an illiterate woman to recall the births and deaths of her children and to specify with accuracy the time when these events occurred. Similarly deaths among the aged may be intentionally overlooked in primitive societies with a view to evading certain financial obligations such as inheritance tax or out of apprehension that income to which the deceased was entitled may be discontinued. Deaths occurring away from the normal place of residence of the deceased may likewise be overlooked.

This potential omission of a number of deceased persons calls for diverse efforts to be made during the census or survey to record the name of deceased, the date of the death, his age and relationship to the head of the family. When a widow or widower is listed among the members of the family the data collector must inquire about the date and place of death of the husband or wife in order to make sure that the deceased has not been overlooked in the reply to the direct question. Since the greatest proportion of deaths usually occurs in the two age groups of old age and infancy, particular attention must be given to questions relative to these two groups to discover all cases of death. The number of deceased children may be deduced from a comparison of the number of live births with the number of those still alive at the time of the census or survey.

6. Marital status

Data on the marital status of each member of the family is of special significance as a means of classifying the population by marital status, sex and age of studying the composition of the population and its repercussions on the level and trends of fertility. A distinction is made in this data between those who are single, married, widowed, divorced or separated with careful definition of each type. One of the major problems faced by the data collector is the lack of standard definitions. For example, should de facto separation be considered the same as legal separation between husband and wife ?

These, then are some of the problems facing data collectors in their efforts to ascertain demographic characteristics and the expendients to which they resort in order to overcome these difficulties.

Definition of the unit under study

A further problem facing the data collector in the census or survey is the delimitation of the unit under study, for example the "family "or the " residential unit", in such a way as to leave no scope for ambiguity. One residential unit may house a single person, another may accommodate several closely related persons while a third may be lived in by persons linked by family ties to others and a fourth may be the residence of several people without any family connexions. The data collector may find an individual living in part of a residential unit (a room) while the other parts are occupied by others and this individual may either be independent in his domestic arrangements or may share in those of the other occupants of the residential unit. In this respect it is necessary to define what can be considered as a family and what should be regarded as an association of different elements with the proviso that the definition must be clear and applicable to all cases so that there can be no ambiguity when enquiries come to be made about the census or survey unit.

Unconventional methods sometimes used in data collection

We have made reference to three conventional methods of collecting census or survey data. In some parts of the region, however,, there are population groups whose way of life or

lack of stability in a fixed environment inhibits the application of conventional methods of data collection. These grups are :

I. The nomadic population

The nomadic population lives in the desert in which it roams according to the seasons, in search of pasture and water. They have their own customs and traditions and a way of life which is different to that of their compatriots living in sedentary communities. For this reason, when investigating the nomads it is necessary to apply different methods more appropriate to their circumstances. An instance of this is the method used in 1946 to enumerate the nomads in Palestine and which took the following form : -

1. Specific tribal groups were assigned to each enumerator instead of geographical districts. The enumerator travelled round in search of the members of his allocated tribe whereever they might be living.

2. The head of each tribal section accompanied the enumerator during his census activities since, as head of the section, he knew all the families in his section and the area where they were likely to be found.

3. The collective enumeration method was used on the basis of the family being the fundamental unit of enumeration.

4. The canvasser method was adopted at a meeting attended by the heads of the families of each group in the tribal section.

5. In an endeavour to ensure completeness of coverage in the enumeration, the data collector asked the head of each group of families about the names of the heads of the other families in the tribal section concerned (all members of the section are closely interrelated and know each other) and then matched these names with those on his control list to ensure that all the families had been included.

6. The data collector obtained information from the section heads about any person temporarily absent and then went to visit them and interview the heads of their families. A comparison was then made between the information collected from these and the information obtained from their relatives.

7. The data collectors were from the tribes included in the census and, as such, were trusted by the nomads. In this way it proved possible to gather more detailed individual data on the basis of a sample made up of 16,000 persons from 3,000 families

A further experiment was made to enumerate the nomadic tribes in the Sudan census of 1955-1956 in the following manner 1/ : -

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1/ **Handbook of population Census Methods.** Vol. 1, U.N. Studies in Methods Series F. No. 5 Rev. 1 P. 100.

Since Sudanese tribes are divided into sheikdoms lists were prepared containing the names of tax payers in each sheikdom and also of registered voters and heads of families wherever possible. The data collector was supplied with lists of these names for his alloted sheikdom and was required to enumerate a given number of individuals from families in his sheikdom equivalent to a fixed proportion of the total number of individuals in the sheikdom. He was also instructed to begin the enumeration in the largest group of families in his assigned sheikdom but was free to select the families to be enumerated provided that these included families from all parts of the group. If, in his enumeration of the families in the families in the first group, he did not reach the appointed number he was to move on to the next largest family group and there continue the enumeration process until the number laid down for the sheikdom was completed.

The data collector interviewed every member of the family where this was permitted by prevailing customs. Failing this he merely gathered his data from the head of the family.

The information obtained in the census was limited to the names of the members of the family, their relationship to the head of the family, whether they were present during the enumeration, present nationality, the tribe to which they belonged, place of birth, marital status, number of wives (in the case of men only), main occupation, secondary occupation, highest educational level attained, age group, fertility and infant mortality (in the case of women of child bearing age). Data was also collected from the family as a whole such as the language they spoke and number of deaths that had occured in the family over the twelve month period prior to the census.

The Hashemite Kingdom of Jordan carried out an agricultural census last year (1975) comprising the nomads during which the following measures were taken :

1. A letter was sent to the headquarters of the Desert Police requesting the names of the tribes and details of where they could be located during the period of enumeration and other basic information about them such as the boundaries of their tribal area. Notification was given of the intention to visit them at their camping places at the time specified for purposes of enumeration.

2. The headquarter of the Desert Police and the Natural Resources Authority were asked to determine the watering places where the nomadic population would be concentrated during the enumeration period and to visit these places to carry out a census of the nomads camping there.

3. The headquarters of the Desert Police was requested to provide guides to accompany the enumerators and direct them to the camping sites of the nomadic population.

4. Contact was established first with the tribal sheikh to explain the purpose of the desired census and to request his assistance. (It might be noted that the tribal sheikhs showed a spirit of genuine co-operation).

In addition to the above, it is also possible by aerial photography to determine the locations of nomatic agglomerations and to use these photograps as a basis for a random selection of certain locations in which to carry out a practical enumeration on a small scale. It would likewise be possible to use a remote sensing system by means of earth satellites. Apart from being more advanced from the technological point of view, this method is also quicker and less costly and the satellite could rephotograph a particular area every 18 days and thus help in the compilation of a series of consecutive maps illustrating the movements and migrations of the nomadic population. This technique was used on an experimental basis in both Afghanistan and the North African desert and made it possible to locate the water holes and observe the movement of the nomadic population around them.

II. Outlying districts to which access is difficult for data collectors

In some countries of the region, population groups live in remote places outside the socio-economic structure of society. These do not usually appreciate the value of census or surveys which to them have no meaning and they may withhold certain information requested from them considering it to an encroachment on their private affairs or because of misgivings about the objectives of the data collection. Furthermore, most of the data listed in the questionnaire or census form may be inapplicable to their circumstances.

In such a case it is better to draw up a form or questionnaire of greater relevance to their way of life and that will not conflict with their customs and traditions.

Since it would be impracticable for the data collectors to try and gain access to, or to live in, these remote parts, an attempt could be made to gather the population of a particular region in a given place such as one of the village nearest to them and to enumerate them there instead of the data collector having to go to each of their places or domicile.

The situation may call for collective enumeration 1/ in which total individual characteristics are lumped together and recorded on one form instead of gathering data from each individual separately. In this type of enumeration the selected group should form unit of reasonable size and not be so large as to make it difficult to carry out the enumeration operation sucessfully. If it should prove impossible for every individual, in particular the aged and the very young, to attend it would sufficient to gather the heads of groups to the central place where each of them can supply information about all the other members of his family.

The method of collective enumeration was used in the East African census in 1948 and in Nigeria in 1952 - 1953. The tribe or residential hut was regarded as the enumeration unit and individuals were lumped together according to sex, age group and marital status. The total of persons fitting into each category was then entered in the appropriate column 2/

1/ U.S. Department of Commerce, **The Methods and Materials of Demography**, Vol.1, Bureau of the Census, 1971, P. 51.

2/ **Handbook of Population Census Methods,** Vol. 1, U.N. Studies in Methods Series F. No. 5, Rev. 1, P. 99.

Following this general enumeration, a 10 per cent sample was selected to enumerate the occupants of the huts included in this sample. In this sample enumeration data was collected on place of birth, religion, economic parameters, fertility, physical defects and education. It was the opinion of those in charge at the time that the reiteration of the questions relating to sex, age group and tribe which had already been asked in the general enumeration would reveal the degree of accuracy obtained and lead to the computation of the appropriate correction factor.

SUMMARY OF METHODS OF EVALUATION AND ADJUSTING DEMOGRAPHIC DATA*

by

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I. Introduction

Demographers are concerned with two basic types of data. The first has to do with the study of the population ' stock ' or, in other words, the size and characteristics of a population at a specific moment in time. The second relates to observation of the 'flow' or the fluctuations and changes in size with the passage of time. Data of the first type is obtained from general population census while the second type is provided by vital registration.

Only a few of the countries of the Third World in general, and of the Arab states in particular, have up to now conducted more than one census or followed an integrated system of vital registration. It is, consequently, very difficult to rely on data compiled from such censuses and vital registration to obtain basic demographic information. There are two main schools of thought on the best method of obtaining this urgently needed information. The first or traditional view is that continuing efforts should be made to improve the traditional sources (censuses and vital registration) and bring them up to the standard currently prevailing in the developed countries and to apply this traditional system at the earliest opportunity. Naturally there are a number of obstacles to be overcome since the improvement and implementation of this system is a very difficult objective to achieve, at least in the near future, for a variety of technical, economic and other reasons. Similarly, bringing the system up to an acceptable standard of accuracy is a long and gradual process. Therefore, in spite of the need for this follow-up, there are strong reasons for having recourse to methods of quick return to provide researchers and planners with the requisite demographic information. This second school of thought has led demographers to direct most of their efforts in recent years towards attempting to develop a number of alternative sources based on methods of estimation. Two basic approches have recently come into prominence. The first has recourse to methods based on demographic models such as those of a stable or quasi-stable population while the second relies on methods of estimation using specific retrospective questions in censuses and surveys with the aim of estimating vital rates. These latter are known as the Brass methods (Demeny, 1971).

In addition, demographers have spared no effort in the pursuit of ways to measure accuracy and adjust demographic data and have lately come to rely to an increased extent on special studies and data based on population surveys conducted by the sample method or by the recurring visit method and sample registration systems etc.

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* Meeting document E/ECWA/POP/WG.5 5/6 .

The fact is that, whatever the uses of the demographic data such as computation of rates or in the field of socio-economic development and the like, the acceptability of the results depends primarily on the reliability and accuracy of the base data. Quality control and evaluation of this data are, therefore, basic requirements. The evaluation exercise in turn highlights trends and aspects of error which are helpful in suggesting appropriate types of correction and adjustments where necessary.

This present study is only concerned with methods of evaluating census data and vital registration and does not evolve into the question of observational errors in cases where samples are used. Errors in these sources (census data and vital registration) are liable to occur at any stage of the work. For example, errors may appear due to improper preparation in the initial stages of design and format of the questionnaire or as a result of incomplete reporting or observational error in the field work due to mistakes on the part of the enumerator or data collector himself or the respondents. During the processing and preparation of data, errors frequently occur in punching, codification and other operations. Finally there are mistakes in interpretation and printing errors. A lot of the errors affecting data can generally be attributed to the human element in the office operations which are characterized by variations in productivity and accuracy. There is a need for more effective office control to minimize such errors.

For purposes of the present study, and without regard to their causes, errors affecting censuses and vital statistics can be classified under main headings as follows : -

(a) Coverage Errors

(b) Content Errors

By coverage errors is meant the comprehensiveness of the enumeration or registration i. e. has data been collected from all the individuals who should be included without omission or duplication ? In census work whole areas or dwellings are sometimes omitted or some members of the family missed out for one reason or another, giving rise to deficiencies in coverage (the converse is possible). Similarly, in vital registration certain important events, for example, may not be reported and the registration is consequently defective.

By content errors we mean incorrect classification of indvidual characteristics. As in the case of coverage errors, content errors may occur at any stage of the statistical work. The most common content errors are in connexion with age since we find that the distribution of individuals by age is usually prone to many errors due to a variety of reasons beyond the scope of the present study.

The following pages contain a brief outline of certain methods for the detection of errors and the adjustment of census data and vital registration. Since there are many methods and numerous writings on this subject the present study must, of necessity, be selective not only in matters of detail and emphasis but also in comprehensiveness of content as regards possible methods and procedures.

II. General Considerations and Bases for Evaluation and Adjustment

A. General Considerations

Methods of evaluation and adjustment differ in various ways with regard to their robustness, accuracy, data requirements and even when they are geared to the same objective. It is, therefore, difficult to recommend the adoption of one specific method or the exclusion of others without laying down a number of preconditions depending on the time and place and on the data itself. The rule is that there is no method applicable to all situations and times or even to certain specific situations. The procedure must depend on the manner in which the errors occurred. It is difficult if not impossible to predict specific patterns of error. In spite of the fact that there is only one true reality there are an infinite number of ways in which errors can occur.

In general it can be said that the analyst should take into consideration the purpose of the evaluation exercise and also the adjustment or correction and the amount of elaboration required of him. This is naturally dependent on the relative proportionate error before and after the adjustment. There is no doubt at all that the task of the demographer would be greatly facilitated if the problem merely involved the use of one specific method which could be applied automatically. The fact is, however, that the demographer must himself discover the appropriate method. The rules and skills of an analyst are, therefore, indispensable when it comes to checking available data and interpreting results. Consequently, the demographer must examine any method for logicality of construction, paying particular attention to its weak points, before putting it into use (Demeny, 1971).

Before resorting to alternative methods, there are a number of useful general consideration, which must be taken into account and of which the most important is to make, or attempt to make, full use of all the available opportunities and all the given data. This is followed by 'revision' in the sense that doubtful data must not be left unrevised although corrections should be limited. This means that the demographer should restrict his corrections and adjustments within reasonable bounds to the bare essentials, otherwise the data would be exposed to errors of a new type.

As already mentioned, the choice of method is entirely dependent on the nature of the subject and on the extent of the errors and it is, therefore, necessary to review the method in the light of locally prevailing conditions. Demographers have learned from past experience that an understanding of local conditions, customs, tradition and the like is of importance since these govern the accuracy of both the data and the methods chosen to check them.

This applies to all aspects of the operation from the initial choice of appropriate questions to the interpretation of the final results (Cox, 1970).

In effect, certain types of error follow a universal pattern such as the rounding off of ages but most errors are usually conditioned by specific administratives and cultural circum-

stances which are, in turn, influenced by customs, traditions, taboos and trends in fertility, mortality, nuptuality and divorce, etc. which should not be overlooked (Brass, 1968).

It would, therefore, be naive to consider patterns of error in a particular region, such as the Arab region for example, as being similar or identical to patterns in other regions of the world or even in the countries of the Third World. In brief, the demographer must always bear in mind that the sources and patterns of error and bias in data within a local context usually differ to some extent from one country to another.

Furthermore, before attempting to check and adjust data on a particular country an effort should be made to peruse the history of this country, at least over the past fifty years. Major historical events such as wars or epidemics generally leave their mark on the demography of the country in question. These historical events frequently provide an explanation for certain so-called deviations from the norm as in the case of the age structure, for example, which would otherwise be considered as errors (Carrier and Hobcraft, 1971).

Finally, correction of many of the errors may not always be possible. In this case the statistician merely points out the existence of these errors leaving it up to the users of this data to decide whether they wish to use the data in spite of the errors or whether they prefer not to use it at all but rather to fall back on other mehods of approximation that meet their requirements (Farrag, 1975).

B. General Bases

There are a number of general bases for classifying techniques and methods used in the evaluation of census data and vital statistics. In general it can be said that there are two main bases, the first of which consists of the various methods of comparison and consistancy checks and the second of methods relying on direct checking. Both of these are valid for evaluation of coverage and content errors in censuses or vital registration. These bases are as follows.

First : Methods of checking consistency

(1) Internal consistency

(2) External consistency

A — with other factual data from the same or from another population.

B — with hypothetical, theoretical and mathematical models.

Second : Methods of direct checking

(1) Surveys and sample methods (evaluation surveys, post census samples, dual record systems ...etc.).

(2) Direct checking from other independent data sources.

Internal consistency means testing for ' plausibility ' ... are the figures reasonable, i. e., are they within acceptable limits / is the resultant distribution acceptable or reasonable ? It also involves answering other questions such as : are the figures identical or similar or do they follow a particular trend when logic so dictates ? In general, internal consistency involves checking the resultant data itself for plausibility and consistency between one part and another whether these be different geographical regions or even individual questionnaires or variations of certain characteristics and the like. Finally, it is possible to follow up a specific tendency whether chronological or based on a particular characteristic. Should these comparisons reveal a definite contradiction we would have every right to suspect an error in one or both of the statements or in the reply to one or both of the two questions under comparison.

In addition, comparisons could be made between the census data and data from one, or if possible more than one, previous censuses to observe the increase or decrease and the magnitude of this variation. A comparison could also be made between census data from vital statistics to detect inconsistencies, determine trends and attempt to find their causes.

Analysis normally requires the establishment of base or reference point for comparison and this is called the model. The actual data under scrutiny are compared with this model which must be similar to the collected data. These models depend to a great extent on the nature of the phenomenon under study. The model be theoretical or mathmatical (i.e., portray the phenomenon in a hypothetical population) or it may be factual and derived from another comparable population.

Demographic models are useful in tracking down and detecting errors to eliminate them from the data but the application of these models requires special skill. Without going into this subject in depth it can be said that the chosen models should possess certain characteristics (Cox, 1970) :

(1) The model should be flexible enough to allow the actual effects of the characteristics to emerge in the data.

(2) The model should be acceptable from a theoretical point of view i. e. it should provide reasonable, acceptable and appropriate interpretations.

(3) The model should employ the greatest possible amount of factual data. Factual data can also be used to test the flexibility of the model.

By comparing the data under scrutiny with these standard models or patterns it is possible to say whether or not there are any specific deviations. The aim is not, of course, complete consistency but rather the observation of variations and the differentiation between the basic distinguishing characteristics of the population and probable errors Not every deviation indicates the existence of a defect. On the contrary, this deviation may be due to causes and factors inherent in the subject itself.

Finally, methods of direct checking rely on making comparisons with data from surveys or specially collected for purposes of evaluation or checking the correctness of data or comparisons with other available data which may not be demographic at all such as school and hospital records. Comparison is made by a process of matching single units.

The so-called ' evaluation surveys ' are among the most important surveys carried out to this effect with the aim of measuring the accuracy of coverage in the census in addition to content errors. They consist of a sample from certain enumerated regions which can be taken as representative of the country. Certain questions are repeated with greater emphasis to establish the extent to which persons or demographic units were omitted, duplicated or incorrectly enumerated in the initial census and the size of these samples depends largely on the cost.

A further method is represented by the dual record systems which are based on the existence of two independent sources, normally a sample and a specific vital registration, with the object of estimating the extent of the defectiveness of the registration by matching the who sources.

In general, there are many such surveys aimed at estimating the magnitude of errors and their sources (whether in connexion with coverage or content). Although it should be noted that they are subject to observational errors these surveys do have the advantage of being based on the following principles :

(1) Inquiries about one particular occurrence normally provide data of greater accuracy than lengthy questionnaires combining many subjects.

(2) Questions about current circumstances or those in the not too distant past provide data of greater accuracy than questions requiring recollection of the remote past.

(3) Meticulous studies of small populations using the method of successive visits or continuous observation over a set period yield data of greater accuracy.

It is noteworthy, in this connexion, that if the traditional sources of demographic data are either entirely unavailable or open to suspicion the only recoures is to indirect methods of estimation. These are of two types (Brass, 1968):

(1) Estimation of vital rates and adjustment of the age structure from a series of indications from the age structure itself or from other indicators on the rate of natural increase taken from model life tables and stable or quasi stable population models.

(2) Adoption of the Brass methods of estimating fertility and mortality from past data on live births and those surviving during the woman's previous child bearing life or during the year immediately prior to the survey.

I will now review very briefly some of the methods used for evaluation and adjustment in the case of both coverage and content errors in censuses and vital statistics. Wherever possible I will attempt to give examples but, as already mentioned, the limits of space allow neither detailed elaboration nor a comprehensive review.

III. Evaluation of Coverage Errors in Censuses and Vital Registration

Correct evaluation depends upon the application of a number of concomitant checks and techniques since reliance should not be placed on the results of one single test. The final result must derive from the fact that a series of tests point to a specific error the existence of which may thus be more definitely assumed.

(1) Internal Consistency

There are a variety of internal consistency checks to ascertain the comprehensiveness of the census enumeration or completeness of the vital registration. Most of them rely on checks for plausibility and consistency between different geographical areas or characteristics. If the given data is from one single census then, in addition to a review of enumeration procedure and information concerning operational methods or, in other words, an investigation of factors entering into the census operation and which might have effect on the accuracy of results, there are also a number of other methods. For example relating a distribution as it appears from the census returns to known characteristics of geographical sub-division or possibly comparing the number of individuals with the number of families or urban areas with rural areas in addition to the use of certain demographic information to establish the degree of consistency in the census returns (United Nations, 1955).

There is usually prior knowledge of the socio-economic characteristics of the various geographical areas in any country. In itself this knowledge is insufficient to prove the soundness or defectiveness of the census figure but it can be used as a guideline in the study of census figures. For example, it is possible to compare family distribution by number of individuals or to calculate average family size in the various areas since it can be assumed that this average is higher in rural than in urban areas. If this interrelationship is not maintained, we consider this to be tantamount to a warning that, failing a convincing explanation, the census figure is faulty and investigation should be made into the causes which led to the observed discrepancies.

It is noteworthy that coverage errors have a direct effect not only on the overall totals but also, of necessity, on data relative to various demographic characteristics. For example, they have an obvious effect on the age structure where their influence is manifested in the form of an understatement of certain age groups such as the young or the aged. These all appear as deviations in the final form of the age structure.

In the matter of vital registration it is also possible to obtain indications of the probable degree of completeness in recording births and deaths by studying the data itself. For example, the number of male births is usally observed to be slightly in excess of female births. In the event of a large deviation it would thus be certain that there is under reporting of births of a particular sex. Indeed, there would be a great probability of icomplete recording of births of both sexes.

Similarly, as a general rule, a greater number of males die in the stages of babyhood, infancy or adolescence while a greater number of females die in old age and any deviation must be for a cogent reason. A study can likewise be made of infant mortality based on age in months (if such data is available). The general pattern is for mortality to be highest during the first month, especially in the first few days, after which the rate begins to decrease. In the same way we must expect a gradual change in the ratio of male to female mortality from one age group to the next. Severe deviation in this regard normally indicate a failure to report all cases of mortality in certain age groups unless there were errors in stating the ages of the deceased.

Other relationships can be used such as the ratio of infant mortality to the total number of deaths at all ages. This ratio is usually stable to a great extent or at least with regard to the various sectors in any country and may be as high as one in four or even one in three in countries with a high birth rate (U.N., 1955). There is a close relationship between the prevailing vital rates and the age structure of any given population. Werthaim (U.N., 1955) devised a useful test known as the " Forty Per Cent Test ". According to him, if forty per cent or more of the population are under 15 years it is very probable that the birth rate in this case would be at least 40 per thousand.

In addition, a plausibility study of the rates represents an important part of the internal consistency studies. For example, a crude birth rate of more than 50 or less than 15 per thousand is rarely observed. Departure from these limits implies errors in the number of births. The same can be said of mortality rates. An instance of this is provided by Jordan where the crude mortality rate is around 5 per thousand which is a clear example of under reporting of deaths since mortality rates are rarely less than 8 except in population with an abnormal age structure.

The infant mortality rate, which is calculated from data taken from vital registration, provides a number of important indications. If the rate is unusual or unexpected with regard to the prevailing conditions as in the case of Jordan where it is only around 15 or 16 per thousand, this gives reason to doubt the accuracy of the vital data.

Finally, birth and mortality figures normally follow regular patterns according to age and any deviations from these patterns may be taken as denoting the presence of errors in coverage at certain ages except where there is a convincing explanation of these observed deviation.

At all events, the indications which we obtain from a study of the data itself regarding the completeness of the enumeration or registration are not in themeselves sufficient, however numerous they may be, to constitute proof of deficiency in the enumeration or registration. They are of use only in tracing errors. The following summarized methods are examples of accurate techniques.

(2) External Consistency

The coverage of the census or vital registration can be ascertained to a more accurate degree if other factual or theoretical demographic data is available for comparison of consistency or for use as a fundamental norm.

If data is available from not just one but several censuses, it is possible to estimate the probable accuracy of each census, including the most recent, and the general principle here is that demographic variations usually follow a regular pattern in the sense that if there are no extraordinary occurrences we can expect variations in the rate of increase to be equal in regard to both the country as a whole or any part of it and to take place gradually in the intervals between censuses. Similarly, a comparison can be made between the observed rate of change and observed rates of change in other countries exhibiting the greatest similarity of conditions (U. N. 1955).

The rate of increase between two censuses (especially if this is largely attributable to natural increase) is most unlikely to exceed 3 per cent or to be a negative rate. Otherwise the question would unavoidably arise as to whether there are explanations for such an unusual rate or whether the census figures are erroneous. Naturally, by making use of certain information, it is possible to set more accurate limits to the growth rate.

The same method gives us a good idea of the true state of affairs by comparing fluctuations in the rates of change in a series of censuses distributed by geographical area i.e., we must compare the change in a given area with the changes occurring in other areas (provinces and the like) and immediately investigate any unusual rate. Variation in the rates of change may be based on variations in social conditions such as an increase in the volume of industrial, commercial or governmental activity. Similarly, internal migration plays an important part in the appearance of variations in growth rates relative to different sections of the population.

One of the most important and useful methods of estimating coverage errors is the so-called " Balancing Equation " method even though it is difficult using this equation to conclusively determine the completeness or accuracy of the figures of any census or vital registration without examining all the constitutent factors. The principle of the balancing equation is basically very simple, namely that the population increases or decreases in the inter-censal period as a result of births and deaths and population movements across the borders. The equation can be expressed as follows : -

$$P_{t+m} = P_t + {}_nB_t - {}_nD_t + {}_nNM_t$$

Where :

P_{t+n} = the total population according to the census at t + n

P_t = the total population according to the first census t

${}_nB_t$ = the total number of births over the period from t to t + n

${}_nD_t$ = the total number of deaths over the period from t to n + t

${}_nNM_t$ = net migration (incoming and outgoing) over the period from t to n + t

Under ideal conditions both sides should match even though no country has yet attained such perfect accuracy. There is, therefore, always a disparity and if this disparity is a large one then the implication is that at least one of the constituent factors of the equation includes an error and further research must be carried out to attempt to locate this error. Should the disparity be slight the implication is not that there are no errors but that possibly the errors are parallel and thus off-set each other.

The usefulness of the balancing equation is increased if it can be applied to specific sectors of the population and, in consequence, we concentrate our attention on errors that may occur due to inaccurate vital statistics. For example, the birth factor can be eliminated if we confine ourselves to the population sector aged 15 or over and the equation would then become :

$$P_{tn}^{15+} = P_t^{5+} - {}_nD_t^{5+} + {}_nNM_t^{5+}$$

This equation can be useful for checking mortality statistics, migration data and the figures from both census with regard to specified ages without involving the birth factor. It is preferable to eliminate the migration factor if statistics on this are available so that the equation will then consist of only three factors-and if the volume of migration is basically very limited mortality statistics can be better evaluated (U.N., 19955).

Similarly, birth statistics can be evaluated by means of the balancing equation if we put the equation in another form appropriate to this purpose. A comparison can thus be made between the number of children below a certain age enumerated in the census and the number of births during the years immediately prior to the census after taking into account cases of mortality and migration among these (Bogue, 1971).

On the assumption that the number of children in the census is correct and that the deaths were recorded we can, therefore, estimate the completeness of birth registration in the sense that the whole of the remainder is the result of an under recording of births or a deficiency in enumeration which is, however, not the case and therefore in addition to this method it is necessary to obtain better estimates by a study of other available information.

This equation can, of course be applied to parts of the population and will naturally be influenced by internal migration between different areas of the country. Consequently, equations relative to areas provide us only with an inadequate indicator especially with regard to mortality statistics. If, however, the vital statistics are of high quality then this method can be used to estimate internal migration.

It is possible to use other methods including those designed to estimate levels of vital rates based on models such as that of a stable or quasi stable population or on the inclusion of specific questions in the census and surveys (Brass methods) and these are used as indicators of the completeness of the enumeration or the registration (Lingner, 1974) but they are not relevant to the present study.

(3) Direct checking

In comparison with the methods already explained methods of direct checking generally provide an estimate of the extent of coverage errors together with the possibility of modification of the statistics in one form or another. Methods of direct checking usually require the collection of new field data and the principle here is one of 'matching' between individual records and not merely final totals. We must note, at the very begining, that implies collecting data by sample methods which, in turn, signifies that estimates of coverage errors and the like will, of necessity, be prone to observational errors.

One of the principal types of survey used to check coverage errors is that known as the 'Reenumeration Survey'. This means the reenumeration by sample of certain sectors of the population and is normally carried out a short time after the census by highly trained and experienced personnel. The reenumeration records are then matched against the corresponding census records and enumeration errors are gauged according to the number of families and individuals shown in the reenumeration records who did not appear in the census. In this way it is possible to obtain a correction factor for the weighting of census totals which is $\frac{S}{N}$

where S is the number of persons counted in the reenumeration

where N is the number of persons whom it was possible to match from census data .

Similarly, it is possible to estimate the extent of deficiencies in the recording of vital statistics by means of questions aimed at obtaining information on the number of births and deaths occurring over a set period of time. This is usually obtained from ' family surveys ' and subsequently the vital events can be matched one by one with the vital records. In this case also it is possible to arrive at correction factors.

It is not always necessary to obtain independent lists from field surveys since there are many different kinds of lists such as school records, electoral lists etc. The only objection is that the completeness of these records is usually doubtful.

One of the main techniques is known as the 'Dual Record System' which, as a method, is consistent with this line of thought. It relies on two independent sources such as records of births and questions from retrospective surveys over a fixed period of time or surveys based on a continuing repetition of questions over a fixed period of time such as every three or six months. After the data has been collected, an estimate can be made of the total number of events occurring during the time period in question even though some of them may not have been recorded in either of the two sources. This method was devised by Chandrasekar and Deming (1949) and can be quickly summarized as follows :

Second Data Source	First Data Source: Recorded	First Data Source: Unrecorded	Total
Recorded	S_{11}	S_{21}	S_{01}
Unrecorded	S_{12}	S_{22}	S_{02}
Total	S_{10}	S_{20}	S_{00}

Where S_{11} = events which appeared in both sources and were matched .

S_{21} = events recorded in the second but not appearing in the first .

S_{12} = events recorded in the first source but not appearing in the second.

S_{22} = events unrecorded in either of the two sources.

Since S_{01}, S_{02}, S_{10}, S_{20}, are the marginal totals as shown.

Then S_{00} which is the total number of events actually occurring irrespective of Whether they were recorded or not = $S_{11} + S_{21} + S_{12} + S_{22}$

Since S_{22} is unknown Chandrasekar and Deming put forward the following estimate

$$S^*_{22} = \frac{S_{21} + S_{12}}{S_{11}}$$

Therefore the estimate of S_{00} will be

$$S^*_{00} = S_{11} + S_{21} + S_{12} + S^*_{22}$$

In the same study an estimate was given for the standard error but there is no need here for further elaboration.

In this context, however, we should mention that the Chandrasekar and Deming method provides unbiased estimates of total number of events when the following conditions are met :

1. The probability of a specific event appearing in one of the two recorded sources is totally independent of the probability of its appearance in the other.

2. All recorded events occurred during a fixed time period in a specific area.

3. Net matching error is equal to zero in the sense that the number of abortive attempts at matching records of a specific event is equal to the number of times that the matching was erroneous.

If these conditions are not met (and it is rarely that they are met) then the above mentioned methods becomes prone to a number of bias errors in addition to other random errors.

IV. Evaluation of " Content " Errors in Censuses and Vital Registration

The second type of error affecting demographic statistics is the " content " error or faulty classification of individual characteristics whether in censuses or vital registration. We will find that many of the methods previously discussed in relation to measuring the extent of coverage errors can also be used to assess content errors. In the following pages, we will review a number of given methods of assessing content errors taking age errors as a basic example not merely for their great importance in demographic analysis but also because of the frequency of their occurrence and since their very presence gives rise to errors in the tabulation of other characteristics especially when analyzing fertility or mortality or constructing life tables.

(1) Internal Consistency

Methods of checking internal consistency to assess content errors consist essentially of examining the data itself, scrutinizing the degree of consistency between its various parts and assessing the accuracy of the classification (especially with regard to age) from the data itself using certain standard figures.

The first test could be a comparison of the various individual classifications by geographical area based on available information on the local population to ascertain whether there are any indications of errors present in the classification of individuals according to the characteristic under review.

In age specific data, the age distribution should follow a set pattern since in populations with stable birth and mortality rates and a positive rate of natural increase, the transition from one age to the next gradually and slowly decreases. Deviation from this pattern may result from any of the following causes :

A. Previous variations in births, deaths and migration. These variations produce genuine fluctuations in the age specific structure and should under no circumstances be considered as errors.

B. Net age error. In other words the number of persons classified at certain ages minus

the true number at this age. This differs from gross age error in as much as the number of people classified at a specific age in which they do not actually belong corresponds to a number that should have been classified in this age but was classified in another age, namely the age of those wrongly classified. The net error is produced when there are certain uniform errors between individuals.

C. Fluctuations caused by coverage errors which, as we have mentioned, are generally restricted to defective enumeration of children and infants and sometimes among the elderly or at the first stage of adolescence.

The net age error can be more accurately determined if the given ages appear in digital form and not as age groups. The first test is an attempt to discover the degree of similarity between the prescribed pattern and the actual data and to locate these variations. With regard to the multi-purpose sample data of Jordan in 1971, we note evident increases at the digits zero and five and a clear decrease at the digits one and nine. This represents a normal and universal pattern of error attributable to preference for certain ages or a tendency towards the rounding off of ages.

A further useful test is to work out the sex specific ratios in each age group. In theory there should not be a great difference in sex distribution between a given age group and the age group preceding it and the successive discrepencies should be close to zero. Otherwise, failing any other explanation, the implication is that there are obvious errors in certain age groups and any great increase in these implies that they are favourite groups among males or ' camouflage ' groups among females and so on.

It is also useful to work out what we may call the age ratio which is arrived at by dividing the number of persons in a given age group by the arithmetical mean of the numbers in both the preceding and following age groups. This ratio is normally multiplied by 100 to appear in the form of a percentage and is calculated separately for males and females. Normally the age ratio should show very little deviation from 100 except in the case of advanced ages (or where this happens as a result of large fluctuations in vital rates in the past).

In connexion with age errors, a number of indexes have also been proposed for use in assessing the extent of digital preferences for certain ages and we will briefly review four of them below without going into detail. Each of them has merits and defects and it should be noted that they are methods for assessing digital preferences and not for assessing the accuracy of the age structure in general (Lingner, 1974).

The first is known as "Whipple's Index" and is obtained by adding the numbers of those aged from 23 to 62 and then calculating the percentage proportions of the total numbers of those whose ages end with the figures 5 or zero in relation to a fifth of the total number. The results should lie somewhere between the minimum of 100 denoting the total absence of any undue accumulation and the maximum of 500 where there are no figures in other ages not

comprising the digits zero and five (U.N., 1955) i. e. this index only gauges the degree of accumulation at the digits zero and five in the age range 23 to 62 years.

The second is 'Myers, Index' which highlights the presence or absence preference for all of the ten digits from zero to 9. His method consists of taking the successive totals of the numbers at each age ending in the given digits using the so-called blending method to eleminate the bias caused by the fact that with advancing age these total tend to decrease. In this way ten figures are obtained of which each should represent 10 per cent and an attempt is then made to identify deviations from 10 per cent of the overall total irrespective of whether these are positive or negative. Positive deviations at specific age digits denote a predilection for these and vice versa. It may be helpful in this context to mention that Myers' Index presupposes an age distribution following a linear function.

The weakness of both the Myers and Whipple methods lies in the impossibility of creating the hypothetical conditions under which Whipple's figure could attain 100 exactly or Myers' figure become zero exactly. Bachi has devised another method to eliminate this flaw based on the existence of certain affinities between ages containing certain digits. This index usually gives results parallel to those of Myer's index (since it varies between zero and ninety its value is normally half that of Myers' figure).

The United Nations has introduced a method of assessing the accuracy of ages by calculating the age/sex ratio. This is generally known as the United Nations Secretariat method and differs from previous methods in being applicable when we do not have data on the age structure in a digital form but only as age groups. One of the distinguishing features of this method is that it is at the same time sensitive to coverage errors or the comprehensiveness of the enumeration and also to errors and predilections in reporting age. In this way it gives a clearer picture of the degree of accuracy of the age structure as a whole. The drawback to this method is that the figure produced only gives a general idea of the magnitude of the error and cannot be considered as an exact measurment. Its significance is most apparent when comparing the accuracy of a number of censuses.

(2) External Consistency

It is difficult to determine from methods of checking internal consistency alone whether the forms of error revealed are mainly due to errors in the data or whether they are in fact a characteristic of the demographic structure. When other external data is available either in the form of data from other previous censuses or a standard distribution etc. it is often possible to ascertain the quality of the data without using complicated techniques.

If data is available from two or more censuses, information of greater accuracy can be obtained regarding errors and in this case a comparison can be made between the age cohorts from one census to the next by comparing, for example, the number in group 10-14 in a given census with the number in group 10-24 in another census ten years later. If consecutive data

is available from three or more censuses the results can be interrelated, and so on. Our findings would be even more accurate if we made a comparison between survival rates of successive cohorts for each sex separately.

The sequence of survival rates from one age group to the appropriate age group in a subsequent census must exhibit a number of characteristics such as :

A. None of them should exceed true one (except where there is migration at this particular age group).

B. Survival rates should gradually decrease (without fluctuations) with advancing age after the age of 10 (the same age pattern is followed for mortality).

C. Survival rates should be plausible and in conformity with the socio-economic conditions prevailing in the country.

D. Survival rates for females should normally be higher than for males.

It should be noted that the method of calculating survival rates for successive age cohorts requires either that there be no significant net migration or that data on migrants be available according to age and sex. A further prerequisite is that coverage errors in both censuses should be of the same type and magnitude.

Balancing equations can still be put to advantageous use in a different way to assess content errors relative to age. Instead of working out the survival rate and attempting to evaluate it for each cohort, we can take actual mortality statistics and consequently obtain a better basis for comparison. Discrepencies between the two sides of the equation would be due either to coverage errors in the two censuses as regards the age cohort in question or to errors in reporting ages in one of the two censuses. Alternatively, they may be attributable to coverage errors in the mortality statistics or to errors in reporting ages at death. In order to determine which of these factors was the most influential the results of other tests must be taken into consideration.

There is no question that balancing equations can be used in many ways to determine the accuracy of classification by following a given classification through the censuses. In case of marriage, for example, an equation can be used in the following form :

$$m_1 = m_0 + z + h - (w + h^*)$$

where m_0 and m_1 represent the number married in two consecutive censuses ;
Where Z represents the number of persons newly married in the inter-censal period;
Where h represents the number of married immigrants arriving in this period;
Where h* represents the number of married emigrants leaving in this period;
Where w represents the number of cases where marriage was dissolved due to death or divorce.

Such an equation naturally requires a variety of data including statistics on marriage and divorce and also on deaths classified according to the marital status. Marriage and divorce statistics are, in fact, normally dependable in the Arab countries which makes the use of these equations even more appropriate due to the greater reliability of a number of their component factors.

A most useful test is to compare the data with a probable distribution or hypothetical model that we believe to be applicable to the data. For example, in countries with a demonstrable or quasi stable population, it is possible to select a stable population model which is, within acceptable limites, appropriate to the actual data with which it can be collected. A comparison can then be made in one way or another between the stable population and the actual population and the end result is usually a number of valuable observation concerning disparities between the two distributions.

As already mentioned, the use of models requires caution and skill. Although it is not a difficult operation to fit a particular model it is necessary to check the closeness of the fit with respect to the plausibility of the results by comparison with the given data.

(3) Methods of Direct Checking :

The methods of direct checking already mentioned can also be used to check content errors and obtain a basis for correcting any errors deriving from the classification. As previously stated, they require the collection of additional field data and the provison of independent records for comparison with the census returns or the birth or mortality statistics.

Direct checking for content errors is known as Content Evaluation Study (CES) and requires the collection of data from a source independent of the census data or the vital registration. Matching takes place in the manner already described and a table can be drawn up as follows (Spiegelman, 1968).

Data from the Independent Source	Data from the Census or the Vital Registration		
	Individuals classified in a group	Individuals not classified in a group	Total
Individuals classified in a group	A	B	A + B
Not classified in a group	C	D	C + D
Total	B + D	A + C	N

This table gives a comparison of the two sources with respect to a particular characteristic in order to determine the accuracy of the classification by occupation or birth order etc. In this way :

A represents those classified in a corresponding group in both sources;

B represents those classified in the independent source but unclassified in the actual enumeration;

C represents the opposite;

D represents the number of those lacking this characteristics in both sources. Here we can work out a number of figures or averages to assess the extent of possible errors as in the following examples :

— The net difference rate. This is to discover the extent of possible uniform errors even with reenumeration from an independent source. Therate in this case would be

$$\frac{C - B}{N} \times 100$$

If this rate has a positive value the implication is that this group was overmagnified in the actual enumeration and vice versa.

— The gross difference rate can be defined as follows :

$$G = \frac{B + C}{N} \times 100$$

i. e., the total of those unclassified in either of the two sources in relation to the overall total of all cases. We can see clearly that the variance in reporting is approximately half of this value $\frac{1}{2}$ G.

— Similarly the index of net shift relative variation for either of the two sources can be calculated in the form $S = \frac{C - B}{A + B} \times 100$ This figure indicates the variation from the independent source of the actual enumeration.

— In the same way the index of stability can be calculated as follows : -

$$T = \frac{A}{A + B} \times 100$$

This indicates stability of reporting in the actual enumeration (census or vital registration) in relation to the independent source.

— Likewise the index of inconsistancy can be calculated and defined as follows :

$$I = \frac{B + C}{(A+C)\ (B+D) + (A+B)\ (C+D)} \times 100\ N$$

Generally $100 \geq I \geq$ Zero

"I" may sometimes appear greater than 100 if N is of very small magnitude and one can say that a high value of "I" implies a large amount of misreporting. "T" is easier to undertand and calculate and is also more stable. It should be noted that, in general, "I" and "T" are mutually complementary in the sense that whenever there is an increase of misreporting we find a corresponding increase in "I" and decrease in "T".

V. Some Useful Derivations for the Adjustment of Demographic Data

We have previously referred briefly to certain bases and techniques for evaluating demographic data including, naturally, some bases for data adjustment such as the use of correction procedures etc. In the present section we will review some useful derivations for adjusting and amending demographic data. But first of all it should be born in mind that the history of the country itself is of great importance and that initial studies of the sources of error are essential. We should always be alert to the fact that the danger of an ' amendment' is that it becomes itself a form of error if taken to extremes. Amendments should not, therefore, be taken too far but be kept within the reasonable bounds of what is essential. Finally, all the possibilities of the existing data should be exhausted in order that the correction be appropriate to the population. The best methods of adjustment are those which make the greatest possible use of available factual data with the minimum reliance on extraneous models.

The grouping method is one of the easiest and consists of assembling the figures in wider groups. This is frequently used, especially for data relative to age or income and is a satisfactory and simple technique since it largely reduces the occurence of chance fluctuations and nullifies opposing trends especially if the researcher is confident that there are no uniform errors. Where uniform errors are present, grouping will retain the bias.

In the same manner the use of moving averages is a means of graduation which is helpful in reducing sudden changes even though it suffers from the same defect inherent in the difficulty of eliminating uniform errors.

In connexion with age distribution, numerous graduation methods can be applied of which some employ techniques of illustration while others rely on curve fitting.

One of the most famous graduation methods is known by the name of the Sprague Multpliers. This latter method helps to smooth or graduate the age curve for data classified in five-year age groups and makes it possible to redistribute the number within the age group over each separate year of life without changing the total number of individuals in the group as a whole. The same method has other uses such as smoothing certain averages based on age, for instance detailed child bearing averages by age or averages by individual age of mother and so on.

The Sprague Multipliers method does, however, have drawbacks such as the fact that it takes absolutely no account of coverage errors in the sense that it does not correct any age group that was under or overevaluated in the enumeration. Such errors should first be corrected by other methods employing integration and the like. Furthermore, this method may be unsuitable for very low ages below ten years (Lingner, 1974).

There are many graduation methods of which some are purely mathematical and based, for example, on the Gompertz curves and their modifications which are sometimes complicat-

ed or on geometrical curves etc. It is , however, difficult to judge their usefulness with regard to data containing numerous defects.

Several graduation methods can be used to smooth mortality and fertility curves. For example, in the case of fertility the curve should begin from zero at age 15, rise rapidly to a peak and then drop once again to zero at age 50 for instance. Brass used polynomial curves in this connexion (Cox, 1970).

At all events, graduation methods are aimed at showing the kind of results that could have been obtained without irregularities or sudden variations. It is, of course, possible to use the various tests for plausibility and reliability to check on whether the actual data differs from the graduated curve by pure chance. The graduation is naturally affected both by the type of mathematical curve used and by the arrangement of the data itself.

In the case of cumulative preference error in age data at specific age digits, it is possible to reduce or eliminate these distortions by the formation of five-year age groups beginning with ages other than 5 or 10. For instance, if there is an evident accumulation at multiples of 5, age groups can be used which are centered on the group of these multiples. For example, in the fertility schedule the ages of the mothers can be grouped in the form 33-37 and so on. Myers suggested a method of determining the ideal starting points for such groups using his interpolation technique already referred to. He suggested adding the percentages of the combined totals for every five consecutive age digits beginning with the digits zero, 1, 2, 3 and finally 4. The results would then suggest the ideal group starting ages to eliminate accumulation errors.

In demographic data it is often required to adjust certain distributions which are inconsistent with specific marginal totals. These distributions may be in one way or two way tables. The most important of these requirements include :

A- Adjustment of sample data to conform with comprehensive census data or independent estimates;

B- Estimation of the distribution for a particular year on the basis of specific data;

C- Adjustment of detailed data for a particular year because of marginal totals taken from another source and that are thought to be more accurate;

D- Finally the most frequently applied adjustment which modifies the distribution of actual groups to include the ' unspecified ' categories (Shyrock, 1971).

There is no question that the category ' unspecified ' presents a problem in a lot of demographic data. Sometimes it can be completely eliminated but usually it is distributed proportionately over the remaining groups as is normally the case with data on age, birth order and the like. This is a satisfactory methods as long as there are no types of error involved which would usually cause the ' unspecified ' category to increase from one given

group to another. For example, the category unspecified by birth order increases as the classification by birth order becomes more systematic. There are numerous ways to eliminate the ' unspecified ' category depending on actual conditions and a study of the probable sources of error.

Standard distributions can also be used to adjust demographic data. By comparing the actual data with these standard distributions the appropriate adjustments can be made. An instance of this is provided in Carrier-Farrag (1959) where upward accumulation is used to check the cumulative percentage age distribution. These standard distributions can, on the other hand, be obtained from regular models such as those of a stable population, based on a model life table, or a quasi-stable population. For example, in a study of the demography of Kuwait Hill used an age distribution based on a quasi-stable population instead of the actual age distribution fearing that, as a result of accumulation errors, the true significance of mortality might be affected by an increase or decrease in certain age groups (Hill, 1975).

Since fertility and mortality do not always meet the requirements of stability, Demeny and Shorter (1968) devised a new method (based on their studies of the Turkish population) for differentiating between true deviations and actual errors in a population. The Demeny and Shorter method is based on the simultaneous use of data from two censuses and also of a life table giving the average number of deaths occurring during the inter-censal period. Their method is based on three suppositions :

(1) That the error in any group is constant in proportion to the number of the population specified in the same age group.

(2) That mortality can be expressed in a suitable model life table.

(3) That the total actual population has been completely enumerated without errors.

Das Gupta has shown that this method gives good results if the two real age distributions in the two censuses are similar or closely matched. The greater difference between them, however, the more difficult it becomes for this method to satisfy all of the three preconditions. Das Gupta has put forward a method which he calls a general method of correction for age misreporting in census populations (Das Gupta. 1975).

In conclusion it can be said that numerous statistical methods have been devised to deal with data in statistically advanced countries but it may not be advisable for certain demographers to let themselves be carried away by their enthusiasm to the extent of putting these methods into direct application without studying their own socio-economic conditions to determine whether the methods are really appropriate to these conditions.

Summary

(1) Consideration has been given in this paper to the extent to which traditional demographic data such as censuses and vital registration is exposed to error, with a brief review of some of the principles and methods used in evaluation and adjustment, without elaborating on the

sources of these errors or their causes whether from negligence in carrying out the field operation or lack of care in processing and printing the data.

(2) Errors affecting data from censuses and vital registration have been classified under two main types, namely coverage errors and content errors. By coverage errors is meant the completeness of the enumeration or registration in the sense that the data has been collected from every individual of the population without omission or duplication and that every vital event has been recorded. By content errors we mean incorrect classification of individual characteristics.

(3) Since there are numerous methods and techniques of evaluation and adjustment, the present paper was necessarily selective not only with regard to points of detail but also in respect of coverage of these different methods. Limitations of space played a part in the extent to which reference was made, even though in name only, to certain methods. Further details on any particular method can be obtained by reference to the sources quoted.

(4) Methods and techniques of evaluation and adjustment differ with respect to robustness, accuracy, the extent of their data requirements and their costs etc. It is, therefore, impossible to recommend the use of a specific method in any individual case since a number of conditions would have to be satisfied before this could be done. The role of the demographer is, consequentsly, an important one since it is not so much a matter of automatically applying a particular method as of skill in checking and applying a method appropriate to the subject and the local population in question and there is no formula applicable to all conditions and circumstances. Experience has shown that an understanding of local conditions and customs is extremely important. The demographer must thus make the fullest possible use of factual data and restrict himself to what is reasonable and necessary by way of data corrections otherwise he becomes exposed to new errors.

(5) Similarly, the demographer must not confine himself to one method but should seek verification by employing a number of checks. Neither should he consider his results as final until all the indications point to the same conclusion.

(6) In connexion with the evaluation and adjustment of data from censuses and vital registration the demographer follows a number of general principles within the overall framework of two procedures of which he applies one or both depending on the facilities available. These are the direct checks and the methods of testing for internal or external consistency.

(7) Internal consistency involves an evaluation of census data in the light of data from the same census or an evaluation of data taken from vital registration in the light of the same vital registration. This includes testing for ' plausibility ' and to see whether the figures fall within acceptable limits in the light of local conditions in the population. It also involves seeing whether the figures are consistent from one geographical area to another or in the various parts of the individual questionaires themselves.

(8) External consistency involves comparing the data under scrutiny with other external data by making a comparison, for example, between the census data and data from a previous

census or other closely related data-which may not be demographic data at all-or data from another comparable population in order to follow up the presumed variation. For purposes of analysis, it is normally necessary to construct a base or standard reference known as a 'model' with which to compare the actual data. The model may be theoretical or mathematical portraying a phenomenon in a hypothetical population. An example of this is the stable population based on model life tables or the quasi-stable population. The object is, of course, not to make the data conform completely to the hypothetical model but rather to help to identify deviations and ascertain whether they are true deviations stemming from the population itself or whether they can be attributed to errors in the data.

(9) Methods of direct checking are based on comparisons or ' matching ' with other data especially collected for this purpose such as post-census surveys or dual record systems or content evaluation studies and the like.

(10) A subsequent section of the paper contained a breaf review of the chief methods used in the evaluation and adjustment of coverage and content errors under any of the previous general bases and in both censuses and vital registration. It was not possible, in view of the space and time available, to give more than a few examples of these methods.

(11) Finally the paper touched on some useful derivations for the adjustment of population data such as grouping, various graduation methods, certain recently proposed techniques for adjusment of the age distribution and methods for redistributing marginal totals together with ways of using demographic models for data adjustment.

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PROBLEMS OF DEMOGRAPHIC DATA COLLECTION IN ARAB COUNTRIES *

by

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A. Introduction

1. This paper deals with practical problems confronting the demographic data collector in Arab countries, based on practical experience gained during the period 1957-1975 in Egypt, Syria, Iraq and Kuwait.

2. Some of these problems are related to the the prevailing environmental and social conditions in Arab countries, among which are :

2.1 Widespread illiteracy and lack of statistical awareness.

2.2 Data obtainable only from one family head.

2.3 Mobile populations and multiple nationality.

2.4 Problem of dialects and diverse languages.

2.5 The perceived relation between data collection and citizen's rights and obligations in some Arab countries.

2.6 Lack of well trained manpower.

3. There are other problems not dealt with in detail in this paper mainly the development of forms and questionnaires in the light of international recommendations; not taking into account the opportunities for accurate implementation in some Arab countries

4. Generally speaking the selection and training of data collectors in Arab countries is not carried out in such a way as to insure the collection of accrate information; in addition, most Arab countries do not have positive and negative stimuli to insure that the data collector completes his mission perfectly.

B. Population Census Problems

I. Widespread illiteracy and lack of statistical awareness

5. The widespread illiteracy in Arab countries is one of the main obstacles to obtaining

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accurate data in population censuses. Despite the efforts to overcome this obstacle by recording data by trained personnel, the desired result is not attained in practice for the following reasons :

5.1 An illiterate person is unable to grasp the concepts on the basis of which the data is collected, even if we assume that the collector is well trained. Examples cover the concept of age in the completed years, profession, economic activity and the like. The illiterate person tends to round his age up or down to the nearest round year, his concept of profession is associated with his nominal position and not the work he actually does. Besides it is difficult to impart to him the concept of children born alive or dead.

5.2 The illiterate is usually unable to estimate with precision time periods. This applies to age, duration of marriage, period of residence and other temporal data covered in censuses.

5.3 The illiterate is usually of limited education and does not appreciate the importance of giving correct information, even if it is assumed that he knows the correct information. He often considers answering the collector's questions a waste of time and useless.

5.4 Regardless of the different publicity methods underscoring the secrecy of personal information guaranteed by law, and that personal information does not entail any rights or obligations, the illiterate is still unconvinced and sometimes insists on giving misleading data expecting on imagined benefit or hoping to avert an unfortunate event that might befall him if he gives correct information.

5.5 The illitercy of the interviewed in certain cases results in erroneous data concerning the social standing of person. For example, some wives insist that husband is not married to another wife, although this is contrary to reality. Sometimes the wife or the son hides the real profession of the householder if he is a doorman, a guard, or a manual worker, insisting that he is a clerk or chief of a department, etc... to enhance the householder's image in the eyes of the researcher. Hence the contradiction between profession and schooling during the tabulation of census data.

5.6 The illiteracy of the interviewed might lead to errors in some figures for which data is requested, such as the number of children born alive and number of surviving children. Very often the interviewed (exmarried women) mentions only surviving children still residing with the family, omitting those who left the household. Moreover, the examination of certain data collected about the children born alive and those surviving shows the two figures equal in many instances, which is unexpected especially in countries with high mortality among infants and children.

II. Obtaining data from one family member

6. In many instances it is difficult for the researcher in Arab countries to enter the household. In certain cases, it happens that the researcher did not actually see any of the household members. He obtained the data through one of the women from behind a closed door. We can imagine the researcher's position and can assume that data obtained thus would contain a lager amount of error than data obtained facing the interviewed.

7. Such cases have occurred during the enumeration of middle class households in particular when no adult males were at home during the visit, or when the housholder does not care to let the researcher into the house, for he does not like to let a stranger into his house.

8. It goes without saying that in such cases the researcher is unable to examine any documents (such as birth or marriage certificates) to check dates for instance. Moreover, the woman who gives information from behind the door usually relies on her memory and does not check with any other family member to verify such data.

9. Even in cases when the researcher is allowed to enter the house, if he calls during the morning, the adult males and females are usually at work, and he obtains his data from an elderly person, from a servant or from a child. In all these cases, the data on education, profession or activity are unreliable. Furthermore, data on age and fertility are almost always incorrect.

10. When customs and time schedule allow the researcher to meet with some of the members, the data are usually more precise than that collected from one person, though the researcher in Arab countries is usually unable to meet with adult women. Marriage and fertility data remains subject to error except in cases when well-trained female researchers are employed (as in Egypt in 1960 and Syria in 1970). In such cases, data concerning marriage and fertility are more reliable.

III. Unstable populations and multiple nationality

11. The size of the nomadic population varies a great deal in Arab countries, though the general trend is towards fixed settlements for most of them. This trend towards greater stability is especially clear in the oil countries where the number of nomads is decreasing due to better work opportunities.

12. The mobile population in Arab countries consists either of bedouin nomads (usually shephered) who live in tents and move around seeking pastures, or bedouins who work on rain-irrigated agriculture unattached to a fixed piece of land (as in Syria). The latter build temporary houses, carrying with them wooden doors and windows before moving elsewhere. This leads to a change in population distribution.

13. Studies have been made in Arab countries about causes and movement patterns of bedouin nomads which can be used to determine the ideal time to count them. But such studies are not available concerning nomads working on marginal rain-irrigated agriculture.

14. In planning fiel operations, some rules have been observed in connexion with mobile population to avoid omission or double counting :

14.1 During the planning for bedouin settlements, the course of their assembly and the time of their assembly and their movements are all determined; and instructions are prepared to have census teams move acordingly.

14.2 As for bedouins who migrate close to an international border, they are counted by census teams (a mobile group of enumerators in a vehicle fit to travel unpaved roads). The count is conducted from national borders towards the interior.

They are counted at the beginning of the census. The necessary steps are taken to count them within a short period (say three days) from the start of the census. Thus the nomadic bedouins who cross the national borders or come from another state are not counted after the census date, while nomadic bedouins who move towards the borders en route to another state are counted as they were within the borders on the census date.

14.3 Census teams put a distinctive mark on each tent to avoid redundancy.

14.4 It is possible (as happened in Kuwait in the 1975 census) to use helicopters to determine agglomerations shortly before the census date.

14.5 It was found in Syria that some bedouins stay around cities and villages in their tents, especially during harvest time to get temporary work, and special arrangements have been taken to count them by teams presided over by the district's chief.

15. Multiple nationality proved to be common among nomadic bedouins who cross national borders. The problem is still uncontrollable as most of them have more than one nationality and they do not usually show these papers to enumerators. This may lead to counting them as nationals of more than one state, especially if neighbouring states do not carry out censuses at the same time.

16. In most cases, there is a need to limit to the minimum the data required from unsettled populations, as their capacity for understanding abstract concepts is limited, and because it is necessary to count them within a short period of time which does not allow a long visiting time to obtain, for example, fertility data.

17. During the 1975 census in Kuwait, a problem arose. Some settled families move entirely to the desert to live in tents during the months of February, March and April of each year.

18. There exist special administrative bodies to supervise nomadic bedouins in some states. There are tribal chiefs and princes in others. It is useful to draw on their help when planning a census of unstable population.

IV. Problem of dialects and diverse languages

19. This problem was clearly manifested while planning the 1975 census in Kuwait, where more than half of the population are nonKuwaitis of different nationalities (mostly Arabs). But a significant proportion of them includes Indians and Pakistanis who do not master the Arabic language.

20. To overcome the multi-language problem, a questionnaire was prepared in English, since it is commonly spoken next to Arabic. When assigning enumerators, those who speak foreign languages were sent to areas where non-Arabs are concentrated. In addition, an inventory of households not speaking Arabic was prepared during the housing census which took place before the population census. Foreign teams were employed to count them.

21. It was possible to overcome the problem of Arabic dialects, by assigning enumerators and supervisors acquainted with Kwaiti dialect to Kuwaiti districts, as well as trying to recruit the

maximum of enumerators with long periods of residence in Kuwait.

V. The relation between collected data citizen's rights and obligations in some Arab countries

22. Naturalization in Kuwait is related to the period of residence. The state of Kuwait allows the recourse to census data to prove residence This is a clear example of the relation between collected data and citizen's rights in Arab countries.

23. Furthermore, some people are not convinced by publicity which affirms that there is no relation between census data and rights and obligations, especially in the Arab countries which have special legislation concerning, for example, ration cards. This encourages some people to exaggerate the number of household members, (e.g. 1947 census in Egypt).

24. Kuwait is another example where certain house-owners of limited income who got their houses through the State were trying to deny sharing the house with other tenants. They feared measures to be taken against them since the law does not permit their sublease. Appropriate instructions were given to enumerators to handle this problem in order to avoid omitting these families from the census.

VI. Lack of well trained human elements

25. Most Arab countries resort to the use of elementary school teachers to carry out statistical field operations as enumerators, since they represent the educated class with equal geographic distribution. Besides, by virtue of their profession, they do not encounter difficult problems in collecting data about households.

26. The census period in most Arab countries is ten days, followed by three to five days to finalize the census, i.e. to check that the data refer to census night.

Thus a full-time enumerator is able to count around 50 persons daily, or 10 families within eight hours. This means that reaching the family and collecting data about its members takes around 45 minutes, which is not enough especially if households were scattered when the enumerator is not provided with a mean of transportation.

27. In certain countries it is difficult to recruit full-time enumerators (such as in Kuwait) due to their commitment to activities governed by regular working hours. In such countries, the enumerator works for three hours outside the regular working hours. This makes it imperative to increase a great deal the number of enumerators, and consequently to try to solve the problems of training and supervision.

28. Arab countries with limited financial resources find it necessary to cut down the number of enumerators by giving them more tasks, while they have no adequate means of transportation. In certain cases, the enumerator cannot spend more than 15 minutes per household. This is reflected of course in the accuracy of data. Such examples are found in Egypt and Syria.

29. Some Arab countries tried to decrease expenditure by reducing the training period to the minimum for enumerators and supervisors. Moreover, no theoretical and practical tests are held to insure enumerator's full understanding of his task, especially when their small number does not permit the selection of the most qualified people. All this leads, in the long run, to lowering the degree of accuracy.

30. In Arab countries with relatively large areas, supervisors spend most of their time in administrative tasks and are not afforded the opportunity to check the soundness of the data as it is collected. Even some of them are unable to meet with enumerators in the field more than once during census period, due to the size of area he is to supervise. This in turn affects the soundness of collected data.

31. In small countries (such as Kuwait), where financial resources are available, it was possible to take some steps to insure quality control by sampling. These steps are summed up as follows .

31.1 Planning the records to be covered a single working day.

31.2 Collecting finished records at the end of the day and carrying them to the supervisor's office.

31.3 Recruiting assistants intensively trained for rapid revision; assigning an adequate number of them to each supervisor to undertake the daily revision; formulating instructions submitted to enumerators the following day to avoid repeating errors on the one hand and to double-check with households whose data included errors on the other hand.

32. In large countries with low population density, it is possible to use the above method in large agglomerations if the census budget permits.

33. Large Arab countries need many centres to train enumerators in their different geographic divisions. It is customary for experts to train a number of census personnel, who would in turn train enumerators in training centres. It is a fact that training the enumerator through several sessions weakens the content of training, for those who train enumerators have less experience and competence than specialized experts. In Syria, a method has been tried to fill this gap. Training programmes in different training centres throughout Syria were designed in such a way that an expert could visit them and give part of the important lectures in each of these centres. The implementation of this plan requires only a staggered timetable with gaps of a few days between the starting dates of each training session to enable the central training staff to travel from one centre to another.

34. Some Arab countries omit the practical field training in data collecting for enumerators and related staff who have only theoretical training. Experience gained in Arab countries proves that practical training is of paramount importance, and that it is the only way to judge the competence of the census-taker in accomplishing task.

35. It is advisable when conducting field training to assign a sufficient number of trainers to correction filled - out training questionnaires and to point out the errors of each trainee. In

addition, it is important to accompany each trainee on at least one visit to get to know his approach in data collecting and to advise him when necessary.

36. The rush in training and the lack of resources to guarantee its success (field training in particular) may lead to defective data, blank columns, incomplete description of profession or activity, or lack in coverage. All these undermine the accuracy of data and render some unfit for sound scientific analysis.

37. In the past, some Arab countries were recruting police or security officers to collect data. Others were employing students or youths affiliated with political and social organizations. This can lead to serious errors on the census due to lack of qualifications among these groups, such as seriousness and responsibilty. In addition, the use of security officers may raise doubts on the minds of the public, and force them to give erroneous data on purpose.

VII. Other problems related to population census activities

38. When appropriate space is not taken into account in the planning of census questionnaires, especially for profession and activity, the filled - in description might be abrupt and insufficient, leading to errors during coding.

39. Poor quality paper used for questionnaires impairs legibiltiy and leads to processing errors.

40. Lack of precision and coverage in administrative zoning is quite common in most Arab countries. Most geographic divisions are not consistent, a fact which creates confusion in field operations and undermines the advantages to be reaped from census data when published and distributed among government departments.

41. Street and buildings in most Arab cities are not named or numbered. This represents a burden to field workers, for they are obliged to number all buildings for census purposes only. These numbers disappear after a while and make it difficult to recognize buildings, houses, and households for sample surveys conducted within the census framework.

42. Some important international recommendations are inapplicable in Arab countries censuses without some modification, e.g. the definition of employed and unemployed, for this definition is related to a minimum number of working hours or days during the reference period. Furthermore, the recommended international classifications need many modifications to be applied in Arab countries censuses, e. g. the classification of professions and economic activities.

43. When planning the content of census questionnaires, the possibility of obtaining precise data in Arab environment is not taken into consideration in some instances. It is preferable not to include any item in the census form before confirming the item's usefulness and the possibility of obtaining the relevant data with an acceptable degree of accuracy.

44. Some Arab countries include data on housing and population in a single questionnaire. Since in many instances more than one family shares the same house, and the visiting time is usually short, collecting data on housing and population at the same time puts a strain on the collector's visiting time which often results in obtaining defective data .

45. Some Arab countries carry out other censuses during the population census period and using the same staff. This requires their training in concepts and methods of data collecting for more than one census. As a result enumerators do not achieve adequate comprehension of concepts and terminology thus affecting the accuracy of data collected, e.g. enumerators are requested to prepare an inventory of buildings and conduct population censuses at the same time.

C. Problems related to the collection of other forms of demographic data

I. Births registration

46. Births registration in Arab countries is usually done by clerks lacking awareness of the importance of demographic data. They give all their attention to the legal aspects of the registration procedure, while other data such as birth order, duration of marriage, parents, professions and the like are left blank or vaguely noted.

47. Birth reporting in Arab countries shows some defects. Despite the discrepancy of registration coverage among Arab countries, most analysts are sceptical about the accuracy of registration for the following reasons .

47.1 An infant born alive who dies shortly after birth is not registered as a birth nor as a death, a fact which affects the reliability of birth mortality rates, especially mortality.

47.2 Lack of sufficient number of registration bureaus, in low-density areas in particular, which imposes high expenses on the reporter for travel and stay, yet alone the many documents required for birth registration in some Arab countries to cover the legal aspect.

47.3 Lack of interest among some population groups to report births, especially when a birth certificate is not necessary to benefit from health and educational services or employment, and especially when it is possible to obtain a certificate later on from a doctor estimating the age, which becomes a valid substitute.

47.4 Preparation of the birth certificate is done by the Ministry of Health or the Ministry of Interior without referring to the competent departments of demographic statistics, and there may be no appropriate channels among these bodies.

II. Mortality registration

48. Mortality under-registration in Arab countries usually surpasses birth under-registration. The causes are similar for infants.

49. Moreover, the determination of the cause of death is often not certified by a doctor. Even when a doctor is called, he sometimes does not inspect the corpse unless a crime is suspected.

III. External migration data

50. All Arab countries suffer from a severe shortage concerning external migration data,

while registration is limited to the number of arrivals and departures strictly for security purposes.

51. Interest was shown recently in external migration statistics especially in Gulf oil producing countries due to their reliance on manpower coming from other Arab countries. Yet there are no appropriate scientific studies to draw a specific policy to ensure the necessary skills and expertise for economic and social development.

52. External migration census data is insufficient for the projection of population or of the formulation of indicators necessary for development planning.

53. There is an urgent need for cooperation among Arab countries, whether they are importers of manpower, to undertake in-depth studies on migration flows and their causes and motives among these countries to enable them to set up a plan to meet their individual needs.

IV. Internal migration data

54. The phenomenon of urbanization in Arab countries is widespread affecting both rural and urban life. Cities grew rapidly and led in some countries to grave problems of providing basic services to city-dwellers. Agricultural production was likewise affected in some of these countries due to rural-urban migration.

55. Data provided by population censuses on internal migration is far from adequate for measuring flows and for discovering the motives of the migrants as a basis for rational policies in this field.

D. Proposals to overcome the problems of collecting demographic data in the Arab countries

56. Due to differences in the experience of Arab countries in collecting population census data and vital registration, it seems desirable to share these experiences through the establishment of a statistical center say at the League of Arab States so that Arab countries, in collaboration with the competent bodies in the United Nations, will contribute to planning, implementation and analysis of demographic statistics.

57. Arab countries should offer the necessary training opportunities to obtain precise demographic data, giving due attention to field training for data collectors.

58. It is advisable that Arab countries offer the approriate stimuli to data collectors and give their specialized staff the opportunity to carrier development. those who gain experience in demographic data collection often switch to other fields seeking better working conditions due to lack appropritate incentives.

59. It is necessary to set up an efficient system for consultation and cooperation among officials concerned with demographic data collection and the departments of statistics and planning in order to guarantee the collection of relevant data, their accuracy and easy flow to tabulation, publication and analysis .

60. A scientific study on inter-Arab migration requires economic cooperation and co-ordination among Arab countries. Projections of migration movements, their causes and consequences need to be established in order to formulate a sound plan to fulfill the needs of each country at the right moment.

MODEL FERTILITY SCHEDULES AND THEIR USE IN ESTIMATING MEASURES OF FERTILITY *

by

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That the paucity of accurate vital statistics severely limits our understanding of demographic processes in the past in many developing areas today is well known. This lack of good data has led demographers to look for common patterns in nuptiality, mortality and fertility. The discovery of fairly simple models which can replicate these processes is certainly of interest in itself; nevertheless, the potential of such models for estimation is a major reason for their formulation.

Several sets of model tables have been developed representing in various ways and in different detail typical age patterns of mortality experienced by human population. The first model life tables were developed by the United Natione in the mid - 1950's (U N, 1955). Later in the mid - 1960's Coale and Demeny (1966) published their set of regional model tables based upon empirical tables which met strict standards of accuracy. Ledermann (1969) with LeBras has developed a more complicated set Finally, Brass (1971) has devised a vary simple scheme for estimating life tables based upon a logit transformation of a single model tables. Finally, Brass (1971) has devised a vary useful tool of demographic analysis.

Fertility schedules have proved to be much more complicated to model because of vast differences in biological and social factors controlling childbearing within marriages and differences in the age pattern of establishment of a stable sexual union. Brass (1968) formulated a two-parameter polynomial to describe age specific fertility rates; one parameter sets the level and the other the origin of a single **pattern** of fertility. Even this restrictive model, when combined with a model mortality function, enabled Brass to develop his elegant method for calculating childhood survivorship rates from information on the proportions of children ever born and surviving to women in standard age groups (Brass, 1968).

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* Meeting document E/ECWA/POP/WG. 5/8. This paper is a synthesized and somewhat simplified version of two papers which have appeared in **Population Index** (Coale and Trussell, 1974; Coale, Hill and Trussell, 1975). The ideas underlying both papers were conceived primarily by Ansley Coale. Allan Hill contributed heavily to the second paper. The errors discovered in the original articles have been eliminated and improvements formulated since their publication have been included.

Recently, a set of model fertility schedules, which offer new possibilities for demographic analysis, has also been developed (Coale and Trussell, 1974). In these age specific fertility schedules, the fertility at each age is expressed as a product of a number representing the proportion married at each age and a number representing the age specific fertility rate of those who cohabit. Accurately recorded fertility schedules, especially in those populations with early marriage and little control of marital fertility, are rare. These model schedules provide opportunity for study of such conditions; for, by varying these two numbers in a model fertility function, we have been able to construct schedules that we believe express essentially the full range of fertility likely to be found in large human populations. One source of this belief is the regularity, both in the age pattern of nuptiality and in the variation of marital fertility with age, noted by Coale (Coale, 1971). A further and sounder basis for this belief in the validity of model fertility schedules is their extraordinary close fit to various accurately fertility schedules of radically different shapes. This fit will be graphically illustrated and described later.

The Basis for Model Schedules of Fertility

The basic assumption upon which the model fertility schedules are calculated is that the age structure of fertility can be generated by the multiplication of tow model subschedules. One of theses schedule is a model sequence of proportions married and the other is a model schedule of marital fertility. Hence, if the proportion married at age a is G @ and the age specific marital fertility rate is r @, then the age specific fertility rate is f @ = r @. G @. Such construction applies exactly to a population which experiences no illegitimacy and no dissolution of marriage before the end of the span of childbearing ages. But it also replicates quite adequately fertility in populations not obeying these two strict assumptions by employing an r @ and G (a) which differ slightly from marital fertility and the proportion married in the actual population.

Age Structure of the Proportion Ever Married G (a)

Let g (a) represent the frequency of first marriages by age, defined as the number of first marriages in an interval divided by the number of people in that interval. If there is no differential mortality between the married and the unmarried, then it is well known that the proportion ever married g (a) is equal to the integral of g (x) up to a :

$$G(a) = \int_{a}^{a} g(x)\,dx \qquad (1)$$

If g @ is normalized by dividing through by the proportion who ever marry E = G (w), then $g^*(a) = g(a)/E$ is a proper probability density function. This function has been found to conform very closely in human populations to a standard distribution g_s (x) (Coale, 1971). The standard schedule, based on a nineteenth-century Swedish data, has origin at the age at which

marriage begins. If, then, for a given population,marrige begins at a_o, and k is a scale factor expressing the number of years of nuptiality in that population equivalent to one year in the standard, then by a simple transformation of variables

$$g^*(a) = g_s\left(\frac{a-a_o}{k}\right) \cdot \frac{1}{k} = g(a)/E \qquad (2)$$

If k is 1.0 then marriage occurs at the same pace as in the Swedish standard; if k = 0.5, then marriage occurs twice as fast in the Swedish standard since into half a year of experience in the given population is packed the equivalent of a whole year of experience in the standard. The mean and median of the standard schedule are known to be 11.4 and 10, respectively; in a given population with a nuptiality pattern given by g (a) the mean and median can readily be computed from (2). By a simple transformation of variable it can be seen that the mean age of first marriage frequency schedule, denoted by Hajnal (1953) as the **singulate** mean, equals a_o + 11.4k and the (singulate) median equals a_o + 10k. The singulate mean age at marriage (SMAM) plays an important role in techniques of estimation employing model fertility schedules.

A closed form expression of g*(a) (which is very useful for estimation) has been developed by Donald McNeil (Coale and McNeil, 1972).

$$g^*(a) = (0.19465/k) \exp\left[(-0.174/k)\,(a-a_o-6.06k)\right. \qquad (3)$$
$$\left. -\exp(-0.2881/k)\,(a-a_o-6.06k)\right].$$

No closed form expression for G (a) has been found, but G (a) can be easily calculated numerically, since $G(a) = \int_{a_o}^{a} g^*(x)\,dx$. This representation of G (a), with appropriate estimates of a_o and k, provides an approximation of the proportion ever married in a cohort, if multiplied by a scale factor E equal to the proportion who will eventually marry.

The Age Structure of Marital Fertility r (a)

Louis Henry has found that there is a characteristic pattern of fertility in populations where there is little or no voluntary control of births.He defined voluntary control as behavior, whether affecting fertility or not, which consistently alters with parity (Henry, 1961). If behavior does not alter with parity, then Henry calls the resulting fertility **natural fertility.** Coale (Coale, 1971) has discovered that marital fertility either follows natural fertility or departs from it in a regular way which increases with age. In any population the ratio of marital fertility to natural fertility is given by

$$r(a)/n(a) = M \exp(m.\, v(a)) \qquad (4)$$

The scale factor M is a factor which sets r (a)/n(a) = 1 at some arbitrary age. Equation (4) is an identity and could in fact be expressed exactly as r (a) = exp ($\overline{M}$. $\overline{V}$ (a) since nothing yet has been said about n(a) or v (a). We assume, however, that n (a) and v (a) are invariant over time and population. This assumption of constancy turns (4) from an identity into an hypothesis.

The functions n (a) and v (a) were derived from empirical data. There were two steps in the derivation : (a) the estimation of appropriate values of n (a) and v (a) by 5-year values above age 20 and (b) determination of single-year values above age 20 by interpolation and extension below age 20 by some arbitrary common sense principles.

Seven values of n (a) at ages 20-24 through 45-49 were derived by arithmetically averaging schedules designated by Henry as natural (Henry, 1961). These schedules begin at age 20 because the effect of premarital conception on teenage birth is large and unpredictable. Ten schedules of natural fertility were averaged after discarding those schedules based on surveys in which age misreporting was known to be extensive and might have distrorted the age pattern of fertility.

Seven values of v (a) were obtained through calculations employing the marital fertility schedules listed in the U.N. **Demographic yearbook** for 1965 (UN, 1966). Again, schedules known to be distorted were discarded. Each of the 43 selected schedules was regarded as embodying its own degree of departure from natural fertility when m was arbitrarily set equal to 1.0. For the $_j$th schedule v_j (a) is then calculated as

$$v_j(a) = \ln [r_j (a) / (M.n (a)] \quad (5)$$

M is chosen so that v_j (a) is zero for the age interval 20-24. The v (a) schedule was then defined as

$$v (a) = \sum_{j=1}^{43} v_j (a)/43 \quad \text{for a} = 20\text{-}24,..,45\text{-}49. \quad (6)$$

Values of the n (a) and v(a) schedules for the seven age intervals are given in table 1.

The function v (a) calculated in this way can be validated by substituting the tabulated values in equation (4), choosing M so that n (a) .M = r(a) for ages 20-24 and solving for the m ed to make (4) exact for each age interval.

$$m (a) = \ln[r_j (a) / (M . n_j (a)] / v_j (a) . \quad (7)$$

If the hypotheses underlying (4) were correct and v (a) were properly estimated, the sequence of calculated m's would be the same for all age groups in a given schedule. The sequence of calculated m's for the 43 empirical schedules is not, in fact, perfectly flat; but the set for most marital fertility schedules falls on a reasonably level plateau and the difference in calculated m's among populations is quite evident, as is seen in Figure 1.

Single-year values of n (a) above age 20 approximately match in average value for each 5-year age interval the values obtained by averaging ten schedules listed by Henry. The extension of n (a) back to age 12 is based on general biomedical information that full

reproductive capacity is reached a few years after menarche and that the mean age at menarche varies from about age 12 to age 16 in different populations. Because G (a) plays the dominant role in determining the rise of the age specific fertility schedule, the choice of particular rates to represent n (a) before age 20 is not very important. Values of v (a) were chosen to match approximately, in five-year averages, values given by equation (6). To avoid a sharp change in the v (a) at age 25, v (a) was assumed to rise smoothly from zero at age 20. Both v (a) and n(a) are shown in Figure 2; average values for five-year age groups are shown in Table 1, and single-year values are listed in a FORTRAN program in the Appendix.

Table 1 : Five-Year Values of v (a) and n (a)[1]

	15-19	20-24	25-29	30-34	35-39	40-44	45-49
n (a)	.411	.469	.442	.399	.323	.167	.025
v (a)	0	-.069	-.314	-.678	-1.040	-1.390	-1.658

Model Fertility Schedules and Their Fit to Actual Fertility Patterns

With single-year values for the three component functions, the full range of age specific fertility schedules in populations in which there is no dissolution of marriage and in which marriage begins at various ages and occurs either rapidly or more slowly and in which marital fertility either displays no departure from natural fertility or declines sharply with age due to control of fertility within marriage can be calculated. Age specific fertility is given by :

$$f(a) = \frac{E \cdot M}{k} \cdot G_s \left(\frac{a-a_o}{k} \right) \; n(a) \; e^{m \cdot v(a)}$$

$$= E \cdot M \cdot G(a) \; n(a) \; e^{m \cdot v(a)} \qquad (8)$$

A FORTRAN program for calculating model fertility and nuptiality schedules by specifying the three parameters a_o k, and m is given in the Appendix.[2]

In actual populations, however, births occur outside of marriage as well as within; and, in the absence of widowhood, the proportion of currently married persons is less than the

1 The values given in the original article (Coale and Trussell, 1974) are incorrect. This error did not affect our original model fertility tables or conclusions, however.

2 This program is significantly superior to the one published earlier (Coale and Trussell, 1974); we offer it not as an example of efficient and elegant programming (it is not) but as a convenience to the interested reader.

proportion ever married because of divorce. If there were no differences in mortality patterns between the married and the unmarried, widowhood would play no role in the departure of $\int_0^a g(x)\,dx$ from G (a) but actual mortality differences do, in fact, provide a further reason for the proportion currently married to differ from the proportion ever married. The above rigid assumptions of no marital dissolution and no illegitimacy can be relaxed by defining legitimate and illegimate births together as products of cohabitation and by identifying dissolution of cohabitation (re-entry into celibacy) as control of cohabital fertility.

Recognition that even when marriage starts relativity late, nonzero fertility rates (probably due to extramarital fertility) typically begin at age 15 or so led to an explicit modification of rates below age 20 when a_o was 15 or more. This modification was achieved as follows : fertility at exact age 20 and in the 5-year interval 15-20 as caculated from (8) were accepted as correct. Values of n and R were found such that $f(a) = T(a-15)^n$ mached the calculated ralve at age 20 and such that $T\int_{15}^{20} (a-15)^n$ matched the cumulated calculated fertility to age 20. No other explicit allowances for marital disolution or extramarital fertility were made. It was instead assumed that the structure of fertility in a population may resemble closely that in a hypothetical population displaying no extramarital fertility or marital dissolution if the later population has slightly different parameters of nuptiality and marital fertility than those in the actual population. This hypothesis was borne out in extensive test of the **patterns** of human fertility schedules to those of model schedules. In these tests only the fit of the **structure** of fertility was tested. Equation (8) was normalized so that total fertility equaled 1; then the normalized schelule was multiplied by the total fertility of the actual population and tested to see how well it fit. The results were surprisingly good (Coale and Trussell, 1974) : actual and model schedules for three quite different structures of fertility are shown in Figure 3 to conform very closely.

One of the two basic components of the model fertility schedules, the model schedule of first marriage frequencies, logically fits the experience of a cohort as it moves through life; it cannot be expected to match the proportion ever-married at age 40 far lower than the proportion ever-married at age 30, a situation which could never be replicated by model nuptiality schedules. An examination of long sequences of Danish and Swedish period and cohort marital fertility schedules revealed, however, that the second component of the model fertility schedule, the marital fertility schedule, fits cross-sectional data far beter than cohort data. Hence, one of the basic components is appropriate for the construction of period schedules and the other is not.

The good performance of a model schedule in matching fertility for Japan 1964 (Figure 3) shows that this logical defect does not necessarily impair the capacity of model schedules to duplicate real age patterns in times of rapid change. The parameters generating the schedule may, however, bear no relation to the nuptiality or fertility parameter in the actual population.

Instead, a good fit may involve complicated tradeoffs among parameters. For instance, the mean age at first marriage implied by the Japanese model schedule is 32.4 years whereas the actual mean is closer to 24 years. The difference in parameters may indicate more than just changing nuptiality, however; the v (a) or n (a) schedule may just not be consistent with experience of a given real population.

Extensions of the Model

Since widowhood, remarriage, and divorce do occur, our model G (a) schedule differs from the age profile of currently married females. We are now in the process of formulating a model schedule of currently married women with the explicit inclusion of widowhood, divorce, and remarriage functions. Moreover, since there is considerably less variations in marital fertility by duration of marriage than by age, we plan to reformulate our model fertility schedules by basing marital fertility on duration. Finally, we hope to include extra-marital fertility so that the model will be completely general.

Uses of Model Fertility Schedules

These model fertility schedules have already found wide use in various problems in demography. Trussell (1975) has them to test two methods of calculating the complex roots of Lotka's integral equation. They were also used to re-estimate the multiplying factors which convert the proportions of dead chilren to women in standard age groups into life table q_x values in the Brass mortality scheme (Trussell, 1975). Another use has been the construction of a method of estimating standard fertility measures from incomplete data in populations which experience natural fertility (i.e., m in equation (8) is zero); this method will be described in detail below.

Estimation of Fertility

Methods for estimating standard measures of mortality in the early years of life, devised by Brass and modified by Sullivan and Trussell (Brass and Coale, 1968; Sulivan, 1972; Trussell, 1975), are widely used and, from a mounting body of evidence, appear to be estimates of about the correct magnitude. These estimates are derived from the proportion of children dead among those ever born reported by women in different age intervals. They remain approximately valid even in populations in which the misreporting of age is severe.

On the other hand, the usual procedures for estimating fertility from a single census are much more vulnerable to inaccuracy in the reporting of age. One widely used approach infers the recent birth rate of the population from the Brass estimate of the proportion dying before the second birthday (q(2)) and the cumulative proportion of the population below certain ages, such as 5, 10, 15, or 20 (united Nations 1967, pp. 76-77). The different estimates that result, based on the proportion under various ages, usually are in disagreement precisely because age is misreported. The choice of a "final" estimate of the birth rate is arbitrary and to a wide range of uncertainly.

Brass has proposed a procedure for adjusting age-specific fertility rates inferred from births that are reported in a survey as having occurred in the preceding year or from births that may be incompletely registered. The method is predicated on three principal assumptions : (1) fixed age-specific rates among young women in the pre-survey years; (2) accurate reports by young women of children ever born; and (3) the correct structure by age (although perhaps an incorrect level) in the reported or registered schedule of age-specific rates. This method incorporates a correction factor equal to the average number of births that young women (say, aged 20-24) report as having occurred in their lifetimes, divided by the average number ever born calculated from the possibly imperfect fertility schedule. But as van de Walle has shown by constructed examples, this correction factor is seriously distorted by misstatements of age of the kind and extent found in much of Africa and South Asia (van de Walle, 1968).

Thus, in spite of several available procedures, there is still need for a method of estimating fertility that can be based on data from a single census or survey and that will be robust in the presence of substantial misreporting of age. We have such a method to report. It provides an estimated age-specific fertility schedule from a single censeus in which a question is asked about the number of children each woman born and in which the responses are tabulated by duration of mariage. The robustness of the method rests on two bases : (1) the apparent lesser distortion that occurs in some populations in reporting duration of marriage than in reporting age; and (2) the greater uniformity of fertility structures based on the duration of marriage than of age-specific fertility structures.

The procedure - at least in its present stage of development - works only in populations in which there is, and has been, very little voluntary control of fertility and in which only a small proportion of births occurs outside of mariage. On the other hand, the method is a simple, it requires no more information than tabulations of data that have already been collected in many censuses or surveys, and it does not require that the mean age at marriage has remained constant in the recent past (as does the Brass method of estimating fertility).

The underlying rationale for the procedure can be stated simply. The age structure of natural fertility - marital fertility in the absence of voluntary fertility control - is very similar in different populations, although the level from one population to another. Moreover, natural fertility varies very little from the beginning of reproductive maturity (about age 20) until the early to mid-thirties when a fairly steep decline begins. Therfore, early marrying populations that do not practice voluntary fertility control have very similar structures (though not necessarily similar leveles) in their schedueles of fertility by duration of marriage. A logical consequence is that, except for a scale factor, the sequence of values for average parity by duration of mariage is very similar in different populations subject to natural fertility. Therefore, it should be possible to compare the reported sequence of average parities (for durations of mariage of less than 5, 5-9, and 10-14 years) with a " standard " that incorporates some " normal " level of natural fertility and, thus, to determine the level of natural fertility in the population in question. The next steps are to estimate marital fertility as equal to standard natural fertility multiplied by the ratio of the level of natural

fertility in the population in question to the standard level, and to estimate the overall fertility schedule as the product of the proportion married at each age and marital fertility at that age. In practice, in estimating the " standard " schedule of parity by duration of marriage, allowance is made for the population's estimated distribution of age of entry into marriage and for the known variation of natural fertility with age.

A more detailed discussion of the theoretical basis for our method is provided in the next section. This discussion is somewhat simplified because various minor adjustments are ignored. The original article (Coale, Hill and Trussell, 1975) should be consulted for a full description of the method. Several examples are worked in detail there.

Theoretical Basis for Estimating Fertility from Values of Average Parity Tabulated by Duration of Marriage .

Suppose that age-specific marital fertility rates, r (a), do not vary with duration of marriage and have not changed with time in the recent past. These conditions are approximately fulfilled only in populations in which there is little voluntary control of fertility. When voluntary control is widespread, fertility at each age may fluctuate from year to year; moreover, with control, marital fertility at any given age characteristically declines as the duration of marriage increases. In any population, marital fertility rates during the first year of marriage are different from subsequent rates. If there are no premarital conceptions, fertility is zero virtually until the nineth month and very high in the last three months of the first year. Fertility during the second year falls from this peak rate because conception cannot occur during the first pregnancy or the postpartum period following the first birth. However, the average value of cumulative fertility, or of parity, during the first five years of marriage is almost identical to that which would be observed if women in fact bore children according to the schedule of age-specific marital fertility recorded without regard to duration. Evidence for this claim, discussed in detail below, is given bey Henry (1972).

For the moment, we shall assume that births occur only to married women; this restrictive assumption will later be relaxed, but it facilities exposition.

The average parity P (x,y) of women married at age x with a duration of mariage of y years is

$$P(x,y) = \int_{x}^{y+x} r(a)\, da, \qquad (9)$$

and the average parity of women who marry at age x and who have been married less than five years, $P_1(x)$, is

$$P_1(x) = \int_{0}^{5} \int_{x}^{y+x} r(a)\, da\, dy. \qquad (10)$$

Let the frequency of first marriages of those who ever marry be g (a), and suppose that this schedule has remained constant in the recent past. Then, the average parity for all women in the population who have been married for a duration of less than five years is

$$P_1 = \int_0^{\omega} g(a) P_1(a)\, da \qquad (11)$$

Equivalent expressions define the average parity of women at durations of 5-9 years (P_2) and 10-14 years. (P_3)

If schedules of r (a) and g (a) were known, fertility estimates could be derived easily. Suppose, instead, either that r (a) or g (a) is not known, or that the reporting of nuptialtiy or fertility is deficient and distorted by misstatement of age, and that the only reliable data are the average parities of women reported by duration of marriage. Given P_1, P_2, and P_3 as defined above, is it possible to invert the process of integration to obtain r (a) and g (a) ? Without further assumptions, of course, inversion is impossible, but with some supplementary information such as the singulate mean age at marriage (SMAM) and some simplifying assumptions, r (a) and g (a) can be estimated.

Our procedure for estimating fertility begins with the hypthesis that g (a) and r (a) can be closely approximated by nuptiality schedule and a schedule of natural marital fertility, respectively. The usefulness of this approach in fitting actual fertility schedules has been confirmed by empirical tests (Coale and Trussell, 1974). The model schedules of nuptiality and the schedule of natural fertility were described in detail above.

Standard schedules of first marriage and a single standard schedule of natural marital fertility given in Table 1 provide the basis for calculating average parities at durations of marriage of less than 5, 5-9, and 10-14 years - average parities that would prevail in populations marrying according to one of the standard nuptiality schedules and experiencing natural fertility after marriage. These parities are valid only up to a factor, however, since natural fertility differs from population to population in level (although not much in pattern) because of differences in health and nutrition, the prevalence and duration of breast feeding, and other such factors.

In other words, it is assumed that in the populations for which this method of estimation is appropriate, marital fertility follows the **pattern** of natural fertility, but at some unknown **level.**

The Progression of Average Parity by Duration of Marriage Related to the Distribution of First Marriages

Table 2 shows, for selected values of the singulate mean age at marriage, the average parities that would be observed in a population experiencing " standard " natural fertility. For

each value of SMAM we present four sets of average parities corresponding to different combinations of the starting age (a_0) and the pace of marriages after the start (k) that yield the given SMAM. (Recall that SMAM = $a_0 + 11.4k$.). If a_0 and SMAM (and, inferentially, k) are specified, the expected sequence of P_1, / P_2, and P_3 can be read (or interpolated) from Table 2. In practice, SMAM is determined or estimated for the population in question, a reasonable value of a_0 is assigned (e.g., 12 or 13 in an early marrying population, and 14 or 15 in a late marrying population), and the sequence of presumably appropriate model parities -- $\hat{P}_1$, $\hat{P}_2$, and $\hat{P}_3$ -- is read from Table 2. The ratio of the observed values to these model value -- namely $P_1 / \hat{P}_1$, $P_2 / \hat{P}_2$ and $P_3 / \hat{P}_3$ hereafter designated as R_1, R_2, and R_3 -- should be approximately the same for all three intervals. This common ratio indicates the level of natural fertility in the given population relative to the standard. (A non-level sequence of R's indicates that fertility does not conform to the natural pattern or women have been shifted from one duration to another. Procedures for adjusting the multiplying factor in certain of these situations are described elsewhere.) Multiplication of the standard natural fertility shedule (Table 1) by R yields the approximate age-specific marital fertility schedule for the population in question. The total number of births is derived by summing the product of the number of married women in each age interval and the calculated age-specific marital fertility rate ; division by the total population yields the estimated crude birth rate. Weighting marital fertility schedule by the proportion married in each age group produces the age-specific fertility schedule.

The discussion has thus far assumed the absence of illegitimacy. To the extent that illegitimate births are included with legitimate births in the reporting of parity, the pattern of parities is distorted, particularly at early durations. We recommend that the procedure not be used where a large fraction of births are extra-marital.

In summary, standard measures of fertility can be estimated accurately for a population experiencing natural fertility within marriage and very few births among those not married, when average parity is tabulated by duration of marriage, and the following additional peices of information are known or can be estimated :

1. SMAM -- the singulate mean age at marriage;
2. a_0 -- the age at which a significant number of marriages begin to take place;
3. the number of married between ages 15 and 49 by five year age groups.

Robustness of the Estimates

One advantage of this procedure arises from the apparently smaller distortion of parity related to duration of marriage than of parity related to age. The smaller distortion results part-

ly from the distribution of fertility by duration of marriage, which is much more nearly uniform for marriages of 10 or 15 years than is the age distribution of fertility for early ages of childbearing. Also, misreporting age in some populations is probably associated with marital status -- a young married woman is more likely to be reported as over 20 than a single woman of the same age. In populations, respondents are unable to supply a sensible figure for their own age (a woman with a grown son may report her age as 25), and the enumerator must often write down his own estimate. The respondent is more likely to have an appropriate idea of the time elapsed since marriage, especially when this important event is not very remote.

A common feature of tabulations of average parities by age of mother is that the parties rise to a peak ages 35-39 or 40-44 and fall thereafter, despite independent evidence that fertility has not changed in the recent past. There is now wide agreement that this pattern is a result to a large extent of the omission of older offspring whio have moved away from home. With marriage beginning by age 15, parity reported by age, even for ages 30-34, may be downward biased. Parities tabulated by duration of marriage are less prone to these errors up to durations of 15 years, since women married 10-14 years are unlikely to have a significant number of children old enough to move away from home.

Another strength of the procedure is its insensitivity to recent changes in age at marriage. It is often assumed in other forms of estimation from a single survey that the past fertility experience of a cohort -- say, women who are now 25-29 years of age -- is represented by the contemporary experience of younger women -- those 15 - 19 and 29 - 24 years of age at the time of the survey. Even when natural fertility prevails, recent change in age at marriage can cause a significant violation of this assumption. For example, if age at marriage has risen, the proportion married at ages 15-19 in the cohort now 20-24 was possibly much higher than in the group now 15-19. Hence, the cumulative fertility of women now 20-24 is substantially greater than the cumulation of current age-specific fertility rates would imply. In contrast, a change in age at marriage from a mean age of 19 to a mean age of 20 would have only a minor effect on fertility rates by duration of marriage.

The estimation by our method of the level of natural fertility in a population requires the determination of the singulate mean age at marriage and the assignment of a plausible value of a_0. Note in Table 2 that the progression of average parities is very little affected by the choice of a_0 for a given value of SMAM. Moreover, for early marriage the estimates of natural marital fertility differ only slightly for different values of SMAM. There are two reasons for this fact. First, if SMAM is early, say around 20, women marry very quickly and the majority of marriages is concentrated in a short span. Second, natural fertility is rather flat over this early span. For example, if all females marry at a single age, an erroneous choice of the true age at marriage produces less in predicted average parity when the true age is 20 than when it is 26. The difference in average,parity at duration 0-4 for women marrying at 19 and 21 is only.014, but the difference for women marrying at 25 and 27 is .035. These differences grow even larger for longer durations of marriage. Moreover, the assumption that all who marry do so at single age has a negligible effect on estimated average parity for ealy marriage, but it is downward

biased, and increasingly so for greater durations, at higher ages at marriage. The general robustness of the choice of a_0, and of SMAM when SMAM is early, is demonstrated more thorough elsewhere (Coale, Hill and Trussell,1975).

However, there are several points in our procedure at which misreporting age biases the estimate of SMAM, as noted by van de Walle (1968). Fortunately, the estimated level of natural fertility is robust to errors in SMAM when marriage is early; therefore, estimation of the **marital** fertility schedule is little affected by misreported age. But, once the level of natural fertility is ascertained, the overall number of births to women in each age interval may be misestimated if the ages of married women are misreported. With too many married women reported in certain age intervals and too few in others, the fertility schedule obtained by multiplying natural marital fertility by the proportion married is likely to have a distorted structure and even a biased total area, if misreporting transfers women from ages of low to ages of high marital fertility. This distortion is not great for the estimated total number of births (and presumbly the crude birth rate) if the total number is correctly reported because levels of marital fertility vary so little from about age 20 to 35. The largest bias in the estimated number of births is produced by age misstatments that transfer married women across age 20. But trial calculations show that even this bias is likely to be only a small fraction of the total.

Since estimates of total fertility and overall age - specific fertility schedules involve multiplying estimated marital fertility by the proportion married at each age, these values are subject to distortion by age misreporting that alters the recorded total number of women in each age interval within the childbearing span. Specially, a from of age misreporting transfers women from below or above the childbearing span into the 15 - 40 interval. Since many of those transferred may be single or widowed, the result may be an understatement of the overall proportion married among women aged 15-49, and hence of total fertility. Altogether, the effects of age misreporting do not seem to be very great.

The accuracy of estimates by our procedure is most vulnerable to biased statements of duration of marriage and to the unsuspected existence of a substantial degree of voluntary fertility control. We have proposed a method of detecting and adjusting for misstatements of the duration of marriage (Coale, Hill, and Trussell, 1975).

Practical Problems of Estimation

As indicated earlier, our procedure is applicable only in populations in which there is little practice of voluntary birth control and in which childbearing by women not currently married is infrequent. These stipulations would make it impossible (at least, without major ad hoc adjustments) to use the method for parts of Latin America and Africa where several forms of cohabitation outside of legal marriage are found, or for nineteenth century Sweden where 10 percent or more of all births were illegitimate. In addition, the method is not applicable to

populations, such as that of India, in which many marriages occur before the age of menarche and there is no close relation between age at marriage and age at which exposure to the risk of pregnancy begins. In some Muslim populations to which our method is potentially applicable (with natural fertility and very little illegitimacy), the date of mariage for many couples precedes the initiation of cohabitation. The result is lower average parity, especially in the first five-year interval of marriage. Another effect is to inflate the proportion of childless women married less than five years to a level higher than would be expected from calculations based on the normal interval between marriage and the first birth when contraception is not practiced. We have described a procedure for adjusting our estimates of fertility to allow for the effects of delay in cohabitation after marriage (Coale, Hill, and Trussell, 1975); because this procedure is rather complex, it will not be described here.

Variations in the Ratios of Observed to Calculated Average Parity

Our system of estimation is predicated on the congruence (except for a scale factor) of fertility rates by duration of marriage with the rates in a hypothetical population characterized by a model distribution of age-of-entry into mariage and by a model schedule of natural fertility rates within marriage. If these assumptions are exactly fulfilled, the sequence of ratios (R_i) of observed parity (P_i) to calculated average parity $(\hat{P}_i)$ will be a constant sequence. However, there are two categories of factors that operate in populations to which the method seems applicable and that may cause the sequence of R_i s to depart from the ideal of uni formity. The R_i s may not be uniform, first of all, because of genuine differences between actual and model average parity at different intervals of duration of marriage. One possible source of such a discrepancy is the absence of births in the first eight or nine months of marriage in populations in which there is no premarital cohabitation. Henry's calculations show that under these circumstances there is a very high rate of childbearing during the last three months of the first year of marriage, followed by damped fluctuations as the proportion of women susceptible to pregnancy (women who are neither already pregnant nor in the non-susceptible postpartum period) rises and falls and then levels off (Henry, 1972, p. 59). The effect of the burst of childbearing that begins toward the end of the first year of marriage is to yield cumulated fertility by the end of the third year that is virtually the same as if the average fertility of women long married had prevailed since the day of marriage. In other words, the susceptibility to conception of newly married women makes up for the absence of childbearing during the first nine months. Moreover, Henry's calculations yield an average parity for the first five years of marriage only about one percent higher than would be produced by the prevalence of average marital fertility throughout the interval. In short, this potential source of variations in the sequence of R_i s can safely be disregarded.

Another potential source of irregularity in the sequence of R_i s is fluctuation in the level of natural fertility a given population experiences. We know that the level of natural fertility varies considerably from one population to another. Change in some factor that causes such variation may lead to fluctution in a given population's level of natural fertility. Two examples may be cited. It is well known that the prevalence and duration of breast feeding

affect the length of the interval between births and, hence, the level of natural fertility. The intrusion of modern influences - - for example, the distribution of reconstituded milk at subsidized prices as a contribution to better nutrition - - can lead to a reduction in the practice of nursing and a rise in natural fertility. Secondly, recent research suggests that poor nutrition can inhibit ovulation and, in particular, can prolong the duration of postpartum amenhorrea of women who nurse their children (Frisch, 1974). Thus, an economic crisis or a sever drought may reduce natural fertility, and transient or secular improvements in nutrition may increase it. When natural fertility increases for these reasons, it tends to rise at all durations of marriage, but the proportionate effect on parity is greatest for the shorter durations.

Defects in the Recording of Data : A more troublesome source of non-uniform sequences of R_i s is defective recording of data on average parity by duration of marriage. The two most prevalent errors are recording zero as " parity not given " or " parity unknown " and mis - stating the duration of marriage. Presence of the first type of error is revealed by a sharp decline in the proportion of women of unknown parity with increasing age or duration of marriage, a reported decline paralleling the genuine decline of the proportion of parity zero. If the " parity unknown " catgory is omitted from the calculation, average parity is overstated, particularly at duration 0-4. If all such women are allocated a parity of zero, average parity is understated. El-Badry (1961) has proposed a method of adjustment that avoids any major bias.

Misstating the duration of marriage biases the average value of parity in both duration intervals affected because the transfer of women from one interval to another is selective with respect to their parity. For example, the women who falsely reported duration of marriage at 5 - 9 years rather than 0 - 4 very probably belong near the upper boundary of the lower interval, and are of generally greater parity than the average for their true interval and of lower parity than the average for the interval in which they are reported. An upward transfer - - an overstatement of duration - - thus introduces a downward bias in the recorded average "parity unknown" category is omitted from the of duration causes an overstatement of average parity in the two groups.

Errors in stated duration of marriage are analogous to errors of reference period in the reporting of events during a fixed interval, such as the past year, and to misstatements of age or of a child's date of birth. The extent and direction of the bias probably depend on the wording of the question by which duration is ascertained, as well as on the education of the enumerator and respondent and on the general cultural context. Asking the date of marriage may elicit a date more recent than is true. and a direct inquiry about the actual duration of marriage may lead some women to round their responses upward to preferred numbers such as five, thus overstating the length of marriage.

We have devised a procedure for testing for misstatement of duration of marriage and correcting recorded parities when there is evidence of misstated duration (Coale, Hill and Trussell, 1975). Although the use of this procedure is quite simple, a full explanation is beyond the scope of this paper.

An important discovery that we have made since the publication of this method is that the adjustments to reported parity obtained from the procedure for correcting for misstatement

of duration of marriage and for a delay between marriage and cohabitation are quite similar in value. In our original presentation we sometimes used one procedure and sometimes used the other. The fact that adjustments dictated by assuming either source of error are similar means that it is unnecessary in practice to identify which source is operating. It should be noted that the procedure for correcting for a delay in cohabitation contained an error; this error has been corrected in the October 1975 issue of **Population Index.**

An Example of the Method : Jordan, 1972 :

This method has been applied to several Moslem countries with varying degrees of success (Coale, Hill and Trussell, 1975) - Egypt 1947 and 1960, Moslem in Israel, 1961, and Kuwait, 1965 - 1970. The recent publication of the National Fertility Sample Survey (Rizk, 1972) conducted in 1972 in the East Bank of the Hashemite Kingdom of Jordan includes tabulations which permit its use there. Unfortunately, a tabulation of the female population by marital status is not available since the only census in Jordan was conducted in 1961. Therefore we will have to content ourselves with an exercise which cannot be expected to yield precise measures of fertility since we lack prerequisite information.

The SMAM calculated by the Hajnal method using the marital status distribution of the women in the survey is 20.2. This figure compares favorably with the SMAM calculated from the marital status distribution given in the 1961 census. Let us assume that the latter figure is correct; it makes little difference which estimated SMAM is chosen because, as stated earlier, the procedure is robust to the choice of SMAM. From Table 2 we can estimate the average parity which would be expected for each marital duration if fertility were natural and experienced at the standard level. As Table 3 indicates, although the ratio of observed to expected parity is not flat, the level of fertility in Jordan is approximately that of the standard. The non-uniformity of the ratios is an indication that perhaps women have misstated their duration or that there is a delay in cohabitation. By making the required corrections described in detail elsewhere (Coale, Hill and Trussell, 1975) , the ratios were adjusted; the adjusted ratios indicated that the marital fertility schedule in Jordan is approximately $2\frac{1}{2}$ percent higher than the standard schedule. This schedule is shown also in Table 3. Since there is no recorded age distribution for Jordan in 1972, any estimation of a birth rate is subject to bias of unknown magnitude and sign. If the age distribution of 1961 is assured to hold also in 1972, then a birth rate of 56 would result. Finally, we can estimate age specific fertility rates by multiplying the proportion currently married by the estimated marital fertility rate at each age in 1972. The total rate implied by this age specific fertility is 8.8, considerably higher than the 7.6 and 7.2 recorded average parities for ages 40-44 and 45-49 respectively. Nevertheless, the lower recorded parity at 45-49 than at 40-44 is a warning that the reported parities are probably progressively understated at higher ages as women leave out children who have grown up and moved away from home.

We conclude, then, by reiterating that the use of the method with the Jordanian survey is only illustrative, and no comparison can be made between estimated and recorded numbers of births due to a paucity of data. The method appears to work well in the examples we have previously reported, but many more tests will have to be performed before we can tell whether the method has widespread applicability.

Table 2. Average party by duration of marriage ($\hat{P}$) for selected values of the singulate mean age at marriage (SMAM), when marrital fertility is experienced at a level indicated in Table 1.

$\hat{P}_1$ 0-4	$\hat{P}_2$ 5-9	$\hat{P}_3$ 10-14	a_o	k
Mean age at marriage = 18				
1.072	3.338	5.500	12	0.526
1.097	3.385	5.555	13	0.439
1.120	3.424	5.601	14	0.351
1.140	3.455	5.638	15	0.263
Mean age at marriage = 19				
1.090	3.337	5.445	12	0.614
1.113	3.381	5.501	13	0.526
1.135	3.417	5.548	14	0.439
1.152	3.446	5.585	15	0.351
Mean age at marriage = 20				
1.097	3.316	5.364	12	0.702
1.119	3.357	5.419	13	0.614
1.138	3.392	5.467	14	0.526
1.154	3.419	5.505	15	0.439
Mean age at marriage = 21				
1.097	3.279	5.261	12	0.789
1.117	3.318	5.315	13	0.702
1.134	3.351	5.362	14	0.614
1.148	3.377	5.402	15	0.526
Mean age at marriage = 22				
1.091	3.230	5.141	12	0.877
1.109	3.266	5.192	13	0.789
1.125	3.298	5.237	14	0.702
1.137	3.324	5.278	15	0.614

Table 3 : Fertility estimated from a table of parities by duration of marriage : Jordan, 1972.

Duration of Marriage	Observed Average Parity	Calculated Average	Ratio
0-4	1.046	1.152	.908
5-9	3.309	3.402	.973
10-14	5.428	5.464	.993

Estimated Marital Fertility Rates : Standard x 1.025

15-19	.421
20-24	.481
25-29	.453
30-34	.409
35-39	.331
40-44	.171
45-49	.026

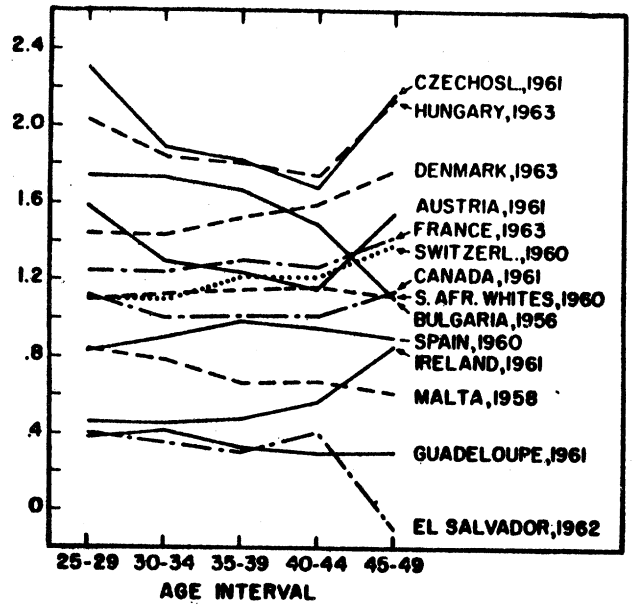

Fig. 1. Values of m, where $m = \log[r(a)/(M \cdot n(a))] / v(a)$, for selected marital fertility schedules

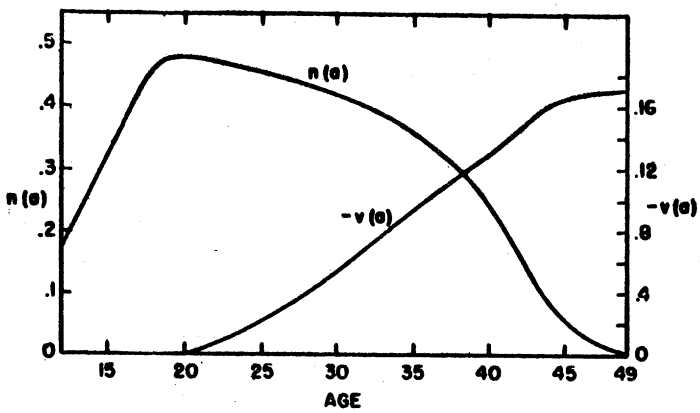

Fig. 2. Values of $n(a)$ (natural fertility), and $v(a)$ (logarithmic departure from $n(a)$)

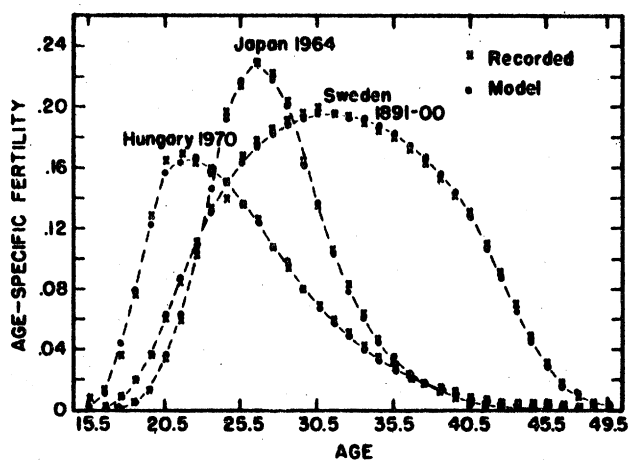

Fig. 3. Age-specific fertility rates of three populations fitted by model fertility schedules

Appendix: FORTRAN IV Program for Calculating Model Nuptiality and Fertility Schedules

```
      REAL*8 X,AKK,ZL,ZU,ZSS,G,DFLOAT
      DIMENSION EM2(38),ZSS(500),H(38),V(38),F(38),T(7),RR(5),CQ(9)
      DIMENSION ZF(38),TT(7),TTT(7)
C
C       V(A), CENTERED ON THE MIDPOINT OF EACH YEAR OF AGE
      DATA V/0.,0.,0.,0.,0.,0.,0.,.004,.03,.06,.10,.15,.20,.25,.31,
     1       .37,.44,.52,.60,.68,.76,.83,.90,.97,1.04,1.11,1.18,1.25,
     1       1.32,1.39,1.46,1.53,1.59,1.64,1.67,1.69,1.70/
C
C       NATURAL FERTILITY, CENTERED ON THE MIDPOINT OF EACH YEAR OF AGE
      DATA H/.175,.225,.275,.325,.375,.421,.460,.475,.477,.475,.470,
     1       .465,.460,.455,.449,.442,.435,.428,.420,.410,.400,.389,
     1       .375,.360,.343,.325,.305,.280,.247,.207,.167,.126,.087,
     1       .055,.035,.021,.011,.003/
      REAL*8 CQ/' PTY1',' PTY2',' PTY3',' PAR1',' PAR2','   12','   13',
     1'   14','10-14'/
      REAL*8 C(48) /' MEAN','STDEV','   R1','M MAR',' % EM','   TF','
     115','   16','   17','   18','   19','15-19','   20','          '   2
     11','   22','   23','   24','20-24','   25','   26','   27','   28'
     1,'   29','25-29','   30','   31','   32','   33','   34','30-34','
     1   35','   36','   37','   38','   39','35-39','   40','   41',
     1'   42','   43','   44','40-44','   45','   46','   47','   48',
     1'   49','45-49'/
  888 FORMAT(5F10.5)
   90 FORMAT(1H0,' AGE',7X,'FERTILITY',14X,'STATISTICS',37X,'NUPTIALITY'
     ?,12X,' AGE ')
   89 FORMAT(74X,'CUMULATIVE',8X,'DENSITY',/)
   95 FORMAT(1H1,20X,'AGE SPECIFIC FERTILITY AND NUPTIALITY SCHEDULE GEN
     ?ERATED BY AO=',F5.1,' K= ',F5.3,' M=',F5.3)
   91 FORMAT(1X ,A5,5X,F10.8,10X,A5,5X,F8.4,20X,2F15.6,5X,A5)
   92 FORMAT(31X,A5,5X,F8.4)
   93 FORMAT(1X ,A5,5X,F10.8,10X,A5,5X,F8.4,20X,2F15.6,5X,A5,/)
   98 FORMAT(1X,A5,5X,F10.8,48X,2F15.6,5X,A5)
   99 FORMAT(1X,A5,5X,F10.8,48X,2F15.6,5X,A5,/)
   96 FORMAT(1H1,'********> ERROR-THE PROGRAM AS WRITTEN WILL NOT ALLOW
     ?AN AO LT 10 <********')
      DO 1234 L=1,38
 1234 V(L)=-V(L)
      DO 637 I=1,100
  637 ZSS(I)=0.0
      FUZZ=1.0D-4
  999 CONTINUE
      READ(5,888,END=3) AAA,AKK,AMM,TF,EM
C       ONLY ONE DATA CARD IS REQUIRED.  AAA=AGE AT FIRST MARRIAGE, AKK=YEARS
C       IN THE POPULATION EQUIVALENT TO 1 YEAR IN THE STANDARD SWEDISH, AMM
C       = THE DEGREE OF FERTILITY CONTROL, TF=TOTAL FERTILITY,DEFAULT =1, EM=
C       PROPORTION WHO EVER MARRY,DEFAULT=1
      IF(AAA.GE.10.0) GO TO 223
      PRINT 96
      GO TO 999
  223 CONTINUE
      FMEAN=AAA+11.37*AKK
C
C       THE SECTION THROUGH STATEMENT 5 ESTABLISHES THE CUMULATIVE EVER-MARRIED
C       BY INTERVALS OF ONE TENTH OF A YEAR; THE ORIGIN IS FIXED AT AAA
      J=10.0*AAA+FUZZ
C       THIS PROCEDURE ALSO COMPENSATES FOR TRUNCATION ERROR(EG, 10*12.00 BECOMES
C       119.9999999..... AND THUS TRUNCATES TO 119 INSTEAD OF 120)
      DO 6 M=101,J
    6 ZSS(M)=0.0
```

```
      ZL=0.0
      K=J+1
      DO 5 I=K,500
      X=DFLOAT(I)/10.0D0-AAA
      ZU=G(X,AKK)
      ZSS(I)=0.1*(ZU+ZL)/2.0
      IF(I .GT. K) ZSS(I)=ZSS(I)+ZSS(I-1)
      ZL=ZU
    5 CONTINUE
C
C      BY AVERAGING THE CUMULATIVE EVER MARRIED FUNCTION OVER THE 11 TENTHS OF
C      A YEAR VALUES BETWEEN A AND A+1, INCLUSIVE, THE AVERAGE PROPORTION EVER
C      MARRIED FOR EACH YEAR FROM 12 TO 49 IS OBTAINED
      DO 25 I2=1,38
      II2=120+10*I2
      ZF(I2)=ZSS(II2)-ZSS(II2-10)
      W=0.0
      DO 24 K=1,10
   24 W=W+0.5*(ZSS(II2-K+1)+ZSS(II2-K))
   25 EM2(I2)=W/10.0
      IF(EM.GT.0.0) GO TO 71
      EM=1.0
   71 EMM=EM/EM2(38)
      DO 75 J=1,38
   75 EM2(J)=EM2(J)*EMM
   58 DO 35 I2=1,38
   35 F(I2)=EM2(I2)*H(I2)* EXP(AMM*V(I2))
C
C      THE 15-19 SECTION OF THE AGE SPECIFIC FERTILITY SCHEDULE
C          ESTABLISHED IN STATEMENT 35 IS NOW TRANSFORMED BY FITTING
C          AN EXPONENTIAL HAVING CONTACT WITH THE AGE AXIS AT AGE 15 AND
C          ORDINATE AT AGE 20 AND AREA UNDER THE CURVE FROM 15-19 EQUAL
C          TO THAT OF THE ORIGINAL 15-19 SECTION. THIS TRANSFORMATION IS
C          NOT PERFORMED UNLESS A0 IS GREATER THAN 15
      DO 1 IL=1,7
      BB=0.0
      CC=0.0
      DD=0.0
      DO 2 JL=1,5
      KL=JL+5*(IL-1)+3
      CC=CC+EM2(KL)
      DD=DD+ZF(KL)
    2 BB=BB+F(KL)
      TT(IL)=CC/5.0
      TTT(IL)=DD/5.0
    1 T(IL)=BB/5.0
      EM15=(EM2(1)+EM2(2)+EM2(3))/5.0
      ZF15=(ZF(1)+ZF(2)+ZF(3))/5.0
      FIRST=(F(1)+F(2)+F(3))/5.0
      IF(AAA .LT. 15.0) GO TO 289
      TX=T(1)*5.0
      FR=.476*ZSS(200)
      SS=FR*5.0/TX-1.0
      CONS=FR/(5.0**SS)
      A=1.0
      DO 44 ML=1,5
      RR(ML)=A**(SS+1.0)/(SS+1.0)*CONS
   44 A=A+1.
      F(4)=RR(1)
      DO 46 M=2,5
```

```
      L=M+3
   46 F(L)=RR(M)-RR(M-1)
  289 CONTINUE
C
C       THE SECTION THROUGH STATEMENT 37 ESTABLISHES THE MEAN, VARIANCE,
C            THE 3 PARITIES, AND R1
      SUMF=0.
      DO 222 I2=1,38
  222 SUMF=F(I2)+SUMF
      DO 333 J=1,7
  333 T(J)=T(J)/SUMF
      FIRST=FIRST/SUMF
      SUM=0.
      SUMSQ=0.
      A=12.5
      DO 33 I2=1,38
C       THE FERTILITY SCHEDULE IS NORMALIZED SO THAT TF=1
      F(I2)=F(I2)/SUMF
      SUM=SUM+A*F(I2)
      SUMSQ=SUMSQ+A*A*F(I2)
   33 A=A+1.0
      SIGMA=(SUMSQ-SUM*SUM)-1.0/12.0
      SIGMA=SQRT(SIGMA)
      SMEAN=SUM
      Q1=(4.5*F(4)+3.5*F(5)+2.5*F(6)+1.5*F(7)+.5*F(8))/5.0 +5.0*FIRST
      Q2=(4.5 * F(9) + 3.5 * F(10)+ 2.5 * F(11)+ 1.5 * F(12)+ .5 *
     1 F(13)) / 5.0 +  5.0*(T(1)    +FIRST)
      Q3= (4.5 * F(14) + 3.5 * F(15) + 2.5 * F(16) + 1.5 * F(17) +
     1 .5 * F(18)) / 5.0 +  5.0* (T(1) + T(2)    +FIRST)
      PAR1=Q1/Q2
      PAR2=Q2/Q3
   37 R1=T(1)/T(2)
C       THE FERTILITY SCHEDULE IS BLOWN UP TO THE RIGHT TF
      IF(TF.GT.0.0) GO TO 78
      TF=1.0
      GO TO 79
   78 DO 77 J=1,38
   77 F(J)=F(J)*TF
   79 CONTINUE
      PRINT 95,AAA,AKK,AMM
      PRINT 90
      PRINT 89
      PRINT 91,CQ(6),F(1),C(1),SMEAN ,EM2(1),ZF(1),CQ(6)
      PRINT 91,CQ(7),F(2),C(2),SIGMA ,EM2(2),ZF(2),CQ(7)
      PRINT 91,CQ(8),F(3),C(3),R1    ,EM2(3),ZF(3),CQ(8)
      PRINT 91,CQ(9),FIRST,C(4),FMEAN,EM15,ZF15,CQ(9)
      PRINT 92,C(5),EM
      PRINT 91,C(7),F(4),C(6),TF     ,EM2(4),ZF(4),C(7)
      PRINT 91,C(8),F(5),CQ(4),PAR1  ,EM2(5),ZF(5),C(8)
      PRINT 91,C(9),F(6),CQ(5),PAR2  ,EM2(6),ZF(6),C(9)
      PRINT 91,C(10),F(7),CQ(1),Q1   ,EM2(7),ZF(7),C(10)
      PRINT 91,C(11),F(8),CQ(2),Q2   ,EM2(8),ZF(8),C(11)
      PRINT 93,C(12),T(1),CQ(3),Q3   ,TT(1),TTT(1),C(12)
      K=4
      DO 102 IN=2,7
      N=IN*5 +3
      M=N-4
      PRINT 98, (C(J+K),F(J),EM2(J),ZF(J),C(J+K),J=M,N)
      PRINT 99,C(N+K+1),T(IN),TT(IN),TTT(IN),C(N+K+1)
  102 K=K+1
```

```
      GO TO 999
    3 STOP
      END
      DOUBLE PRECISION FUNCTION G(X,AKK)
      IMPLICIT REAL*8(A-H,O-Z)
      CONS=0.19465/AKK
      B=0.1740/AKK
      W=0.2881/AKK
      G=CONS*DEXP(-B*(X-6.06D0*AKK)-DEXP(-W*(X-6.06D0*AKK)))
      RETURN
      END
```

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INDIRECT METHODS OF ESTIMATING MORTALITY ILLUSTRATED BY APPLICATION TO MIDDLE EAST AND NORTH AFRICAN DATA*

by

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The traditional procedure for measuring mortality requires information on the number of deaths among defined categories of persons (classified by area, sex, age, etc.) in a known time interval and on the numbers exposed to risk in these groups. From the data, age specific death rates are calculated and these in turn form the basis for the derivation of the life table functions which describe mortality. In many parts of the world (covering at least 70% of the total population) satisfactory vital registration to provide the numbers of deaths has not yet been established and accurate statistics of population at risk may also be difficult to obtain.

It therefore becomes necessary to devise techniques for estimating mortality from data in non-traditional form which are available or can be obtained more quickly and cheaply than by establishing a sophisticated vital registration system. Much effort has been put into the invention and improvement of these methods over the past fifteen years or so. They are essentially opportunistic, making use of measures which are related to death rates in various ways. Inevitably the resulting values are incomplete and often erratic. It is then necessary to graduate them and fill in the gaps by the application of model life tables. The estimates then obtained are partly an expression of mortality levels in the population, affected to some extent by the assumptions about how these are related to the non-traditional measures chosen and partly an inference from the experience of populations with accurate data. In such circumstances, evaluation of how successful a method is can not be based simply on the deviation of the estimated from the true values. If the latter were known it would not be necessary to apply the techniques. The relevant questions are whether an indirect method can give reasonable results at low cost where no other valid estimates exist or whether it can give better or equally good returns compared with alternative approaches.

It is convenient to use the term " indirect " to cover a variety of estimating procedures which differ in the sources of the data from which the measures are calculated and in the extent to which corrections are applied. Some methods attempt to adjust for errors in statistics obtained by traditional ways, for example through vital registration or to validate direct substitutes such as numbers of deaths in a period counted at repeated household surveys; others manipulate existing stock information on census age distributions at different times

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to derive dynamic measures for the interval between them. Many indirect methods, however, depend on special questions asked at censuses or demographic enquiries. This has proved a simple and powerful procedure for arriving at reasonable estimates in situations where the data base is otherwise lacking but if the questions have not been included in an appropriate enquiry, progress is blocked.

The present paper considers several of the indirect methods which are the most promising for the estimation of mortality in the populations which are the particular concern of ECWA. In each case the principles and the application of the technique are described but the details of the theoretical derivation and validation are omitted. Most of the descriptions follow closely those in papers already given at ECWA seminars but with some modifications suggested by recent studies. Each method is then illustrated by application to data from the region or from a neighbouring population with similar problems. The movement outside the region was because of the inability to find appropriate sources of data for the application of one technique which is potentially of high value. The nature of the methods, their strengths and disadvantages are brought out by comments on the examples.

Childhood Mortality Estimation

The collection of information on total children born and surviving for broad age groups of mothers, as an indication of mortality, has a long history but the systematic translation to conventional measures dates from the Princeton African Population Programme in the early 60's. The data can be obtained from simple census questions on children in aggregate but in sample surveys are often the result of more intensive interrogation about individual births in order to improve accuracy. A typical set of results is shown in Table 1 .

Table 1. Bahrain : Census of 1971

Age group of women	i	P_i (mean children born per woman)	D_i (proportion of children dead)
15-19	1	0.298	.077
20-24	2	1.785	.086
25-29	3	3.677	.108
30-34	4	5.114	.145
35-39	5	6.111	.181
40-44	6	6.131	.260
45-49	7	6.043	.308
50-54	8	5.373	.384

Clearly the proportion dead for a given age group of mother (D_i) depends on the lengths of time since the children were born and may be equated to the probability of dying between birth and some age T_i [denoted by $q(T_i)$] which is a form of average of the lengths. T_i will depend on the differences between the ages of the mothers at the date of the survey and those at which the children were born, that is on how early child bearing starts. It will also be affected by the way fertility changes with age of woman and the pattern of mortality in childhood. Since these latter do not vary too greatly and have subsidiary effects only, however, it seems reasonable to seek an estimation method based only on some knowledge of the locations of the fertility distribution.

This was done by the numerical calculation of the values of T_i for a fixed standard pattern of mortality and a model fertility distribution of a simple form which varied only with the mean age of childbearing. Conveniently, the values of T_i for each age groups of women were close to integers, r (one year for the 15-19 age range, two years for 20- 24 and so on). A practical procedure was then constructed by calculating the factors by which the proportions of children dead D_i had to be multiplied to give the appropriate q(r). These are shown in Table 2 against the corresponding age groups of mothers and useful indices of the location of the childbearing period.

Table 2 against the corresponding age groups **proportion of children born alive who die by age r, q(r), from the proportion dead among children ever born to women 15-19, 20-24, etc.**

Age group of woman	**Factors**							
15-19 q(1)	0.859	0.890	0.928	0.977	1.041	1.129	1.254	1.425
20-24 q(2)	0.938	0.959	0.983	1.010	1.043	1.082	1.129	1.188
25-29 q(3)	0.948	0.962	0.978	0.994	1.012	1.033	1.055	1.081
30-34 q(5)	0.961	0.975	0.988	1.002	1.016	1.031	1.046	1.063
35-39 q(10)	0.966	0.982	0.996	1.011	1.026	1.040	1.054	1.069
40-44 q(15)	0.938	0.955	0.971	0.988	1.004	1.021	1.037	1.052
45-49 q(20)	0.937	0.953	0.969	0.986	1.003	1.021	1.039	1.057
50-54 q(25)	0.949	0.966	0.983	1.001	1.019	1.036	1.054	1.072
55-59 q(30)	0.951	0.968	0.985	1.002	1.020	1.039	1.058	1.076
60-64 q(35)	0.949	0.965	0.982	0.999	1.016	1.034	1.052	1.070
Guide to selection of multiplier								
P_1 / P_2	0.387	0.330	0.268	0.205	0.143	0.090	0.045	0.014
P_2 / P_3	0.616	0.577	0.535	0.490	0.441	0.421	0.344	0.271
m	24.7	25.7	26.7	27.7	28.7	29.7	30.7	31.7

In order to select the right series of factors by age group for deriving the q(r) from the observed D_i , an estimate of the location of childbearing is needed. The obvious measure is m, the mean age of the specific fertility distribution. This is usually calculated from age specific fertility rates obtained from reports of births in the year preceding the survey (errors in the time period or omissions of births do not bias the calculation if they are approximately the same at each age of woman). However m does not always give a good index for the youngest ages of childbearing which is the period that matters in the estimates [q(1), q(2), q((3)]of infant and early childhood mortality. An alternative index is P_1/P_2(the ratio of mean children born per woman in the 15-19 and 20-24 years age group) which shows the pattern of fertility change at early ages. The original rule suggested was that, where possible, P_1/P_2 should be used to determine the factors for the first three age groups and m for the later ones. Subsequent studies have indicated that the single indicator P_2/P_3 is an adequate choice of a located parameter since P_1 is sensitive to age reporting errors at the start of childbearing and also sample fluctuations due to the relatively small numbers of births to women aged 15-19 years. P_2/P_3 is particularly satisfactory for the estimates of q(2),q(3) and q(5) which are the most reliable obtained by the procedure.

Sullivan has examined the estimation problem in a different way by studying the relations between the D_i and the q(r) for a large number of computations. In these, observed fertility distributions (rather than a model) were combined with model life tables of the Coale-Demeny Regional System (rather than a fixed mortality schedule). From the calculations he concluded that the multiplying factors shown in table 2 give satisfactory estimates but he proposed modified procedures based on linear equations for $q(r)/D_i$ in terms of P_2/P_3

Typical of the equations are those for the "West" mortaliry pattern of the Coal - Demeny Regional System (which is close to the median case) shown below :

$$q(2)/D_2 = 1.30 - 0.54\ (P_2/P_3)$$

$$q(3)/D_3 = 1.17 - 0.40\ (P_2/P_3)$$

$$q(5)/D_4 = 1.13 - 0.33\ (P_2/P_3)$$

If something is known about the pattern of child mortality so that the relevant model can be chosen improvements in accuracy are possible. Recently Trussell has constructed more complicated equations based on an improved set of fertility models. In practice, the estimates from these sophisticated derivations differ only slightly from those reached by the original system. When data errors are at all appreciable they swamp the differences due to the choice of technique.

These are the formal elements of the method. The justification of its value lies in the large number of applications in which the estimates of child mortality obtained have been

sensible and plausible. Nearly always they have been substantially higher than the death rates arrived at by other means, where such checks exist. In a few cases where it has been possible to make comparisons with vital registration statistics, believed to be substantially complete, agreement has been good with slightly higher mortality in general coming from the retrospective reports. Of course, this experience does not prove that the estimates derived in this way for developing countries are fully accurate but it strongly suggests that the effects of errors are slight or moderate. It seems likely that children who die very young will tend to be omitted from the records; the absence of children of mothers who died in child-birth from the retrospective records will also bias the rates downwards since these births have a smaller chance of surviving. The estimates are not sensitive to age mis-statements by the mother and the effects of these can be limited by suitable averaging of the q's (see below). Such graduation is also usually necessary to reduce sample errors when the data are from small surveys.

When the method was first constructed it was hoped that mortality up to early adulthood would be obtained from the reports by the older women.For example table 2 gives factors for estimating q(35) from deaths of children to women aged 60-65 years. Such measures have proved quite unreliable because of misreporting by the older women, more severe for dead than live children, and, possibly, differential mortality of mothers so that the experience of those living to greater ages is not representative for the population as a whole. In addition the data for the younger women reflects the child mortality of the recent past since the bulk of their pregnancies were not long before the survey. For these reasons the most satisfactory estimates are of q(2) and q(3) and q(1) suspect because of the difficulty of locating fertility at the beginning of reproduction precisely and the sampling fluctuations from small numbers.

Example. The application of the technique to the child death tabulations from the 1971 Census of Bahrain is shown in Table 3. The calculated value of P_2/P_3 is 0.485 which lies slightly past the measure for the fourth column of factors in Table 2, in fact one/tenth of the way towards the fifth column of factors. Correspondingly the multiplying factor for the age 15-19 years in Bahrain is taken as $0.977 + (1.041-0.977)/10 = 0.983$. The factors for other age groups are obtained from the appropriate rows of Table 2 in the same way. They are given in column (5) of Table 3. Multiplication of the D_i in column (4) by these gives the estimates of q(r) in column (6), for the (r) ages shown in column (8).

The Sullivan equations for the "West" mortality pattern were also applied with the Di and P_2/P_3 values of Bahrain to provide the estimates of column (9).

The graduation procedure mentioned above and described in the next section was applied to the values calculated for q(2), q(3) and q(5) from the multiplying factors and extrapolated to later ages by a model life table. These "fitted" estimates are given in column (7).

Table 3. Estimation of childhood mortality : Bahrain 1971

Age group of women	i	P_i (mean children born per woman)	D_i (proportion of children died)	K_i (multiplying factor)	q(r) Estimated	q(r) Fitted	r	q(r) Sullivan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
15-19	1	0.298	.0771	.983	.076	.068	1	-
20-24	2	1.785	.0855	1.013	.087	.097	2	.089
25-29	3	3.677	.1080	.996	.108	.112	3	.105
30-34	4	5.114	.1447	1.003	.145	.127	5	.140
35-39	5	6.111	.1809	1.012	.183	.151	10	
40-44	6	6.131	.2602	.990	.258	.161	15	
45-49	7	6.043	.3080	.988	.304	.177	20	
50-54	8	5.373	.3844	1.003	.386	.199	25	

P_2 / P_3 = 1.785/3.677 = .485

Comments

The estimates of early childhood mortality show good consistency. The values of q(1), q(2) and q(3) could easily be matched in other populations with measures of known accuracy. However the q(r) estimates at later ages from 5 years onwards display increasingly larger deviation from the fitted model values. Although the latter may not represent very closely the actual mortality pattern, the discrepancies are impossibly big. The obvious explanation is that there had been a substantial fall in child mortality over the twenty years prior to the Census. The influence of this is apparent even in the estimated q(5) measure and therefore also in the graduated values of column (7) for q(2) and q(3). Since the estimates of column (6) at these early ages have an acceptable pattern and the most up to date measures are required a q(2) of .087 and a q(3) of .108 seem the most satisfactory choice. Neither of the estimates for q(1) can be regarded as very reliable, the fitted value being greatly dependent on the mortality pattern of the model. The first estimate of .076 should be retained. It should be noted that in many applications, the first estimates are erratic and the distortion of the graduation through falling mortality is small. The fitted estimates are then preferable. Little can be concluded about the relative merits of the multiplying factor and Sullivan estimates; the choice of either set would give virtually the same level of childhood mortality in Bahrain. The suggestion that it might be possible to determine trends in childhood mortality from the changes in q(r) at ages above 5 years is a tempting one. However studies in other populations have demonstrated that this is difficult because of progressive omission of children in reports by the older women. For Bahrain the existence of this error is indicated by the fall in the P_i value after the age group

40-44 years and also the smallness of the excess for this group over the one five years younger . The D_i proportion of children dead are therefore likely to be biased to an unknown extent at the later ages.

Extension to Later Mortality by Model Life Tables

If the child mortality estimates derived from the retrospective reports are the only acceptable measures of the incidence of deaths available, the extension to higher ages must be carried out by the use of one parameter model life tables. The refinement and generalization of model life tables have been an active field of research over the past ten years; the assessment of the value and the use of these tools is now a complex task which has not been undertaken in full breadth although there are good accounts of limited aspects. In this paper the account will be concentrated on one particular system which is particularly convenient for use with the estimation techniques discussed. We select a typical life table, characterized by the probability of surviving from birth to age x, which will be denoted by $l_s(x)$ (this is the normal survivorship function of the life table with the radix taken as one). Transform $l_s(x)$ to $Y_s(x)$ where the logit function $\frac{1}{2} \log_e [1-1(x)]/1(x)]$ which is the same as $\frac{1}{2} \log_e [q(x)/(1-q(x)]$. Then the equation $Y(x) = a + B Y_s(x)$, where a and B are constants with B positive, will give the survivorship probabilities 1 (x) of another life table. Broadly a change in a alters the overall level of mortality and B the relationship between adult and childhood death rates in ways which conform with observed life tables. Local features of the pattern of mortality, for example a particularly high death incidence in the second and third years of life compared with the first, or relatively severe adolescent rates (futures often found in developing countries) can be incorporated in the standard $l_s(x)$. Thus a flexible model system with a two parameter variation (a and B) of a basic standard pattern $l_s(x)$, which can be adjusted to suit particular applications, is obtained. There has been considerable use of a general standard which is close to the average shape of known life tables (or the West pattern of Coale and Demeny) and an African standard. Carrier and Hobcraft have published a monograph with many convenient tabulations, based on the latter, for particular applications of mortality models.

The two parameters in the system can be reduced to one by puting B equal to its central value of 1.0. If the level of child mortality is estimated [say q(2) which is equal to [1-1 (2)], then the corresponding life table of the one parameter system can be determine by fixing a from the solution a of $Y(2) = \hat{a} + Y_s(2)$. The 1(x) at all ages can then be estimated from $Y(x) = \hat{a} + Y_s(x)$. It is often useful with the multiplying factor estimates to average the logits of q(2),q(3) and q(5) and calculate â from $\overline{Y}(2,3,5) = \hat{a} + \overline{Y}_s(2,3,5)$ where $\overline{Y}(2,3,5)$ denotes the mean value of these logits. Errors due to age biases as well as time and the sample fluctuations are then reduced. If the $l_s(x)$ chosen as the basic life table is the General or African standard, or in fact any reasonably central set of survivorship ratios the estimated life tables will exhibit quite similar mortalities. The use of other one parameter models (e.g. the Coale-Demeny Regional or the Ledermann sets) will also give results which are not greatly divergent for rough purposes. It might seem then that the technique of extrapolation from child-

hood measures to later ages was satisfactory. Although in many applications this is so, the procedure is unreliable in the sense that it can give very poor estimates for some countries where the relation of adult to childhood mortality is typical. To some extent the different Coale-Demeny Regional patterns allow for variations in this relation but they do not cover the range for observed populations and the right choice of the four patterns has to be made. For example, well supported evidence for Turkey in the mid-1960s showed that the level of childhood mortality corresponded with expectations of life at age 5 years of 48 on the West pattern and on the South pattern, but the actual value was around 60 years.

Example The estimated q(r) values at ages 2, 3 and 5 for Bahrain were graduated as described. The mean of the three logits $\overline{Y}(2,3,5)$ is -1.0 394 and the corresponding mean $\overline{Y}_s$ (2,3,5) of the African standard life table is 0.7273. The estimated $\hat{a}$ is then $-0.7273 + 1.0394 = 0.3121$. The graduating equation becomes $Y(x) = 0.3121 + Y_s(x)$, since B is taken as 1. From this the values of Y(x) and hence 1(x) were determined for x equal to 2, 3 and 5. These graduated estimates are shown in column (7) of Table 3. The equation was also used to provide the extrapolated measures at age one year and at the five year interval points from 10 to 25, given in the table.

The $l_s(x)$ and $Y_s(x)$ measures of the African and General Standrads, required for the application of the logit model system, are shown in Table 4.

Table 4 **Survivorshhip ratios $l_s(x)$ at age x and corresponding logits $Y_s(x)$ of the General and African Standard life tables.**

Exact age in years x	$l_s(x)$ General	$l_s(x)$ African	$Y_s(x)$ General	$Y_s(x)$ African	Exact age in years	$l_s(x)$	$Y_s(x)$
1	.8499	.8802	-.8670	-.9970	47.5	.5329	-.0659
2	.8070	.8335	-.7152	-.8052	50	.5106	-.0212
3	.7876	.8101	-.6552	-.7252	52.5	.4858	+.0284
4	.7762	.7964	-.6219	-.6819	55	.4585	.0832
5	.7691	.7863	-.6015	-.6515	57.5	.4291	.1428
7.5	.7582	.7673	-.5714	-.5965	60	.3965	.2100
10	.7502		.5498		625	.3602	.2873
12.5	.7439		-.5331		65	.3210	.3746
15	.7362		-.5131		67.5	.2807	.4705
17.5	.7265		-.4884		70	.2380	.5818
20	.7130		-.4551		72.5	.1944	.7108
22.5	.6974		-.4175		75	.1516	.8611
25	.6826		-.3829		77.5	.1102	1.0444
27.5	.6673		-.3480		80	.0768	1.2433
30	.6525		-.3150		82.5	.0492	1.4780
32.5	.6376		-.2825		85	.0276	1.7810
35	.6223		-.2496		87.5	.0139	2.1311
37.5	.6064		-.2161		90	.0059	2.5642
40	.5898		-.1817		92.5	.0020	3.1063
42.5	.5723		-.1456		95		3.7090
45	.5535		-.1073		97.5		

Note that the General and African standards are the same ofter age 10 years.

Linking Childhood and Adult Estimates

The estimation of childhood mortality from reports of children died by age of mother has proved simple and efficient. Adult mortality is much more difficult to determine in the absence of accurate vital registration. The rest of the paper presents four methods for attempting to do this. The principle of one of these approaches is old but the techniques of application is relatively new. The other procedures have all been developed quite recently. If no satisfactory measures for childhood death rates are available, a level can be chosen which is in accord with the adult mortality according to some one parameter model life table system. Such estimates are unreliable for the same reasons which makes the converse derivation of adult from childhood mortality unsatisfactory and the consequences of the errors are likely to be even more important for the calculations of reproduction and growth rates. Often, however, there will be independent estimates of childhood mortality from retrospective reports of children ever born and died or other sources. Estimates will then be derived of mortality in early childhood and from some later age (B say) varying according to the method. To put these estimates together and smooth out their fluctuations, a model life table must be fitted. At least two parameters are required to take into account the childhood and adult evidence, unless the two sets of rates are to be spliced together arbitrarily which is an untidy and inconvenient procedure. The logit life table system provides a particularly neat solution. The l_s (x) and the derived logits Y_s (x) chosen as a suitable general average or to incorporate any special local characteristics which are believed to hold. The **a** in the linear relation is then fixed from the measures of childhood mortality whose logits will be denoted by $\overline{Y}$ and $\overline{Y}_s$ [these may be the logits of particular values, e.g. 1(2) but will often be means of the logits q(2), q(3) and q(5)] . Then $\overline{Y} = a + \overline{B}Y_s$ and eliminating **a** gives $B = (Y-\overline{Y}) / (Y_s - \overline{Ys})$. The second parameter B is then obtained from the estimates of adult mortality. Since the 1(x) and hence the Y(x) for adults cannot be calculated without a knowledge of 1(B), this is essentially done by a trial and error process. As the first step, a valve of 1(B) which is reasonable in relation to the childhood mortality is chosen by reference to one parameter model life tables. 1 (B + N) and hence Y (B + N) can then be determined from the ratios 1 (B + N) / 1 (B) which have already been estimated for series of N. For each of these a B can be calculated from the equation above. A first estimate of B is then taken as an average over an appropriate range of the N + B. The averaging can be of the individual B's or alternatively of the logits of the 1 (B + N) before a B is derived. The results from these two alternatives differ vey slightly. The exact procedure will depend on the particular circumstances since as will be seen in the specific applications, some estimates of 1 (B + N) are more subject to biases of reporting and changing mortality than others. From this first estimate B_1 a new consistent trial level of 1 (B) is found from $[Y(B)-\overline{Y}]/[Y_s (B)] - Y_s = B_1$. The procedure is then repeated with the 1(B + 25) calculated from the new 1(B)to give B_2. Although in theory, we should go to further stages in the same way obtaining B_3, B_4, etc. until constancy is reached, in partice B_2 is often sufficiaently accurate. More sophisticated fitting procedures, for example by weighted least squares with various criteria for fixing the weights have been explored. The resulting estimates generally differ little from those obtained by the simpler techniques and it is not clear that they are superior.

Mortality from Successive Censuses

Attepts to measure mortality from survivorship between successive censuses date back to the nineteenth century. In the earlier applications the age distributions of the censuses were first smoothed by actuarial procedures. Further graduation was often needed also when age mis-statements and coverage errors were appreciable. As a consequence the resulting estimates depended to an appreciable extent on the graduation methods chosen. The development of model life tables has greatly improved the techniques for fitting mortality patterns to the data and several approaches have been devised. The one described here has several advantages. There is only one graduation which makes it much easier to see what corrections are being made to the observations; it can be applied simply for any census interval n and most of the other methods are difficult except for intervals of five or ten years; the flexibility of the two parameter logit mortality model system is exploited. The procedure is particularly powerful when there are independent and acceptable estimates of childhood mortality but it can be applied without these.

From the age distributions at two censuses n years apart (corrected approximately for inter-censal migration where this is necessary and possible) measures of survivorship which may be denoted by ${}_nP_{0-4}$, ${}_nP_{5-9}$ ect. can be calculated . These (for males, females or the two sexes together) are found by dividing the numbers 0-4 years, 5-9 years and so on at the earlier census into the corresponding totals at the second census for the age group n years older. When n is a multiple of five years this is easily done; when n is integer and numbers are available by single years of age at the second census the data can be put together for the appropriate five year groups; in other circumstances, standard interpolation techniques can be applied. From the series of P survivorship ratios a stationary age distribution corresponding to the mortalities can then be constructed as follows. From the evidence on childhood mortality the ${}_5L_0$, ${}_5L_5$ etc. measures giving the numbers in the life table stationary population aged 0-4 years, 5-9 years are calculated up to age n. If n is five years, only ${}_5L_0$ is required. When n is not a multiple of five, the residual index to cover the interval up to n is needed. For exemple for n equal to 9 years it would be ${}_4L_5$, for n equal to twelve years ${}_2L_{10}$. Multiplication of ${}_5L_0$ by ${}_nP_{0-4}$ will then give the estimate of the survivors in the stationary population at ${}_5L_n$, the five year age group n years older and so on. By these means, starting from the initial L values at up to n years, the complete age distribution of the stationary population is built up. For example, if n is ten, ${}_5L_{10}$ is estimated from ${}_5L_0 \times {}_{10}P_{0-4}$ and ${}_5L_{15}$ from ${}_5L_5 \times {}_{10}P_{5-9}$; the derived ${}_5L_{10}$ and ${}_5L_{15}$ in turn can be multiplied by the appropriate P's to give ${}_5L_{20}$ and ${}_5L_{25}$ and so on. When n is not a multiple of five years, successive estimates have to be combined by simple linear weighting to provide the results for the standard five year intervals. For example is n is 12, ${}_5L_{15}$ is calculated as :

$$\frac{1}{5}\left[{}^{2}\cdot {}_5L_{12} + {}^{3}\ {}_5L_{17}\right]$$

Ten year census interval are common. In this case the series of age group numbers of the stationary population starting with ${}_5L_0$ and derived by successive multiplication of P's is ${}_5L_0, {}_5L_{20}, {}_5L_{30}$ etc. This is not directly linked except through the childhood values with the series based on ${}_5L_5$, i. e. ${}_5L_{15}, {}_5L_{25}$ and so on. As a consequence, a particularly erratic P measure can so effect one or other of the two series that they form two diveragent sets of values which are difficult to smooth. A simple device overcomes this difficulty and is often most effective. This is to estimate a series of five year survivorship measures from the ten year ones by the equation ${}_5P_a = ({}_{10}P_{a-1} . {}_{10}P_a)^{1/4}$ i. e. taking the fourth root of the right hand side product. a is here written for any five year age group and a-1 for the one before it. The product can also be written as ${}_5P_{a-1} . ({}_5P_a)^2 . {}_5P_{a+1}$.

In practice ${}_5P_{a-1} . {}_5P_{a+1}$ is very close to $({}_5P_a)^2$ in comparison with the other biases present and the result folows.

By these means a stationary life table age distribution is obtained but since there has been no deliberate graduation or correction, it is distorted by errors in age statement. If these errors were the same proportionately at the two censuses and the interval is a multiple of five years, it can be shown that the stationary age distribution includes these same biases. When the interval is not a multiple of five years the method automatically introduces some smoothing which is often fairly effective. In general, however, a fairly rigid graduation of the measures is still required which implies the use of model life tables. It would, of course, be possible to refer to the Carrier-Hobcraft computations of stable age distribution measures for the two parameter logit mortality schedule, fixing the specific life table from the known childhood mortality and zero rate of natural increase. If the age reporting is poor or the survival proportions distorted by migration nothing further is justified. In favourable circumstances it is possible to extract more detailed evidence about the pattern of mortality. The measures $\frac{1}{5}.{}_5L_N$ are equal to $1(\overline{N})$ where $\overline{N}$ is between N and N + 5 (for most age groups close to the mid-points) . If we denote the logits of the $\left[\frac{1}{5}\,{}_5LN\right]$ by $Y(\overline{N})$, the linear relation can be taken as $Y(\overline{N}) = a + B\ Y_s(N)$ to a very close approximation. By graphing the derived $Y(\overline{N})$ against a selection of possible standards $Y_s(\overline{N})$ (General, African, Coale-Demeny Regional schedules, life tables with particular features) the one which gives the most linear relation can be found. The values of a and B can then be determined by the methods of fitting outlined previously, essentially by solving two equations of the form $\overline{Y} = a + B\overline{Y}_s$. In one equation the $\overline{Y}$. $\overline{Y}_s$ are mean values over the logits in childhood and in the other means over the later ages.

The major limitation of the intercensal survivorship method is its sensitivity to errors of coverage and of age. Mortality is estimated from the change in numbers of those alive at the first census by the time of the next. This change is small relative to the absolute numbers. As a consequence quite minor percentage deviations from the true numbers at either census can cause a large bias in the estimates, particulary at younger ages. The most serious deviations are due to fluctuations in the completeness of census taking and

migration; it is difficult to allow for either of these with much confidence. Age errors are less important since they do not cause a systematic bias but these prevent the detection of the pattern of mortality precisely. If they are substantial it is impossible to determine the best choice among model life tables of about the same overall mortality level.

Example: The technique is applied to the age distributions from the Syrian censuses of 1960 and 1970. Only the results for females are shown. The procedure is presented in Table 5. Column (2) shows the ${}_{10}P_a$ survivorsip are shown. The procedure is presented in Table erratic nature is obvious. The fourth roots of the products of successive pairs of ${}_{10}P_a$ give the estimates of ${}_5P_a$ in columm(3). For Syria there are measures of childhood mortality found from the proportions of children dead by age of mother at the 1970 census. The q(2) value is 0.132. Although this represents the level for the few years before the census, it can be assumed that the average for 1960-1970 was somewhat higher. An approximate q(2) of around 0.160 is assumed. Since this is for females it may be a little high, depending on the rate of fall in mortality and the sex differential in child death rates. However, the estimates for adult ages by the present techique are negligibly influenced by moderate variations in the choice of q(2). A model life table with childhood mortality of about this level was chosen to give the ${}_5L_0$ and ${}_5L_5$ measures shown at the top of colums (4). These model measures were, in fact, calculated from the African standard but the use of a North region life table with l_0 equal to 46.5 gives almost the same values. Application of the ${}_5P_a$ successively to the corresponding age group in columm (4) starting with ${}_5L_5$ allows the stationary age distribution to be completed.

The simplest procedure is now to calculate e_{10} from the ungraduated stationary age distribution. This is done by summing the ${}_5L_N$ from 10 years upwards to give T_{10} (in the usual life table notation) and dividing by the measure of $l_{(10)}$ assumed for the derivation of of ${}_5L_5$. The result is (39,829)/7502 = 53.1 years. An appropriate model table can then be chosen. Since there is some evidence that the South region set of Coale and Demeny may fit North African and Middle East patterns we might take level 12 of that group with e_{10} equal to 53.5 years. It is interesting to note that the corresponding $l_{(10)}$ is 7610, indicating a childhood mortality close to that adopted (although the estimated e_{10} is virtual independent of the choice of ${}_5L_5$). A West table with the same e_{10}, however, would give a very different $l_{(10)}$ of 8300.

The method of fitting a two parameter logit model, however, makes no assumption about the relation with childhood mortality and is illustrated in the table. Column (5) shows the $\overline{(N)}$ measures found by dividing the entries in column (4) by 5 and column (6) gives the corresponding $Y(\overline{N})$ logit values. These are plotted against the $Y_s\ \overline{(N)}$ measures of the African standard in Graph 1. Although the points deviate from a straight line, particularly at the upper ages, the discrepancies are moderate considering the erratic fluctuations of the

original ${}_{10}P_a$. A simple method of fitting a line has been used. The lower average point is fixed by $Y(\overline{5})$ and $Y_s(\overline{5})$ which were taken from childhood mortality. The upper average point is taken as a weighted mean of the measures from $Y(\overline{10})$ and $Y_s(\overline{10})$ upwards. Since the early points are close together compared with those at late ages, the last three have been given three times this weight. The calculation of B then proceeds as follows:

$$\overline{Y}\ (\text{lower}) = -.5991; \quad \overline{Y_s}\ (\text{lower}) = -.5965$$

$$\overline{Y}\ (\text{upper}) = (-2.1611 + 3X1.7472)/21 = .1467$$

$$\overline{Y_s}\ (\text{upper}) = (-1.5681 + 3X3.2574)/21 = .3907$$

$$\text{and } \hat{B} = \frac{.1467 + .5991}{.3907 + .5965} = .755$$

Trials with other weighting schemes gave B' s of around .75 and this has been taken as the final estimate. Then

$$\hat{a} = Y(\overline{5}) - \hat{B}\ Y_s(\overline{5}) = -.5991 + .75 \text{ x } -.5965 = -.1517 .$$

In these calculations the Y_s were taken from the African standard with $Y_s(\overline{N})$ as $Y_s(N + 2\frac{1}{2})$ The fitted line is shown on Graph 1. From the estimated value of $\hat{a}$ and $\hat{B}$ the full life table can then be constructed and the usual measures calculated. Although this can be done by traditional methods the Carrier-Hobcraft tables are helpful for reducing the labour.

Table 5 . Inter-censal Survivorship : Syria 1960 -1970 Females

Age group, a	${}_{10}P_a$	${}_{.5}P_a$	${}_{1000}{}_5L_N$	$l(\overline{N})$	$Y(\overline{N})$
(1)	(2)	(3)	(4)	(5)	(6)
0-4	.9360		4191	.8382	-.8224
5-9	.8988	.9577	3841	.7682	-.5991
10-14	.9055	.9498	3679	.7358	-.5121
15-19	.9693	.9679	3494	.6988	-.4208
20-24	.9738	.9857	3382	.6764	-.3686
25-29	.9352	.9869	3333	.6666	-.3464
30-34	.9331	.9665	3256	.6512	-.3121
35-39	.8214	.9357	3147	.6294	-.2648
40-44	.9461	.9389	2945	.5890	-.1799
45-49	.7988	.9324	2765	.5530	-.1064
50-54	.8622	.9110	2578	.5156	-.0312
55-59	.9298	.9462	2348	.4696	+.0609
60-64	.6860	.8937	2222	.4444	.1117
65-69	.6248	.8091	1986	.3972	.2086
70-74	.5044	.7493	1607	.3214	.3737
75-79	.3745*		1204	.2408	.5743
80-84			841	.1682	.7992
85 +			1042		

* Survivorship from 75 and over to 85 and over.

Comments

The e_{10} of the fitted life table at 54.3 is slightly higher than the observed value but this is because of the impossibly large ${}_5L_N$ measures at high ages in column (4) and compensating lower value at earlier ages where the absoulte effects are greater. This is clearly due to the over-reporting of ages in the later years of life. The higher e_{10} may then be a correction in the right direction. The "bending" of the ploted points at late ages is another outcome of this form of age error. Although the B estimate of .75 is low it is by no means an exterme result. Nevertheless it gives some support for the view that the estimate of child mortality odapted was too high. A lower incidence would have moved B nearer to its central value of one. If we compare the life table derived from the logit system with that selected from the South models there is quite good agreement but the former follows the observations more closely at later ages. For example the e_{50} calculated from column (8) is 23.7 years compared with 23.1 for the logit model and 22.1 for the appropriate South life table.

Death Distribution Method

Possibly the most commonly available data on mortality in countries with inadequate vital registration is of deaths in a period but with an unknown completeness of coverage. The statistics may come from defective vital registration or from single round or multi-round household surveys in which questions are asked about deaths in a previous time interval. If the numbers of deaths are recorded by age at death it becomes possible to check their accuracy on certain assumptions since the pattern of mortality is related to level and also to the characterstics of the age distribution. The method for checking and adjusting the reported deaths, which is described below has only recently been developed, although somewhat similar procedures have been suggested previously, e. g. by Bourgeois-Pichat. The technique has been extensively applied in a variety of situations with, in most cases, good results. There remains, however, the possibility of serious biases in some conditions; an active programme of research to define what these are and how modifications could be made to overcome them is under way.

In regular conditions the change in numbers with age over a short range depends on the mortality in the appropriate interval and the growth of births when the cohorts were born. There should therefore be a relation between the distributions by age of the living and the deaths in a period. It is this relation which establishes the principles of the method. The basic equation for exposition is $N_y = rPy + dDy$ where Ny is the population proportion per year of age around the point y, Py is the proportion over age y, Dy is the proportion of deaths in the period beyond the same age, r is the natural increase per year and d the crude death rate. The expression is exact for a stable population but there are also good reasons for believing it is robust, that is not much biased by deviations from stability, particularly if caused by changing deaths rates. Such deviations may produce a best value of r for inserting in the equation which is not close to the true growth of the population but still give

a good estimate for the death rate d which is the parameter of interest. Clearly the proportions Dy will remain the same whatever the percentage of under-registration as long as this is constant at all ages. The equation is also valid for any fixed age (as well as zero) upwards and it is, therefore, not necessary to assume that reporting of the deaths of young children is as good as that at older ages. In fact, since the estimation of the d depends on the pattern of mortality at later ages, the procedure effectively refers only to the completeness of registration of adult deaths.

In practice the value of d can be estimated from the equation, written in the form $N_y / P_y = r + dD_y / P_y$. N_y / P_y is plotted on a graph against D_y / P_y and a straight line is drawn through the points. The slope of the line is the required rate d. P_y and D_y the proportions at risk and dying after age y, respectively, are calculated without difficulty. N_y , the population proportion per year around y is found, sufficiently accurately, as the average of the age groups on either side of y. Since these are usually five years in length the normal expression for N_y is $\frac{1}{10}\left[N_{y-} + N_{y+}\right]$ where N_{y-} and N_{y+} stand for the proportion in the age groups below and above y. The equation can also be written in another way which is illuminating, and in most cases more logical, as $n_y / p_y = r + f\, d_y / p_y$. Here, P_y and d_y are written for the **numbers** at risk and dying after age y (rather than proportions) and n_y is the population number per year at y. The coefficient f is the estimated ratio of the true to the reported deaths and thus gives a correction factor directly. The advantages of this formulation is that it does not implicitly assume that the correction factor f is the same at younger ages as at later and that it is easy to compare the points with a line of slope one (accurate reporting). A useful property of the technique is the use of division at all ages y in the estimation. If the points lie closely on a straight line, the assumptions are given support and there can be confidence in the results; if the points show clear signs of curvature, the derivation of a reliable correction is difficult although it is usually possible to deduce whether under-reporting is large. Rather commonly, however, the deviations from linearity are erratic and unsystematic. It is then not easy to fit the best line. Since the deaths at older ages are such a large proportion of the total, the values D_y/P_y or d_y / p_y are closely clustered together until late middle years are reached. The points at high ages thus have a heavy weight in the fixing of the slope. Age mis-statements in this region can, therefore, be particularly troublesome. For example, if there are no adjustments for digit preference the n_y / p_y values can fluctuate sharply at successive points. Experience of applying the method to a considerable range of populations suggests that there is a tendency for the ages of the old in some cases to be overstated to a greater extent than for the living. The results is a "dipping" of the points on the graph which should be ignored in the fitting of a straight line. Often there is also a distortion at younger post-childhood ages where mortality is low. This apperas to be due to a combination of fertility changes and age errors. It is probably best to ignore these points in fitting the line.

Example The application of the technique to vital registration and census statistics for Iraq is demonstrated in Table 6. The mean age-specific death rates over the period 1960-70 were calculated and applied to the population totals for the corresponding age groups from the 1965 census. The resulting numbers of deaths per year of the period are taken for the derivation of the d_y. At ages over 20, the specific death rates were only available for ten year groups. From the population and death distributions then n_y, p_y and d_y were calculated as described. The only slight modification was the need to estimate n_y from $(n_{y-} + n_{y+})/20$ at ages twenty years and over where n_{y-} and n_{y+} denote the numbers in the ten year age groups below and above y respectively. The plot of the values of n_y / p_y against the d_y / p_y is shown in Graph 2. The points for both male and female relationships are shown on the graph although only the derivation of the latter are shown in the table. The inclusion of points for both males and females on the graph can be an advantage since it is reasonable to assume that any lines which are fitted should have the same mesure of r, that is should meet on the vertical at the origin, although the slopes may be different. Completness of coverage for male and female deaths need not be the same.

The points at higher ages are quite close to linearity both for males and for females (although on different lines). Despite the small number of relevant measurement the evidence of consistent coverage at later ages is satisfactory. At the younger ages, however, the points are erratic and display a peculiar curvature upwards at the lower end of the graphs. Inspection of the basic data shows that this is caused by the extremely sharp drop in numbers over the first few five year age groups. The cause is difficult to specify with confidence. Possibilities are sharp falls in child mortality, increases in fertility or age errors. None of these, however, are relevant to the correction of adult mortality. It is clear that the points can not be described by a line with a slope anywhere near one but it is not easy to decide how to achieve best adjustment. The lines shown on the graph were fitted by eye to meet on the vertical axis, ignoring the upturn of the lower points. The estimates of f from the slopes of the fitted lines are 1.50 for males and 1.88 for females. These factors are used to multiply the age specific death rates over the range for which the correction is taken to be applicable. Here this is possibly from 15 or 20 years onwards but mortality 5 to 15 is so low that little overall error will generally be caused if the same adjustment is adopted from five. Life tables can then be calculated from one of these ages onwards by traditional means. If there is a reliable estimate of childhood mortality the full life table can be constructed.

Comments

The reported crude death rates for males and females respectively were 4.48 and 3.35 per thousand. Multiplication by the factors above gives 6.72 and 6 .30 per thousand. These measures are unbelieveably low. Inspection of the age specific death rates, however, shows

that the values at under five years are the most unsatisfactory. An assumption that a correction for deaths at later ages could be applied in childhood is obviously invalid. The adjusted death rates at over ten years of age are 8.57 and 7.80 thousand for males and females respectively. Reference to the South set of Coale-Demeny model life tables shows that for a population with the Iraq age distribution these estimates correspond approximately to the level 14 mortality. At this level the expectation of life at age zero is 49.6 and 52.5 for males and females respectively and the crude death rate for the Iraq age distribution is about 15.5 per thousand. These estimates, although the mortality incidence is perhaps somewhat lower than expected, are by no means unreasonable.

An alternative method of estimation is to consider the proportional division of deaths beyond childhood (say deaths at over 30 or 50 years as a proportion of those after five years) and find a model life table which would give the same division. The principle behind this (considered by Bourqeois-Pichat some years ago) is that the lower the level of mortality the higher the proportion of deaths at later ages if the age distribution of those at risk is allowed for. However, the procedure is not reliable because it is very sensitive to age errors and the mortality pattern chosen as well as the assumption that under-reporting is the same over the age range. Attempts to apply it to the data for Iraq gave no reasonable results, apparently because the under-reporting at younger ages (up to 30 years) was more extreme than for the older groups.

Orphanhood

The difficulties of estimating adult mortality satisfactorily from period data on deaths have lead to the development of several indirect procedures based on measures related to the death rates. The best established uses orphanhood. The required questions put to each person in a census or survey are " Is your mother alive ?" and " Is your father alive " giving results of the type in Table 7.

Table 7. Death Distribution Method : Iraq 1960-70; Females

Age group	Number (thousands)	Deaths (thousands)	Age point	n_y	(thousands) P_y	d_y	n_y / P_y	d_y / P_y
0-4	766.7	2.13	5	137.0	3226.7	11.25	.0425	.0035
5-9	603.0	.36	10	109.4	2623.7	10.89	.0417	.0042
10-14	491.2	.34	15	83.5	2132.5	10.55	.0392	.0049
15-19	343.4	.31	20	68.3	1789.1	10.24	.0382	.0057
20-29	531.1	.74	30	49.5	1258.0	9.50	.0393	.0076
30-39	459.2	.87	40	38.7	798.8	8.63	.0484	.0108
40-49	315.5	.95	50	27.2	483.3	7.68	.0563	.0159
50-59	227.6	1.02	60	19.2	255.7	6.66	.0751	.0263
60-69	155.8	1.90	70	11.6	99.9	4.76	.1161	.0476
70-79	75.9	4.76						
80 & over	24.0					f (estimated)	= 1.88	
Total	3,993.4	13.38						

Table 7 Morocco National Sample Survey, 1972-73

Age group of children	Proportion of parents surviving to daughters*	
	Mothers	Fathers
10-14	.9622	.9093
15-19	.9292	.8374
20-24	.8721	.7467
25-29	.7775	.6215
30-34	.6313	.4592
35-39	.5183	.3172
40-44	.3622	.1992
45-49	.3220	.1069

* Proportions for sons are very similar but the measures for daughters seem to be less distorted by age errors.

The mortality rates of adults by age obviously determine these orphanhood proportions and Lotka, for example, made a number of calculations relating the former to the latter. The inverse problem of estimating adult death rates from orphanhood was considered by Henry and a method based on the United Nations model life tables proposed but this uses length of marriage rather than age as the variable. Several techniques, similar in nature to those for obtaining childhood mortality have been developed since.

We will consider female mortality first. The proportion of mothers surviving for a given of child (N say) depends on this known exposure length N and the initial age when the mothers were known to have been alive, that is at the birth of their children. There will then be an age (B say) such that the proportion is equal to $1(B+N)/1(B)$, that is the probability that a woman will survive from B to B + N. The measures B will be a particular form of average of the ages of mothers at birth, strongly related to the mean of the specific fertility distribution. By the use of the same model fertility distribution and fixed schedule of mortality as for the child survivorship technique the value of B corresponding to different locations of the child-bearing period can be calculated. It is inconvenient, however, to work with 1 (B) for non-integer B or indeed, in adulthood, for ages other than those which are a multiple of five. This can be avoided by, in effect, adjusting the interval N by the use of a weighted average of the proportions of mothers alive to children in adjacent age groups. When this is done it turns out that B can be fixed at 25 years for the range fertility locations that commonly occur. The relevant estimating equation is then $1(25+N)/1(25) = W_N \cdot {}_5S_{N-5} + (1-W_N) \cdot {}_5S_N$ where ${}_5S_N$ is the proportion of mothers surviving for the age group of length 5 years, beginning at N and W_N is a multiplying weight which depends on N and the location of the childbearing period. The weights are shown in table 8.

Table 8 Weighting factors W_N for converting proportions of mothers alive into survivorship proportions from age 25 years

N (central age)	M (mean age at births of children) 22	23	24	25	26	27	28	29	30
10	.420	.470	.517	.557	.596	.634	.674	.717	.758
15	.418	.489	.556	.618	.678	.738	.800	.863	.924
20	.404	.500	.590	.673	.756	.838	.921	1.004	1.085
25	.366	.485	.598	.704	.809	.913	1.016	1.118	1.218
30	.303	.445	.580	.708	.834	.957	1.080	1.203	1.323
35	.241	.401	.554	.701	.844	.986	1.128	1.270	1.412
40	.125	.299	.467	.630	.791	.950	1.111	1.274	1.442
45	.007	.186	.361	.535	.708	.884	1.063	1.250	1.447
50	.190	.017	.158	.334	.514	.699	.890	1.095	1.318
55	.368	.220	.059	.101	.270	.456	.645	.856	1.083
60	.466	.352	.217	.084	.053	.220	.378	.579	.800

The measure to allow for the ages of the women at the birth of their children is now denoted by M and differs from the previously used m, which is the mean of the specific fertility distribution or the mean age at births of a cohort of women experiencing these rates over the reproductive period. M is the mean age of the women at birth in any one year, allowing for the fact that in general the numbers of women fall with age over the reproductive period. The calculation of M is normally made from the survey reports of the data into specific rates. If such observations are not made there are a number of more indirect methods for estimating M depending on the information available. In developing countries M is usually in the region of 25 to 27 years and if other evidence is lacking can be fixed at 26. Strictly the relevant values of M are for the years in which the children were born and these could differ appreciably from the current measure. In populations where there has been little change in fertility, this is likely to be a negligible source of error but difficulties would arise if there had been a notable fall in birth rates. In some parts of table 8 the weighting factors are negative or greater than one. This occurs when, for the model calculations, $1(25+N)/1(25)$ does not lie between the surviving proportions in the age groups adjoining N. The estimate is then obtained, in effect, by extrapolation beyond the two age groups rather than interpolation between them. The results in these cases are likely to be rather less reliable and greater accuracy could be achieved by other devices, for example replacing N by N plus or minus five years appropriately or altering B from 25. However, the improvement would be at the expense of further complications in fitting together estimates for irregular age ranges. The studies made so far suggest that the modifications would not be justified.

In principle the estimation of male adult mortality from survivorship of fathers proceeds in exactly the same way as for mothers but there are additional difficulties. Specific fertility distributions of males are less well known than for females and have a much higher spread of ages, particularly in polygamous societies. Surviving proportions of fathers by age of children are likely to be sensitive to the numbers of older men included because of the rapid increase in mortality at late ages; the representation of older men may vary considerably among populations in which the mean ages of the fathers do not differ greatly. Despite these problems, the attempt to arrive at mortality estimates from survorship of fathers is justified by the lack of other sources of information. Blacker and Hill have devised a simple polynominal model with the right characteristics for describing male fertility. Hill has constructed a table of weighting factors, using this model and a fixed mortality schedule, in the same way as for females, apart from one slight modification. This is required to allow for the fact that the father of a child is known to be alive at its conception but not necessarily at its birth. The N should therefore become $(N+\frac{3}{4})$ years which is an awkward age to work with. There is nothing in principle against finding the weighting factors which correspond to $(N-\frac{3}{4})$ years from birth and N from conception, where N is the central age of two adjacent groups; in practice, however, it turns out that less extrapolation is required of the weight for survivorship over the interval to the end of the upper age are used. Table 9 shows the W_N values to be inserted in the estimating equation

$$1(B+N+2\tfrac{1}{2})/1(B) = W_N \, {}_5S_{N-5} + (1 W_N) \, {}_5S_N$$

where the ${}_5S_N$ is the proportion of fathers surviving to children aged N to N+5 years. Two levels for B are given, 32.5 and 37.5, to allow for the wide possible range of M (here the mean age of the fathers at the birth of the children). The determination of M raises a number of difficulties. It is usually best found by adding to the M for women the mean difference between ages of husband and wife at marriage; for monogameous populations the latter measures can be obtained roughly from the proportions of mean and women still single by age group. For polygamous populations, several alternative approaches have tried but it is not yet established which is the most satisfactory. For reasons for which will be clear from the previous disscussion, it is not possible to specify a fixed M for fathers which would be expected to give reasonable results in the absence of any information about the true value.

So far we have only considered the methodology of estimation. The substantive question is the extent to which the reports of orphanhood represent the mortality of the population. For this to occur certain conditions must hold. The first is that adult mortality must not be correlated with the numbers of surviving children to a parent. Obviously the death rates of women and men without children have no weight in the orphanhood data. Equally, the experience of parents with many surviving children will be overrepresented because it will be reported as often as there are offspring. Biases of different kinds and both upwards and downwards are likely to be present because of this differential weighting of adult mortality and the evidence to assess the net effect does not exist. Another problem is that of changing rates; the parents of the older children have undergone the mortality of many years proviously. However, because of the sharp increase in rates at later ages, the bulk of the deaths of parents will

Table 9. Weighting factors W N for converting proportions of fathers alive into survivorship proportions, (a) from 32.5 years and (b) from 37.5 years.

9 a

N	M (mean age at births of children)									
(central age)	27	28	29	30	31	32	33	34	35	36
10	.115	.192	.258	.322	.388	.455	.521	.587	.650	.714
15	.044	.151	.243	.336	.429	.522	.613	.702	.790	.877
20	-.090	.043	.166	.287	.406	.523	.638	.750	.861	.969
25	-.251	-.093	.051	.194	.335	.474	.611	.744	.877	1.007
30	-.503	-.327	-.161	.001	.162	.319	.475	.627	.779	.931
35	-.800	-.640	-.408	-.211	-.047	.109	.269	.438	.610	.782
40	-1.051	-.856	-.714	-.554	-.379	-.203	-.034	1.33	.303	.480
45	-1.285	-.1.120	-.963	-.806	-.651	-.495	-.340	-.183	-.024	.141
50	-1.296	-i.162	-1.031	-.903	-.776	-.651	-.524	-.396	-.264	-.128
55	-1.142	-1.040	-.943	-.850	-.758	-.667	-.576	-.486	-.397	-.104

9b

	36	37	38	39	40	41	42	43	44	45
10	.384	.460	.537	.613	.687	.758	.827	.897	.969	1.040
15	.378	.484	.588	.690	.790	.888	.984	1.079	1.174	1.268
20	.324	.455	.582	.708	.833	.954	1.075	1.195	1.318	1.441
25	.164	.315	.465	.613	759	.904	1.051	1.197	1.346	1.497
30	-.043	.122	.286	.450	.614	.778	.944	1.116	1.295	1.480
35	-.359	-.183	-.015	.152	.321	.496	.677	.863	1.062	1.278
40	-.624	-.473	-.316	-.157	.003	.168	.342	.529	.722	.923
45	-.757	-.631	-.503	-.372	-.237	-.099	.047	.208	.393	.601
50	-.742	-.650	-.559	-.471	-.377	-.280	-.182	-.069	.063	.225
55	-.599	-.541	-.485	-.425	-.366	-.308	-.238	-.149	-.049	.091

have taken place in the more recent period preceding the enquiry. As a consequence the calculations of the effects of changing mortality reveal that the resulting bias in the estimates are not as large as might be feared.

The ultimate justification of the method is that very plausible estimates of adult mortality, both for females and males, have been obtained by its application. Most of the populations are in Africa but the relevant data have also been collected in Latin America and the Pacific Islands; the analyses are mainly recent and many are still unpuplished. Blacker has been particularly active in pursing these studies. So far the only criterion that can be adopted for assessing the results is the internal consistency by sex and age of the death rates and of their relation to the childhood mortality. One bias has appeared regularly in the applications, namely the over-reporting of mother survivorship for young children. The problem explanation if the adoption of young children of dead mothers by other women who are then regarded as the true mothers.

Example The technique has been applied to the proportion of mothers surviving in Morocco, 1972-73, which are shown in Table 7. Details of the calculation are given in Table 10. The only auxiliary measure needed is M, the mean age of the mothers at the births of their children. This was calculated from the reports of births by age of mother for the period covered by the survey, as 29.0. Reference to Table 8 gives the appropriate weighing factors W_N in the column for 29. These are shown at the corresponding age points N in column (4) of Table 10. The weighted averages which give $1(25+N)/1(25)$ according to the specified equation are derived in column (5). This essentially completes the estimation of female adult mortality by the method. However, these estimates are for groups of women of different generations; in addition measures of childhood mortality from reports of children born and died by age of woman from the 1972-73 survey have been derived. The final step in the linking of the childhood and adult mortality estimates in the most sensible way.

This is done by the use of the logit model system, as described in section 4. The African standard was used as the reference mortality pattern. The 1(2) measure for females was estimated as 0.833 which coincidentally is the same as that for the African standard. The equations used in the calculations are

$$Y(25) = Y(2) + B\,(Y_s(25) - Y_s(2)) \qquad \text{and}$$

$$\overline{Y}(50,55,60) = Y(2) + B\left[\overline{Y}_s(50,55,60) - Y_s(2)\right]$$

where $\overline{Y}(50,55,60)$ stands for the mean of the logit values at ages 50 55 and 60. Insertion of the reference standard values from Table 4 and the specified Y(2) measure gives

$$Y(25) = -.8052 + .4223\ B$$

$$\overline{Y}(50,55,60) = -.8052 + -.8959\ B$$

For a first approximation B is taken as one giving Y(25) = -.3829 and 1(25) = .6826. 1(50), 1(55) and 1(60) are found by multiplying .6826 by the second, third and fourth entries in column (5) of Table 10 giving .6029,.5510 and .4517 respectively. The mean of the corresponding logits $\overline{Y}(50,55,60)$ is -.0714. Insertion in the second equation above leads to a B of 0.82. The cycle is now repeated with this estimate of B. The next value of B is .076. From the pattern of change it can be guessed that the value which will be consistent for both equation is about 0.73 and this is easily verified. The fitted measures of (N + 25) and ratios 1 (N + 25) are shown in columns (6) and (7) of Table 10.

Comments

The example illustrates well the main problems of the orphanhood technique. The estimated 1(25 + N)/1(25) of column (4) are considerably higher than the fitted measures at N equal to 15 and 20 but lower at N of 35 years and above. This is a typical pattern for a population of rapidly falling mortality. Clearly it would be desirable for the B vaue to be estimated from the survivorship of mothers to children for the younger ages since these measures would represent the recent experience. Unfortunately this is prevented by the " adoption " effect. Survivorship of mothers to children of 15-19 years is clearly too low and at younger ages the bias is greater. The choice of the best N value for use in the determination of the B is then a balancing between two types errors operating in opposite directions. In general the best compromise seems to be the choice of the N in the range 25 to 35 as here. Since the estimated B of 0.73 is low, it seems unlikely that the higher mortality of the past has biased the derivation very much. Conversely at these ages the residual effect of the adoption error should be small. It may be noted that in most application of the orphanhood technique the deviations between fitted and observed measures have been considerably smaller than in this example.

Table 10. Survivorship of Mothers of Daughters : Morocco, 1972-73

Age group of daughters	N	Proportion of Mothers alive	W_N	1(25 + N)/1(25)	1(25 + N)	Fitted 1(25 + N)/1(25)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
10-14	15	.9622	.0863	.9577	.6674	.9152
15-19	20	.9292	1.004	.9294	.6429	.8817
20-24	25	.8721	1.118	.8833	.6136	.8415
25-29	30	.7775	1.203	.8072	.5769	.7911
30-34	35	.6313	1.270	.6618	.5311	.7283
35-39	40	.5183	1.274	.5611	.4711	.6461
40-44	45	.3622	1.250	.3722	.3970	.5444
45-49		.3220				

Widowhood

The orphanhood method has now been applied extensively to provide plausible estimates of adult mortality. However, as has been discussed above, it raises a number of substantial difficulties namely, the multiple counting of parents according tc surviving children, the " adoption " effect for mothers, the wide spread ages at births of children for fathers, the biases due to rapid changes in mortality. There is another indirect set of measures related to death rates which in suitable situations are less subject to these problems. Marriages are dissolved by the death of a partner to provide a distinctive class, the widowed. In populations where marriage is clearly defined, and entered into by almost all persons over a limited range, of ages, the proportions ever widowed by age provide such a set of measures. Marriage takes place earlier and over a much less dispersed age distribution than child-bearing, and the widowed are aware of their state. In monogamous societies there is a one to one correspondence of partners but even where there is polygamy multiple counting is much less than for parents. Widowhood seems a particularly valuable measure for the estimation of the mortality of adult males.

Of course, widows often re-marry and a special question is required in a census or survey to obtain the right measures. This question is of the form, " Is your first husband (wife) alive?". It has now been included in several National enquiries notably in Honduras, Bolivia and Bangladesh. From the responses the proportions never widowed among those exposed to risk are calculated by age group. Recently K.H. Hill has devised a simple technique for the estimation of adult mortality from such measures. No full account of the methods has yet been published but brief outlines have been given in reports of their application to Honduras and Bangladesh.

On first examination it would appear that the problems of estimation might be complex. In the comparable orphanhood procedure the length of exposure of the parents to the risk of death is known from the age of the child and only the effective average age at the beginning of exposure has to be determined. In the widowhood case neither the commencing age or the length of exposure are known. Implicitly they must be arrived at from the ages of men and women at marriage in relation to the age of the respondent at the time of the survey. In theory, the results will depend on the bivariate distribution of ages at marriage of men and women; not much is known about such distributions for countries with poor vital registration. In practice, however, it turned out that, provided women were married over a fairly narrow range of ages (almost universally true for the relevant populations) the bivariate pattern was unimportant. Using the same mortality model as for orphanhood and simple functions for the distribution of ages at marriage Hill was able to devise a convenient estimating procedure.

The form it takes is the same as for orphanhood. Weights W_N are calculated from the models for insertion into an appropriate equation which combines proportions never widowed in the successive age groups. For specificity the estimation of male mortality from female responses will be described first. The equation used are

$$1(N+5)/1(22\tfrac{1}{2}) = W_N \,{}_5P_{N-5} + \left[1 - W_N\right] {}_5P_N \qquad \text{and}$$

$$1(N+5)/1(27\tfrac{1}{2}) = W_N \,{}_5P_{N-5} + (1-W_N)\,{}_5P_N \qquad \text{where}$$

${}_5P_N$ is the proportion never widowed in the age group of women N to N + 5. The first equation is used where the mean age of female marriage is under 20 years and the second where it is over this age. On the left hand side of the equation the ages exposure are made 5 years older than those of the women to allow for the fact that on average, husbands are older than their wives by round this amount. Devision from this average are adjusted by the weights W_N but more accurate estimation is achieved by ensuring that the left hand side is reasonable close to the actual male exposure. The weights W_N are fixed by two measures, the mean age of marriage of the cohort of women and the period mean age of marriage of men. It is important to distinguish between the two different types of mean. The length of exposure is fixed by the difference between the current age of a group of respondents, centred at N say and their mean age of marriage as a cohort moving through time. On the other hand the mean ages of the husbands at the start of exposure will be a period measure that is dependent on the number of men in different age groups in the population at the time of marriage. In growing populations the number of men at younger ages will be relatively higer than if they had been a cohort moving through time. The period mean age of marriage is, therefore, normally lower than the cohort mean age.

Approximate mean ages can usually be obtained reasonably simply from the proportion of persons single by age group. By differencing, first marriages in age intervals are found The cohort mean is then calculated from these in the standard way. For the period mean age the marriages in each interval must first be multiplied by a factor proportional to the population numbers in that interval (in the context, of males). The required measure is the mean of the distribution derived. The values calculated will refer to a recent period. Estimates made from the proportions of older persons widowed may, therefore, be biased if ages of marriage are changing. Allowance can be made for this if data on marriage at earlier periods are available, for example from censuses. Experience suggests that these biases are relatively small.

The W_N have to be determined by three measures, namely the two mean ages and N. This does not, however, necessitate a set of two way tables because it has been found that one basic table for a fixed mean age of female marriage plus a table of simple corrections is sufficient for each equation. These are given here as Tables 11A and B. The first part of 11A shows the W_N for a female mean age of marriage 18 years for the estimation of $1(N+5)/1(22\frac{1}{2})$, the second part is for a female mean age of marriage 22 years to estimate $1(N+5)/1(27\frac{1}{2})$. Table 11B gives the correction for a different female mean age of marriage. This has to be added to each provisional W_N found from Table 11A.

The description need not be repeated for the derivation of adult female mortality from responses of men about the proportion of first wives that have died since it is identical apart from the range of measures. The two estimating equations are :

Table 11A. Weights for Converting Proportions Into Life Table Functions : Female Respondents

Part 1. Function Estimated : $1(N+5)/1(22\frac{1}{2})$ Cohort Mean age at Female Marriag : 22 years

Period Male Mean	Central Age of Woman									
	20	25	30	35	40	45	50	55	60	65
19	.4564	.2573	.2488	.2209	.1741	.1102	.0279	-.0404	-.1478	-.2305
20	.4928	.3052	.3100	.3003	.2771	.2386	.1802	.1299	.0363	-.0430
21	.5232	.3459	.3648	.3744	.3749	.3614	.3259	.2934	.2137	.1393
22	.5481	.3805	.4142	.4440	.4683	.4790	.4657	.4508	.3853	.3178
23	.5678	.4097	.4590	.5099	.5580	.5921	.6002	.6028	.5521	.4940
24	.5830	.4344	.5006	.5731	.6447	.7015	.7303	7504	.7154	.6696
25	.5945	.4563	.5404	.6349	.7294	.8079	.8568	.8944	.8767	.8462
26	.6038	.4770	.5799	.6965	.8131	.9123	.9807	1.0359	1.0375	1.0257
27	.6120	.4979	.6205	.7589	.8966	1.0154	1.1027	1.1761	1.1994	1.2103
28	.6204	.5204	.6630	.8226	.9802	1.1178	1.2236	1.3160	1.3639	1.4026
29	.6300	.5449	.7078	.8878	1.0643	1.2197	1.3438	1.4569	1.5326	1.6057
30	.6408	.5715	.7547	.9543	1.1485	1.3212	1.4636	1.5998	1.7071	1.8235

Part 2. Function Estimated : $1(N+5)/1(27\frac{1}{2})$ Cohort Mean Age at Female Marriage : 18 years

Period Male Mean	Central Age of Women									
	20	25	30	35	40	45	50	55	60	65
19	3.1951	.6196	.3856	.2623	.0757	-.1584	-.4145	-.6257	-.8404	-.9722
20	3.0786	.6513	.4344	.3263	.1631	-.0394	-.2606	-.4428	-.6368	-.7617
21	2.9801	.6780	.4763	.3841	.2454	.0747	-.1129	-.2677	-.4419	-.5600
22	2.8983	.7002	.5121	.4367	.3235	.1844	.0291	-.0997	-.2547	-.3663
23	2.8329	.7180	.5424	.4851	.3922	.2902	.1658	.0617	-.0746	-.1797
24	2.7839	.7318	.5682	.5303	.4703	.3928	.2980	.2176	.0992	.0011
25	2.7490	.7424	.5910	.5738	.5409	.4930	.4263	.3681	.2677	.1776
26	2.7243	.7509	.6127	.6171	.6113	.5918	.5516	.5149	.4319	.3514
27	2.7054	.7584	.6347	.6615	.6823	.6897	.6745	.6585	.5930	.5240
28	2.6871	.7640	.6582	.7078	.7544	.7875	.7957	.7996	.7521	.6970
29	2.6659	.7747	.6537	.7563	.8277	.8847	.9155	.9389	.9104	.8719
30	2.6407	.7846	.7112	.8968	.9919	.9317	1.0340	1.0768	1.0690	1.0504

Table 12A. Weights for Converting Proportions Into Life Table Functions : Male Respondents

Part 1. Function Estimated : $1(N\text{-}5)/1(17\frac{1}{2})$ Cohort Mean Age at Male Marriage : 23 years

Period Female Mean	Central Age of Men 25	30	35	40	45	50	55	60	65	70
15	.3853	.1129	.0999	.1110	.1113	.1043	.0861	.0483	.0172	-.0593
16	.4423	.1930	.1869	.2087	.2252	.2371	.2380	.2174	.1988	.1325
17	.4944	.2635	.2669	.3004	.3332	.3638	.3831	.3790	.3733	.3175
18	.5399	.3242	.3386	.3847	.4343	.4835	.5209	.5332	.5408	.4964
19	.5783	.3758	.4017	.4614	.5284	.5964	.6516	.6804	.7017	.6704
20	.6160	.4191	.4566	.5310	.6161	.7028	.7757	.8211	.8568	.8408
21	.6357	.4546	.5041	.5943	.6980	.8034	.8939	.9563	1.0070	1.0090
22	.6553	.4828	.5451	.6522	.7751	.8990	1.0070	1.0865	1.1535	1.1765
23	.6693	.5049	.5811	.7061	.8483	.9906	1.1160	1.2127	1.2977	1.3447
24	.6790	.5228	.6143	.7579	.9193	1.0795	1.2221	1.3360	1.4413	1.5154

Part 2. Function Estimated : $1(N\text{-}5)/1(22\frac{1}{2})$ Cohort Mean Age at Male Marriage : 27 years

Period Female Mean	Central Age of Men 25	30	35	40	45	50	55	60	65	70
15	3.7890	.4844	.2145	.1575	.0613	-.0825	-.2588	-.4511	-.6037	-.7760
16	3.5958	.5381	.2932	.2462	.1628	.0397	-.1097	-.2744	-.4057	-.5625
17	3.4103	.5870	.3636	.3277	.2584	.1567	.0333	-.1049	-.2163	-.3577
18	3.2457	.6297	.4253	.4010	.3468	.2671	.1695	.0567	-.0355	-.1613
19	3.1049	.6659	.4784	.4657	.4279	.3708	.2987	.2106	.1373	.0269
20	2.9865	.6861	.5233	.5223	.5021	.4682	.4214	.3572	.3027	.2076
21	2.8889	.7208	.5602	.5717	.5703	.5688	.5381	.4972	.4615	.3818
22	2.8142	.7393	.5897	.6148	.6333	.6470	.6494	.6313	.6143	.5505
23	2.7622	.7536	.6129	.6529	.6924	.7391	.7563	.7604	.7619	.7153
24	2.7289	.7831	.6320	.6883	.7696	.8109	.8601	.8857	.9056	.8777

Table 11B. Corrections for Cohort Male Mean Age at First Marriage

Estimating Equation

Mean Age at First Marriage	$1(N+5)/1(22\frac{1}{2})$ Correction	Mean Age at First Marriage	$1(N+5)/1(27\frac{1}{2})$ Correction
15	0.6	20	0.4
16	0.4	21	0.2
17	0.2	22	—
18	—	23	-0.2
19	-0.2	24	-0.4
20	-0.4	25	-0.6

Table 12B. Corrections for Cohort Male Mean Age at First Marriage

Estimating Equation

Mean Age at First Marriage	$1(N-5)/1(17\frac{1}{2})$ Correction	Mean Age at First Marriage	$1(N+5)/1(22\frac{1}{2})$ Correction
20	0.6	25	0.2
21	0.4	26	0.2
22	0.2	27	—
23	—	28	-0.2
24	-0.2	29	-.04
25	-0.4	30	-0.6

Table 13. Estimation of Male Adult Mortality from Female Widowhood : Kuwait 1965

Age of women	N	Proportion never widowed	II	W_N	$1(N+5)/1(22\frac{1}{2})$	Fitted $1(N+5)$	Fitted $1(N+5)/1(22\frac{1}{2})$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
25-29	30	.9885	.9414	.4799	.9351	.7156	.9272
30-34	35	.9758	.9293	.5965	.9179	.6907	.8949
35-39	40	.9461	.9010	.7131	.8705	.6621	.8579
40-44	45	.8343	.7946	.8123	.7758	.6274	.8129
45-49	50	.7291	.6944	.8807	.6719	.5836	.7562
50-54	55	.5313	.5060	.9359	.5009	.5285	.6848
55-59	60	.4480	.4267	.9375	.4170	.4563	.5912
		.2854	.2718				

a = -.2419 B = 0.88

$$1(N—5)/1(17\tfrac{1}{2}) = {}_{W_{N.5}}P_{N-5} + (1-W_N)\ {}_5P_N, \qquad \text{and}$$

$$1(N—5)/1(22\tfrac{1}{2}) = {}_{W_{N.5}}P_{N-5} + (1-W_N)\ {}_5P_N.$$

for male mean ages of marriage of under 25 and over 25 respectively. Tables 12A and 12B provide the materials for the determination of W_N from the cohort male mean age at marriage and the period female mean age.

As yet it has only been possible to apply the widowhood technique to a few surveys because of the special data requirements. It has given particularly good results for male mortality but, in at least one instance, there was evidence of under-reporting of deaths of first wives by older men. The reason was, almost certainly, the failure of the interviewers to enquire sufficiently closely in households where the man had remarried.

In some populations there is a possibility that the technique might be applied, to a reasonable approximation, without the need for special survey data. The opportunity occurs where remarriage of widowed females is limited, particularly after the early part of the reproductive period. If a small proportion p of women re-marry after widowhood and we use II for the proportion of **marriages** unbroken by the death of the husband then in an age group beyond that in which re-marriages take place.

$$II = \frac{1-W}{1+p}$$

where W is the proportion of widows at the time of the recording. This formulation differs slightly from the previous one where each respondent was only counted once. II refers to marriages and not to persons because someone can be widowed and remarry but appear as a widow because of the death of the second husband. In theory this alters the mean ages relevant to the choice of the W_N but in practice, for the situation considered, the effect is so small that it can be neglected.

Since widowhood data are traditionally collected at censuses this modification opens up the scope for the useful application of the technique very widely. It would seem particularly promising for the investigation of trends in mortality in populations where statistics from the past are greatly limited. For example in the 1974 demographic enquiry of bangladesh questions were asked both on current marital status and on the survival of first spouse. The proportions of widow remarried could be calculated for each age group. These then served as the basis for the calculation of II from the marriage data of the 1961 and 1951 censuses and hence for the estimation of adult male mortality in the earlier periods. If there is no direct survey of re-marriage it may be possible to arrive at rough estimates of p from marriage registration statistics even if these are incomplete. When p is small its effect on the difference between the proportions widowed and ever-widowed becomes relatively unimportant at higher ages. In consequence useful estimates of mortality can be obtained even from very approximate levels of p. In particular if re-marriage practice is not changing a reasonable estimate of trends in male mortality may be reached from a series of censuses.

Example There have been no surveys in the ECWA region or in neighbouring areas in which the special question on the survival of the first spouse have been asked. The technique is tentatively illustrated in the modified form by aplication to the marital status data from the 1965 census of Kuwait. A preliminary, speculative estimate of p for females of .05 is made. This 5% of widows remarried is assumed to hold from age 25 years and upwards, i. e. at 25 years, 5% of the marriages are taken to be of women who had been widowed and no further increases take place thereafter. It should be noted that in Kuwait over 90% of the women had been married by the age group 25-29 years. No doubt better measures for p can be found after further investigation. (1-W) was found for each age group by dividing the number married by the total of the married and the widowed. II was then calculated from the formula given. These measures are shown in columns (3) and (4) of Table 13. The cohort female mean age of marriage was derived as described from the changes in the proportions ever-married between age groups as 18.5 years. In the calculation of the period male mean age at marriage, the weighting of the proportions married in age intervals was not taken from the male age distribution since this is greatly distorted by migration but from a stable population with the birth rate of Kuwait. The effect of this modification is, however, small. The mean age obtained was 26 years. The preliminary W_N are then found in the first part of Table 11A along the row for a male mean of 26. Reference to Table 11B for the adjustment to allow for the difference between the observed female mean age at marriage of 18.5 years and the effective 18.0 for the preliminary weights shows that the latter must all be reduced by 0.1. The W_N of column (5) of Table 13 are thus reached. Application of these in the weighting equation corresponding to the first part of Table 11A gives the estimates of $1(N+5)/1(22\frac{1}{2})$ of column (6). Graduation and linkage to child mortality are then carried out exactly as described for the orphanhood method except that $1(22\frac{1}{2})$ is now the intermediary measure. The child mortality required for the application is the level in the few years or so prior to 1965. After examination of estimates made for this period a choice of 1(2) of .870 was decided upon. The B parameter was estimated as 0.88 from the average of the logits for N equal to 35, 40 and 45, that is from the reports on widowhood by women in the age range 30-50 years. The fitted $1/(N+5)$ and the resulting survivorship ratios $1(N+5)/1(22\frac{1}{2})$ are given in columns (7) and (8) of the table.

Comments

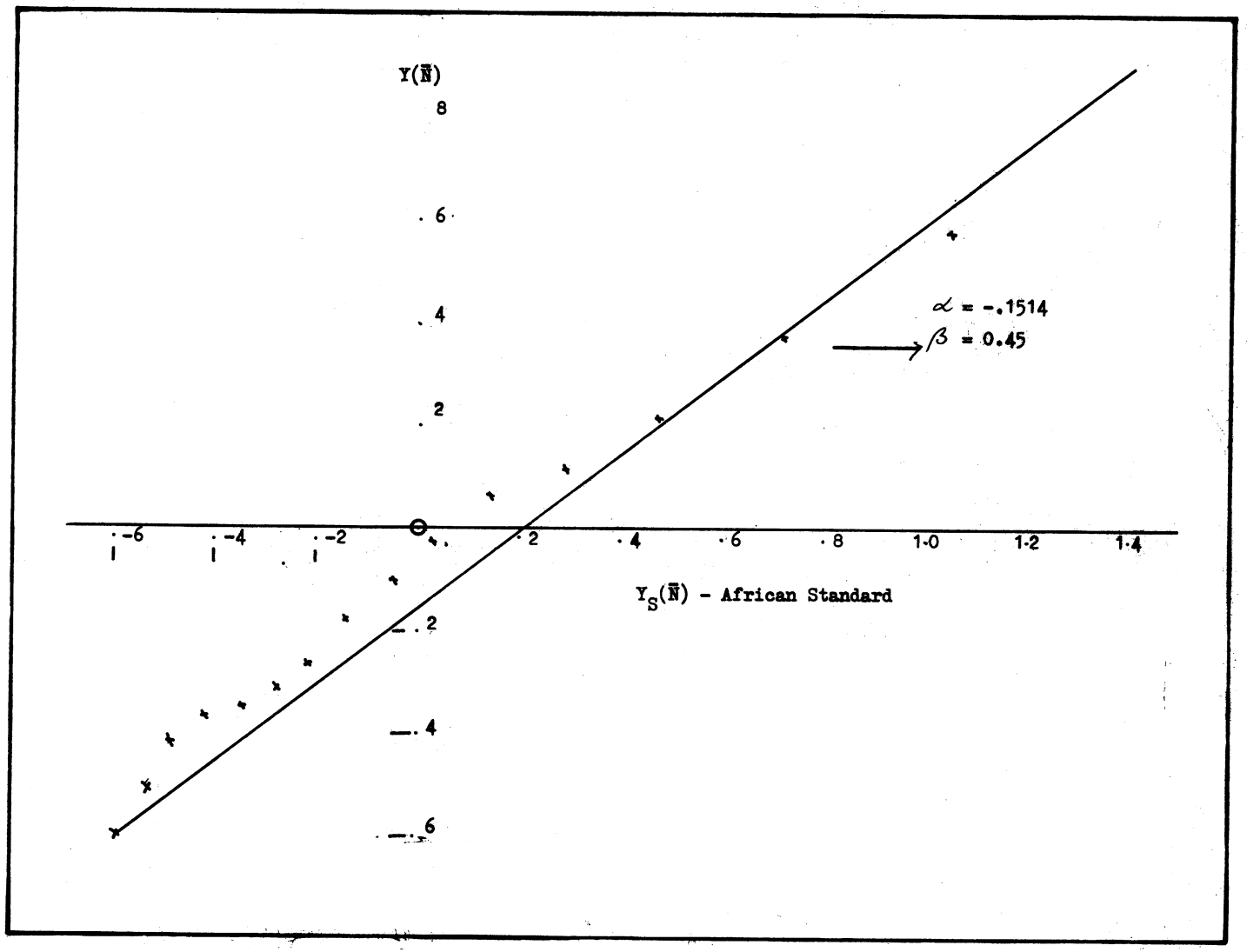
The fitted survivorship ratios are a little below those derived initially for N up to 40 but, thereafter, exceed them increasingly. This is consistent with the pattern expected in a population with rapidly decreasing mortality. If p was raised appreciably (say to 10%) the resulting estimates would show considerably higher mortality and greater consistency between survivorship for N at 40 and less and the measures at later ages. On the other hand, the decrease in survivorship between N's of 30 and 40 would be in poorer agreement with the observations. This brings out the point that for a population where trends in mortality are slight the pattern of the observations will give good evidence of the size of p. In the present example the interpretation is confused by the rapid changes and auxiliary information on remarriage of widows is needed to

provide convincing estimates. The mortality measures derived from the analysis of Table 13 are, however, quite plausible. The life table which is constructed from the African standard by the logit transformation with the specified a of-.2419 and B of 0.88 is very close to the South Regional model of level 16 with an expectation of life at birth of about 52 years.

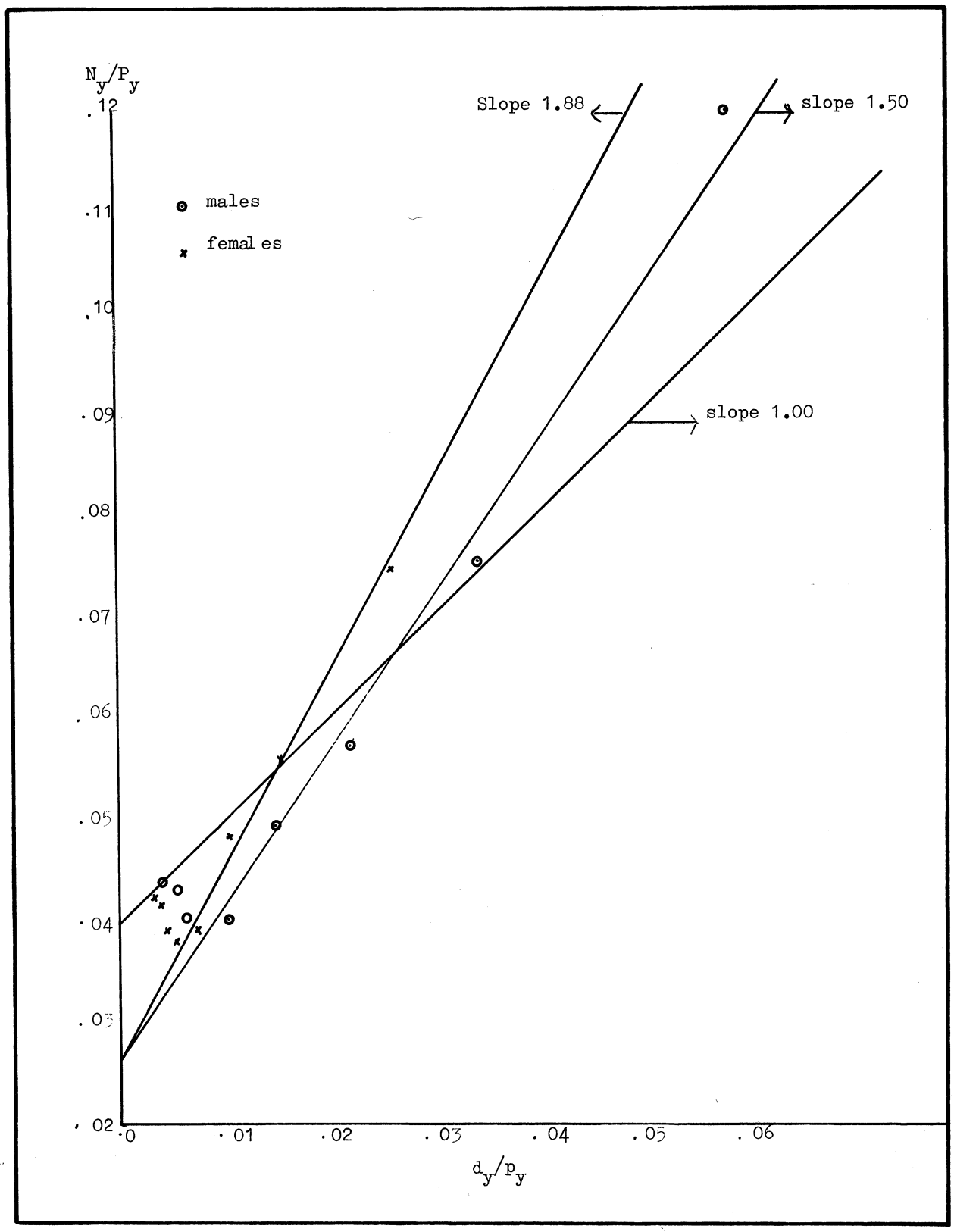
Conclusion

The paper has described one indirect method for the estimation of childhood mortality and four principal methods for deriving mortality, with more limited reference to others. The apparent lack of balance is deceptive.In fact the childhood technique has been almost universally effective but all the procedures for finding adult mortality are uncertain. They can give excellent estimates in the right conditions but are subject to biases which may be serious for particular applications. However the methods have different weak points. It is very unlikely that all (or even most) would fail for the same population. The exposition of the paper may tend to mislead since each method has been illustrated by a different population. In fact the objective in indirect estimation is to apply as many methods and checks as possible. Accuracy is achieved through the accumulated evidence of the variety of approaches and not by banking on any individual one. Of course, the weight to be given to a particular estimate depends on a close knowledge of the strengths and weaknesses of the method in the specific situation. As yet there is relatively little experience of the application of these techniques to the populations of the ECWA region. Judgement of their reliability will strengthen with the growth of use.

GRAPH 1: Stationary population from inter-censal survivorship, Syria 1960-70 females, plotted against African standard on logit scale.



GRAPH 2: Population age distribution measures plotted against death rate distribution measures for Iraq, 1965.



DEMOGRAPHIC DATA COLLECTION IN THE SULTANATE OF OMAN*

by

The National Statistical Department

Sultanate of Oman

So far no general population census has been carried out in the Sultanate of Oman, and, therefore, no accurate estimates of the number of the inhabitants of the Sultanate are available. The estimates drawn up by the International Bank and some consultative instructions have varied, but the estimate taken for the purpose of development planning is approximately one and a half million. As a first step towards a general population census, in 1974 the Government of the Sultanate, in co-operation with the United Nations, prepared a socio- demographic sample survey project for five towns in the Sultanate, namely, Muscat, Matrah, Sur, Sohar and Nizwa. The field work for that survey, which was carried out in co-operation with the Economic Commission for Western Asia, was completed in late May 1975, and the questionnaires were transmitted to the Commission's headquarters in Beirut for analysis there under the Commission's supervision.

The results of this survey will cast light on the demographic and social characteristics of the population of those urban areas, in addition to paving the way for the carrying out of a general census of the population of the Sultanate in the future. The survey was a valuable experiment, in the course of which were revealed many of the administrative and organizational problems and difficulties, the problems relating to the provision and training of the necessary manpower and the provision of the necessary funds and the other difficulties for which appropriate solutions must be sought if a general population census is to be carried out.

The Sultanate of Oman is fully aware of its urgent need for reliable data on which to base programmes required for economic and social development planning to promote the welfare of Omani citizen and raise their living and social standards. The Sultanate realizes that this is not possible unless there is available basic data about the population, with regard to size , composition and geographical disribution among the various administrative divisions, the objective of which is to assist in the drafting of economic and social development plans relating to employment and programmes for manpower, migration, housing, education, health and other services.

The delay in the allotment of funds by the United Nations, did not constitute an obstacle to the execution of the project, because the Government of the Sultanate made available the necessary appropriations for use until the requested assistance was obtained.

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* Meeting document E/ECWA/POP/WG. 5/10.

One of the difficulties revealed during the survey operation was the lack of trained and qualified personel, since this was the first time that such a study had been made in the Sultanate. There was also a notable shortage of the surveyors and draftsmen needed to do the preparatory work of dividing up and selecting population units for the taking of the sample.

Lastly, the high proportion of illiteracy among the population of the Sultanate constitutes one of the greatest obstacles to the obtaining of accurate data. This placed additional burdens on the researchers and supervisors, who were obliged to spend much time and effort in explaining the aims of the census to citizens and thus gaining their confidence and co-operation. Illiteracy also prevented the communication ofpropaganda and awareness to large segments of the population in writing.

The Economic Commission for Western Asia contributed by providing three trained supervisors and in addition, two local employees were trained as supervisors. The task of making the enumeration was entrusted to teachers working in the Sultanate, in co-operation with the Omani Ministry of Education. They received satisfactory training under the guidance of the supervisors assigned by ECWA. The work was well done, and they gained experience which will serve as a good basis for the conduct of such studies in the future. The financial appropriations collected by the United Nations for this survey project included the training of two Omani employees of the National Statistical Department in the processing of analyzing results by means of electronic computer in Beirut, but recent events in Beirut prevented the use of this grant. However, one of the candidates for this grant has obtained the general diploma in demography from the Cairo Demographic Centre. The great shortage of employees in the National Department of Statistics made it impossible to send any training missions abroad last year. We hope that this year we shall be able to send some employees on study missions in statistics generally and in the demographic science in particular, inasmuch as we believe that training is the basis for the establishment of an efficient statistical system.

AVAILABLE DEMOGRAPHIC DATA IN THE SYRIAN ARAB REPUBLIC*

by

The delegation of the Syrian Arab Republic

I. Introduction

In spite of the errors which flaw the civil status registers in the Syrian Arab Republic, both because they are not comprehensive owing to incomplete registration of vital events, such as births, and of social events such as marriages and divorces, and because they are lacking in necessary social data on individuals, these registers were the sole source of social statistics until 1960. In that year the first scientific census was made, the results of which made it possible to obtain reference data for all demographic indicators in the country in subsequent years, for all the censuses made prior to 1960 were carried out for special purposes which were totally different from the purposes of population censuses in the modern sense of the term. The first known official census in Syrian history was made in 1854, but it was confined to males only.

Then came the census of late 1885, which, for the first time, covered the whole population. It was followed by a third census in 1905. At the beginning of the French Mandate came the census of 1922, which was taken as a basis forthe correction and organization of the civil status registers based on earlier censuses. At the dawn of the era of independence in 1947 a one-day population census was made, but its results were not consolidated nor published.

II. Censuses and surveys carried out in the country since 1960

1. The 1960 census

The 1960 population census is regarded asthe first scientific operation carried out in the sixties, because it furnished for the first time analyzable population data from which it was possible to derive certain demographic indicators. The census form included data relating to sex, age, marital status, educational status, place of birth, original and current place of customary residence and, in the case of married women only, the number of live births and surviving children as well as other data relating to nationality, religion and infirmities.

The 1960 census was thus not confined to the size of the population but provided a general description of the population with regard to size, age structure and social and economic characteristics, which enabled researchers to derive certain essential indicators for the population estimates required for the drafting of economic and social plans.

2. The labour force survey

This survey is one of the earliest statistical surveys made in the country, because the Statistical Deparment in the Ministry of Planning began it in 1961. It was carried out by the

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* Meeting document E/ECWA/POP/WG. 5/11 .

controlled random sample technique four times a year, then twice a year and then once a year every October. It deals with the social and economic characteristics of the labour force in the Syrian Arab Republic. In 1970 it was given the new name "demographic sample survey".

However, its initial goals remain the study of the labour force, but it also furnishes demographic estimates for use during the ten-year interval between two censuses.

3. The 1970 housing and population census

Ever since its establishment in 1968, the Central Bureau of Statistics has been endeavouring to ensure the periodicity of population censuses, because of their great value in providing sound reference points for comparisons and the derivation of the necessary indicators for population projections. The Bureau had to persuade the responsible authorities in the country of the need to carry out population census after the elapse of ten years from the 1960 census. That was done as a result of the promulgation of Legislative Decree No. 323, which provided for the carrying out of a census of housing and population in 1970, with the following goals:

1. To provide data on the size of the population, its geographical distribution and its social and economic characteristics;
2. To observe internal population movements in order to arrive at indicators of the volume and trends of internal migration;
3. To arrive at certain demographic indicators relating to age, sex and marital structure;
4. To arrive at certain indicators reflecting fertility and mortality by a listing of live births and surviving children.
5. To study family size and social and economic structure, in order to arrive at family structure averages and average structural variables to assist in estimating the number of families in the future;
6. To determine the average population growth during the period 1960-1970.

The 1970 general census was preceded bysome field studies which may be regarded as a substitute for preliminary experiments for the census. The most important of these were the the following :

(a) The social statistical survey of the areas covered by the El-Asad Lake (Euphrates Dam), which was carried out by the Central Bureau of Statistics for the Public Institution for the Exploitation of the Euphrates Basin; the following two basic principles were observed in the designing of this survey : 1) To achieve the goals sought from the survey by the Institution; 2) To aim at universalization so that it would form a replica in miniature of the residence and population census, with regard both to the form and content of the printed material and instructions and to the staffing structure, execution technique and work stages; it should be noted here that this study, which was carried out in 1968, led to

greater thoroughness in the experiments of the leadership elements made after the 1970 housing and population census and to the refinement of their expertise;

(b) The comprehensive collection of basic data in principal towns, villages and farms; some of the most important goals of this study were the following:

1. To obtain a complete list of population agglomerations (farms, villages and principal towns) according to the most recent administrative divisions;

2. To arrive at the most accurate population estimates for these agglomerations;

3. To list the schools in all the agglomerations, since they would be taken as places of work for employed persons in the census;

4. To list the teachers in these schools, since most of them would be participating in the census operations;

5. To list the names of the mayors, because of their influence in conducting field work in their villages;

15 September 1969 was chosen as the date for the commencement of the execution of the study, since it was close to the base date adopted for the 1970 census.

6. Field studies carried out after the 1970 housing and population census.

After the publication of the results of the 1970 housing and population census, it became apparent that there was an urgent need to form a special agency to supervise the conduct of the various population studies made by the Central Bureau of Statistics. Accordingly, in 1972 a Population Studies and Research Center was established. It assumed responsibility for supervision of the execution of the following series of field studies :

(a) Study of infant mortality in the city of Damascus:

This study was directed in its design and execution towards the achievement of two types of goal, namely :

1. Direct goals, which may be summarized as follows:

— To measure the volume of the incidence of mortality among infants and children under five years of age in the city of Damascus during the period 1968-1972;

— To obtain information concerning the type, trend and seasonality of the deaths;

— To study the social and economic disparities affecting the deaths;

— To obtain a knowledge of the principal health causes leading to the death of infants and children;

2. Indirect goals, which may be summarized as follows :

— To obtain information concerning fertility levels in the city of Damascus and to study fertility trends during the past five years;

— To study certain social and economic characteristics prevalent in the city of Damascus;

— To make an initial measurement of the volume of the incidence of mortality among migrant to and from the city of Damascus.

The study was carried out in two stages. The first comprised the listing of the families in the areas covered by the study and the collection of certain date about individuals, in order to obtain certain demographic indicators so as to have a sound framework from which to draw the sample. The second stage comprised the collection of data pertaining to infant mortality and its causes, trends and seasonality. The processing and analysis of the data obtaind in this study have been completed, and the final report has been prepared and is curretly being printed.

(b) Study of the relationship between family size and health:

This study was conducted in 1973, and among its most important goals were the following :

1. To obtain information concerning the relationship of family size and health, in order to determine accurately the effect of the number and timing of pregnancies and the age of the mother on the health of both mother and child;

2. To discover the relationship between infant mortality and birth techniques.
The study was carried out by the survey sample technique. The sample was drown from three categories, namely, large cities, represented by Damascus, and small towns, represented by two towns in the Suwaida Governorate. The sample comprised 600 families.

— Field work and medical examinations;

— Office revision and codification.

The date has been recorded on magnetic tapes and sent to Geneva, as agreed with the World Health Organization, in co-operation with which the study was conducted, for the purpose of preparing electronic classification programmes for analysis operations and the preparation of the final report.

(c) Study of working women in State agencies and the public sector :

This study was carried out in co-operation with the General Union of Women and the Syrian Ministry of Social Affairs and Labour. It comprised a comprehensive survey of all women employed in State agencies and the public sector in the principal towns of the governorates only. Its most important goals were the following :

1. To obtain information concerning the social and economic characteristics and the age structure of working women in the country :

2. To obtain information concerning the degree of the adequacy of day nurseries for children of working women and to estimate the need for such day nurseries;

3. To find out how the day - time hours of working women were distributed among official work, housework and rest and recreation;

4. To arrive at simple indicators of fertility and mortality among working women in the country.

This study was completed, the date processed and the final report prepared, printed and published.

In addition to these studies, the Central Bureau of Statistics and the Population Studies and Research Center have carried out other considerable analytical demographic studies which are not mentioned in this paper.

III. Technical and financial difficulties encountered by the Bureau in conducting censuses and surveys:

(a) Technical difficulties:

1. The preparatory operations for the 1970 housing and population census came during a period of growth and personnel training in theBureau, which placed considerable burdens on the responsible officials owing to the difficulties of reconciling the needs of institution building. on the one hand, and preparation for the census, on the other.

2. Because the knowledge gained from the 1960 census had not been documented, the Bureau had to seek out this information for the purpose of designing the 1970 census, in order to make it possible to compare its results with those of the 1960 census. In spite of all this and in spite of the small number of technical cadres, the Bureau was able to arrive at a sound design for the 1970 census in a time period that may be regarded as normal when compared with the time taken for the design of similar censuses in other countries.

3. There were no special maps available for the purpose of census and statistical survey, which led to a redoubling of efforts in the preparatory and design stages of the census, because the Bureau was obliged to take urgent steps to arrange for the responsible authorities to prepare such maps.

4. There was no independent office for demographic censuses and surveys, and the Bureau was obliged to seek out the qualified personnel who had participated in the 1960 census from the various Goverment departments, which disrupted the work of these departments throughout the census period.

5. The Bureau suffered from a scarcity of a sufficient number of qualified personnel capable of carrying out the census operation. Its qualified personnel were therefore obliged to train a technical body of staff capable of conducting the various field operations.

6. The widespread phenomena of illiteracy and non-registration constituted serious obstacles, because the enumerators and statistical researchers were obliged to utilize a variety of methods to determine certain required data, such as age and the dates of other events, particularly in the rural areas. The enumerators and researchers were therefore provided with lists of the most important outstanding historical events with which the various events could be correlated.

(b) Financial difficulties :

1 . Although the responsible officials were aware of the importance of statistics as a basis for all sound scientific planning, the Bureau's budget and, consequently, the appropriations for field studies remained very limited. This was in keeping with the framework of the potentials and priorities of the Syrian economy, since the continuation of Israeli aggression against the country in particular and against all the Confrontation States in general resulted in the country's having war economy which had to reconcile the requirements and priorities of the development process with its national goals of liberating occupied territory and restoring the national rights of the Palestine Arab people.

2 . Secondly, there was the paucity of the financial aid provided by the United Nations, which placed restrictions on the Bureau's aspirations to achieve the greatest possible comprehensiveness and specificity in all the studies carriedout.

(c) Other difficulties :

1 . There was a delay in the promulgation of the legislative instruments for approval of the censuses by the supreme State authorities, which caused difficulties in reconciling the potentials of the qualified cadres with the requisite time for preparation for the census operation. For example, in the 1970 census the interval between the date of commencement of the field work and the promulgation of Decree No. 323 providing for the conduct of the census was less than one year.

2 . The Bureau lacked special rooms for training and revision operations, which called for a sizable staff. The Bureau was therefore obliged to lease one of the buildings in the Damascus International fair complex, and the staff working suffered inconveniences during their work because of the cold and the lack of basic work prerequisites

3 . There has been a lack of census staff stability, because of the seasonality of this work. The Bureau has therefore had to train new personnel when it carried out any survey, which increased the expense and difficulty of these censuses.

4 . The grants forthcoming from the United Nations have been small and have not been utilized at the approporiate time. This has led to a shortage of trained cadres, and, consequently, the additional effort expended by the responsible officials to conduct the various population censuses and surveys has been wasted.

IV . Censuses and surveys to be carried out in the future

(a) The ongoing demographic sample study :

The purpose of this study is to observe the natural growth of the population (births and deaths) and to derive global and specific indicators of those components. It also aims at measuring the volume of population movements between the various governorates in the

country (internal migration) and between Syria and other countries (external migration). In addition, it aims at determining the incidence of marriage and divorce in the country and studying its general characteristics . In the conduct of this study, the multiple category sample technique is being followed, and the country has been divided into three categories which are homogeneous as regards population size. The first category comprises large towns, and the second category small towns and comprises the other population agglomerations classified as towns in the 1970 census. The third category comprises rural areas and the other population agglomerations.

The volume of the study has been estimated on the basis of successive visits to families, so that each family in the sample will be visited seven times. The volume is approximately 12,2000 families, but the visits of the first year will be confined to 6,000 families only, and the complete sample will be taken in the following year.

It had been decided that the first visit begin in October 1974, but because the UNFPA', approval of the plan submitted by Syria was delayed, the Bureau had to change the time schedule, so that it was decided that the first visit would be made in April 1976.

(b) Sample population census :

It was assumed that the field work for this census would be carried out in September 1975, i. e., five full years after the completion of the 1970 general population census. However, the delay in the UNFPA's approval for the financing of this study obliged the Bureau to change the time schedule and include it in its work plan for 1976. It has been decided that the field work be carried out in October 1976.

In the designing of the study, the survey sample technique has been followed, and the field work will be carried out in two stages. During the first stage a comprehensive survey will be made of all the residences in the population agglomerations chosen by sample, in order to obtain information concerning the families occupying them and the number of males and females in each family, so that the current framework can be adjusted so as to be suitable for the selection of the families sample by the controlled random technique. The second stage comprises vists to the families included in the sample and the collection of complete data on all the individuals concerned, in order to arrive at the social and economic characteristics of the population.

The most important goal of this census is to provide basic data concerning :

1 . The overall size of the population and its geographic distribution;

2 . The basic features of the demographic framework (age and type structure, family composition, etc.);

3 . The social environment;

4 . The economic environment;

5. The population movements and social and economic shanges occurring during the past six years.

(c) The World Fertility Survey :

In addition to the two above-mentioned studies to be carried out, the Syrian Arab Republic will participate in the conduct of the World Fertility Survey, in co-operation with the International Statistical Institute in London. This survey has been discussed with the experts assigned for this purpose, and the special from for it has been prepared, discussed with the experts and agreed upon. The time schedule, staff structure and budget estimates for the survey have also been arranged. It was decided that the draft family form should include data on mortality in the country, which made it necessary to increase the size of the sample to approximately 12,000 families. A family form will be filled in for each , so that these families will form a framework from which 4,000 families will be selected. The data concerning females in the female's form will be obtained from the females personally. It has been decided that the field work for this survey will start at the beginning of June 1976.

V. Local and foreign exertise available in the country and training opportunities

(a) Local expertise :

There is currently in the country a bodyof specialized workers in the field of demography comprising some 24 demographers. Twelve of them are working in the Central Bureau of Statistics and the rest in the State Planning Commission.

This body of demographers qualified either at the Cairo Demographic Centre or at other demographic institutes, such as the Demographic Institute of the University of Bordeaux. In 1973 the Central Buteau of Statistics establishetd an eighteen-member demographic commission to co-ordinate and participate in the preparation of analytic demographic studies.

The Central Bureau of Statistics also has a special centre for statistical training, the purpose of which is to train personnel from statistical bodies in the various ministries, Government departments and institutions. The study period at this centre is two academic years. In the first year students acquire knowledge of general statistics, and in the second they specialize in the field of either social or economic statistics. The centre has so far completed 21 courses, during which approximately 600 statisticians from the various ministries have graduated.

(b) Foreign expertise :

There is no expert in the field of demographic studies in the country at present. Agreement was reached with the Fund for Population Activities for the assignment of a demographic expert for a period of three months, but because a suitable individual was not available, this aid was not provided. The Bureau renewed the expert in the plan it submitted recently to the UN Fund for Population Activities, and it has been decided that the expert in question will arrive early this year.

In addition, the previous plan agreed upon with the UN Fund for Population Activities included provision for the furnishing of technical assistance in the form of a survey on an eight-month assignment. The country has utilized only two of these months, and it is being requested that the remainder of this assistance be provided during the four years between now and 1979.

AVAILABLE DEMOGRAPHIC DATA IN THE HASHEMITE KINGDOM OF JORDAN*

by

The Department of Statistics of the Hashemite Kingdom of Jordan

Introduction

The Jordanian Department of Statistics is the central agency for collecting statistical data at the national level, co-ordinating, analyzing and publishing this data, carrying out public censues and surveys, particularly in the demographic, economic and social fields, and arriving through an analysis of the data at conclusions, interpretations and projections pertaining to economic and social phenomena.

Since its establishment in 1949, the Department of Statistics has been a source for providing ministries, Government departments, international, national and scientific institutions and individuals with figures reflecting the achievements of the Government, economic and social activity, the characteristics and structure of this activity and the extent of the progress and growth achieved in these fields over specific periods of time.

Since the beinning of 1970, the Department of Statistics has been successfully using the electronic computer which it possesses in the studies, censuses and surveys which it carries out, and particularly in studies and surveys of a demographic nature.

I. Censuses and surveys carried out in Jordan

1. In 1952 the Department of Statistics carried out a population and housing census in Jordan on both banks. The Kingdom was divided up into eight census areas, corresponding to the administrative provinces, and each province was divided up into subprovinces and some of the subprovinces into districts. The census unit was the residence. For the purpose of this census, the word "housing" means any place where a person lives and sleeps, whether the housing is fixed or mobile as in the case of cloth or hair tents, wooden houses and caves.

It may generally be said that this census was a de jure one, since an enumeration was made of all persons customarily occupying each residence and persons temporarily absent who returned to the residence as their permanent abode. Excepted were temporary visitors having residences elsewhere, foreign visitors, aliens employed in embassies, delegations and consulates and persons absent from the Kingdom enrolled in the army or away from their families for purposes of work.

2. The first general population and housing census of 1961

This census may be regarded as the first and only one conducted in the Kingdom so far, inasmuch as it was a comprehensive census of the various demographic, social and economic characteristics of the population and the housing.

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* Meeting document E/ECWA/POP/WG. 5/12.

For the purposes of the census the Kingdom was divided up into nine census areas, corresponding geographically to the eight administrative provinces and covering all the inhabitants of towns, villages and scattered houses. The nineth census area coverd the inhabitants of tents in the provinces and in the desert (bedouins), a matter not taken into consideration in the 1952 housing census.

Prior to the commencement of the census operation, all streets and buildings in the towns and villages were named and numbered (contrary to the procedure followed in the 1952 housing census, when the buildings were numbered directly after the completion of the census process), and tables were prepared showing the number of families and individuals living in each building. Following this, the towns and villages were mapped and divided up into census units with one enumerator for each. Because of certain considerations, the number of families in each census unit varied between 150 and 300.

After the field apparatus had been organized, each enumerator visited all the buildings located within his unit during the initial census period, which took three weeks, in order to collect the required data on the buildings and the characteristics of the inhabitants. The occupants of public institutions were counted during the last week of the initial census period, and the data collected were then scrutinized a second time on the census day. In the case of foreign visitors in hotels, each was provided with a card to fill in with the required data, and these were collected in the morning of the census day. The counting of members of the Jordanian armed forces in camp was done by military personnel trained for the this purpose. Members of Jordanian diplomatic and military delegations abroad and their families were counted through Jordanian embassies abroad and were added to the total population. Members of foreign diplomatic and military delegations in Jordan and their families were counted but were not regarded as part of the total population.

It may generally be said that this census was a de facto one, since it comprised a count of all individuals in their various locations on the census day.

Table I shows the principal results of this census.

Table 1 .

Population Distribution By Province And Percentages for Urban And Rual Areas in 1961, Compared with The 1952 Housing Census .....

Population distribution	1952		1961	
	Total population	Distribution percentage %	Total population	Distribution percentage %
Jordan	1,329,174	100	1,706,226	100
Amman Province	218,465	17.5	433,618	25.4
Balqa Province	64,926	4.9	79,057	4.6
Ajlun Province	213,077	16.1	273,976	16.1
Karak and Ma'an Province	89,617	6.8	114,125	6.7
Hebron Province	125,651	9.5	119,432	7.0
Jeursalem Province	301,402	22.7	344,270	20.2
Nablus Province	315,236	23.8	341,748	20.0
Urban and rural areas				
Urban areas 1)	482,434	36.3	748,291	43.9
Rural areas and Inhabitants of scattered tents	846,740	63.7	957,935	56.1

Sources : The Department of Statistics, **First General Population and Housing Census, 1961**, Vol. I, p. 29.

The average annual growth rate of the population of Jordan during the period 1952-1961 was 2.8 per cent.

The conclusions of this census were published in four volumes:

I. General characteristics of the population;

II. Economic characteristics;

III. Family and housing characteristics;

1V.Techniques used in the census operations.

There was a total of 20 preliminary reports on the provinces.

1 / For the purposes of comparison between the two censuses, the rural population and the inhabitants of scattered tents have been merged, because no distinction was drawn between these two categories in the 1952 census.

3. The 1967 study of internal migration and comprehensive count:

In view of Jordan's lack of precise statistics on internal migration and the population growth of large cities since the conduct of the first general population and housing census of 1961, the Department of Statistics undertook this study in order to discover internal migration trends, the areas losing and attracting inhabitants, the motives and causes of migration and the structure and the marital, educational and economic status of migrants.

This study covered the cities of Amman, Zarqa, Rusaifa, Aqaba, Irbid and Jerusalem. It had been intended that it should cover the other cities in the Kingdom, but Israeli aggression on the West Bank prevented the completion of this study.

The city of Amman was divided up into14 census areas, corresponding in many cases to the city's main districts. These census areas were, in turn, divided up into census units with an enumerator working in each. Each of the other cities covered by the study was regarded as a census area and divided up, in turn, into census units. Special maps of these cities were then prepared.

It emerged from the study that the main cause of migration in all the cities was the migrant's desire to join his family; the percentage varied between 63 per cent in the city of Aqaba and 74 per cent in the city of Amman. This was followed by migration for job reasons, which varied between 12 per cent in the city of Rusaifa and 19 per cent in the city of Aqaba.

Jerusalem was the primary source of migrants to the city of Amman (24.4 per cent), while 15.8 per cent came from outside Jordan and 15 percent from the towne and villages of the Amman Governorate itself. The primary source of migrants to the city of Zarqa was the Irbid Governorate (31 per cent), followed by the Amman Governorate (19.8 per cent). Migrants to the cities of Rusaifa and Aqaba came from the Amman Governorate, the percentages being 38.5 per cent and 33.5 per cent respectively.

In 1968, the Department of Statistics carried out a similar study for the cities of Jarash and Ajlun following the same technique as was followd in the first study in 1967.

4. Study of employment in establishments employing five or more persons (ongoing study since 1967)

The execution of this study was begun early in 1967. Its purpose was to obtain data on an ongoing basis concerning employment and the labour force and it's characteristics, particularly with regard to the eduational level and economic activity of workers in the establishments under consideration.

The Department of Statistics had undertaken a number of studies on the labour force, but not on an ongoing basis. They included the following :

1. The 1957 study of employment in establishments;

2. The 1959 industrial census;

3. The 1963 study of manpower in establishments;

4. The 1966 labour force study;

5. The 1967 study of population and employment in the agricultural sector;

6. he 1970 labour force study.

5. Study of patients under treatment in Jordanian hospitals

The Department of Statistics began the conduct of this study on an annual basis in the second half of 1969 and has continued it up to the present. The purpose of this study is to collect comprehensive data on patients under treatment in Jordanian hospitals with reference to their social and health characteristics and some of their economic characteristics, whereby it will be possible to analyze the health standard and the extent of the efficacy of health activites and to study the progress of certain diseases on the one hand and analyze the relationship between morbidity and mortality by age, sex and place of residence on the other.

It emerges from the study that the number of physicians on the East Bank rose from 392 in 1969 to 764 in 1973 and that the number of individuals per physician from 4,082 in 1969 to 2,397 in 1973. The number of patients under treatment in Jordanian hospitals in 1974 totalled 77,153, more than half of them being treated in the Governorate of the capital, Amman. The study has shown that the mostwidespread diseases are diseases of the digestive system, diseases of the urogenital system, diseases of the respiratory system and complications of pregnancy and childbirth.

6. The multipurpose family study (ongoing study since 1971)

During the ten years following the first population and housing census in Jordan in 1961, there was not sufficient field data available concerning the population and its composition, distribution and various economic and social characteristics. In 1971 the Department of Statistics embarked on the conduct of a multipurpose family study in order to discover through the family certain demographic, social and economic characteristics of the population and to

observe the changes occurring in these characteristics periodically through a continous flow of statistical data. Each family in the sample is visited once every four months in order to discover the changes that have taken place in the above-mentioned characteristics of each family member.

The sample and the method of its selection

The sample was selected as follows :

The variable checking fraction classified sample was employed and was multiple-staged in parts. On this basis, the demographic community (families) was divided up into three categories : families in towns, families in refugee camps and families in villages and rural areas. Bedouins and nomads were excluded from the scope of the study.

In the towns, use was made of the registers of buildings and land at the Ministry of Finance and its offices in the governorates. After the survey of the registers of buildings and land and the selection of a small sample, the controlled random sample technique was employed, the selected residential locations determined and the registered address of each selected lot written down.

In the camps, a census was made of the families in all the camps on the East Bank. After tables had been made of the number of families, the controlled random sample technique was used to select the study sample units.

In the villages and rural areas, villages were selected by the multiple-stage small random sample technique, and then a rapid population census was made of thses villages. The sample decided upon was then selected from each village by the controlled random sample technique. It may be noted that the size of the sample was approximately 6 per cent of the total number of families living on the East Bank in 1971.

Among the most important conclusions of this study were the following :

1. The average size of the Jordanian family, in urban and rural areas alike, is on the uprise. It emerged that more than half the families consist of six or more persons. It emerged also that each economically active person supports an average of 5.1 persons in urban areas and 5.4 persons in rural areas.

2. The proportion of the total population aged 12 years and over who are able to read and write is 65.4 per cent, or 70.9 per cent in urban areas and 48.7 per cent in rural areas. The proportion of illiterate persons is 34.6 per cent, or 21.4 per cent of all males and 48.2 per cent of all females.

3. The proportion of economically active persons, including persons seeking employment, is 19.9 per cent of the total population, or 35.7 per cent of all males and 3.5 per cent of all females.

4. The proportion of unemployment in the labour force is 2.7 per cent of the total population aged between 12 and 64 years, 2.5per cent being males and 5.9 per cent femaies.

7. The census of the city of Amman of 31 December 1971

The city of Amman faced a large growth population as a result of internal migration, particularly from the West Bank of Jordan following the Israeli aggression against the Arab States in June 1967 and the continuous process of forcible emigration since that date. The Department of Statistics carried out a comprehensive census of the population of Amman city at the end of 1971. The city was divided up into 23 census areas, and use was made of special maps and plans of these areas.

The results of this census showed that the population growth rate of Amman city during the period between 1 May 1967 and 31 December 1971 was approximately nine percent annually.

It may be noted that the Department of Statistics made a comprehensive census of the size of the population of Amman city in the first half of 1967, within the framework of the study of internal migration and comprehensive count mentioned earlier. The population of Amman was at that time 330,220 persons.

9. The 1973 economic and social study of the the eastern region of the Jordan Valley.

This survey was the first of its kind to be conducted at the national level in this region. It was made on the basis of a sample representing all married or formerly married under 50 years of age, excluding bedouins and nomads. The sample comprised 5,214 women. The main purpose of this survey was to study the fertility history of these women, to determine the specific fertility rates of the various age categories and to discover the degree of difference in fertility between the rural and urban population and between women of various economic, social and educational levels. The survey included data on the trend of Jordanian families towards the desired family size and the extent of Jordanian women's knowledge and use of family planning methods.

One of the main conclusions emerging from this survey was that the fertility rate of Jordanian women may be regarded as one of the highest in the world. The survey showed that the average Jordanian woman gives birth to approximately 8.2 children during her child-bearing period. It showed also that the fertility rate in urban areas does not differ significantly from that in rural areas.

9. The 1973 economic and socal study of the eastern region of the Jordan Valley.

This study covered all the inhabitants of the region between the River Yarmuk in the north and the Dead Sea in the south. The purpose of this study was to collect basic data on the demographic, economic and social characteristics, the housing characteristics and the structure of the agricultural activity of the population of this region, particularly after the migration of many of them as a result of the successive acts of Israeli aggression since 1967.

The study employed the "comprehensive count" technique, comprising the visiting of all families in the region and social and economic survey of them. The study technique also included a programme for a comprehensive scrutiny of all agricultural holdings in the Jordan valley region. For this purpose registers and surveys of the agricultural units were prepared by the Land and Survey Department and the Natural Resources Authority.

The eastern region of the Jordan valley was divided up into three subregions : the northern, central and southern Jordan Valley.

At the time of the study, the number of the inhabitants of the eastern region of the Jordan valley totalled 64,012, and the average family size was 5.7 persons. The labour force constituted 30.5 per cent of the total population. This percentage is high when compared with the labour force percentage for the whole country, which is 19.9 per cent, according to the conclusions of the multi-purpose family study of January-April 1972. This high figure is due to the participation of women in economic activity generally and in agricultural work in particular in the Jordan valley region. The proportion ofilliteracy was 66.8 of the total population in the category aged 12 years and over.

It may be noted that in 1961 the Department of Statistics had carried out a partial economic and social study of the region lying between the River Yarmuk in the north and the northern part of the central Jordan Valley.

10. The labour force survey of March 1975.

The Department of Statistics carried out a comprehensive survey of the labour force on the East Bank, covering all workers in the various types of economic activity, with the exception of agriculture, the armed forces, public security and civil defence.

The agricultural labour force was counted in an agricultural census that was carried out at approximately the same time. The purpose of the labor force survey was to obtain data on persons working in establishments, showing social, economic, professional and educational characteristics, the type and duration of the training received by each and his employment history.

The study used the "comprehensive count" technique. Public statistics personnel are currently engaged in deriving the conclusions of the survey with the electronic computer, in preparation for their analysis and the writing of the final report of the survey. The initial results show that the number of workers covered by the survey totalled approximately 128,000.

II. Difficulties pertaining to the conduct of population censuses and demographic surveys

Among the most important difficulties by the Department of Statistics in carrying out population censuses and demographic surveys are the following :

1. Firstly, there has been the continuous Israeli aggression against Jordan, particularly in 1948 and 1967, and its occupation of the West Bank of the Jordan. This led to the expulsion of hundreds of thousands of citizens from the West Bank, most of them going to the East Bank. The Israeli occupation of the West Bank has made it impossible to carry out a population census since 1961 and has prevented the completion of some important studies, such as the 1967 study of interal migration and com-prehensive count.

2. Then there is the difficulty of checking external migration, because the forcible mass emigration from Palestine since 1948 and from the West Bank since 1967 has caused a caused a considerable and rapid disruption of the population and its geographical distribution and social, economic and demographic characteristics. This has contributed to a lack of accuracy in estimates to the population of the East Bank,owing to the successive forced rapid emigrations, which has made it difficult to follow up the rapid transformation of demographic characteristics resulting from these processes.

3. There is also the difficulty of checking internal migration on the East Bank, from the villages, rural areas and valleys to the towns,and of checking migration between governorates. This has led to cities such as Amman and Zarqa in particular becoming crowded with large number of citizens when they are not prepared to receive such vast numbers or to cope with the resultant detrimental effects, such as bad geographical distribution of the population, detrimental effects in the social economic field and incapacity to provide the population with the various essential services. As a result, it is difficult to make a really accurate annual estimate of the population of the principal towns.

4. So far in Jordan no civil register has been established to provide ongoing, accurate and up-to-date data on the various characteristics of the population and on the vital situation in particular.

5. There is a lack of accuracy in the registration of vital events and of deaths in particular. The proportion of accuracy in the registration of births is 95 per cent, if not more, while the proportion of accuracy in the registration of deaths is 40 per cent, or slightly more, as emerged from the analysis of the first population and residence census of 1961.

6. There is difficulty in making a census of Jordanians abroad. Many citizens have emigrated abroad because of the Israeli occupation of the West Bank, and many skilled and professional workers have emigrated to other Arab countries or elsewhere abroad in search of a higher standard of living. There are no available data on the number and type of these emigrants. A number of attempts have been made to assess the number and various characteristics of these emigrants, but without success.

III. Population censuses and surveys planned for future execution

1. 1976 survey of human fertility in Jordan.

The Department of Statistics intends to undertake a fertility survey in Jordan in the first half of 1976, within the framework of the programme of the World Fertility Survey, in co-operation with the International Statistical Institute and with financing from the United Nation Fund for Population Activities.

This survey will be carried out by the sample technique. Approximately 20,000 families will be selected to fill out the family questionnaire, and from these approximately 4,240 married and formerly married women under the age of fifty will be selected from urban and rural areas. Bedouins have been excluded from this survey, in view of their nomadic way of life and because they are not settled in any one place and it is difficult to reach their places of residence.

Use will be made of special maps and plans of the principal towns and of a project for the numbering of buildings and streets, which is currently being carried out in the these towns, when the survey sample is selected.

This survey aims at achieving a number of goals, the most important of which include the following:

— To obtain sound data for comparison with the data provided by the national survey of fertility and fertility trends carried out in 1972;

— To produce data pertaining to fertility levels, family types and the factors influencing fertility in Jordan; the National Population Commission will utilize these data as indicators to assist in the drawing up of a population policy for Jordan that is based on scientific facts;

— To find a framework for the study of the relationship between fertility and social and economic population factors;

— To find data for use in international comparisons of fertility; the agreement on this survey between the Jordanian Government and representatives of the Wold Fertility Survey Board was signed in November 1975.

2. 1977 study of the socio-economic and demographic impact of population growth and movements in urban, rural and nomadic areas.

The Department of Statistics intends to carry out this study in order to obtain accurate and comprehensive data on the population, its economic and demographic characteristics, which are regarded as basic prerquisites for social and economic planning. This study is regarded as tantamount to a comprehensive census and its characteristics since the

first and only population census in Jordan was carried out in 1961.

It has been decided that this study will be conducted in four stages. The first stage will comprise the numbering buildings and streets in Jordan. The execution of this project in 1976 will concentrate on the completion of numbering in the city of Amman and then on numbering in the nine following cities: Zarqa, Irbid, Salt, Ma'daba, Suwailih, Wadi Sir, Jarash, Rusaifa and Aqaba.

The three following stages will comprise a study of the social, economic and demographic characteristics of urban, rural and nomadic areas. It has been decided that the collection of data for this study will be completed in 1977.

3. Additional projects in the 1976 - 1980 Development Plan

In addition to the two aforementioned studies, the Five - Year Development Plan for 1976 - 1980 includes a number of statistical studies directly relating to population questions, namely :

(a) A sample census of the population of Jordan in 1980;

(b) A labour force survey in 1980;

(c) A family budget in 1976.

SOME TECHNICAL PROBLEMS ENCOUNTERED IN THE POPULATION CENSUS IN THE YEMEN ARAB REPUBLIC

by

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Introduction :

There is a consensus among many scholars, on the basis of all the available evidence to date, that the region of Western Asia was the birth - place of humanity from which successive waves issued forth to all parts of the inhabited world, at time intervals which make the years seem like seconds in the context of the ages. It is therefore not surprising that the land of Yemen should constitute the cradle and torchlight of the earliest civilizations; the Yemeni historian Ahmad ibn Abdullah ar-Razi says that the city of Sana'a, which lies at the heart of Yemen, is one of the oldest cities on earth and that Shem son of Noah sought a Godly place and found Yemen to be the most pleasing. The surroundings of Sana'a were affected by civilizations of which the imprints still bear testimony to this day. The great Marib Dam is the best example of that, for from there men went forth to populate the ancient world and build kingdoms in the north of the Arabian Peninsula.

Surveys conducted in Yemen

The antiquity of human settlement in the land of Yemen is commensurate with the the recency of demographic statistics there, for the first attempt to obtain reliable demographic data is only four years old. The Central Planning Organization, in co-operation with the Population Division of the Economic Commission for Western Asia, embarked on the conduct of a sample population survey of the city of Sana'a in late 1972. Although this survey was limited in its geographic scope, its results produced far-reaching effects from the viewpoints both of execution and of the data forthcoming. The most important of these results was perhaps that it formed a spearhead for advancing to the conduct of the first housing and population census in the history of Yemen. This census was carried out in early February 1975 and crowned the arduous efforts begun early in 1973, when the Central Planning Organization took the census, the detailed results of which are expected early next year. It should be noted that the United Nations Fund for Population Activities provided generous assistance in the form of equipment, expertise and cash funds, which unquestionably helped to lighten the burden on the Yemeni Government in carrying out this survey; no financial obstacles worthy of mention were encountered in any stage of its execution.

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* Meeting document E/ECWA/POP/W G.5/13.

The principal difficulties encountered in the census operation

As is well known, the design and execution of an operation such as a population census require a large number of components for their success, for example, the availability of the essential data for planning the census and the existence of advanced skills in numerous fields, such as organization, administration, accounting, information, demography and so forth. They also need considerable facilities in the field of transport, communications and printing, as well as requiring the polarization of intensive efforts on the part of many Government agencies. While these requirements are regarded as urgent in any country where a population census is to be taken, they were all the more urgent in a country such as Yemen, owing to the situation there. The statistical information and data are still not adequate to give an overall picture of the country, and the Government machinery is of recent formation and still in the process of construction. and lacks adequate quantities of human skills. The natural geography of the country is diverse, comprising valleys and mountains, plains and deserts, the climate is unstable and irregular, and the population is distributed over a tremendous number of small agglomerations and scattered buildings. The road network still connects only the principal agglomerations. The psychology of the population is still affected by the vestiges of the past. Then there are other difficulties as well. We do not know whether such obstacles are encountered by other countries or whether they are unique to us. However we would like to state at the outset that we have overcome these obstacles and been able to carry out a census that has been successful from all viewpoints. Our hope in endeavouring to review these obstacles and the solutions devised for them is to make available to those active in this field expertise that may be of value in other regions.

I. The lack of data necessary for census planning:

Before taking the preparatory steps for the census, we lacked much of the data necessary for estimating the number of workers we would have to recruit, the material with which they have to be provided, the number of forms which would have to be printed and so forth. Moreover, we did not have a list of all the population agglomerations (towns, villages and other settlements) in Yemen, and this wasnecessary so that the enumerators could cover them. In order to solve this problem, we made a comprehensive administrative survey, in the course of which teams toured all parts of Yemen in accordance with a set plan and time schedule. These teams were able to prepare a list of all population agglomerations and their administrative dependencies and to collect data on each, such as estimates of the number of buildings and inhabitants the types of roads leading to them and other essential information. These data helped in the preparation of a sound plan for the execution of the counting stage and the procurement of all the necessary material for its execution.

II. Difficulties arising from the country's natural geography and climatic conditions

There is great disparity in the country's climatic conditions, and this made it difficult to determine the time period for making the population census. For almost every region there was

a specific time of the year that was suitable for the census operation there but not elsewhere. As a result of the studies which we carried out, we found that February was the only month that was climatically suitable for carrying out the counting operation in most parts of Yemen, although not in all. Although it was difficult at that time of the year to give enumerators sufficient preparation, February was chosen as the only solution. Moreover, this time of year does not fall within any specific agricultural season, and, consequently, we anticipated that most of the population would then be in their customary places of residence. Secondary schools and the university were selected as the sole source of the manpower required for the execution, and, since the month selected did not fall within a school vacation period, it was necessary to close the schools and the university through the census period. There was, in fact, another difficulty relating to the timing of the census, namely, that our choice of February as a suitable data for the census still left with the problem of determining the year for its execution. We had before us two alternatives only.

The first alternative was to choose February 1975 as the census month, which would make the preparatory period relatively short .

The second alternative was to choose February 1976 as the census month, but this conflicted with the State's urgent need for population data in the light of which it could draw up the development plan due to begin in 1976/77. The first altenative was chosen, on the basis of the reasoning that it would be possible to redouble efforts and make sacrifices during the preparatory period in order to gain a year's time and ensure utilization of the census results in development planning.

III. The lack of scientific skills and expertise in the field of census - taking and its requirements

The first step taken by the Central Planning Organization to overcome this obstacle was to send a number of employees for training in census work abroad.They received a minimum of theoretical knowledge, which was reinforced by practical experience and the foreign expertise provided by the UN Fund for Population Activities.

IV. Difficulty of transport

The problem of transport resided not only in the lack of a road network connecting all population agglomerations but also in the difficulty of procuring a sufficient quantity of means of transport in the areas suitable for travel by car.

Our experiment in the large-scale use of animal transport for the enumerators was successful, considering the magnitude of the problem. Moreover, the support which we received from the competent Government agencies, which helped us to mobilize sufficient numbers cars from the private sector, was a model worthy of emulation.

V. Difficulty of communications

The radio station was used by the Central Census Office for transmitting instructions to and communicating with the leaders of the workers in the field through a special programme broadcast twice a day, while, by virtue of a special decree issued by the President of the Council of Ministers, all field workers were given the right to free use of all communication facilities belonging to civil and military authorities alike. This arrangement enabled both the Central Office and the census field workers to make the necessary comunications at all times.

VI. The psychology of the population

The information campaign conducted prior to and during the field work was the decisive factor in attracting the attention of citizens and ensuring their co - operation with the census workers. The campaign was carried out according to a time schedule, and its execution lasted one whole year. Its most important components were as follows :

1. The imams of mosques were instructed to devote a portion of their Friday sermons to inculcating awareness in citizens and preparing them psychologically to accept the census operation;

2. A large number of cars were equipped with loud-speakers, and these cars toured the towns and villages broadcasting national slogans and anthem;

3. Coloured pamphlets and posters were printed and distributed widely throughout all parts of the country, and a large number of placards were posted in all Yemeni towns;

4. The radio station participated in the execution of the goals of the information plan through a variety of programmes and items;

5. The press played a considerable role in inculcating awareness in citizens through the publication of appropriate articles and interviews;

6. The State regarded the day of the commencement of work on the field count as a holiday for State departments.

Conclusion

Ever since the idea of conducting a general population census in Yemen was still a dream in men's minds and up untill the completion of the field work, many people believed that the conduct of a population census in Yemen lay more in the realm of the impossible than in that of the possible. This belief was strong among those who had a reasonable degree of knowledge of the nature of population censuses, the efforts required for their preparation and the material potentials needed for their execution.

Nevertheless, sound scientific planning, based on a knowledge of the realities of life on a thorough study of all considerations, both great and small, enabled us to overcome all difficulties. Our success in conducting the census confirmed an indisputable fact, namely, that any work plan must be based on the reality from which it originally emanates and to which it is ultimately applied. Just as the aloe plant adapts so as to be able to live in the driest of climates, so we adapted to reality and were thus able to carry out the first successful housing and population census in the history of the YemenArab Republic.

THE DEMOGRAPHIC SITUATION IN THE KINGDOM OF SAUDI ARABIA*

by

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Introduction

Population figures for the Kingdom of Saudi Arabia were a field of conjecture open to many differing estimates due to the lack of statistics based on an actual census of the population. However, the population census carried out in September 1974, of which the recently published results will be discussed below, finally put an end to these conjectures. The Kingdom of Saudi Arabia is considered to be among those Arab countries which still lack precise demographic data on population growth, birth, mortality and fertility rates etc., even though in recent years it has witnessed a number of studies and research projects aimed at providing the fundamental statistical indicators needed for socio-economic development plans. We are all hoping that further efforts will be made in this field of study and research now that the basic fromework for their implementation (ie. the actual size of the population) has been established.

1. The Size of the Population

From the preliminary results of the census it appears that population of Saudi Arabia is 7,012,642 in accordance with the following table which shows the population distribution over 14 administrative areas.

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* Meeting document E/ECWA/POP/WG. 5/14.

Table 1. Population of Saudi Arabia by Administrative Area

Administrative Area	No. of Demographic Units	No. of Families	Population		
			Sedentary	Nomadic	Total
Riyadh	1 992	198 936	965 805	306 470	1 272 275
Mecca	4 088	325 789	1 513 634	240 474	1 754 108
Eastern Province	667	120 684	690 188	79 460	769 648
Asir	4 597	127 131	434 884	246 477	681 361
Medina	1 742	98 835	282 195	237 099	519 294
Jizan	4 537	85 483	387 161	15 945	403 106
Qaseem	509	48 724	215 447	101 193	316 640
Hail	540	45 338	117 210	142 719	259 929
Tabouk	472	33 642	105 388	88 375	193 763
Al-Baha	1 296	34 323	156 997	28 908	185 905
Najran	242	26 569	91 555	56 415	147 970
Northern Frontiers	130	19 345	42 666	86 079	128 745
Jauf	85	10 243	34 093	31 401	65 494
Qurayyat	98	5 873	18 432	12 972	31 404
Frontier Nomads	—	30 000	—	210 000	210 000
Saudis resident abroad at time of census	—	—	73 000	—	73 000
Total	20 995	1 210 915	5 128 655	1 883 987	7 012 642

Demographic Units : consisting of towns, villages, settlements, farms, water wells and nomad agglomerations.

The following table shows the principal towns with a population in excess of 30,000. These 16 towns account for 39 per cent of the population.

Table 2. Principal Towns in Saudi Arabia with a Population of over 30,000

In Order of Population Size

Town	Administrative Area	Number of Families	Population
Riyadh	Riyadh	101 506	666 840
Jidda	Mecca	97 363	561 104
Mecca	Mecca	67 947	366 801
Taif	Mecca	30 877	204 857
Medina	Medina	35 390	198 186
Dammam	Eastern Province	21 513	127 844
Hofuf	Eastern Province	14 551	101 271
Tabouk	Northern Province	10 696	74 825
Buraida	Qaseem	8 774	69 940
Mubarraz	Eastern Province	7 775	54 325
Khamis Mushait	Asir	8 142	49 581
Khobar	Eastern Province	9 023	48 817
Najran	Najran	9 149	47 501
Hail	Hail	6 065	40 502
Jizan	Jizan	5 648	32 812
Abha	Asir	5 413	30 150

The remainder of the population is distributed over approximately 20 980 demographic units and, taking into account that the area of Saudi Arabia is estimated at around 2¼ million square kilometres, the population density is no more than 3 persons per square kilometre. However, large areas of the Kingdom, such as the Rub al Khali desert, are uninhabited thus increasing the population density in the inhabited areas.

An important data requirement was to determine the nomadic population and the preliminary census returns did in fact show that the proportion of nomads represents 25 per cent of the total population.

Vital Statistics

As in the case of other Arab States, Saudi Arabia has also established a civil registration system for the recording of vital events such as births and deaths under the terms of a law promulgated in 1962. Registration is, however, limited to cases occurring in hospitals and a certain number of other maternity cases in the main towns where the population is aware of the importance of birth registration in facilitating the admission of their children to the schools. With regard to deaths only a very small proportion are registered since there are no formalities requiring the issue of a death certificate prior to interment except in certain of the principal towns of the Western Region as Jidda, Mecca and Medina where, in the interests of public health and for the safety and protection of the pilgrims, health regulations do not permit interment until the relevant permit has been issued. In spite of this, however, no analysis has yet been made of mortality rates in these towns.

At the present moment the Ministry of Health is looking after the registration of births and deaths but it is intended to set up a Directorate of Civil Status attached to the Ministry of the Interior (Office of the Deputy Minister of the Interior for Passports and Civil Status) and will then assume responsibility for the registration of all civil events such as births, marriages and divorces.

Demographic Studies

Faced with the incompleteness of available records of births and deaths the Central Department of Statistics felt that it was necessary to undertake a demographic field sample survey during the period 1972-73. A sample of 10,000 families was chosen, distributed over the urban, rural and nomadic sectors in accordance with rough estimates of the proportion of each of these sectors to the total population of Saudi Arabia since, at that time, no com - prehensive census was available. Statistical data was collected over a full year during which four visits were arranged to the urban and rural families included in the sample. The first visit was to gather basic information on the structureof the family chosen for the sample while the three subsequent visits at four-monthly intervals were to determine and record any instances of birth, death, marriage or divorce occurring since the previous visits. The purpose of this was to overcome the problem of the family's overlooking certain vital events should only one visit be made during the year. A single visit was, however, inevitable in the case of the nomads due to the imposibility of following them or tracing their whereabouts. For this reason visits to the nomadic families were made once only at the end of the year when they were asked about vital events that had occurred during the past year.

The results obtained are currently being analysed and the preliminary results appear to show that the birth rate is in the range of 46-47 per thousand while the same results show that the death rate is extremely low, in the range of 9 per thousand. This signifies deficient report- ing of instances of mortality due to the families' failure to report accurately all of death, in particular among infants who are born and die in the interval between two visits.

Now that the census has provided a comprehensive demographic framework, the Department intends to select an appropriate sample and to resolve the problems which it faced in the first survey, at the same time including details on immigration into Saudi Arabia from abroad.

Population Growth

As indicated above, no precise figures are available for birth and death rates in the Kingdom but, taking into consideration the improvement in health services which has led to a reduction in the death rate and an increase in the fertility rate due to the absence of regulations or programmes aimed at birth control, and based on the pattern set by certain Arab States, we would expect the birth rate to be in the rage of 48 - 50 per thousand with a death rate of 18-20 per thousand. The rate of natural increase would thus be around 2.8 - 3.0 per cent annually. Since Saudi Arabia attracts alarge amount of manpower from a number of Arab countries, immigration is running at a highlevel and may bring the population growth rate to 4.0 per cent annually, thus giving rise to an expected rapid increase in the population. It is, in fact, anticipated that the Kingdom's population will reach around 10 million in 1985 and 12-13 million by 1990.

Demographic Problems

Saudi Arabia is endowed with large economic resources and a vast territorial area. It does not, therefore, have to face the problem of overpopulation or the so-called ' population explosion ' which is being faced by most of the developing countries. On the contrary, the wide scope of the development plan and of the progress being made in the country, together with the provision of social services for the population and the distribution of economic resources definitely requires greater human resources to accelerate development. Hence, the Saudi Arabian Government considers that family planning or birth control is a matter for personal discretion which it neither forbids nor encourages. Means of contraception are available on request in all the pharmacies and drug stores. Health care programmes, in particular those concerned with mother and child care, take into consideration the effect of pregnancy on the health of the mother if her general state of health is such as to require the prevention of pregnancy. There is also a strong belief in the close relationship between development, with its concomitant spread of education and popular awareness and the employment of women in appropriate fields of work, and a lowering of fertility. This does not mean, however, that Saudi Arabia is facing no demographic problems whatsoever. On the contrary, it shares certain other demographic problems with sister Arab States, for instance the rapid internal migration from the countryside to the city with all the resultant housing problems in the cities, especially when this migration is accompanied by high immigration from abroad, as is in fact happening, together with other problems such as the ability to develop rural areas which, in turn, are facing the problem of population dispersal which makes the provision of services a difficult and expensive matter especially when compounded with a scarcity of trained manpower to provide these services. This has led the Government to give serious thought to the question of establishing schemes and projects aimed at grouping the population in the small villages and settling the nomads so that services can more easily be made available to them, thus giving added impetus to socio-economic department.

REPORT ON THE SITUATION OF THE PALESTINIAN ARAB CHILDREN AND YOUTH AND THE GENERAL CONCEPT OF NATIONAL ACTION*

by

The Palestine Liberation Organization

The first part of this report describes briefly various aspects of the situation of Palestinian children and youth and attempts to define the problems and difficulties facing the Palestine Liberation Organization in its task of serving the Palestinian people and mobilizing them to achieve the liberation of all Palestinian land and build a new society.

The second part of the report illustrates the Palestinian concept of the role of children and youth (up to age 18) within the Palestinian National Development Plan.

The compilation of such a far reaching report is rather a utopian endeavour in view of the difficulties of the Palestinian situation brought about by occupation, uprooting, dispersion and repression which are far from conducive to the provision of accurate data and statistics or favourable to the formulation of a comprehensive and coherent plan. The main aim, therefore, of this report is to define an order of magnitude for the social tasks confronting the Palestinian masses and the Liberation Organization and assist this Organization to formulate an over-all concept of its tasks. This concept would then enable it to mobilize all its resources to achieve these objectives, relying for support on all the sister Arab countries and other friendly states and on the response of international organizations as a reflection of official international recognition of the Liberation Organization as the sole legitimate representative of the Palestinian Arab People.

Part I : The Situation of Palestinian Arab Children and Youth

Section One — Socio-Historical Preface

1. The catastrophe of 1948 was not merely an uprooting from the natural environment of the homeland. It also represented the shattering of both individual and collective aspirations in the political and social fields. Shortly before 1948 Palestinian Arab society had begun to make rapid progress in its economic and cultural development in the hope of achieving an independence for Palestine similar to that which it had seen attained by neighbouring Arab countries. Suddenly the dream collapsed and part of this society became refugees seeking shelter, food and work in neighbouring Arab countries although intent on returning to their homes. Others remained under Zionist occupation only to suffer from the same feeling of uprootedness within their homeland since they were not allowed to return to their original villages and towns and thus continued to suffer constant persecution. Others living in Gaza and the West

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* Meeting document E/ECWA/POP/WG.5/15.

Bank were deprived of most of their fertile land lying within the Zionist state. The working masses of these areas suffered a noticeable drop in their living standards as a result of the influx of refugees and the consequent rise in unemployment and drop in wage rates.

2. When UNRWA was established in 1950 the number of refugees was 940,000 1/ . This agency, however, adopted the policy of only registering destitute Palestinians and by 1951 around 856,000 destitute persons had been recorded as follows :

Both banks of the Jordan	465,000
Gaza Strip	200,000
Lebanon	107,000
Syria	83,000

The care of 10,000 persons in Egypt and 5,000 in Iraq was left as the responsibility of the local authorities.

3. The United Nations Relief and Works Agency for Palestinian Refugees in the Near East (UNRWA) was established in accordance with General Assembly Resolution 302 in December 1949. As is apparent from its title the purpose of the Agency is to assist the refugees and organize their rehabilitation. This latter aspect was UNRWA's main object of concern in the early stages due to the insistence of the imperialist states, which were both financing the agency and exercising general hegemony over the United Nations at that time, on financing agricultural projects in the Arab States aimed at a definitive settlement of Palestinians. The Palestinian people, however, rejected this settlement on principle and insisted on a return to their homes in accordance with the United Nations resolutions. With the failure of this settlement scheme UNRWA restricted its activities to the relief aspect although retaining its provisional title. For the past twenty years it has existed in an atmosphere of unhurried activity and scarcity of resources. Education provided by UNRWA is of tangible benefit to the Palestinians whereas its other limited services hardly provide the minimum requirements of life by way of nourishment and health care.

4. The Palestinians have had to live with a severe lack of material resources due to the poverty in the Gaza Strip and Jordan and the refusal of the Lebanese Authorities to grant Palestinians the same rights as their nationals in the field of employment such as were given to them in other Arab States. Living standards were improved to a certain extent through the discovery of petroleum in the states of the Arabian Peninsula and their need for trained man-power. Thousands of young Palestinians went to work in those regions primarily as teachers. This demand for trained manpower was an added incentive to the Palestinian Arab people's determination to educate its children. Provision of university education for the rising genera-

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1 / U.N. Annual Report of the Director of the UNRWA, 1953 (A/2470). P.5.

tion came to be of greater importance than clothing as a means of ensuring a brighter future since, in the absence of financial capital, a university degree became the effective capital needed to provide for the needs of both the large and the small family.

5. The individual and collective aspirations of the Palestinian Arab people remained centered on a return to their homes. With this end in view the people resisted the evolution of the Zionist State after 1948, as they opposed the settlement schemes, and finally took up arms in 1965 to liberate their land. Imperialism and Zionism persistently tried to impose a 'fait accompli' and negate the Palestinian presence.The military defeat of the Arabs in 1967 war was used by the Zionist as an excuse for the expulsion of hundreds of thousands of Arabs whom they refused to readmit into Palestine. 2/ New camps of despair appeared in Jordan, many of their inmates being refugees for the second time. Yet this defeat was a further incentive to the Arabs and especially the Palestinians to escalate the struggle to liberate the Arab territories and set up a democratic Palestine. To this end, all the resources of the Palestinian Arab people are being mobilized both within and outside the occupied territories where they are willingly making sacrifices in the face of repression and intimidation.

Section Two : Demographic Data on the Palestinian Arab People

1. In 1948 the Palestinian Arab people totalled 1,400,000 persons. In 1970 their number was privately assessed at 3,060,000. By comparing estimates made by the statistical departments of both Jordan and Syria it can be seen that the average annual natural poulation increase for 1960-1970 was 36 per thousand. We do not expect any significant change in this rate in view of present social concepts and relationships within Palestinian society. The anticipated population growth of the Palestinian Arab people is therefore as follows :

1970	3,060,000
1975	3,624,000
1980	4,283,000
1985	4,962,000

2. This natural population growth rate of 36 per thousand implies the preponderance of child and youth elements in the human structure of the Palestinian Arab people. It can be inferred from the demographic status of the Palestinians in the general population census taken in

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2/ According to Jordan Government estimates around 400,000 Palestinian refugees had crossed over to the East Bank of the Jordan by June 1968. See the Jordanian newspaper ' Al Dastour ' 17 June 1968.

Syria in 1970 3/ that the basic age group distribution is similar to that in the corrected Jordanian deductions based on the results of the general census of 1961 (Table I).

Table I - Basic Age Group Distribution of the Palestinian Arab People

Age Group	Syria 1970	Jordan 1961
0 — 14	49.4 %	49.4 %
15 — 59	45.3 %	45.4 %
60 and above	5.3 %	5.2 %

The Syrian census is the more accurate since the Palestinian agglomerations there lend themselves more readily to enumeration and this census will therefore be used to define the proportions and magnitude of Palestinian age groups (Table II). This table gives a good idea of the magnitude of the burdens placed on the PLO in its endeavours to give political and social guidance to the Palestinian Arab people. The age group 0 - 14 represents around half of the population while children under 6 years of age make up 35.2 per cent of the total.

Tables II - Proportions and Magnitude of Palestinian Age Group Distribution, 1970.

Age Group	Percentage	Number
0 — 4	17.9	547 000
5 — 9	17.3	528 000
10 — 14	14.2	434 000
15 — 19	10.4	317 000
20 — 24	7.7	236 000
25 — 29	6.7	204 000
30 — 34	5.5	168 000
35 — 39	4.5	138 000
40 — 44	3.5	107 000
45 — 49	3.1	95 000
50 — 54	2.2	67 000
55 — 59	1.9	58 000
60 and above	5.3	161 000
	100.00	3 060 000

3. The problem is aggravated by the dispersion of the Palestinian Arab people (Table III).

3/ Syria. Central Bureau of Statistics : **General Population Census, 1970.**

Table III - Distribution of Palestinians in Various Regions, 1970 4 /

Jordan	925 000
West Bank	680 000
Gaza	365 000
Territory Occupied in 1948	370 000
Lebanon	250 000
Syria	157 000
Kuwait	148 000
Egypt	35 000
Saudi Arabia	30 000
Iraq	25 000
Arabian Gulf States	15 000
Algeria	5 000
Libya	5 000
United States	25 000
Other countries	25 000
	3 060 000

It can be seen from this table that the number of Palestinians in occupied territory is 1,415,000 persons with 1,392,000 in the traditional Arab host countries and 203,000 in the Arab oil producing states including Algeria. The total given, however, does not include Palestinian emigrants to the Americas prior to 1948.

4. A passing reference to the Palestinian demographic situation in Kuwait may be of interest as a reflection of the search for employment and an indication of the number of families who joined those working there after the fall of the West Bank and Gaza in 1967. The Kuwait population census of 1965 shows the number of Palestinians and Jordanians as 77,712 with the age group 0 - 14 representing 35.4 per cent of the population. It should be pointed out that the great majority of Jordanians in Kuwait are Palestinians. In the 1970 census the Palestinians and Jordanians numbered 147,699 persons of which 50.4 per cent were in the 0 - 14 age group. The proportion of children under the age of 15 is therefore higher than their proportion in relation to the total population of the Palestinian Arab people.

4 / These estimates are based on internal studies undertaken by the Palestinian Research and Planning Centre. Official Arab figures were adopted with the addition of Palestinians not registered as refugees in States such as Lebanon, Egypt and Iraq.

Section There - Housing Situation and Living Standards

1. On mention of the housing situation and living standards the name of UNRWA springs to mind as the Agency responsible for assisting the Palestinian refugees. In this regard we would like to clarify the following points :

(a) As already noted UNRWA did not register all the refugees either in 1948 or 1967 but persistently endeavoured to drop from their records the names of those who had found work through the Agency's employment office or who were receiving the minimal regular income stipulated in UNRWA's regulations. Furthermore, some of those whose circumstances had improved did not bother to register their children with the Agency. In general, however, it may be said that all destitute Palestinian refugees are included in the figure of 1,583,646 persons registered with UNRWA in the second part of 1974. 5 /

(b) UNRWA is providing subsistence for only 830,000 persons. The total cost per capita of such aid is less than 3 dollars per month which represents a daily nutritional value of, at best, 1600 calories.

(c) Due to the increasing number of students arising from the high rate of natural population growth there has been an increase in the budgetary allocations for education. The increase was partly due to the rising market prices of various commodities and the increase in wage rates. The proportion of the general budget allocated to education increased from 42.6 per cent in 1970 to 47.5 per cent in 1973. This does not imply an improvement in the educational standard, however, since the budget is restricted to recurrent regular expenditure. On the contrary, there was a noticeable lowering of the educational standard as a result of abandoning the expansion policy aimed at leasing or building additional premises for new schools or classrooms and omitting to provide certain facilities. This situation will be further elaborated in the section on the educational situation.

2. UNRWA's name is also associated with the supervision of the refugee camps. Camps officially recognized by the Agency receive additional benefits by way of housing, general services, health and the extra meal for children. Dwellings have been constructed to fixed specifications and damaged zinc sheeting replaced. The distribution of camps among the various countries and their population is shown in Table IV.

5/ UN. Report of the Commissioner-General of the UNRWA, 1974 (A/9613), P. 62.

Table IV - Number and Population of Palestinian Refugee Camps in Different Areas, 1974 6/

Country	Population of Camps	Number of Camps
Jordan	211 122	10
West Bank	73 736	20
Gaza	195 216	8
Lebanon	97 111	15
Syria	51 352	10
	628 537	63

This number represents approximately 40 per cent of all Palestinians registered with UNRWA and 18 per cent of the Palestinian Arab people. The UNRWA figures, however, are not completely accurate since they do not include all the inhabitants of the camps. It often happens that the names of Palestinians moving into a camp from outside are not transferred by the Agency onto the camp records, as a result of which they remain registered in their previous areas. This is apparent from the number of students receiving primary education and which gives an indication of the true size of the population. It can also be inferred from surveys of the camps in Lebanon that the population of these exceeds 115,000 persons.

The housing situation in the camps has been described by one observer 7/ as follows : " Housing units in the camp are crowded together in compact lines with no more than one metre separating one from the other. Some of them are enclosed with a wall crudely constructed by the refugee himself of tin sheeting, sack cloth brick or cement blocks to ensure a minimum of privacy, albeit psychological, while others are left unfenced. The roads leading to these houses are muddy in winter with streams of dirty water running down the middle from the doors of the houses due to the lack of a proper underground sewage system ".

3. The Lebanese Ministry of Planning made a study in 1971 of the housing situation in the camps in Lebanon. The first part of this study is of relevance to our present theme. It records number of houses in 15 camps recognized by UNRWA and 5 others unrecognized by UNRWA as 16,55. Of these 34.1 per cent are less than $30m^2$ in area and accommodate an average of 4.1 persons per room. 56.6 per cent of the houses have an area of $30\text{-}80m^2$ with an average room occupancy of 3.7 persons. It should be pointed out in this context that the population

6 / UNRWA : Annual Report of the Director of Health, 1974, P. 58.

7 / M. Yaghi. **Life : Refugee problems in the Jordanian camps as seen by their children in the UNRWA training centre in Amman.** M.A. Thesis, Abridged version issued by Palestinian Planning Centre, Beirut, 1975. p. 44.

census that accompanied the housing census was not completely correct since it is seen from the Syrian census that the average size of the Palestinian family is 5.9 persons which implies an understatement of the two previous figures.

The proportion of houses consisting of one or two rooms is 79.2 per cent accommodating 70.4 per cent of the population. Houses with 3 or more rooms do not provide a greater degree of comfort since most of them accommodate two or more families. The following table (Table V) gives an idea of the situation regarding house amenities and facilities.

Table V - Proportionate Availability of Housing Amenities in the Camps in Lebanon, 1971.

Amenity	Proportion of Houses Containing Amenity
Kitchen	81.8 %
Bath	11.8 %
Toilet*	39.3 %
Electricity	66.6 %
Running Water	40.0 %
Telephone	0.1 %
Ordinary Heating	58.0 %

* 40.7 per cent of other houses share communal toilets.

4. The Palestinian camps exhibit two patterns of population increase. The first pattern is a natural one arising from natural population increase with married children remaining near their family in the camp to take advantage of the free housing and availability of services, in particular education and health. Since most of the camp inhabitants are of rural origin they have remained a close knit community within their new habitat, dividing the camps into sections named after their original villages. This polarisation of families and clans is a reassuring factor for individuals and also encourages the development of the second pattern of population increase in the camps as a result of refugees from the same Palestinian village joining their kinfolk in one particular camp. The population of the camps increased from 305,000 persons in 1955 representing 33.6 per cent of the Palestinians registered with UNRWA to 533,000 in May 1967 representing 39.6 per cent of those registered.

5. As a consequence of the uprooting, a change took place in the structure of Palestinian labour force (Table VI).

Table VI - Distribution of the Palestinian Labour Force in the Three Principal Economic Sectors.

	1945	1970
Agriculture, Fishing, Forestry	50 %	30 %
Industry and the Professions	6 %	20 %
Services and Construction	44 %	50 %

In spite of the growth of the labour force in the industrial and professional sector the basic feature is that of work in the employ of others and the lack of appropriate professional specialization with no scope for adequate professional training for the rising generation. This distribution of the labour force is a result of the geo-demographic situation of the Palestinians outside the occupied territories where they are concentrated in or near the main towns.

If we take the UNRWA statistics as a standard norm, since they cover the Palestinian working class, we find that according to Table VII most of the Palestinians in Jordan and Syria are to be found in Amman and Damascus. Although the official proportion of Palestinians in the camps in Beirut is low the actual proportion is much higher due to UNRWA's omitting to transfer the names of Palestinians to their actual areas of domicile in conformity with the official Lebanese policy of discouraging the drift to the capital and constantly thinking of ways to transfer the camps from Beirut to other areas.

Table VII - Proportion of Palestinians registered with UNRWA in the vicinity of the Arab Capitals.

Amman	70.8 %
Beirut and its neighbourhood	38.0 %
Damascus	77.0 %

Section Four - The Health Situation

1. The increasing birth and decreasing mortality rates among the Palestinian people is a result of the availability of a minimum of health care and also of family solidarity in matters of medical treatment. The geographical concentration of the Palestinians near to the principal towns also contributed to this situation. It was an easy matter for UNRWA or the Palestinian Red Crescent to open clinics and make use of the medical services available in these towns. The spread of education from the late 50s onwards also helped to raise the cultural level of Palestinian Arab society even though the conditions of poverty and the low general health level in the camp do not permit an improvement in health standards.

2. It can be inferred from UNRWA statistics 8/ that most of the prevalent illnesses (chicken pox, conjunctivitis, diarrhea, dysentery, influenza) are due to the bad living conditions of the population, poor general sanitation and malnutrition. Open sewers and cesspits and communal toilets in the middle of the camps are a source of disease while the crowded living conditions and high room occupancy rate are conducive to the spread of epidemics. " As a result of low income and increasing poverty the people are obliged to eat whatever food they can get to fill their bellies regardless of quality or nutritional value " 9/ .

Of the contagious diseases the most prevalent are caused by intestinal parasites from which one child in five is suffering.

3. UNRWA has instituted a system of therapeutic and preventive medicine which has helped to improve health conditions. However, the problems inherent in the perpetual lack of material resources and rising labour costs due to the increasing cost of living have forced UNRWA to either freeze or reduce the level of services in spite of the growing needs of an increased number of Palestinians registered with it. UNRWA's preventive medicine campaign is facing another problem in the lack of public response due to administrative deficiencies in the system and the discouragement of public participation. This negative attitude on the part of the Palestinian masses springs from the marked bureaucratic nature of their relationship with UNRWA and their mistrust of its objectives which have always been oriented towards settlement of the refugees.

4. The Palestinian Red Crescent and other Palestinian medical organizations have taken it upon themselves to serve the public in all the countries where the PLO is allowed to operate but, in view of their limited material resources and main preoccupation with the treatment of those wonded in battle, they are unable to offer additional health servies to the public. On many occasions however, they have been able to provide substantial help and assistance. The Palestinian Red Crescent has learned by experience that the best way to serve the public is thorough application of preventive medicine techniques based on popular awareness and public participation. A campaign of this nature has been initiated through the establishment of a maternity and child welfare centre in Lebanon.

Section Five - The Educational Situation

1. In spite of the political division of Palestine and the expulsion of most of its population, the Palestinians continued to make progress in the field of learning and were able to be of service both to their own people and to the Arab World in general. This extraordinary progress can be attributed to several factors 10/ :

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8 / Previous source. p. 7 UNRWA : Annual Report.

9/ D. Husni : **Report on Health Conditions in the Camps, 1975 -** Palestinian Red Crescent Society and the Planning Centre. p. 1.

10 / The following details are taken from a study made by Dr. Ibrahim Abu Lughud on **problems of Palestinian education** by the Planning Centre in 1972.

a) The undeniable fact that the Arab World, in the midst of which the Palestinians are living, opened the doors of its educational institutions to the Palestinians and since the Arab World was expanding its educational services, the Palestinians were able to profit from this positive step.

b) The translocation imposed by the catastrophe led to a larger number of Palestinians living in urban areas. Consequently there was a significant swing in population ratio away from the rural towards the urban areas which could offer more and better educational opportunities and services.

c) Deprived of their natural institutions and of freedom of choice regarding their life style the Palestinians began to look on education as the best means of preserving their dignity and ensuring their social and economic progress.

d) The normal options open to a stable society (leading to schools drop outs and the suspension of further education) were not available to most Palestinians. This was an incentive for them to remain in school for the longest possible time to obtain the highest possible qualifications. In other words, the negative effect of the lack of options, which would otherwise be an incentive to leave school, together with the positive reward provided by education by way of better opportunities and the competitive nature of the Arab market combined to produce large numbers of highly educated Palestinians.

Table VIII shows the numerical increase of pre-university students and we find that the proportion of students to total population rose from 9.2 per cent in 1947-48 to 20 per cent in 1969-70.

Thble VIII. Increase in Number of Pre-University Students in Proportion to the Palestinian Arab Population, 1947-48 to 1969-70.

Year	Palestinian Population	Students	Percentage
1947—48	1350000	125000	9.2%
1969—70	3000000	600000	20.0%

2. In spite of the difficulty involved in obtaining accurate figures it is nonethless possible to arrive at reasonable estimates and show general trends in Palestinian education. Out of a total population of three million Palestinians in 1970 there were 600,000 students (round number of those registered at the preuniversity level) in the academic year 1969-70 (Table IX). UNRWA is educating a little more than half of this number although the education provided by the Agency is limited to the preliminary and preparatory levels. The remaining students are studying in various Arab countries.

Table IX : Distribution of Palestinians by Education Authority, 1969-70.

UNRWA (Both banks of Jordan, Lebanon, Gaza Strip)	310 687
Both Banks of Jordan	239 801
Kuwait	23 041
Syria	11 055
Lebanon	8 514
Saudi Arabia	4 801
Qatar	2 101
	600 000

The distribution of these students by educational level is as follows : - 71.9 per cent at primary level; 28.05 per cent at preparatory and secondary level (TableX).

Table X : Distribution of Palestinians by Educational Level, 1969 — 70

Educational Level	Students		Proportion of students to Population
	No.	Percentage	
Primary	431 718	71.95%	144 per thousand
Preparatory and Secondary	168 282	28.05%	56 per thousand
	600 000	100.00	

3. The proportion of primary students to their age group is 85 per cent in the UNRWA schools and 100 per cent among Palestinians in Kuwait and the Arabian Gulf. This disparity arises from the difference in social conditions since in the camps there are indications that students are still dropping out of the upper primary grades. In the academic year 1973-74 11/ the proportion of students at age 11 in UNRWA schools in relation to their age group was 77.6 per cent for females and 81.1 per cent for males. The female proportion does not denote any significant lagging behind but is rather a clear indication of the increased proportion of girls attending schools. The trend is towards numerical equality of males and females at the primary level. The drop out rate at the preparatory level is much lower but further efforts are still required in order to ensure compulsory education to the end of this level. Table XI gives us

11/ UNRWA : Department of Education Statistical Yearbook, 1973-1974.

an idea of the proportion attending preparatory school by taking age 12-14 as the most representative age of students in the three preparatory grades.

Table XI - Proportion of Students aged 12-14 years attending UNRWA Schools, 1973 - 74

Age	Proportion	
	Males	Females
12	79.5	71.8
13	74.0	62.5
14	65.9	55.8

In spite of the low proportion of females at this level it becomes clear from a historical comparison that their proportion in relation to males has increased very notably from 27.5 per cent in the academic year 1960 - 61 to 44.8 per cent in 1973 - 74 12/ . This growing tendency among girls to remain in school is reflected in their proportion at the secondary level which was around 40 per cent of students in public schools and 49 per cent in Gaza. Only in Lebanon, where there is an insufficient number of public schools and where Palestinian attendance is restricted, does the proportion of girls at secondary level attending both public and private schools drop to 27.4 per cent. It might be noted that the total number of Palestinian students at secondary level in Lebanon is less than their total in Syria even though the number of Palestinians there is less than in Lebanon (see Table III). This disparity arises from the fact that in Syria public education is universal and open to all Palestinian secondary students. In Lebanon Palestinian girls are more prone than their brothers to drop out of school in view of their families' greater willingness to bear the expense of a son's education as a material guarantee of his future which, at the same time, is also a guarantee for the future of the family as a whole.

4. With the occupation of the West Bank and Gaza a new phenomenon appeared in the form of students dropping out of school in those areas. We will use the UNRWA figures for the Gaza Strip as a basis since, with Palestinian refugees forming the majority of the population in the Gaza Strip, the UNRWA schools there take in all the refugee students at primary and preparatory level. While we find an increase of 31 per cent in the number of primary students between the academic years 1968-69 and 1973-74 there is a corresponding decrease of 8 per

12/ **Ibid.** p. 22.

cent over the same period in the number of students at preparatory level. The main reason for this drop out rate is the departure of young men aged 13 and over to work in the Zionist economy.

5. When referring to the extraordinary increase in Palestinian population in Kuwait we mentioned the appearance of several problems, chief of which was the educational requirements of the large number or new arrivals among students and children of school age. The PLO therefore obtained the agreement of the Government of Kuwait to the conversion of certain public schools into evening schools under the supervision of the Department of Educational and Cultural Affairs. The number of students in PLO schools in the academic year 1972-73 was 14,482. Subsequently the number began to decrease following a relaxation of the restrictions on attending public schools. The number of Palestinian students in all types of schools in Kuwait (PLO, public, national and and private) rose from 23,041 in 1969-70 to 47,445 in the academic year 1972-73.

6. Table IX shows the way in which Palestinian students are distributed between several educational philosophies. This situation is reflected in both their intellectual outlook and in the different values and attitude imported by their education, instead of theing oriented by a single educational system with uniform objectives geared to the fulfilment of the aspirations of the Palestinian Arab people. Palestinian society is also witnessing a drop in the standard of education provided by UNRWA as a result of the policy of financial austerity under which an ever increasing proportion of its schools operate on a double shift basis. These school lack even the minimum of basic school material and equipment such as laboratories and libraries. UNRWA is giving up all attempts to improve the situation on the plea of its financial crisis. The occupation authorities are at the same time following an indirect policy of hitting at Arab education and distorting the student's Arab identity through distortion of the school books and expulsion nationalist teachers and supervisors, replacing them with incompetent persons distinguished only by their submissiveness to the occupation authorities.

7. In addition to the PLO schools in Kuwait the Society for the Welfare of Families of Palestinian Martyrs and Freedom Fighters sponsors two schools for the children of martyrs, one of which is in Souk al Gharb in Lebanon and is operated by the Palestinian Women's Union under the name of the Greater Felicity School for Children. This school had 430 boarders in the academic year 1974-75. The other school, in Amman, bears the name of Bait Al-Maqdis (Jerusalem) and has 750 girl pupils. The Society also supports a kindergarten in the Baalbek camp in Lebanon.

The Society has begun construction of the first primary and preparatory schools in the township of ' Martyrs ' Children near the city of Damascus which will be completed during the course of a five year plan. Its financing will depend on aid which the Arab States intend to give to the Fund for the Assistance of the Families of Palestinian Martyrs and Detainees which was established during the ordinary session of the Arab League in April 1974. In its final stage the township will accommodate 9600 student boarders.

The project's education committee held a meeting in February 1975 during which the foundations were laid for the educational activities. Specialized committees were set up to establish educational curricula and programmes together with administrative regulations for the various schools and institutes.

8. The PLO is supporting some national schools in the occupied territories and encouraging the establishment of others to raise the educational level of the younger generation of Palestinians and preserve their Arab identity. The PLO is also providing financial backing for the expansion of both the University of Bir Zait and the young University of Bethlehem to ensure that university education is available to students in the occupied territories who would thus be more likely to remain there and hold out in the interest of the community. Both universities are endeavouring to expand their programmes in the interest of the Arab community with regard to programmes of social service and national heritage which normally go hand in hand with university education. They are also encouraging the students cultural activities as a stimulus for general cultural activity in the occupied territories. Consideration is currently being given to the foundation of vocational institutes and higher specialized institutes for medicine, engineering disciplines etc. to encourage as many students as possible to remain in the occupied territories to develop the Arab economy.

9. The use of leisure time presents a serious educational and social problem for Palestinian children and youth due to the lack of proper organization and development of extracurricular activities in and outside school. The Zionist State is attempting to channel the students' leisure time in such a way as to influence their conduct and political views by encouraging them to visit Israeli cities and make use of the recreational facilities there and drawing them into the orbit of the Zionist economy through employment either on a semi voluntary-recreational basis (the Kibbutzim) or as paid workers.

The Supreme Council for Youth Welfare of the PLO is endeavouring to organize leisure activity in Arab countries where the PLO is allowed to operate. Branch councils organize youth and scout clubs in affiliation to central bodies such as the Palestinian Scout and Guide Association. The permanent and summer camps of the clubs give ample scope for a sound and healthy upbrining. Within the occupied territories the Schools, institutes, universities and town councils are all striving to organize the leisure of young people and draw them into the various youth and scout clubs.

Past experience has shown the importance of building up specialized youth cadres for work among young people and of providing the essential inner and external material resources. The Palestinian revolution, for its part, realizes that youth leisure is as important a concern as formal education with regard to its ultimate social and educational benefit. Youth activities help to build the child's character, intensify his intellectual awareness, broaden his mind and inculcate more positive social attitudes and at the same time employ his full potential in the interests of both himself and the community.

10. The Liberation Organization and the national institutions have initiated a policy of setting up and supporting kindergartens in the context of a clearly defined pedagogical strategy instead of restricting themselves within the narrower confines of the routine activities of kindergartens and social work. The Palestinian Planning Centre has set up a special kindergarten section to develop teacher training methods and kindergarten programmes and organize pre and post assignment training courses for teachers.

The Centre has encouraged the General Union of Palestinian Women to take an interest in kindergartens and, consequence, this Union has set up four kindergartens in Lebanon and has plans to extend these activities into various other Arab countries. Some international unions are financing kindergartens in Gaza and the West Bank in co-ordination with UNRWA. Other associations are active in the kindergarten field such as the Association for Family Revitalization in Al-Bira (West Bank) which is running one kindergarten as well as supporting four other in rural areas. The Association for Camp Revitalization and the Ghassan Kanafani Foundation in Lebanon are both running three kindergartens.

DEMOGRAPHIC CONDITIONS ON THE WEST BANK

AFTER THE 1948 WAR*

by

The Palestine Liberation Organization

A) Demographic Conditions on the West Bank after the 1948 War :

Following the 1948 war the influx of a large number of Palestine refugees into the West Bank led to a sudden increase in population density. The number of persons per square kilometre of agricultural land on the West increased from 200 to 580 as a direct consequence of the foundation of the State of Israel 1/ . The West Bank, in fact, absorbed the largest number of Palestine refugees in spite of its being already among the most densely populated areas of Palestine and one of the poorest with regard to availability of natural resources and, in particular, agricultural land. As an aftermath of the war, economic and living conditions on the West Bank became very grim indeed due to the severing of the economic ties linking it with the rest of Palestine and to the new demographic situation arising from immigration. These new conditions were aggravated by the relative backwardness and low productivity of agriculture on the West Bank in comparison with other parts of Palestine. Around two thirds of the land on the West Bank was either uncultivated or unsuitable for agriculture as is shown in the following table.

Land on the West Bank, 1950 2/ . In Square Kilometres

Irrigated Land	23
Orchards (excluding citrus trees)	631
Unirrigated Agricultural Land	1 492
Uncultivated Land	3 103
Forests	273
Sites of Towns and Villages	33
Total	5 555

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* Meeting document E/ECWA/POP/WG.5/16.

1/ Assistance to Palestine Refugees : Report 07 Director, UNRWA, GAOR (VI) Suppl. No. 16 (A/1905)2.

2/ Jordan, Department of Public Statistics, **Statistical Yearbook, 1951.** No. 2. Table No. 45.

Postwar changes in provincial and district boundaries in those parts of Palestine that subsequently formed the West Bank and the lack of accurate statististical information make any assessment of the population of the West Bank a field of conjecture open to several varying estimates. The following table shows the population of the West Bank in both its old pre-war and new Post-war boundaries :

Size of the (Arab) Population of West Bank Districts

in their Pre and Post 1948 Boundaries 3/

District	Population within 1931	The Old Boundaries 1944 Estimates	New Boundaries (After the Catastrophe) 1944 Estimates
Hebron	65 487	89 570	87 400
Bethlehem	16 731	(	
Jerusalem	78 071	147 750	96 760
Jericho	3 085	(	
Ramallah	39 061	47 280	38 990
Tulkarm	45 646	71 240	67 940
Nablus	68 312	89 200	90 160
Jenin	41 406	56 880	55 720
Total	357 799	501 920	436 970

Most estimates of the West Bank population within the post war boundaries vary from 420,000 to 490,000.

If we take the figure of 436,970 as the population of the West Bank in the latter part of 1944 with a natural population growth rate over the same period of 2.5 per cent it can be deduced that the original population of the West Bank in May 1948 was approximately 475,400 which is close to other estimates of the West Bank population for that period 4/ .

In other words, around one third of the Arab population of Palestine was living on the West Bank at a time when the Bank constituted only one fifth (21.3 per cent) of the total

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3/ S. Hadawi, **Village Statistics, 1945;** O.L.O. Research Centre. Table I, **Census of Palestine 1931,** Vol. III. Table III.

4/ The International Bank for Reconstruction and Development estimates the population of the West Bank at the end of 1947 at around 460,000. Other sources estimate the West Bank population in 1948 at around 471,770. See IBRD, **The Economic Development of Jordan, 1956.** P. 3. Walter Pinner, **How Many Arab Regugees ?** London, 1959 p. 29.

area of Palestine. This is of importance considering that the West Bank was one of the poorest parts of Palestine in regard to fertile agricultural land and availability of water and also, at that time, one of the least industrially developed areas owing to the concentration of industry in the north of the country.

Emigration to the West Bank after the 1948 War :

Official sources estimate the Arab population of Palestine at the end of 1945 5/ at around 1,255,700 or from 1,332,200 to 1,348,600 in May 1948 on the assumption that the natural in - crease of the Palestinian people in that period varied between 2.5 and 3 per cent. Most sources give a figure of from 1,282,000 to 1,380,000 6 / for the number of Palestinians in mid 1948. Of these only 156,000 remained under Israeli occupation. If we add to these the population of the West Bank and Gaza which was not displaced by the Zionist occupation we can deduce that the number of Palestinians turned into refugees by the Zionist occupation in 1948 ranges from 615,000 to 635,000, taking into account that those not made homeless (although a consider- able number of these suffered the loss of their land and their jobs) amount to around 715,000 7 /

The greater part of the refugees went to the West Bank (around 43 per cent) and the East Bank (around 12 per cent) , most of the remainder going to Lebanon (15 per cent), the Gaza Strip (22 per cent) and Syria (9 percent) according to UNRWA'S estimates.

The UNRWA figures indicate that the majority of the refugees (54 per cent) who left for the East Bank settled around the town of Amman with the remainder establishing them- selves in the province of Irbid and in the campat Karameh. Those settling on the West Bank were distributed as follows 8 / .

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5 / **Statistical Abstract of Palestine 1944—45,** Jerusalem 1946, p. VII.

6 / See, for example, S. Hadawi, **Village Statistics, 1945,** PLO Research Centre 1970, p. 17. W. Pinner, **How Many Arab Refugees ?** London 1959, p. 27.

7 / The original population of Gaza in 1948 is estimated at around 85,000 (see Muhammad Ali Khalousi, **Economic Development in the Gaza Strip,** 1967. p. 5.) The UNRWA figures are in fact, inaccurate as can be seen from the fluctuations in the years following the Israeli occupation in 1948. UNRWA estimated the number of Palestine refugees in the early part of 1949 at around 982,700 and this figure decreased to 829,654 at the start of 1951 and to 772,166 in 1953. This was due to both the absence of accurate statistics and the the vagueness of UNRWA's initial definition of the term ' refugee ' . See **UNRWA Statis - tistical Bulletin,** May 1950 June 1951. General Table No. 5.

8 / United Nations Assistance to Palestine Refugees. General Assembly, Paris 1951, suppl. No. 16 (A/1905).

Jericho District	12.7 %
Jerusalem District	8.5 %
Ramallah District	17.5 %
Nablus District	33.8 %
Bethlehem District	10.4 %
Hebron District	16.9 %

It can be inferred from the foregoing data and from the official figures that the number of refugees on the West Bank in August 1952 amounted to 204,000 while the total population of the West Bank in that year was 742,000 9/ i. e. the proportion of refugees to the total population was approximately 27.5 per cent 10/ This percentage is, in fact, equal to the percentage of Palestine refugees in the total population of the East Bank in the same year. The population of Transjordan in 1943 was estimated at around 340,000 11/ i.e. the equivalent of 417,000 in 1952 on the assumption that the natural population increase in Transjordan was 2.3 per cent at that time. The 1952 housing census shows that the total population of the East Bank in that year was in the range of 586,000 which indicates the presence of around 169,000 Palestinians (the majority being refugees) on the East Bank in that year. This figure is equivalent to 28.8 per cent of the total population of the East Bank.

This figure indicates the volume of migration from the West to the East Bank in the period directly following the 1948 war and which heralded the beginning of the transformation of Transjordanian society into a Jordanian-Palestinian society, at least from the demographic point of view. The proportion of Palestinians continued to increase, amounting to 40 per cent of the East Bank population in 1961 and over 58 per cent in 1972 12/ .

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9 / The Hashemite Kingdom of Jordan, **Housing Statistics for the year, 1952,** Amman 1953, Table (1).

10 / We arrived at this figure on the basis that the original population of the West Bank in May 1948 which was in the range of 475,000 or the equivalent of 538,000 in August 1952 on the assumption of a natural population increase of around 3 per cent. The 1952 housing census gives a combined figure of 742,000 for the original and refugee population of the West Bank.

11/ A. Konikoff, **Transjordan : an Economic Survey**, Jerusalem 1946, p. 22.

12/ These percentages were estimated as follows :

— The population of the East Bank in the latter part of November 1961 (according to official statistics) was 891,724 while the number of Transjordanian inhabitants (based on a natural annual increase of 2.8 per cent) in the same year can be estimated at 535,000. The proportion of Palestinians in the total East Bank population in 1961 would, therefore, be 40 per cent.

— At the end of 1972, according to official estimates, the East Bank population totalled 1,774,000.

— The original population of Transjordan in the same year can be estimated around 742,000. The number of Palestinians on the East Bank in 1972 would thus be a little over one million forming 58.5 per cent of the population.

The catastrophe also represented the beginning of a widespread migration of population from the West to the East Bank on the part of both the original inhabitants of the West Bank and its refugee population. A significant indication of this trend is provided by the enormous growth in population of the town of Amman. In 1943 the population of Amman was no more than 30,000 whereas by mid 1952 it exceeded 108,000 13/ i.e. the town's population increased three and a half times over a period of only 9 years. The principal source of this migration (a part from natural increase and migration from rural areas of Jordan) was the population of the West Bank 14/.

Size of Population

Name of Town	1945 Arab Population only	1952
Jerusalem	60 800	46 713
Nablus	23 250	42 499
Hebron	24 560	35 983
Tulkarm	8 090	21 872
Ramallah	5 080	17 145
Bethlehem	8 820	19 105
Jenin	3 990	12 663

In the early fifties refugees constituted over half the total population in some West Bank districts and especially in that of Jericho where they made up over 80 per cent of the total population and the districts of Ramallah and Bethlehem where they formed around 50 per cent of the inhabitants. In the Nablus, Jerusalem and Hebron districts the proportions were 37,35 and 45 per cent respectively 16/.

B) Living and Economic Conditions of the West Bank Population after the Catastrophe :

It was necessary to review the demographic situation on the West Bank brought about by the 1948 before touching on the main features of the economic and living conditions of the population.

13/ See the 1952 Housing Statistics page 3 and page 16 and the previous source Konikoff.

14/ Amman continued to grow in this manner throughout the period of Hashemite rule over the two banks of the Jordan.

15/ Source : Jordan, **1952 Housing Statistics;** Sami Hadawi, **Village Statistics, 1945, op. cit.**

16/ IBRD, **The Economic Development of Jordan,** Baltimore, 1957, p. 334.

After the catastrophe the West Bank lost an important part if its resources and economic potential within occupied Palestine. The West Bank used to supplement many of its production and consumption requirements from other parts of Palestine making use of their ports and other public utilities since its economy was in many ways linked with the Palestinian economy as a whole both as regards satisfying the needs of its population and as a source of income for a large number of its inhabitants.

The Situation of the Original Population of the West Bank :

It is possible to define the main categories of the original inhabitants of the West Bank who were directly and most severcly affected as a result of the occupation of Palestine in 1948 as follows :

1- Those working in government departments under the mandate or with the British armed forces.

2- Labourers and employees living on the West Bank but working in parts of Palestine that came under occupation. Most of these worked in the towns, especially occupied Jerusalem, in the citrus plantations, the ports and oil refinery at Haifa.

3- The third category consists of inhabitants of the West Bank working on the West Bank itself who lost their jobs as a result of the Bank's amputation from the rest of Palestine. This applies in particular to the Arab inhabitants of Jerusalem who resided in the old but worked in the new quarters of the city.

The loss of the new quarter of the city of Jerusalem led to many workers, members of the middle classes and some capitalists losing their jobs, properties and investments in the city and it is well known that much of the Arab light industry was located in that part of Jerusalem which was occupied by Israel in 1948. Furthermore, Jerusalem was an important tourist centre in which many tourist facilities such as hotels, restaurants and places of entertainment were concentrated. In addition there are those categories who were employed or connected with firms and businesses the existence of which was dependent on freedom of work and movement between the variouns parts ofPalestine (such as transport companies, banks and certain public utilities). To give only one example, the sources of water supply and electric power plants for the whole of Jerusalem Bethlehem and Ramallah were located within the region occupied by Israel.

Villages in the border areas lost a large part of their land and property and, in addition, many of their inhabitants were deprived of their livelihood and left without work.

The following table shows that more than 38 per cent of the land belonging to the border villages ended up within " Israel " as a result ofthe armistice lines drawn between Jordan and the Zionist entity in 1949 17/.

17/ R. S. Porter, **Economic Survey of Jordan,** British Middle East Office, 1953, p. 16.

District	Size of Local Population	Original Area of District (in Dunums)	Present Area (in Dunums)	Proportion of Land Lost by the District
Jenin	10,260	311,110	114,008	63.3%
Nablus	7,500	327,912	305,883	6.7%
Tulkarm	39,020	267,424	109,153	59.2%
Bethlehem	6,230	30,741	20,742	32.5%
Jerusalem	7,230	31,107	21,673	30.0%
Ramallah	2,850	28,647	22,887	20.1%
(Ramala)	(11,430)	(139,146)	(58,708)	(57.8%)
Hebron	34,630	709,699	490,556	30.9%

The above table in fact conceals the magnitude of the loss since it does not show the type of the lands occupied by Israel. It is well known that these were among the best lands and comprised many of the fruit groves and much of the irrigated land.

The following table shows that around 60 per cent of the remaining land in the border villages are uncultivable 18/ :

(District)	Area of fruit and olive graves (in dunums)	Lands suitable for agriculture (in dunums)	Uncultivable Lands (in dunums)	Proportion of uncultivable lands (in dunums)
Jenin	9,262	30,436	74,310	65.1%
Nablus	16,407	88,810	200,666	65.6%
Tulkarm	36,133	57,158	15,862	14.5%
Bethlehem	9,287	6,187	11,268	42.1%
Jerusalem	3,163	5,771	12,739	58.7%
Ramalah	4,660	10,045	8,182	35.7%
(Ramla)	10,786	16,885	31,037	52.8%
Hebron	12,473	155,965	322,118	65.6%
Total	102,171	371,257	676,182	58.8%

18/ **Ibid**, Page 17.

This signifies that the average per caput holding of agricultural land in the border areas decreased to less than four dunms (3.9 dunums) or 20 dunums per family which is far less than the area needed by a single family to support itself in that region since the required area is estimated at a minimum of 95 dunums 19/ .Consequently, a large number of the inhabitants of the region found themselves out of work. If we take into account that the vast majority of the population in these areas was mainly dependent on agriculture it can be seen that the lands which escaped occupation were no longer sufficient to support more than 24,500 person out of a total population of 119,190 i.e. only about one fifth of the population.

On the other hand, many of the inhabitants lost their land (or the greater part of it) without losing their houses and property within their villages. This led to their being excluded by UNRWA from the "refugee" classification with consequent loss of entitlement to relief. Only a very small number of the inhabitants of the border towns and villages were registered by UNRWA as refugees.

The following table shows the number of the latter 20/ .

District	No. of border towns and villages	No. of refugees registered with UNRWA
Nablus	40	7,481
Ramallah	18	4,113
Hebron	9	394
Jerusalem	6	876
Bethlehem	7	3,729
Total	80	16,593

It thus becomes clear that, after the Zionist occupation of Palestine in 1948, the lands in the " border villages " were no longer adequate to support more than a small proportion of the inhabitants of these villages. Taking into account the assistance provided by UNRWA, this proportion did not exceed 35 per cent of the population of these areas.

19/ See Anglo-American Committee of Enquiry, **Survey of Palestine,** Jerusalem 1946-7. pp. 279-289.

20/ Derived from UNRWA, **Statistical Bulletin,** May 1950 - June 1951, Tables No. 10-11.

So much for the border villages. As for the West Bank as a whole, the number of inhabitants who lost their livelihood was - according to some conservative estimates - in excess of a quarter of population distributed as follows 21/ :

	Number of families	Number of persons
Loss of income due to loss of land	16,000	80,000
Loss of income due loss of job with mandatory government	4,000	20,000
Loss of income due to loss of job in occupied Palestine	4,000	20,000
Total	24,000	120,000

The above estimate does not take into consideration the agricultural situation on the West Bank outside the border villages nor does it make allowance for the situation of the Palestine refugees who emigrated to the West Bank

In the early fifties the land suitable for agriculture on the West Bank was estimated at around 3,300,000 dunums capable of supporting only about 35,000 rural families or 175,000 persons 22/ . Assuming that these families are able to provide employment in non-agricultural sectors for an additional 60,000 persons approximately, then the agricultural land would be capable of providing a livelihood for no more than 235,000 persons. This implies that around 100,000 of the rural population of the West Bank were left, after the occupation in 1948, without visible means of support 23/. The number of destitute families (or those living in condition of severe poverty) on the West Bank can thus be estimated at 44,500 families (or 50,000 of the potential labour force) distributed as follows :

21/ See Porter, **op. cit.** page 19.

22/ Assuming that a rural family requiries 95 dunums of agricultural land (of the type available on the West Bank and without the introduction of modern methods of production) to provide itself with a reasonable standard of living.

23/ On the assumption that 70 per cent of the population of the West Bank in 1948 were from rural villages. It is, however, probable that this rural proportion was even higher since the proportion of the population living in the main towns (Jerusalem - Nablus - Hebron) was only about 25 per cent of the total population of the West Bank.

Reason for impoverishment	Number of families 24/	Number of persons
A — Rural unemployment	36,000	180,000
— Israeli occupation of agricultural lands in border villages	16,000	80,000
— Increase in demographic pressure on agricultural lands in the rest of the West Bank	20,000	100,000
B — Urban unemployment	8,500	40,000
Total	44,500	220,000

In other words, more than 45% of the original inhabitants of the West Bank became destitute after the Israeli occupation of the greater part of Palestine in 1948.

Situation of the Refugees on the West Bank

In spite of the bad economic and living conditions of the inhabitants of the West Bank following the 1948 war, the situation of the refugees who migrated to the West Bank remained for a long time even more wretched than that of the original inhabitants. Although a small minority of the refugees managed to carry with them part of their movable possessions (bank notes, jewellery etc.) the remaining majority of the refugees were compelled to rely on assistance from UNRWA. This assistance provided only the minimum basic requirements particularly food) needed to sustain life and it is estimated according to UNRWA's official statistics that the amount of money spent by the Agency on each refugee in the financial year 1950-51 was only 39 U.S. dollars. This means that the amount spent by the Agency in that year on each Palestine refugee was less than 11 U.S. cents per day for food, health, education and other services.

To further elucidate the deprivation suffered by the Palestine refugee at that time it is enough to mention that less than half of UNRWA's expenditure in the financial year 1950-51 was allocated to food (46 per cent), under 3 per cent to shelter and clothing, around 2 per cent only to health services and less than 1 per cent to education while more than 12 per cent of the Agency's expenditure was allocated to administration and the cost of distributing the aid 25/.

24/ The figures are derived from Report of the Director of the United Nations Relief and Works Agency for Palestine refugees in the Near East, General Assembly. Supp. No. 16 (A/1905).

25/ **Ibid,** Page 32.

In other words, the amount spent by the Agency on the Palestine refugee was no more than 4.8 cents per day on food and less than a quarter of a cent on health. In the financial year 1951-52 the total amount spent by the Agency per refugee was estimated at 31 dollars and 40 cents ie. less than 9 cents per day distributed among the Agency's various activities 26/. The amount spent by UNRWA per refugee was thus less than one thirtieth of the average income of an American at that time. This amount (39 dollars per annum) is equavalent to one eighth of the average income of an Arab worker in 1942 (98 Palestinian pounds per annum) 27/.

There is no accurate data on the number of refugees who were able to alleviate their wretched living conditions through employment but available information definitely indicates that the vast majority of the Palestine refugee labour force was totally unable to find work.

A report by the International Bank for Reconstruction and Development states that in Jordan more than 50 per cent of the total Palestine refugee labour force in 1954 was totally unemployed with a further 20 per cent or more employed on a seasonal basis only 28/. It can thus be inferred that not less than 110,000 of the West Bank labour force (original population plus refugees) were either totally or seasonally unemployed ie. two thirds of the total labour force on the West Bank 29/.

Employment and Wage Rates on the West Bank after the Catastrophe

This new situation had inevitable reprecussions on the living and working conditions of the inhabitants of the West Bank. This is clearly apparent from the housing situation where official statistics for 1952 30/ indicate that 28 per cent of all housing units on the West Bank consisted of tents of cloth or animal hair, caves and wood or mud huts. Only one third of the dwellings (33.2 per cent) were provided with a private water supply (running water inside the building or a private well) and only 21 per cent had access to a private toilet (outside or inside the building). Only 2.6 per cent of these dwellings enjoyed electric lighting.

26/ **Ibid.** Page 25.

27/ Anglo-American Committee of Enquiry, **Survey of Palestine,** Palestine 1946. Vol. III, Table 2. Section 13.

28/ IBRD, **The Economic Development of Jordan,** Baltimore 1957, P. 443.

29/ The figures are approximate due to the lack of precise figures on the number of refugees on the West Bank and the lack of accurate statistics on employment and unemloyment. The above deducations remain, however, fairly realistic and are, in the main, conservative estimates. The number of refugess working on UNRWA projects in Jordan did not exceed 6000 persons in 1950 and was much less in 1951.

30/ Jordan, **Housing Census, 1952, op. cit.**

This new situation also had repercussions on employment and working conditions on the West Bank where no less than 30,000 of the labour force lost their livelihood in occupied Palestine and on the West Bank itself.

In addition, not less than 60,000 of the labour force from occupied Palestine flooded into the West Bank. It was inevitable that vast reserve of labour should lead, in the conditions prevailing after the catastrophe, to an aggravation of the already desperate plight of the Palestinian working classes. Wage levels are the best indicator of the extent to which the situation of these classes had deteriorated.

The following table shows the extent of this deterioration as affecting Palestinian workers and employees 31/.

West Bank : Daily Wage Rates of Adult Males Employed in Industries other than Agriculture in October 1952

District	Average Daily Wage in Fils	Average No. of Working Days during last 12 Months	Annual Income (in Dinars)
Jerusalem	221	277	61
Hebron	178	270	48
Nablus	209	232	48
General Average for Both Banks	224	242	54

The statistics referred to show that the average daily wage and number of working days were as follows 32/ :

Industry Activity	Average Daily Wage in Fils	Average No. of Working Days during last 12 Months	Annual Income
Construction	229	136	31
Food Industries	235	264	62
Communications	259	275	71
Other Industries	227	263	60
Professions	235	246	58
Services	204	264	54

31/ Porter **op. cit.** Page 39.

32/ **Ibid.** Page 40.

A comparison of these averages with the available figures for wage rates in the period before 1948 shows the extent of the drop in income of the Palestinian workers.

The above table gives a fair illustration of the dramatic slump in the level of non-agri - cultural activites.

This is clearly seen from a simple comparison 33/ of average wage rates in Palestine in 1947 and wages on the West Bank in 1951. It is clear from the following table that wages decreased by two thirds or more between 1947 and 1951.

Sector	1947 Palestine Mils	1951 Jordanian Fils
Food	535	160
Construction	641	250
Transport	739	190

The following table shows the drop in the wage levels for various economic activities (other than agriculture) that resulted from the Zionist occupation of the greater part of Palestine :

Sector	Average Daily Wage 34/ of Arab Worker in Palestine 1947. In Fils	Average Daily Wage 35/ in Jerusaelm (October 1952) In Fils
Flour Mills	480	264
Bakeries	268	206
Olive and Cooking Oils	400	188
Carpentry	500	188
Tailoring	641	198
Vehicle Repair	683	142
Mechanized Industries	400	154

33/ Palestine Government, **Monthly Bulletin of Current Statistics,** January 1948, Jordan, Ministry of Economy, **1951 Wages Survey.**

34/ Government of Palestine, **Monthly Bulletin of Current Statistics,** December 1947. pp. 849-850.

35/ Porter, **op. cit.** pp. 40-45.

It is clear from the previous table that wages dropped by more than half in many sectors of employment and by around two thirds in other sectors quite apart from the decrease in the number of working days (under employment) which greatly diminished the worker's annual income. This state of affairs applies equally to the agricltural sector.

In 1947 the average daily wage for an unskilled worker in the Jerusalem district ranged from 300 to 500 fils during the summer season and this dropped to around 180 fils in 1952. From a sample survey of agriculture conducted in 32 villages in Jordan in 1952, it was seen that the average wage for an agricultural labourer in the peak working season was 229 fils dropping to 189 fils at normal times 36/.

This growing volume of unemployment on the West Bank and the increasing competition in the labour market led to wage rates on the West Bank becoming lower than similar rates on the East Bank, which was the major incentive behind the migration of inhabitants of the West Bank across the Jordan River and to other Arab countries. Amputation of the Bank from the occupied part of Palestine and the attendant loss of markets and disruption of the network of communications linking the west Bank and Transjordan with the ports of Palestine brought about an increase in export and import costs and created a shortage in both local and imported foodstuffs which led, in turn, to a sudden and noticeable rise in the cost of living. The distance from Jerusalem to Haifa is no more than 140 kilometres while the distance from Jerusalem to Beirut (when this port took the place of Haifa) is 440 kilometres (ie. the distance was tripled). Similarly the distance of 250 kilometres between Amman and Haifa was replaced by the longer route of 330 kilometres being the distance from Amman to Beirut. In 1952 transportation costs from Beirut to Amman amounted to over 1.2 million dinars. Although this new situation had serious detremental effects on both banks of the Jordan its repercussions were most severe on the West Bank. In certain border areas the distance seperating them from the nearest port open to them increased from 40 or 50 to 500 kilometres.

All this had the effect of raising the cost of living. Official UNRWA statistics indicate that the cost of living index rose between 1950 (base year) and January 1952 from 100 to 172 37/ .

36/ **Ibid.** pp. 40-50.

37/ Cited by Harris, G. L, **Jordan : its People; its Society ; its Culture.** New Haven, 1958, p. 129.

ESTIMATION OF MORTALITY AND RATE OF POPULATION GROWTH IN THE PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN*

by

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Introduction

Professor Brass published his hypothesis under the title of ' Death Distribution Method for Estimating Mortality ' .

The hypothesis can be summarized as follows : -

1) Using the downward age distribution of the total population of a country (or part of the population of a country) and of mortality.

2) Computation of (ny) which is the binary total of two successive population groups.

3) Finding the ratio of binary population distribution to downward population distribution and the ratio of downward death distribution to downward population distribution .

4) Plotting these two coverage should give us a line of slope one if there is 100 per cent coverage in the recording of deaths. If, however, such coverage is less complete, we will find a slope deviating from the true 1 as a reflection of the correction factor for the mortality figures. Consequently, it is possible to estimate the level of mortality.

5) A second advantage of this theory is the possibility of proving that the point of intersection of the curve and the vertical axis provides an indicator of the population growth rate in the country or part of the country under survey.

Preconditions and Assumptions : The hypothesis is dependent on the following assumptions :

1) A stable or quasi stable population growth.

2) The defective registration of deaths being distributed equally over all age group.

3) That a slight deviation from these assumptions does not impair the robustness of the method and that inaccuracies in registration are possible without affecting the results.

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* Meeting document E/ECWA/POP/WG.5/17.

The preconditions are :

1) A population distribution by age (eg. 5 year age groups).

2) A mortality distribution in accordance with the same age distribution of the population.

All of these assumptions and preconditions are fulfilled in the case of the population of Democratic Yemen.

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work then proceeds in accordance with the following table.

Age groups	Population of Region One by Sample	Multiplying Factor	Population of Region One
0 — 4	4,140	9.7096	40,198
5 — 6	1,656	9.7096	16,079
7 — 9	2,331	9.7096	22,633
10 — 12	1,921	9.7096	18,652
13 — 14	975	9.7096	9,467
15 —	537	9.7096	5,214
16 — 17	803	9.7096	7,797
18 — 19	844	9.7096	8,195
20 — 24	1,773	9.7096	17,215
25 — 29	2,016	9.7096	19,575
30 — 34	1,779	9.7096	17,273
35 — 39	1,718	9.7096	16,681
40 — 44	1,095	9.7096	10,632
45 — 49	851	9.7096	8,263
50 — 54	709	9.7096	6,884
55 — 59	350	9.7096	3,398
60 — 64	373	9.7096	3,621
65 — 69	155	9.7096	1,505
70 +	331	9.7096	3,214
Not specified	399	9.7096	3,874
Total	24,756		240,370
	240,370		Size of Population

$$\text{Multiplying factor} = \frac{\text{Size of Population}}{\text{Size of Sample}} = \frac{240{,}370}{24{,}756} = 9.7096$$

We note the appearance of one group (Not specified.). By distributing this group over the various groups we arrive at the following table .

Age Groups	Population P (x)	Deaths D (x)	Starting Age of Group	Population (In Decreasing order of Magnitude) Py	Deaths (In Decreasing order of Magnitude) Dy	ny	ny/py	dy/py
—	7,411	361	0	240,370	2,131	—		0.0089
1 — 4	33,446	330	1	232,959	1,770	—		0.0076
5 — 9	39,347	79	5	199,513	1,440	8115	0.0407	0.0072
10 — 14	28,580	52	10	160,166	1,361	6793	0.0424	0.0085
15 — 19	21,553	41	15	131,586	1,309	5013	0.0381	0.0099
20 — 24	17,497	42	20	110,033	1,268	3905	0.0355	0.0115
25 — 29	19,896	48	25	92,536	1,226	3739	0.0404	0.0132
30 — 34	17,556	57	30	72,640	1,178	3745	0.0516	0.0162
35 — 39	16,954	73	35	55,084	1,121	3451	0.0626	0.0204
40 — 44	10,806	79	40	38,130	1,048	2776	0.0728	0.0275
45 — 49	8,398	70	45	27,324	969	1920	0.0703	0.0355
50 — 54	6,997	117	50	18,926	899	1650	0.0814	0.0475
55 — 59	345	63	55	11,929	782	1045	0.0876	0.0656
60 — 64	3,680	131	60	8,476	719	713	0.0841	0.0848
65+	4,796	588	65	4,796	588	848	0.1768	0.1226
	240,370	2,131						

$$n/_5 = \frac{1}{10}\left(\frac{5}{4} P_{1-4} + P_{5-9}\right)$$

$$n/_0 = \frac{1}{10}\left(P_{5-9} + P_{10-14}\right)$$

$$n/_5 = \frac{1}{10}\left(P_{10-14} + P_{15-19}\right)$$

$$n/_{65} = \frac{1}{10}\left(P_{60-64} + P_{65+}\right)$$

Age Group	Population	Population ...after Adjustment
0 — 4	40,198	40,857
5 — 9	38,712	39,347
10 — 14	28,119	28,580
15 — 19	21,206	21,553
20 — 24	17,215	17,497
25 — 29	19,575	19,896
30 — 34	17,273	17,556
35 — 39	16,681	16,954
40 — 44	10,632	10,806
45 — 49	8,263	8,398
50 — 54	6,884	6,997
55 — 59	3,398	3,453
60 — 64	3,621	3,680
65 +	4,719	4,769
Not specified	3,874	—
Total	240,370	240,370

On breaking down the age group O — 4 to obtain the population at age zero and at age 1 — 4 in accordance with the SPRAG tables we find that :

Po = 40,857 x .3616 — 39,347 x .2768 + 28,580 x .1488 — 21,553 x . 0336 = 7,411

p1 — 4 = 40,857 — 7411 = 33,446

Conclusion

1) These ratio (ny/Py, dy/Py) were plotted and gave the result shown on the graph.

2) The straight line intersect with the y axis at point 0.031 which gives us the population growth rate as specified in this hypothesis.

3) The slope of this line can be calculated in the following manner :
   a) We take two points on the line as central as possible between age 20 and age 50.
   b) The following rule is then applied :

$$\frac{Y1 - Y2}{X1 - X2}$$

As a result we selected the two groups (40 — 44) and (20—24) . The slope was :-

$$b = \frac{0.0730 - 0.0355}{0.0375 - 0.0040}$$

$$= \frac{0.0375}{0.0335}$$

$$\text{slope} = 1.119$$

4) The slope of this line represents the correction factor for estimating mortality by age groups.

5) By this hypothesis there is a deficiency of 0.119 per cent in the registration of deaths.

6) Now that the number of deaths have been estimated it is possible to use them to estimate specific death rates.

7) The aim of this study was to take the calculated population growth rate to be the population growth rate of the Republic.

ANNEX

Table 1 . Estimation of Population of the Republic by age — sex and economic activities (ISIC) for the years 1974—1976 Base data Census 1973.

ISIC Code	Industry	1976 estimate		1976 estimate		1974 estimate	
		Females	Males	Females	Males	Females	Males
1	Agriculture, Hunting & fishing	52150	129915	50582	26010	49061	122221
2	Mining and Quarrying	—	2232	—	2165	—	2100
3	Manufacturing	2139	13685	2075	13273	2012	12874
4	Electricity, gas and water	34	3111	33	30178	32	2927
5	Construction	—	16797	—	16292	—	15802
6	Wholesale and Retail Trade and Resturants & Hotels	236	27719	229	26885	223	26077
7	Transport, storage and communication	67	14508	65	14071	63	13648
8	Financing, Insurance Real estate Business Services.	46	485	45	471	43	457
9	Community, social and Personal services	5106	82114	4953	79645	4804	77251
0	Activities not adequately classified	5820	14491	5645	14055	5476	13633
X	Individuals with no Activity	292995	328686	575165	318804	557871	309218
Y	Individuals less than 7 years of age	221706	228755	215039	221877	208573	215206
	Total	880300	862501	853832	836568	828159	811414

Source : Based on a Sample from the census returns, 1973.

Table 2 . 1973 Population of the Republic by sex and distribution of Urban, Rural, Nomads and estimated distribution by Employment status.

Employment Status	Females				Males			
	Total	Nomads	Rural	Urban	Total	Nomads	Rural	Urban
Less than seven years	202302	20005	122642	59655	208735	18519	125939	54277
Employer	268	37	201	30	16792	599	9130	7055
Own-Account workers	18896	9805	8497	594	86233	19470	49573	17190
Employee	5455	103	991	4361	134668	8430	13736	66240
Unpaid worker	30450	16910	12316	1224	31284	13678	28928	3870
Unemployed	15929	1632	7562	6735	55593	4453	28928	22212
Not at work and not seeking work	474340	25247	289252	159841	214538	8478	119949	86111
Unable to work	50828	4169	31778	14881	29790	2438	19930	7422
Not stated	4790	15180	1701	1571	9384	1011	2579	5794
Total	803258	79426	474940	248892	787017	77076	429770	280171

Source : Based on a sample for the censivs returns, 1973.

Table 3 . Estimation of Population of the Republis by age — sex and working status (ISCO) for the year 1974 — 1976 Base data Census 1973.

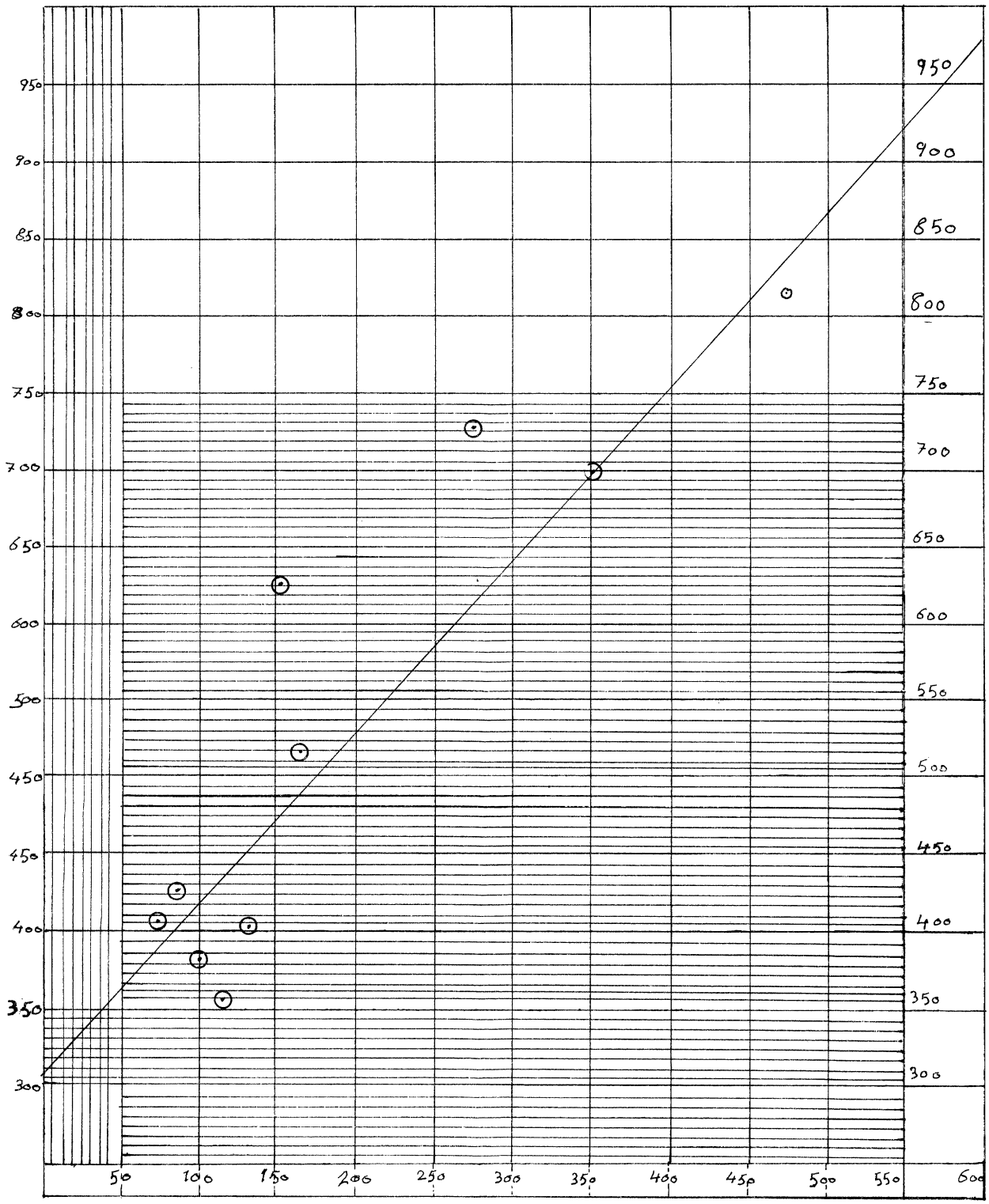
Employment Status	1976		1975		1974	
	Females	Males	Females	Males	Females	Males
Less than seven years	221705	228755	215039	221877	208573	215206
Employer	293	18402	285	17849	276	17312
Own-Account workers	20708	94504	20086	91662	19482	88906
Employee	5978	147583	5798	143147	5624	138843
Unpaid worker	33370	34284	32367	33254	31394	32254
Unemployed	17456	60924	16932	59093	16423	57316
Not at work and not seeking work	519835	235114	504205	228045	489044	221189
Unable to work	55703	32647	54028	31666	52404	30713
Not stated	5249	10284	5091		4938	9675
Total	880301	862561	853832	8365468	828159	811414

Source : Based on a sample from the census returns, 1973.

Table 4 . Population of the Republic by sex and Distribution in Urban, Rural, Nomads and estimated distribution by industry , 1973

ISIC Code	Industry	Females				Males			
		Total	Nomads	Rural	Urban	Total	Nomads	Rural	Urban
1	Agriculture, Hunting and Fishing	47586	25986	20684	916	118546	35697	73700	9149
2	Mining and Qrarrying	—	—	—	—	2037	966	674	397
3	Manufacturing	1952	690	576	686	12487	50	4995	7442
4	Electricity, gas and water	31	—	21	10	2839	153	568	2118
5	Construction	—	—	—	—	15327	236	8887	6204
6	Wholesale and Rotail Trade & Resturants and Hotels	216	21	67	128	25293	273	8483	16537
7	Transport, storage and communication.	61	—	—	61	13238	857	3470	8911
8	Financing, Insurance Real Estate Business Services	42	—	—	42	443	—	22	421
9	Community, social and Personal services	4660	—	392	4268	74928	3696	30660	40572
0	Activities not adequately Classified	5311	1676	1966	1669	13223	1260	3565	8398
X	Individuals with no Activity	541097	31048	328592	181457	299921	15369	168807	115745
Y	Individuals less than 7 years of age	202302	20005	474940	59655	208735	18519	125939	280171
	total	805258	79426		248892	787017	77076	429770	64277

Source : Based on a sample for the census returns, 1973.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DEMOGRAPHIC DATA COLLECTION TECHNIQUES IN THE STATE OF KUWAIT*

by

The Central Statistical Office

Planning Board

Kuwait

I : General Population Censuses

The first general population census carried out in the State of Kuwait using modern techniques took place in 1957. This was followed in 1961 by a general population count which, however, did not provide such comprehensive data as the previous census since its basic aim was confined to establishing the size of the population by category in the various geograhical areas.

The last three censuses carried out in 1965, 1970 and 1975 may be considered as a new series in so far as they are all fully comprehensive in regard to both geographical scope and subject content. In designing the 1975 census, which is the most recent of the series, several important considerations were taken into account. These can be summarized as follows:

1- Division of the country into ' demographic agglomerations ' with clearly defined boundaries conforming as far as possible with the actual administrative divisions.

2- Partition of the agglomerations into ' sectors ' subdivided into ' blocks ' in such a way as to permit an equal distribution of the work load among the various categories of census takers and facilitate their circulation and the efficient organization of their work.

3- Setting up a complete territorial framework during the course of the census and marking it on the various scale maps with the aim of facilitating its use in designing ' area samples ' for future family surveys.

4- Designing a data classification programme to allow comparison of the returns of the last census with those previous censuses without detriment to the comprehensive subject content or geographical scope of these results.

5- Following a numbering system (for roads, districts, buildings and units) both useful in facilitating the field work and practicable as a basis for standard numeration in the future.

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* Meeting document E/ECWA/POP/WG.5/18.

Use was made of both local and international experitise in designing this census and the technical efforts put into the design were complemented by efforts on the part of the Central Statistical Office to ensure proper implementation in the various subsequent phases and overcome potential technical difficulties and problems in each phase in the following manner :

1- **Number of personnel** : in its desire to complete the field work in the shortest possible time, the Central Statistical Office found it difficult to mobilize the requisite number of field personnel of various categories. Enumerators were assigned from various government organizations (1640 enumerators) as were the supervisors (34) while the 3 observers were selected from personnel with prior experience gained either in census work or in various field statistical surveys.

2- **Training** : in designing the census, care was taken to provide all categories of personnel with manuals containing precise details of their duties and field work procedure together with clear definitions of terminology used in the census questionnaire.

In addition an intensive training programme was developed for the personel who were divided into relatively small groups and given lectures on all aspects of the census operation by members of the technical staff who also contributed to the design of the census.

This theoretical instruction was accompanied by practical field and office training in which all categories of personnel were given the task of filling out census questionaires beginning with the phase of listing buildings and continuing through to the end of the operation. This training was used at the same time as a test of the data appearing on the questionnarie.

3- **Publicity** : a sufficient amount of time was allowed for the mounting of an intensive campain to familiarize the puplic with the census operation. Use was made of the various information media to broadcast talks on the radio, stage television plays, promote short slogans calling for co-operation with the enumerators and issue various information pamphlets etc in addition to the passing of special legislation requiring everyone to give truthful statements to the enumerators.

This campaign was very effective in eliciting a favourable response on the part of the public and rendered the task of the census takers much easier than it had been in previous censuses.

4- **Office processing of data** : the Central Statistical Office assigned a select team to check the questionnaires and examine the recorded data for completeness and uniformity of content on the basis of a pre-arranged programme which defined procedure for making the various checks.

The Central Statistical Office had manuals giving the various classifications needed to codify the data including classification by occupation and economic activity in accordance

with international recommendations after these had been tailored to suit locally prevailing conditions. All personnel, including those who had previously worked on coding of statistical data, were trained in the use of these manuals.

5- Mechanical processing : The Statistical Office took pains to ensure the participation of computer specialists and technicians in the design of the census questionnaires and provided them at an early stage with the manuals used in data classification. They also participated in the systematic arrangement of data which was worked out at the very beginning.

This participation and co-ordination of work was most effective in facilitating the mechanical processing operation and speeding up the rectification of field errors which had not been picked up at the office processing stage.

6- Financial resources : work began on the preparatory stages a long time before the census was due to be carried out so that the time factor would not impede the success of the work. The Central Office took care to prepare detailed budget estimates for the various stages including adequate reserve funds for all contingencies.

7- Future censuses : in spite of its relatively small population, the State of Kuwait is distinguished by two outstanding features - its high rate of population growth due to immigration from abroad and the rapid change in the characteristics of this immigrant community because of its rapid and continous mobility. For this reason, and in spite of the magnitude of the task, a general population census is carried out once every five years. The Central Statistical Office hardly has time to finish publication of the results of one census before it begins work on the next. This is one of the difficulties facing the Central Statistical Office but efforts are being made to overcome the problem in co-operation with other government bodies and officials.

It is intended to carry out the next general population census in 1980 as a continuation of the series which began in 1965. This forthcoming census will also coincide with the end of the first and the start of the second five year development plan.

II : Demographic Surveys :

1- Population assessment by sample survey : in view of the rapid change in demographic characteristics, particularly in the immigrant community, the Central Statistical Office thought it advisable to undertake a population count in 1972 by means of a field sample survey. For this purpose the geographical framework derived from the 1970 census was used to select a likely sample from the ' sectors ' 1/ and a complete enumeration was carried out in each of the chosen sectors. This operation was repeated in the following year (1973). This method

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1/ A sector is a relatively small geographical unit representing part of an ' area ' or demographic agglomeration. The number of statistical sectors in the 1970 census was 320 with a percentage observation of around one per cent.

proved to be indispensable and could not be substituted by other office methods of assessment since it became evident that the rate of population growth derived from the results of these surveys had dropped noticeably below the rate calculated from the two previous quinquennial censuses (1965 and 1970).

In these two surveys the stratified cluster sample method was used with the consequent division of the sectors into strata according to the proportion of the Kuwaiti population in each sector. In this way it was possible to obtain a population assessment by main type and nationality.

2- Census of the labour force by sample survey (1973) : this survey was carried out on a sample of families chosen from the framwork of the sample census undertaken in 1973 with the aim of assessing the labour force in that year. The questionnaire prepared for data collection included the main demographic characteristics and it thus proved possible to obtain an assessment of these characteristics within the limits of estimated observational error.

3- Sample family budget survey (1972-1973) : the Central Statistical Office was engaged for a full year from April 1972 to March 1973 in collecting data from a typical sample of families selected from the framework of the 1972 sample census. In addition to family expenditure and income, data was included on the periodic changes in demographic characteristics of the members of each family.

III : Future Programmes

The State of Kuwait is participating in the World Fertility Survey programme which is due to be implemented next September. The framework of the 1975 general population census will be used in designing a sample for this survey.

The Central Statistical Office's work programme includes an assessment of the population by the field sample method as already used in 1972 and 1973 but no definite date has as yet been set for this survey.

The Central Statistical Office is currently considering participation in the survey which the Economic Commission for Western Asia is planning to carry out, possibly next year, to study international migration and population mobility in certain countries of the region and in the United Nations project to study the characteristics and mobility of the region's labour force.

IV: Technical Expertise :

The recurring operation involved in taking a general population census at frequent intervals and carrying out demographic field surveys in between census years were of considerable

benefit in helping personnel in the statistical service and other government bodies to gain useful experience in this work.

The Central Statistical Office also showed keen interest in broadening the experience of its personel by sending a number of them to training centres abroad such as the Cairo Demographic Centre and elsewhere within the United Nations programme.

The Central Statistical Office is currently engaged in setting up a statistical research and training centre to provide theoretical and practical training for its own personel as well as for those in other government bodies. The centre will also cater for trainees that other countries in the region might wish to send.

In addition, the Central Statistical Office is making use of the services of experts from countries and of United Nations specialists.

INITIAL STUDY ON A PROJECT FOR THE ESTABLISHMENT OF A PALESTINIAN STATISTICAL DIVISION *

prepared by the delegation of the Palestine Liberation Organization

As a result of the Zionist enemy's usuropation of the greater part of the Palestinian territories in 1948-1949 and the expulsion of hundreds of thousands of Palestinians from their land, so that they were distributed as refugees over a large number of Arab and foreign States, and as result of the inclusion of the West Bank in the Hashemite Kingdom of Jordan and the elimination of Palestinian institutions generally and then the Zionist occupation of the remaining Palestinian territory in 1967, the Palestinian people was deprived of its presence in its homeland and of its economic, social and political unity. Because of this, the Palestinian people had no accurate statistical data covering the various aspects of its life, with regard either to demography and population distribution or to stratification and economic, social, education and other conditions.

As a result of this general situation, statistical operations were restricted to certain non-Palestinian institutions, such as UNRWA and Arab organizations, which collected some partial and unmethodic statistics. For this reason, none of these statistics were placed at the service of the Palestinian people and its cause, and the Palestinian people began to look upon any statistical operation with doubt and apprehension. This was, for example, the case with regard to the UNRWA statistics relating to settlement.

At the outset of the Palestinian revolution, when the role of the Palestine Liberation Or - ganization as the central body representing the Palestinians and concerned with their political mobilization, organization and living and social problems began to increase in magnitude, there became an increasing need for a statistical centre for Palestinians, to assist the Liberation Organization in performing its numerous tasks on scientific foundations based on solid facts and figures.

The Palestine Planning Centre, the Palestine Research Centre and the Institute for Palestine Studies were the first to be aware of this need, these institutions made strenuous efforts to meet this need partially. However, the Palestine Liberation Organization has now become more aware of the necessity of fulfilling this need than at any point in the past. It has become essential to study the question of establishing a centre for Palestinian statistics to assist the political leadership in taking appropiate decisions through the procurment of the data required for arriving at such decisions in the political, military, organizational, educational, economic and social fields. Here there arise such questions as a knowledge of Palestinian manpower and its distribution, potential and capacities in the various fields. This would help in sound decision making with regard to such issues as military conscription, tax collection, the cat - aloguing and utilization of scientific and technical skills, educational policies, information and relations with political and economic forces in the Arab world and internationally.

All this is by way of example and is not exhaustive, because the benefits to be reaped from the existence of accurate, analyzed statistical data go beyond the fields mentioned above.

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* Meeting document E / ECWA / POP / WG. 5/19.

It must be noted from the outset that the establishment of a central statistical institute for the Palestinian people is no easy matter and that its work would be the more difficult because of the dispersion of the Palestinian people and varied conditions under which each palestinian community lives. However, that does not preclude an endeavour to overcome these difficulties gradually. For its execution, however, such a project would have to be divided into stages.

First stage

This would comprise the establishment of a nucleus of a Palestinian statistical centre and then developing into an autonomous central institution of the Palestine Liberation organization. The primary function of this nucleus would be as follows :

(a) To assemble available statistics or to catalogue everything relating to statistics on Palestinians and to endevour to assemble it and to compile archives pertaining thereto (statistical libray and statistical archive) ;

(b) To classify available statistics ;

(c) To analyze these statistics;

(d) To draw up, in the light of the above - mentioned compilation, classification and analysis, a practical plan for the work of the statistical division in the second stage;

(e) To delimit the tasks of the statistical centre nucleus for the first stage and the anticipated budget.

Initial detailed description of the first stage :

(a) Assembling all available statistical data on Palestinians (a considerable portion of these are to be found at the Research Centre) and compiling an archive thereof;

(b) Building up a close relationship with official Arab and Palestinian institutions which issue statistics and encourging them to develop and expand the statistics works which they produce;

(c) Evaluating the significance of avilable statistics by conducting specific studies;

(d) Urging Palestinian authorities to make statistical use of the data available to them and drafting necessary forms for obtaining more extensive and more accurate data;

(e) Training cadres in Palestinian derpartments, institutions and mass union to accord importance to statistical work and to understand its preconditions and making them more accurate in the collection of data and the derivation of statistics ;

(f) Undertaking certain activities in the statistical survey field by the use of the sample or general survey technique, on a limited basis.

Scope of the second stage

The division may develop into an independent centre connected with the Liberation Organization. The division will determine the goals of its activity, which will relate to full mobilization of Palestinian potentials and to the preconditions for preparation for the post - liberation period. The most important part of this workload is the organization of model population statistics of the Palestine Arab people and the derivation of the necessary demographic social, economic and educational statistics.

The Establishment of a Statistical Division

Statistics, available sources and evaluation

1. UNRWA statistics :

(a) Annual report of the Commissioner - General of UNRWA, starting from 1951;

(b) Comprehensive statistics on Palestinian refugees (number, places of residence in Palestine, places of refugees, occupations), 1951 ;

(c) Annual statistics of the Department of Education, starting from 1963;

(d) Annual report of the Department of Health, starting from 1964;

(e) Miscellaneous statistics, including public statistics and special tables.

Evalution

UNRWA statistics cover all Palestinians registered with the Agency in the Arab States and the occupied territories. The importance of these statistics lies in the fact that they begin from 1951 and that they contribute to an understanding of certain developments and give an account of the educational and health situation. Their value is partial with regard to population studies.

2. Statistics of the Kingdom of Jordan :

(a) Statistical Yearbook, starting from 1950;

(b) 1961 housing and population census (four general sections and seven section on the provinces);

(c) 1952 housing census ;

(d) Annual statistics of the Department of Education;

(e) Statistics on internal migration;

(f) Economic statistics (national income, industrial sector, commerce, etc.).

Observations

— The Jordanian Department of Statistics is very active and issues many annual statistics .

— Post - 1967 statistics cover the East Bank only.

— The various ministries issue annual reports and statistics.

— There are special studies and statistics on the Jordan Valley and the city of Amman.

Evaluation

No distinction is drawn between Transjordanians and Palestinians. The population statistics prior to 1967 were relatively good, but the situation changed after 1967 as a result of the migration of a large number of the inhabitants of the West Bank to Eastern Jordan.

3. Gaza Strip Statistics :

(a) Annual report of the Governor-General;

(b) General commercial and economic reports.

Evaluation

Demographic statistics are not reliable.

4. Syrian statistics :

(a) Statistics of the Palestinian Child Welfare Foundation : annual report;

(b) Central Bureau of Statitics (formerly the Directorate of Statistics) : Syrian annual Statistied Abstract;

(c) General population censuses of 1960 and 1970;

(d) Annual statistics of the Universities of Damascus and Aleppo.

Evaluation

Syrian statistics are good with regard to demorgraphy and Palestinians.

5. Kuwaiti statistics :

(a) General censuses of 1955, 1960, 1965 and 1966; starting in 1960 aliens were recorded by nationality;

(b) Statistical Office : Kuwaiti annual statistical abstract.

Evaluation

The demographic and educational statistics are good. No distinction is made in economic activity among the alien labour force, except in the case of the public sectors.

6. Statistics of the enemy State :

(a) **Statistical Abstract of Israel,** starting from 1950; this has included from the outset demographic data on Arabs in the occupied territories and since 1967 an annex on the newly occupied territories ;

(b) Compendium of the conclusions relating to the Arab population in the 1961 census;

(c) Annual reports of the Military Governor of the occupied territories.

Evaluation

The population and educational statistics are good, but there is a paucity of economic statistics.

7. Egyptian and Iraqi statistics :

The annual reports of both Governments on the Palestinians who are registered with them and receive assistance from the State.

8. Statistics of Saudi Arabia and Qatar :

Only educational statistics are available.

9. The University and the Cultural and Scientific Organization ;

Both are concerned with Palestinian educational statistics and conduct correspondence with all the Arab States on the matter.

10. Palestinian sources :

(a) Statistics and data of the Social Affairs Institution and the Martyrs' Families Society; the data of these two institutions can be developed;

(b) Utilization of the membership forms of the mass unions; these forms can be developed, and these union can be requested to provide additional statistics relating to certain social and economic matters;

(c) Statistics and data of the Palestine Red Crescent;

(d) Statistics and data of the Liberation Organization Offices in some of the Arab States, where Palestinians are registered; the work of these offices can be developed, and the staff can be trained to deal with statistical affairs;

(e) Statistics from a project for the collection of data on advanced Palestinian skills;

(f) Statistics of the various Palestinians institutions such as clubs and boy-scout associations;

(g) Activity of the Reseach Centre : the Centre has endeavoured to assemble the above-mentioned printed statistics and has published the following books containing statistical data :

(1) Elias Khouri, **Palestinian Statistics,** Beirut, 1974;

(2) Annan al-Amiri, **Agricultural Statistics on Palestine, 1919-1970,** Beirut, 1974;

(3) Bilal al-Hasan, **Palestinians in Kuwait, a Statistical Study;**

(4) Shahhada Yusif, **The Palestinian Reality and the Trade-Union Movement,** Beirut, 1973; this contains statistical annexes which are mentioned in the main text.

11. Statistics of the Mandate Government prior to 1948 :

There are varied and numerous statistics, the most important being the general census of 1922 and 1931 and the annual and monthly statistics.

AVAILABLE DEMOGRAPHIC DATA IN THE LEBANESE REPUBLIC*

Oral intervention made by the Lebanease Delegation

1. Methodological Note

Before proceeding to review the demographic data available in Lebanon, specifying its character and pinpointing the financial and technical difficulties encountered in the matter, it must be noted that no comprehensive census or count of the population has been made since 1932. That year witnessed the only endeavour that can be regarded as a general population census, namely the population census carried out by the French Mandate authorities for the purpose of discovering the size of the Lebanese population and Organizing personal status registers and records.

Until 1964, all population estimates used this census as a basis for estimating the population of Lebanon, by bringing the data up-to-date and adjusting the conclusions. The updating operation was based either on sample studies conducted for the whole or a part of the Lebanese population or on a calculation based on the subtraction of the number of registered deaths from the number of births registered in the past year, as is done by the Departments of Personal Status in the Ministry of the Interior in the case of the registered population. Actually, the fact that no comperhensive population census has been conducted is not due fundamentally to financial or technical difficulties - although these are considerable - but to political moves relating to the confessional balance on which the system existing in Lebanon is based, with all that it customarily entails with regard to the distribution of political and administrative positions and powers according to confessional adherence and the affecting of the position and weight of each confessional community by the number of its members.

We shall try to give a brief account of the most important population surveys conducted in Lebanon in the past.

2. Available demographic data

The absence of any comprehensive population census in Lebanon does not mean that there have been no population surveys involving specialized demographic studies, because the requirements of economic and social planning and increasing awareness of the need to cope with increasing social problems, some of which emanate from demographic variables, have made it necessary to resort to the conduct of certain population surveys and checks, in order to collect the data required for an understanding of certain social phenomena, the volume of the demographic variables and their economic and social repercussions. Table 1 shows the principal

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* Meeting dacument E/ECWA/POP/WG.5/20.

population estimates and surveys carried out in Lebanon in the past according to their time sequence and with an indication of the source and type of each. With regard to this table, the following observations may be made.

1. The statistics of the Ministry of the Interior cover the registered population. It is well known that the registers of the size of the population are subject to a considerable degree of error in general and with regard to deaths in particular. Furthermore, these statistics do not give a picture of the number of persons residing in Lebanon on any specific date, because they do not show migration to and from Lebanon.

2. The estimates of the IRFED Mission, (1959), the Ministry of General Planning (1970) and the Population Unit of U N E S O B (1970) cover the Lebanese, other Arab and foreign population, to the exclusion of Palestinians living in camps.

3. The survey made by the Central Directorate of Statistics is the most recent available estimate of the population residing in camps.

4. The United Nations Population Unit estimate indicated in the table is based essentially on the sample survey made by the Ministry of Central Planning in 1964 and was made before the issuance of the results of the survey made by the Central Directorate of Statistics, which were published in July 1972.

5. The table does not include all the specialized sectoral studies which have been carried out, such as the family budget study, the census of establishments and of agricultural holdings, etc.

3. Financial and technical difficulties encountered in the conduct of population surveys

While the basic obstacle encountered in the conduct of a comprehensive population census in Lebanon is of a political character, namely, the absence of a political will to conduct population censuses and an awareness of the importance of such censuses, it may be said that the financial and technical difficulties encountered in the surveys which have been and are being conducted in Lebanon do not differ in detail from some of those described by the delegates of sister States. Among the most important of these difficulties are the following :

1. A shortage of statistical technical cadres in general and of middle-level cadres, such as assisant statisticians, in particular and a shortage of demographers, which was acute prior

Table 1. The Principal Global Estimates And The Most Important Specialized Surveys Carried Out In Lebanon

Year	Overall population size	Source and type of estimate
1932	793,426	Comprehensive census made by the French Mandatory authorities.
1944	1,064,186	Subsistence Office or Fiscal Census, as emended by Alexander Gibb.
1953	1,416,570	Ministry of the Interior, personal status data, registered population.
1959	1,626,000	IRFED Mission (conjectural estimate) .
1961	2,150,526	Ministry of the Interior, personal status data, registered population.
1964	2,179,634	Sample Survey, Regional Activities Service, Ministry of General Planning, resident population.
1965	2,367,141	Ministry of the Interior, personal status data, registered population.
1970	2,614,000	United Nations Economic and Social Office, Population Unit, estimate based on the emendation of available data.
	2,126,00	Central Directorate of Statistics, Ministry of General Planning, statistical sample survey (resident population) of the labour force in Lebanon, November 1970-July 1972.
1971		Sample survey on internal migration in Lebanon, its sources, trends and motivation; results published in 1974.
1973		Study on family planning, sample survey carried out by the Lebanese Family Planning Association, in co-operation with the Ministry of Labour and Social Affairs.
1974		Sample study of wages and employment in the industrial and small trades sector; screening and analysis of the data not yet completed.

to 1960, after which date the situation improved;

2. Instability in the reserve of statistical cadres because of the constant drain-off of statisticians owing to financial incentives attracting them to work in the private sector or outside Lebanon;

3. An absence or lack of co-operation and co-ordination among the various departments to which census matters are assigned and a lack of clarity in the legislative text pertaining thereto;

4. A lack of statistical awareness among citizens generally and a lack of co-operation with investigators.

5. The non-existence of a classification of occupations and economic activities which conforms to conditions in Lebanon and to the level of development of the division of labour there, plus the lack of any uniform classification of occupations, which does not always conform to conditions in Lebanon, inasmuch as the classification of occupations is closely linked to the level of economic development in each country and the division of labour within each occupation;

6. The absence of geographical maps prepared for statistical purposes and the non - existence of regulations governing establishments and residential units, etc.;

7. The difficuty of enumerating certain categories of residents, such as workshop staff and seasonal agricultural workers;

8. The financial difficulties lying in the lack of appropriations earmarked for population studies and surveys, owing to a priorities which does not accord these studies their due importance.

However, it is hoped that there will be an increase in the attention accorded to general, specialized and sectoral population surveys with an increase in awareness of the importance of such statistics for the understanding of demographic variables having far-reaching economic and social repercussions.