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World demographic trends

Report of the Secretary-General

Summary

Prepared in accordance with resolution 1996/2 of the Economic and Social Council, the present report reviews the results of six population-projection scenarios prepared in order to explore the implications of different fertility trends for population growth and population ageing over the next three centuries. The scenarios considered underscore the importance of reaching replacement-level fertility in all countries of the world in order to avoid unsustainable increases or decreases of the population. They thus provide a rationale for addressing current population imbalances and reinforcing policies that foster fertility reductions in countries where fertility is still above replacement level.

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I. Introduction

1. The world population is poised to reach 7 billion in 2011. Although the rate of population growth has been declining since the late 1960s, the doubling of the world population between 1950 and the late 1980s has meant that, over the past half century, each additional billion has been added more rapidly than at any other time in history, with the last two in a record 12 years each.

2. The additions to the world population are increasingly being concentrated in the developing regions of the world and particularly in Africa. Consequently, the share of population growth in the developed regions has declined markedly and is expected to decline further as a rising number of developed countries experience population declines. Such trends are producing population imbalances that will increasingly underpin development prospects and condition long-term sustainability.

3. In the 1970s, awareness of the challenges posed by rapid population growth prompted the international community to hold the first intergovernmental conference on population, the 1974 World Population Conference. The Conference galvanized national and international action to provide family planning and enable people to have the number of children they desired. The Conference recommended that Governments pursue a two-pronged strategy to address population growth, including by establishing and strengthening family planning programmes, on the one hand, and improving people's well-being by reducing child mortality and increasing educational attainment, particularly of girls, on the other. Countries that followed those recommendations experienced marked reductions in fertility. In 2005-2010, 40 per cent of all developing countries saw their fertility drop to less than half their 1970-1975 levels, and fertility levels declined in virtually all other countries in the developing world.

4. Yet, because fertility declines generally followed and were accompanied by significant reductions in child mortality, population growth remained substantial. Annual population increments passed from 47 million in 1950-1955 to 75 million in 1975-1979 and peaked at 89 million in 1990-1995. Since then, annual population increments have been declining but are still high by historical standards, averaging 79 million persons per year.

5. The inertia intrinsic in population growth is partly responsible for the maintenance of high population increments. Because women of reproductive age are today nearly three times as numerous as their counterparts were in 1950, they have 40 per cent more births annually than their grandmothers had in the 1950s, even if their fertility is, on average, half what it was then. Because of this "population momentum", even if the fertility of every country were to reach "replacement level" in 2011, that is, a level that would ensure zero population growth eventually, the world population would continue to grow by an average of 66 million persons annually during 2010-2025.

6. Recognition that the increase in world population is unlikely to change much in the near future, coupled with a sense that fertility decline is far advanced in most countries and that the rate of population growth continues to slow down, has led to a generalized view that population trends are no longer an issue of concern in regard to the development or sustainability of life on the planet. Moreover, the success of United Nations official population projections in forecasting global population growth has so far led to the widespread acceptance of the medium scenario as the

definitive word regarding future population trends. As a consequence, the continued reduction of fertility levels in developing countries is taken for granted and insufficient attention is being paid to the possibility that the population of the future may turn out to be significantly higher than the approximately 9 billion projected by the medium scenario for 2050. Given that in 2012 the international community will focus once more on ways to ensure sustainable development, the present report uses different projection scenarios to illustrate the challenges posed by a failure to achieve stabilization of the world population within the twenty-first century.

II. Scenarios of future population change

7. Projections over long periods are useful for assessing the sensitivity of population trends to small changes in the components of population growth. As part of *World Population Prospects: The 2008 Revision*, long-range projections to 2300[1] have been prepared for every country on the basis of different assumptions about future fertility, mortality and migration. Beyond a few decades, the long-term projections can only be considered as scenarios illustrating the consequences of "what if" assumptions about future trends in fertility and mortality.

8. When considering the projection results, one should bear in mind that, if fertility remains at replacement level for long periods, mortality remains constant and international migration is zero, the population eventually stops growing and reaches a "stationary state" where the annual number of deaths equals the number of births and the age distribution of the population stops changing. In the absence of migration, if fertility is maintained above replacement level and mortality remains constant, the rate of population growth eventually becomes positive and the population increases. Conversely, with constant mortality and zero international migration, fertility that stays below replacement level eventually leads to a decreasing population.

9. In all cases, time is of the essence. When fertility declines from above replacement level to replacement level or below, population momentum keeps the population growing for some time until the number of mothers declines sufficiently. Similarly, when the population is already declining and fertility increases from below replacement level to replacement level or above, population momentum will keep the population declining for some time until the number of mothers increases sufficiently.

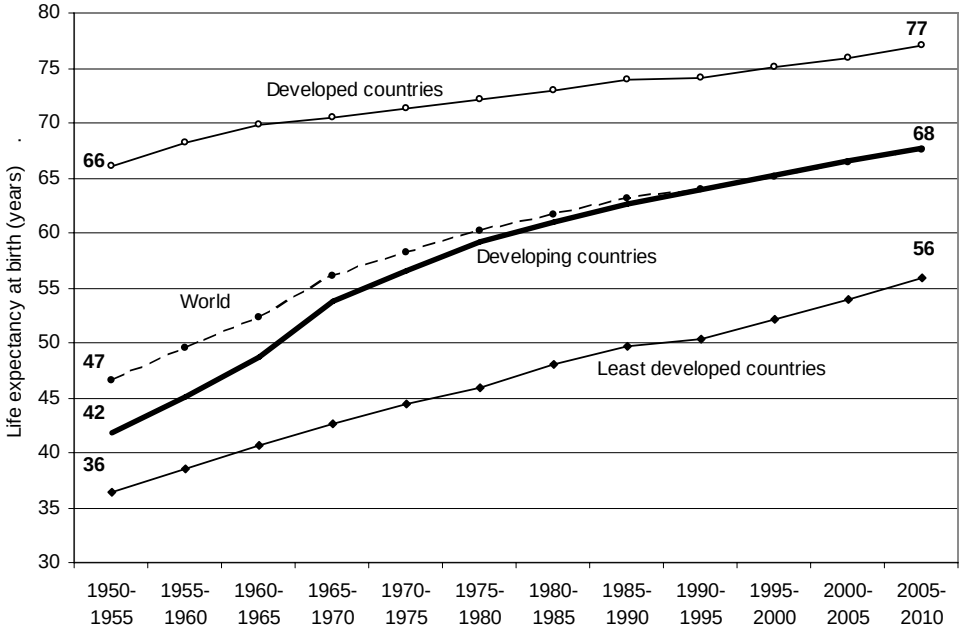
10. Replacement-level fertility is the number of children that women need to bear, on average, to ensure that every woman ever born is replaced by only one daughter. Because women have to survive to childbearing age in order to reproduce, mortality levels have to be taken into account in calculating the average number of children per woman that ensure replacement. Furthermore, because more boys are born than girls, even if mortality were zero, women would have to bear slightly more than two children, on average, to ensure that enough daughters are born. In low-mortality populations, where the probability of surviving to the mean age of childbearing is very close to one, replacement-level fertility is close to 2.1 children per women and may be even slightly lower. In high-mortality populations, replacement-level fertility may be much higher. Thus, in the least developed countries today, replacement level is estimated at 2.5 children per woman.

[1] United Nations, *World Population Prospects: The 2008 Revision, Long-Range Projections Supplement* (CD-ROM version) (POP/DB/WPP/LRPS/Rev.2008).

III. Review of past trends

11. The period 1950-2010 has witnessed unprecedented demographic changes: both mortality and fertility have declined markedly in most countries. As figure I[2] illustrates, life expectancy has increased in all development groups. In developed countries, where life expectancy was already a high 66 years in 1950-1955, it has increased by 11 years to reach 77 years in 2005-2010. In the least developed countries, whose life expectancy is still comparatively low, it rose by 20 years, from 36 to 56 years over the same period, and in the rest of the developing countries, average life expectancy increased even more markedly: by 26 years, from 42 to 68 years. As a result, the gap in life expectancy between developing and developed countries has narrowed considerably. Life expectancy is expected to continue to rise in all groups of countries. The least developed countries, in particular, are expected to strengthen efforts to reduce child mortality, combat the spread of HIV/AIDS and reduce the incidence of other major infectious and parasitic diseases in order to meet the Millennium Development Goals. Improvements in health and longevity are also expected in the other developing countries and in developed countries.

Figure I
Life expectancy at birth by major development group, 1950-2010

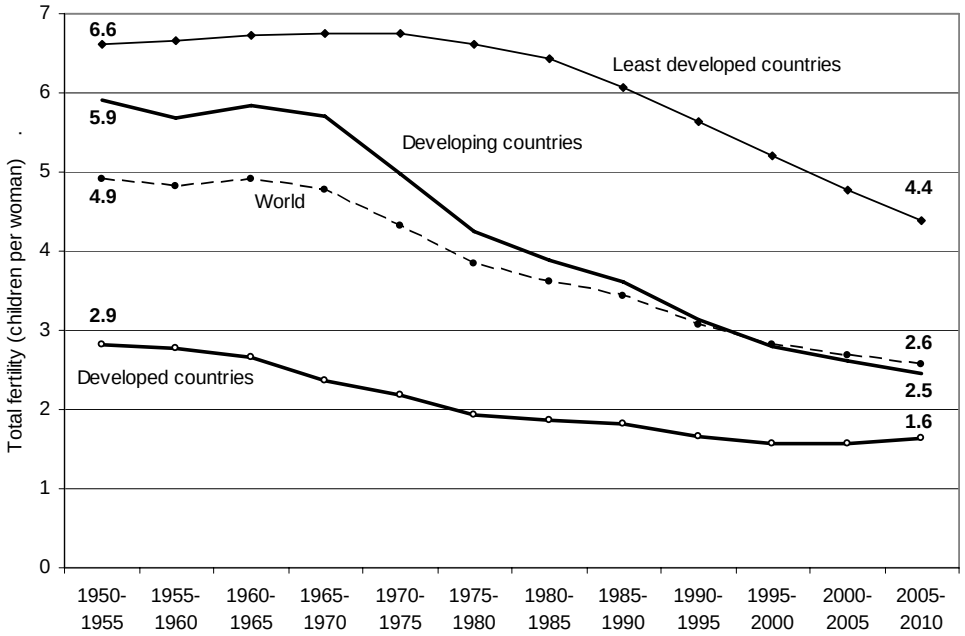


12. With respect to fertility, the changes recorded since 1950 are equally extraordinary. Never before in human history have global fertility levels dropped so much, so fast. Furthermore, they did so mainly as a result of the voluntary decisions by millions of people to limit their family size. Yet, fertility still varies considerably among countries, and there is a marked difference today between the fertility of the least developed countries (4.4 children per woman) and that of the rest of the

[2] Tables and figures in the present document are from *World Population Prospects: The 2008 Revision, Long-Range Projections Supplement*.

developing world (2.5 children per woman). In addition, the average fertility of developed countries, which first dropped below replacement level in 1975-1980, continues to be well below replacement at 1.6 children per woman despite the recent increases recorded by several developed countries (see figure II).

Figure II
Total fertility by major development group, 1950-2010



13. Future fertility trends are less certain than future mortality trends. For one thing, the low fertility of developed countries was unexpected and so was its persistence over such a long period. Although the increases in fertility recorded recently in some developed countries have been predicted by studying trends in the postponement of childbearing, these increases have not yet been sufficient to return the fertility of all developed countries to replacement level. Whether and when it may do so is an unanswered question.

14. Another key question is whether below-replacement fertility will become generalized in developing countries. Today, 30 developing countries, representing 40 per cent of the population of the developing world, have below-replacement fertility, but it is not certain that most of the remaining developing countries will reach such low levels soon. The large and diverse population of India, for instance, may continue to have large segments with high fertility, which could counterbalance the fertility declines in other segments. Furthermore, other populous countries, such as Egypt, Nigeria, the Philippines or Pakistan, still have moderate to high fertility.

15. The least developed countries have been lagging behind in reducing fertility and in many of them the desire for large families is still common. Although the unmet need for family planning to space births and limit family size is high in most of them and their Governments have committed to reducing that unmet need in order to achieve the Millennium Development Goals, there is considerable uncertainty about whether changes in access to family planning and in other important factors, including improving education among girls, will occur fast enough.

IV. Assumptions underlying the six scenarios of future population change

16. Bearing in mind the uncertainties discussed above, six different projection scenarios were prepared, five of which differ only with respect to the path that future fertility is assumed to take. The sixth scenario, named the "no-change scenario", differs from the others with respect to both the path of future fertility and the path of future mortality.

17. The "medium scenario" assumes that future fertility follows a path informed by the past experience of countries at different stages of development. For countries with fertility above 1.85 children per woman, fertility is assumed to decline at a pace derived from the experience of developing countries since the 1970s. Fertility is allowed to decline until it reaches a level of 1.85 children per woman and once that level is reached, it remains at that level for 100 years. After that period, fertility increases slowly until it reaches replacement level and is then maintained at replacement level from that point until 2300.

18. For countries with current fertility below 1.85 children per woman, fertility in the medium scenario is projected to increase, usually slowly, to reach 1.85 children per woman. It then remains at that level for enough time to complete 100 years of below-replacement fertility, after which it rises slowly to replacement level and remains at replacement level until 2300.

19. Because the medium scenario maintains the fertility of all countries at below-replacement level for about 100 years, it leads to a reduction of the population in each of them, although the timing of that reduction varies. Nevertheless, it produces a contraction of the world population over a lengthy period within the next three centuries. By assuming an eventual return to replacement-level fertility, the medium scenario prevents a continuing population decline.

20. The "low scenario" and "high scenario" are constructed to test the sensitivity of future population growth to small changes in fertility trends. In the high scenario, fertility remains half a child above the fertility of the medium scenario until 2050 and then falls to about a quarter of a child higher than the fertility of that scenario for the rest of the projection period. In the low scenario, fertility is at first set to be half a child below the fertility of the medium scenario but after 2050 it rises to be about a quarter of a child below the fertility of that scenario and maintains the difference until 2300.

21. Over the medium term, the fertility trends projected in the medium scenario for each country can be considered plausible continuations of current trends under the assumption that the average past experience of the developing countries whose fertility had declined since the 1960s would be repeated by countries where fertility decline was lagging behind and that the fertility of all developing countries would, like that of developed countries, fall below replacement level and remain below replacement for lengthy periods.

22. In the long run, the medium scenario is based on the neutral assumption that all countries will converge to replacement-level fertility and will therefore tend towards a stabilization of their populations. Nevertheless, no country will achieve a fully stationary stage because mortality keeps on decreasing in the medium scenario; consequently, increasing longevity maintains population growth positive. In the low and high scenarios, future mortality evolves in the same way as in the medium scenario.

23. Given that replacement-level fertility is the key to population stabilization, a projection where fertility is set at its actual replacement level for each country and each five-year period is produced under the “instant-replacement scenario”. In that scenario, as in the medium scenario, mortality keeps decreasing until 2300 and, owing to increasing longevity, the population does not quite achieve a stationary state.

24. Two scenarios are produced to assess the sustainability of current levels of the components of population growth. The first is the “constant-fertility scenario”, which keeps fertility constant in each country at the level it had in 2005-2010 and lets mortality decline as in the medium scenario. The second is the no-change scenario, which keeps both fertility and mortality constant at the levels they had in 2005-2010. The constant-fertility and no-change scenarios provide useful insights about the implications of current population imbalances for future population change.

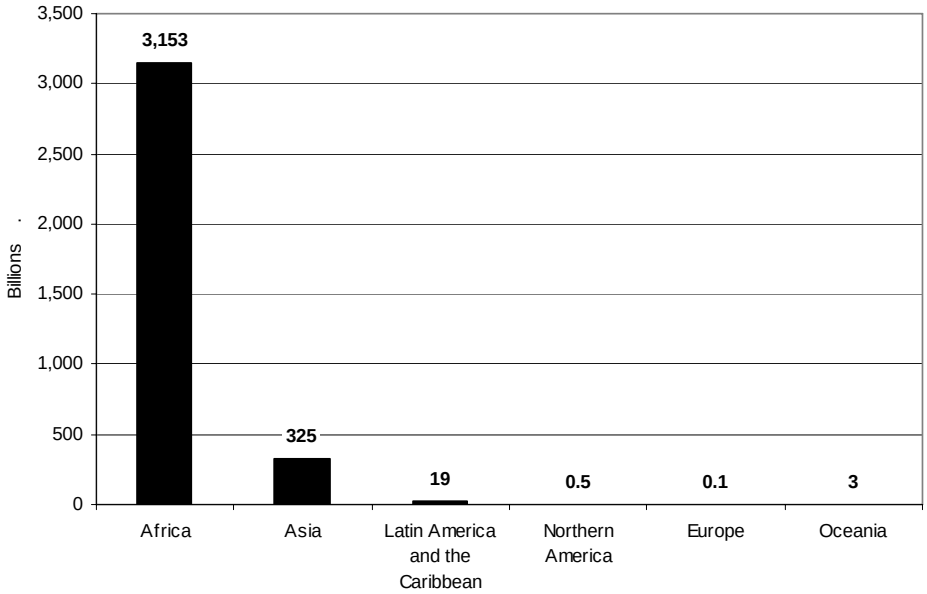
25. In all the scenarios described above, international migration is not zero at the country level over the period 2010-2100 but is set to zero for every country after 2100.

V. Population trends according to different scenarios

A. Unchanging fertility: no-change and constant-fertility scenarios

26. The no-change scenario allows an assessment of the potential sustainability of current population dynamics. Because high-fertility countries tend to have relatively high mortality, this scenario does not yield the highest population growth among the scenarios considered. Nevertheless, it produces a world population of 3.5 trillion people in 2300, with 3.15 trillion in Africa alone (see figure III). Under this scenario, the population of Asia reaches 325 billion in 2300, that of Latin America and the Caribbean, 19 billion, and that of Oceania, 3 billion. In contrast, the population of Northern America grows to a mere half a billion and that of Europe decreases to just 0.1 billion (100 million).

Figure III
Population in 2300 by major area according to the no-change scenario

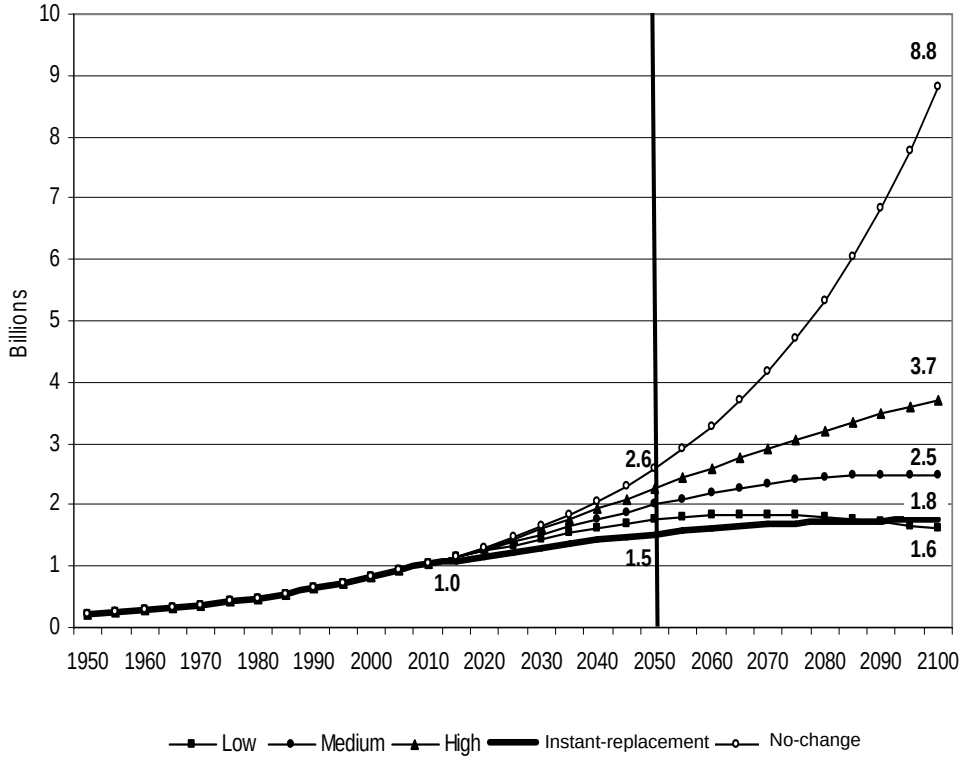


27. By exaggerating current population imbalances, the no-change scenario makes them more obvious. Its results indicate that the current demographic dynamics of Africa would produce an unsustainable population in the long run. Even if, in the medium term, the population of Africa in the no-change scenario were not greatly different from that produced by other, more plausible projection scenarios, by 2100 the difference between the no-change scenario and other scenarios would be large (see figure IV). Such comparisons suggest that current demographic trends in much of the continent will have to change over the rest of the twenty-first century and, in order to ensure that they change in ways that improve well-being, policies similar to those implemented by developing countries in other areas, and which aim to achieve reductions in both mortality and fertility, will need to be pursued with determination.

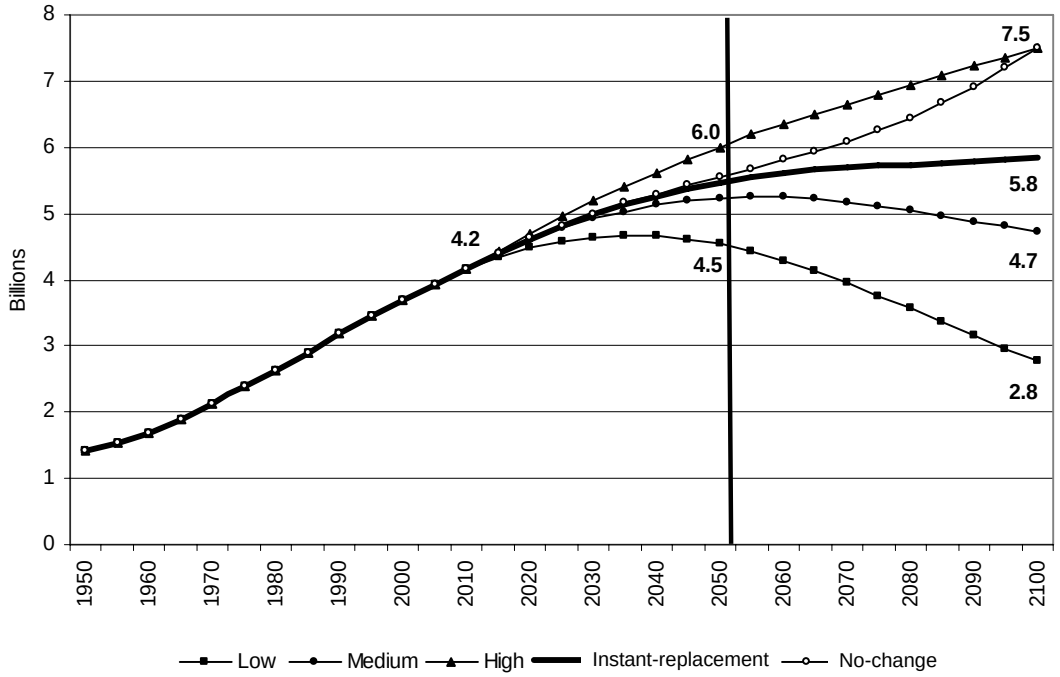
Figure IV

Population by major area according to different projection scenarios, 1950-2100

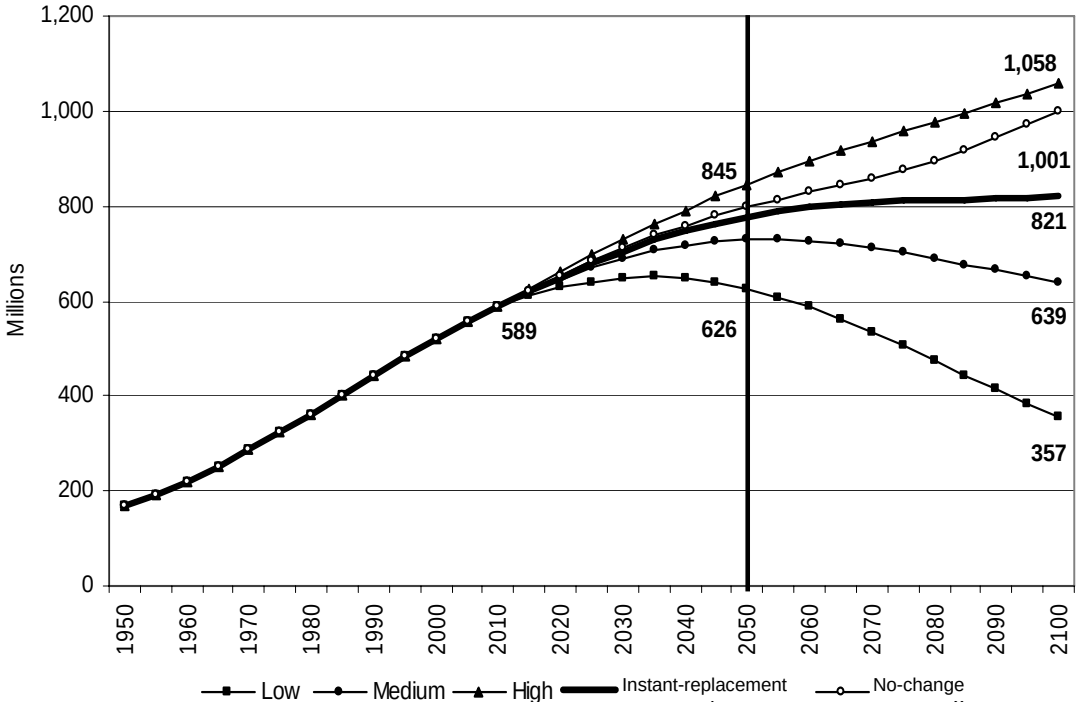
A. Africa



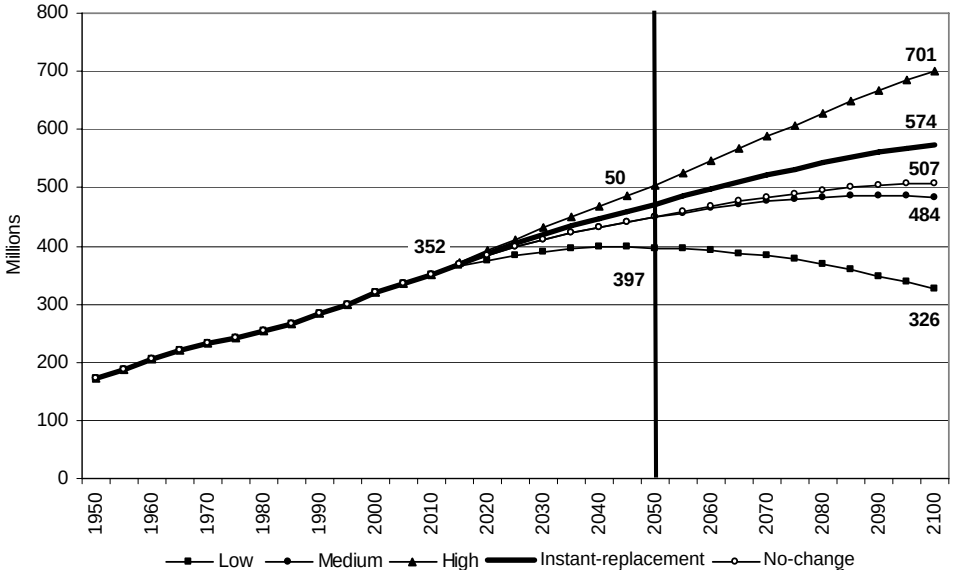
B. Asia



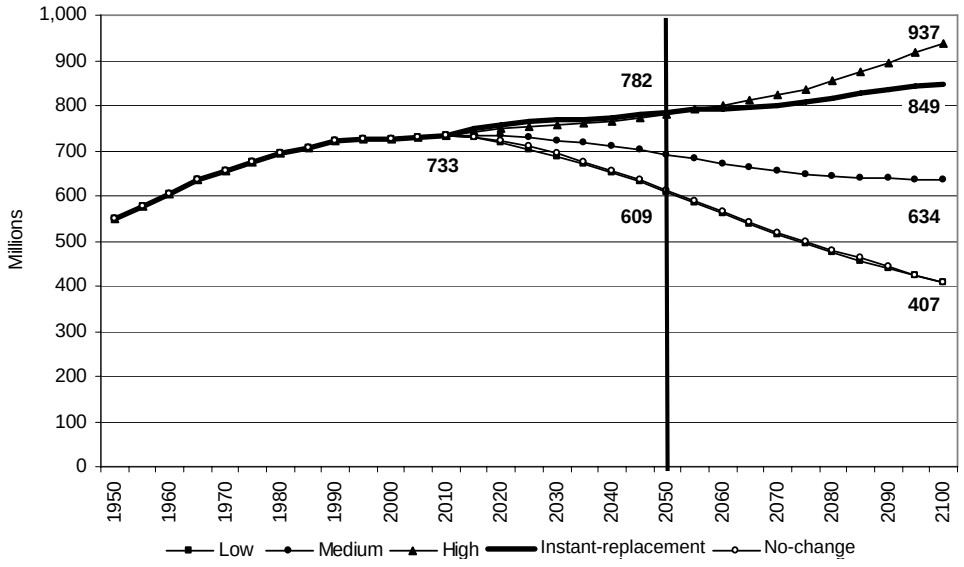
C. Latin America and the Caribbean



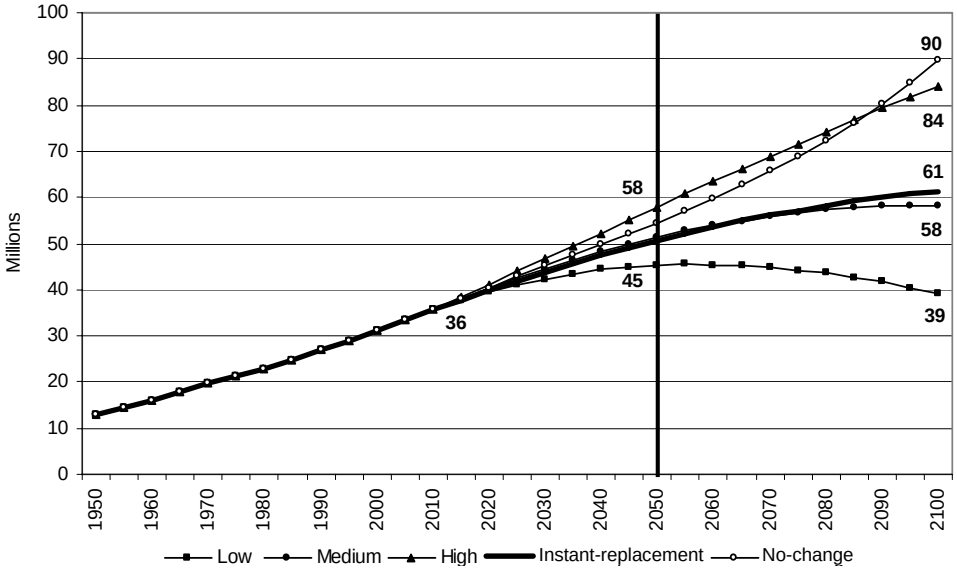
D. Northern America



E. Europe



F. Oceania



28. The results of the no-change scenario for other developing regions are also sobering. They indicate that, despite the major achievements made so far in reducing fertility and mortality in Asia, Latin America and the Caribbean and Oceania, the two are still not sufficiently balanced and the potential for unsustainable population growth still exists.

29. In the case of Europe, the no-change scenario confirms that current fertility levels pose the challenge of sustained population decline (see figure IV.E). At current fertility and mortality levels, the population of Europe could be halved by 2110. In contrast, Northern America, whose current fertility is close to replacement level, would experience continued though moderate population growth fuelled by a combination of population momentum, continued immigration and increasing longevity.

30. An interesting feature of the no-change scenario is that, although life expectancy and total fertility remain constant for each country, they change at the world level because the populations that grow faster have higher mortality and higher fertility. Thus, whereas the scenario starts with a world life expectancy of 68 years in 2005-2010, it ends with 53 years of life expectancy in 2295-2300. Similarly, although its starting fertility is 2.6 children per woman in 2005-2010, fertility rises continuously over the projection period to reach 6.2 children per woman in 2295-2300. That is, the no-change scenario produces a future world where not only does the population reach huge numbers but also where average well-being in terms of survival chances diminishes.

31. Whereas the no-change scenario maintains both fertility and mortality constant at their estimated levels for 2005-2010, the constant-fertility scenario assumes that fertility remains constant and that mortality continues to decline in all countries as in the medium scenario. Because of its declining mortality, the constant-fertility scenario yields a much larger world population in 2300 than the no-change scenario: 34 trillion people, compared with 3.5 trillion. Once more, most of that population is

in Africa (31 trillion). The results of the constant-fertility scenario provide further justification for the conclusion that fertility decline needs to continue in all developing countries having above-replacement fertility if improvements in human survival are to be achieved and maintained and if the numbers of people in the planet are not to reach unsustainable levels.

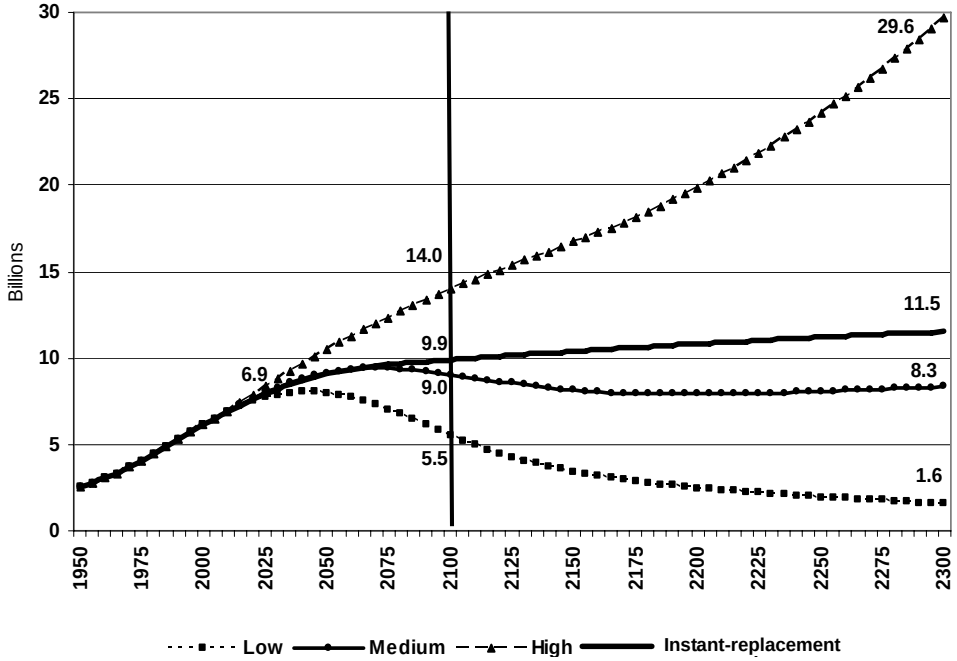
B. Instant-replacement scenario

32. In the "instant-replacement scenario", fertility is set at exact replacement level for each country as of 2010-2015 and remains at replacement level until 2300. Replacement fertility is calculated separately for each country and period on the basis of the corresponding mortality and sex ratio at birth. If mortality were to remain constant over the projection period, the scenario would eventually produce a population of unchanging size and age structure. However, because life expectancy is projected to increase from 68 years in 2005-2010 to 95 years in 2295-2300, the instant-replacement scenario produces a population that increases over the projection period, at first because of both population momentum and increasing longevity, and eventually because of increasing longevity alone. In addition, up to 2100, international migration is non-zero for most countries.

33. According to the instant-replacement scenario, the world population increases from 6.9 billion in 2010 to 9.1 billion in 2050, reaches 9.9 billion in 2100 and keeps rising to attain 11.5 billion in 2300 (see figure V). In addition, under this scenario, the populations of all major areas increase. By 2100, the highest relative increases are projected for Africa and Oceania (their populations increase by 71 per cent relative to 2010) and for Latin America and the Caribbean (an increase of 63 per cent). Both Asia and Northern America are projected to experience a population increase of nearly 40 per cent by 2100, but in the case of Northern America the increase is partly caused by projected migration. The smallest increase occurs in Europe, whose population rises by just 16 per cent by 2100.

34. By 2300, the instant-replacement scenario produces a doubling of the populations of Africa and Oceania and a population in Europe that is a third higher than it is today. The population of Northern America increases by 90 per cent and the populations of Asia and Latin America and the Caribbean by approximately 60 per cent each. Although Africa's share of the world population will have increased from 15 per cent in 2010 to 18.5 per cent in 2300 and there will be a small decline in the shares of Asia and Europe, the distribution of the world population by major area in 2300 according to the instant-replacement scenario is not markedly different from what it is today.

Figure V
Projected world population according to different projection scenarios, 1950-2300



35. Although the components of population growth at the world level may return in the future to a path where fertility is just low enough to counterbalance mortality but is not much higher or lower than that, in the medium term, replacement-level fertility is unlikely to prevail, mainly because fertility in Africa is still about 1.8 children higher than replacement level and fertility in Europe is 0.6 children lower than replacement level (see table 1). In all other major areas, fertility in 2010-2015 in the medium scenario is close to replacement level. Consequently, the instant-replacement scenario suggests that a reduction of today's population imbalances, whereby the low fertility of European countries would increase to replacement level and that of countries in Africa would decrease towards replacement level in as short a span as possible, would be sufficient to set world population on a path towards sustained but very slow population growth, provided increases in longevity continued over the long run. Such a path would also be the most likely to produce a future distribution of the world population by major area close to that which prevails today.

Table 1
Total fertility in 2010-2015 according to the medium and instant-replacement scenarios

	Medium	*Instant-replacement*
	Children per woman	
Africa	4.27	2.51
Asia	2.26	2.26
Latin America and the Caribbean	2.09	2.11
Northern America	1.98	2.08
Europe	1.53	2.10
Oceania	2.39	2.15

C. Low, medium and high scenarios

36. In the medium scenario, where fertility over the medium term is projected to decline in most developing countries, the world population increases at an ever-slowing pace until 2070, when it reaches 9.4 billion. At that point, because the fertility of every country is projected to remain below replacement level for a century, the medium scenario produces a declining world population that reaches a minimum at 7.9 billion in 2195. The eventual return of fertility to replacement level in all countries stops the decline and leads to a slowly increasing population that reaches 8.3 billion in 2300.

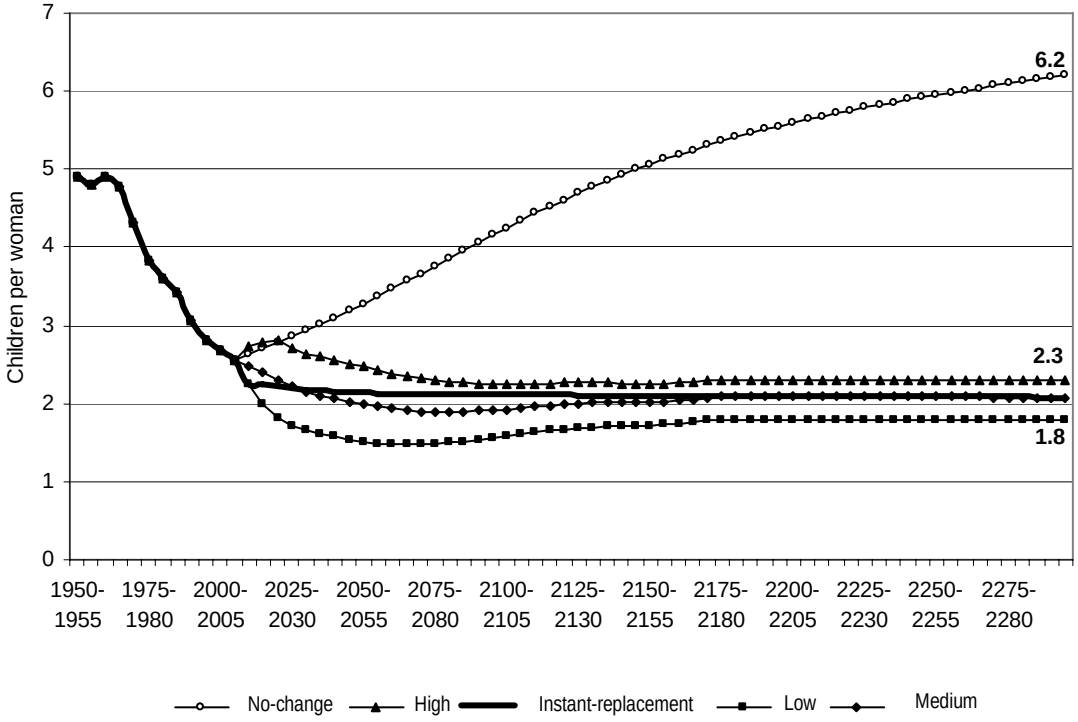
37. The high and low scenarios reveal the sensitivity of long-range population projections to small variations in fertility. With a fertility that stays just a quarter of a child above the fertility of the medium scenario over most of the projection period (2050-2300), the high scenario produces an ever-increasing population that reaches nearly 30 billion in 2300. Its counterpart is the low scenario, where fertility remains a quarter of a child below the fertility of the medium scenario from 2050 to 2300. As a result, the low scenario produces a world population that reaches a maximum at 8 billion in 2040 and then declines steadily to 1.6 billion in 2300. The two scenarios indicate that even relatively small deviations from replacement-level fertility maintained over the long run can lead to dramatic changes in the size of the world population. The high scenario, in particular, suggests that even in countries where fertility has already declined markedly from 1950 levels but remains above replacement level, additional reductions are necessary to avoid large population increases over the long run. The population of India, for instance, reaches 2.3 billion in 2100 in the high scenario, a population 0.9 billion higher than that projected by the medium scenario (1.4 billion). By 2300, the difference between the two is even higher (3.1 billion), with the high scenario producing a population of 4.4 billion.

38. In the medium scenario, the populations of Asia, Latin America and the Caribbean and Europe in 2300 are similar to those in 2010, those of Northern America and Oceania are about 50 per cent larger and that of Africa is twice as large. The high scenario produces populations in 2300 that are several times larger than those today: seven times for Africa, five times for Northern America and Oceania, four times for Asia and Latin America and the Caribbean, and three times

for Europe. In sharp contrast, the low scenario produces smaller populations in 2300 than the populations of today: Asia and Latin America and the Caribbean drop to a fifth of their current size, Europe drops to a fourth, Africa to a third, and Northern America and Oceania to about two fifths.

39. Given their divergent trends, the low and high scenarios produce global populations that differ more as time elapses (see figure V). In 2050, their difference is 2.5 billion; that difference rises to 8.5 billion in 2100 and surpasses 28 billion in 2300. Such increasing differences between the high and low scenarios mean that, in order to attain sustainable population growth over the long run, future fertility has to vary over a narrower range around replacement level than the one encompassed by the low and high scenarios (see figure VI).

Figure VI
Total fertility according to different projection scenarios, 1950-2300



D. Adding new billions

40. Another way of assessing the implications of different fertility trends for population growth is to consider the time it will take to gain an additional 1 billion people according to different projection scenarios (see table 2). Because of population momentum, the eighth billion will be added in a relatively short time in every projection scenario: 10 years in the high, 15 years in the medium and instant-replacement scenarios, and 17 years in the low scenario. Important differences appear after the eighth billion is reached. Thus, the low scenario never adds another billion, the high scenario adds one in just 11 years, the medium scenario does so in 20 years and the instant-replacement scenario in 21 years. From there on, only the

high and instant-replacement scenarios keep adding billions. The instant-replacement scenario does so at ever-increasing intervals (62 years for the tenth billion and 115 years for the eleventh). In sharp contrast, the high scenario adds a billion every 12 to 15 years over the rest of the twenty-first century and at slightly longer but still relatively short intervals over the rest of the projection period.

Table 2
Years during which the world population reached or is expected to reach each additional billion according to different projection scenarios

	Low		*Medium*		*High*		*Instant-replacement*	
Population (billions)	*Year reached*	*Number of years elapsed*	*Year reached*	*Number of years elapsed*	*Year reached*	*Number of years elapsed*	*Year reached*	*Number of years elapsed*
1			1804					
2			1927	122				
3			1960	33				
4			1974	14				
5			1987	13				
6			1999	12				
7	2011	12	2011	12	2011	12	2011	12
8	2038	17	2025	14	2022	10	2026	15
9			2045	20	2033	11	2047	21
10					2045	12	2110	62
11					2057	12	2225	115
12					2070	13		
13					2085	15		
14					2100	15		
15					2118	18		

41. Although there is no consensus on the maximum number of people that the Earth can support, and recent history has accommodated a world population that has been growing by a billion every 12 to 14 years without witnessing major collapses, the planet is nevertheless beginning to show signs of stress. Without major changes in technology, maintaining such a pace of population growth over the long run will add several billion people over the life of each generation and make it very difficult if not impossible to continue improving standards of living without severely straining the planet's resources.

E. Population prospects by major area

42. The results of the projection scenarios by major area confirm that differences in population trends since the 1970s have set the stage for the future divergence of population trends among major areas. In the case of Africa, for instance, all projection scenarios produce a growing population until at least 2100 (figure IV.A). The medium scenario, which projects a continued reduction of fertility at a moderate pace until it reaches 1.85 children per woman around 2100 produces for

Africa a population of 2.5 billion in 2100, one and a half times larger than it is today. If future fertility declines more slowly than projected in the medium scenario, the population of Africa could reach 3.7 billion in 2100, as it does in the high scenario. Even if all countries in Africa were to reach replacement level in 2010-2015 and maintain it, Africa's population would increase 80 per cent by 2100, to 1.8 billion.

43. For Asia, both the low and the medium scenarios project a declining population by 2100 because a number of populous countries in that major area already have below-replacement fertility or have fertility levels that are not far from replacement level. For that reason, the instant-replacement scenario produces a higher population for Asia in 2100 than the low and medium scenarios do. Given past trends, it seems reasonable to expect that the population of Asia will cease increasing over the course of the twenty-first century. However, that outcome depends on whether all countries in the continent, in particular in the Indian subcontinent, reduce their fertility to below-replacement level. The no-change scenario, which produces initially a lower population for Asia than the high scenario, eventually catches up with the latter and both produce 7.5 billion inhabitants for the continent in 2100 (see figure IV.B).

44. For Latin America and the Caribbean, as for Asia, the instant-replacement scenario produces a higher population in 2100 (821 million) than the low or medium scenarios (639 million and 357 million, respectively) because most countries in that major area already have fertility close to or below replacement level. Without further declines in current fertility, however, the population of Latin America and the Caribbean would keep on increasing, as the no-change scenario indicates, and could reach 1 billion by 2100. Therefore, as in the case of Asian countries, reductions in fertility are still necessary in order for the population of Latin America and the Caribbean to move towards stabilization during the twenty-first century.

45. Northern America stands out because it is the only major area where the no-change scenario produces a population in 2100 that is fairly close to that yielded by the medium scenario: 507 million, compared with 484 million. The similarity indicates that the below-replacement fertility projected in the medium scenario has a similar effect on population growth as constant mortality has at the 2005-2010 levels in the no-change scenario. Because of declining mortality, the instant-replacement scenario produces a significantly higher population for Northern America in 2100 (574 million). Given past trends, the future population of Northern America seems likely to fall somewhere between the medium and the instant-replacement scenarios because its fertility is not expected to drop to the levels projected in the low scenario or increase to those projected by the high scenario.

46. In contrast to Northern America, Europe is at a stage where population change similar to that followed by the low scenario is not out of the question. The no-change scenario and the low scenario produce similarly low populations for Europe in 2100: 407 million, a decline of 44 per cent with respect to the 733 million in 2010 (see figure IV.E). Until at least 2100, the effect of lower fertility projected by the low scenario on future population growth is similar to that of the constant mortality projected in the no-change scenario. Because of the persistence of low fertility in Europe, even the medium scenario, which projects an increase in fertility and an eventual return to replacement level, produces a drop in Europe's population by 2100: to 634 million, a 14 per cent decline with respect to 2010. Europe's

fertility would have to return to replacement level sooner than it does in the medium scenario in order to avoid population reductions. Thus, the instant-replacement scenario produces an increasing population and so does the high scenario, in which Europe's projected fertility returns early to levels well above replacement. Given current trends, Europe's population seems unlikely to follow either of the two scenarios over the midterm future.

47. Oceania contains two very distinct populations: that of developed Australia and New Zealand and that of the developing countries in the Pacific. Partly because of that composition, the no-change scenario, which starts by producing populations close to those yielded by the medium and instant-replacement scenarios, diverges from them to produce a population of 90 million in 2100, equivalent to nearly three times the population of Oceania in 2010. In addition, because Australia and New Zealand already have low fertility, the medium and instant-replacement scenarios produce similar populations in 2100 (58 million, compared with 61 million). Given past fertility trends in the developing countries of Oceania, its future population is more likely to lie between the medium and high scenarios than towards the low scenario. Therefore, an important increase in its population is expected over the coming decades even if the fertility of its developing countries declines as projected in the medium scenario.

F. Population prospects for the most populous countries in the developing world

48. In 2010, there were 18 countries in the developing world with populations of at least 50 million (see table 3). Together they accounted for 63 per cent of the world population and include China and India, a further nine countries in Asia, the five most populous countries of Africa, Brazil and Mexico in Latin America (see table 3). The 18 countries are at very different stages of the transition to low fertility. Thus, whereas Brazil, China, Iran (Islamic Republic of) and Thailand are reckoned to have below-replacement fertility, the Democratic Republic of the Congo, Ethiopia and Nigeria still have fertility levels above 5 children per woman. The rest have fertility ranging from close to replacement level (Turkey and Viet Nam) to 4 children per woman (Pakistan). This variety of current fertility levels results in very different prospects for future population growth.

49. In order to gauge the potential for future growth, the number of times the current population is projected to increase by 2100 according to the no-change scenario should be considered (see table 3). Under unchanging fertility and mortality, the population of the Democratic Republic of the Congo would increase 23 times over the next 90 years, that of Ethiopia 17 times, and that of Nigeria 13.5 times. The population of Pakistan would increase 7.5 times, while that of the Philippines would quadruple, the populations of India and Egypt would triple, and that of Bangladesh would double. By contrast, the populations of both China and Thailand would decline, by about 30 per cent in the case of China. The rest of the populous developing countries would see their populations increase between 2010 and 2100 by amounts ranging from 10 per cent in Iran (Islamic Republic of) to 90 per cent in South Africa. Such results suggest that current levels of fertility are unlikely to be sustainable over the long run in most of the populous countries of Africa and in several of those in Asia, particularly those whose population would at least triple by 2100 under the no-change scenario.

Table 3
Ratio of population in 2100 to that in 2010 according to projection scenarios for selected countries with 50 million or more inhabitants

Country	*No-change*	*Instant-replacement*	*Low*	*Medium*	*High*	*Total fertility in 2005-2010*
China	0.7	1.2	0.5	0.8	1.3	1.77
Thailand	0.9	1.3	0.6	1.0	1.5	1.81
Iran (Islamic Republic of)	1.1	1.5	0.6	1.1	1.8	1.83
Brazil	1.2	1.4	0.5	0.9	1.5	1.90
Mexico	1.4	1.2	0.4	0.9	1.6	2.21
Viet Nam	1.4	1.4	0.7	1.1	1.8	2.08
Turkey	1.5	1.5	0.7	1.2	1.9	2.13
Indonesia	1.6	1.4	0.6	1.1	1.8	2.19
Myanmar	1.7	1.5	0.7	1.2	1.8	2.32
South Africa	1.9	1.4	0.6	1.1	1.7	2.55
Bangladesh	2.0	1.5	0.7	1.2	2.0	2.36
India	2.7	1.5	0.7	1.2	1.9	2.76
Egypt	3.4	1.6	0.9	1.6	2.5	2.89
Philippines	4.0	1.5	1.0	1.6	2.5	3.11
Pakistan	7.5	1.7	1.3	2.1	3.1	4.00
Nigeria	13.5	1.7	1.4	2.1	3.1	5.32
Ethiopia	17.2	1.8	1.6	2.4	3.6	5.38
Democratic Republic of the Congo	23.4	1.8	1.8	2.7	4.0	6.07

50. In the majority of the populous developing countries, further fertility reductions would lead to more moderate population increases, as indicated by the results of the medium scenario (see table 3). According to that scenario, the population of the Democratic Republic of the Congo would at most triple by 2100, those of Ethiopia, Nigeria and Pakistan would more than double, and those of Egypt and the Philippines would increase by 60 per cent. With the exception of Brazil, China, Mexico and Thailand, whose populations would decline or remain the same, the rest of the populous developing countries would see their populations increase by between 10 and 20 per cent in the medium scenario. To achieve such moderate population increases, all populous developing countries would have to reduce their fertility to below-replacement level and maintain it below replacement for a lengthy period. If future fertility were to remain at replacement level, as in the instant-replacement scenario, the 2100 population of the majority of populous developing countries would be higher than that produced by the medium scenario, a result underscoring the importance of attaining and maintaining fertility below replacement level for lengthy periods in order to accelerate the attainment of stability.

G. Population prospects for countries or areas with the fastest-growing populations

51. The 20 countries or areas that had at least 1 million inhabitants in 2010 and are also projected to have the fastest-growing populations during 2010-2100 in the medium scenario are listed in table 4. In 2010, they accounted for 5 per cent of the world population and most of them are least developed countries. All have populations that have grown rapidly since 1950. Thus, the populations of Kenya, Niger and Uganda have increased six-fold and those of most of the other countries considered have at least quadrupled. Only Afghanistan, Guinea, Guinea-Bissau and Timor-Leste have experienced just a tripling of their populations.

52. Because of their high fertility, the fast-growing populations are expected to increase multiple times by 2100 according to the no-change scenario. If fertility and mortality remained constant until 2100 at 2005-2010 levels, Niger would see its population increase 57 times, Uganda 34 times and Timor-Leste nearly 31 times. Kenya would experience the smallest population increase among the countries considered and yet its population would increase 14 times by 2100 under the no-change scenario.

Table 4
Ratio of population in 2100 to that in 2010 according to projection scenarios for countries or areas with the fastest-growing populations

Country	*No-change*	*Instant-replacement*	*Low*	*Medium*	*High*	*Total fertility in 2005-2010*
Kenya	14.2	1.8	1.7	2.7	4.1	5.0
Rwanda	14.6	1.8	1.8	2.7	4.0	5.4
Madagascar	14.7	1.9	1.7	2.7	4.2	4.8
Liberia	15.7	1.7	1.8	2.8	4.2	5.1
Guinea-Bissau	16.3	1.6	2.1	3.1	4.4	5.7
Yemen	17.9	1.9	1.8	2.8	4.2	5.3
Occupied Palestinian Territory	19.0	1.9	2.0	3.1	4.6	5.1
Angola	19.1	1.8	2.0	3.0	4.4	5.8
Benin	19.4	1.8	2.2	3.3	4.9	5.5
Guinea	19.6	1.9	2.2	3.3	4.7	5.5
Malawi	20.8	1.8	2.1	3.3	4.8	5.6
Somalia	21.3	1.7	2.7	3.9	5.4	6.4
United Republic of Tanzania	21.4	1.8	2.3	3.6	5.3	5.6
Zambia	22.7	1.8	1.8	2.9	4.2	5.9
Afghanistan	24.6	1.8	2.6	3.7	5.1	6.6
Chad	24.6	1.8	2.4	3.5	5.0	6.2
Burkina Faso	29.2	1.9	2.4	3.6	5.1	5.9
Timor-Leste	30.5	1.8	3.0	4.4	6.2	6.5
Uganda	33.7	1.9	2.7	4.0	5.8	6.4
Niger	56.8	2.0	5.3	7.3	9.8	7.1

53. If their fertility were to drop below replacement level during the twenty-first century, as it has in the medium scenario, the population of Niger would increase 7 times by 2100, the populations of Timor-Leste and Uganda would quadruple. The majority of the other fast-growing populations would at least triple by 2100. Population increases would be even higher according to the high scenario, where the populations of fast-growing countries would at least quadruple.

54. Given that fertility has declined relatively slowly or has even increased in the 20 countries considered, it is likely that those countries will achieve at best the fertility reductions projected in the medium scenario, and more effective programmes are therefore urgently needed in order to improve reproductive health and expand access to modern contraception together with measures to accelerate the reduction of child mortality and to increase educational attainment, particularly of girls.

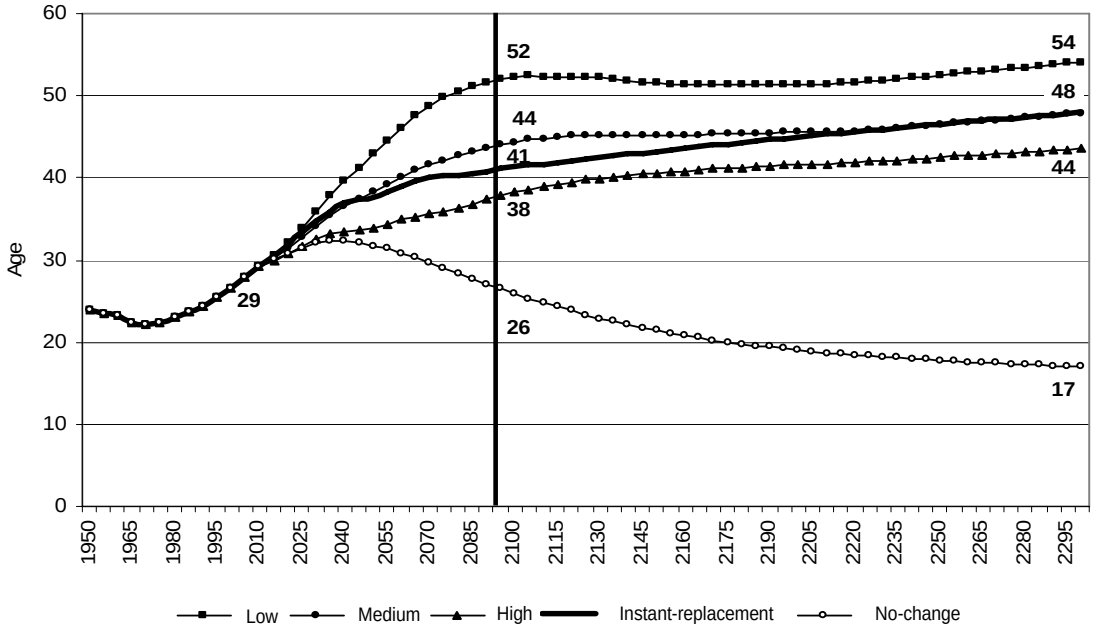
55. Even if all the countries with rapidly growing populations would achieve replacement fertility today, their populations would still nearly double by 2100, largely as a result of population momentum. Consequently, the reductions of fertility that are likely to be achieved by increased efforts to attain the Millennium Development Goals will not stop their populations from growing over the medium term; slowing that growth, however, will expand the options that families and communities have to improve their well-being.

VI. Population ageing

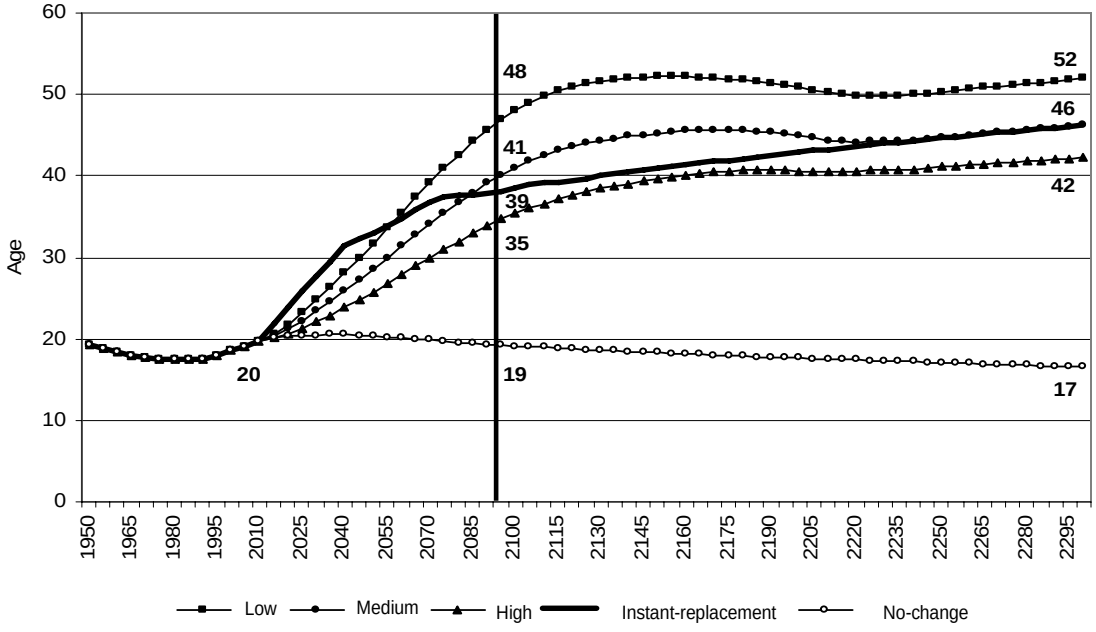
56. An unavoidable consequence of reductions in fertility is population ageing. Because future fertility follows different paths in the various projection scenarios, it is useful to consider their implications for population ageing. To do so, the median age of the population, that is, the age that divides the population in two equal parts, is used as an indicator of population ageing. As a population ages, the median age increases, as it does in most of the projection scenarios shown in figure VII.

Figure VII
Median age for the world and major areas according to different projection scenarios, 1950-2300

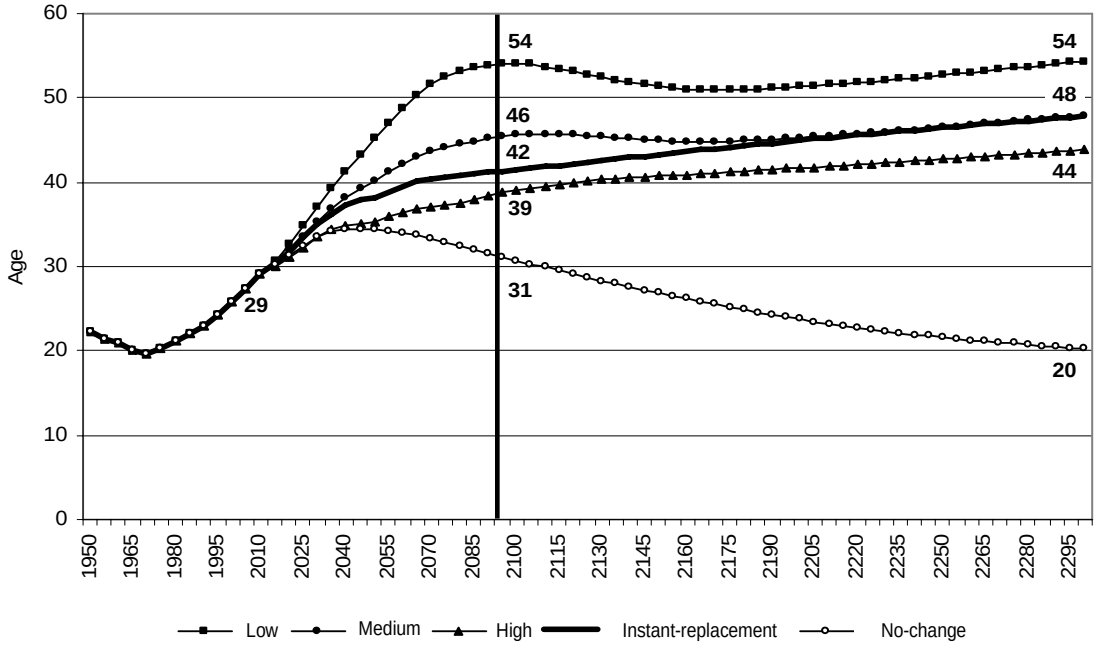
A. World



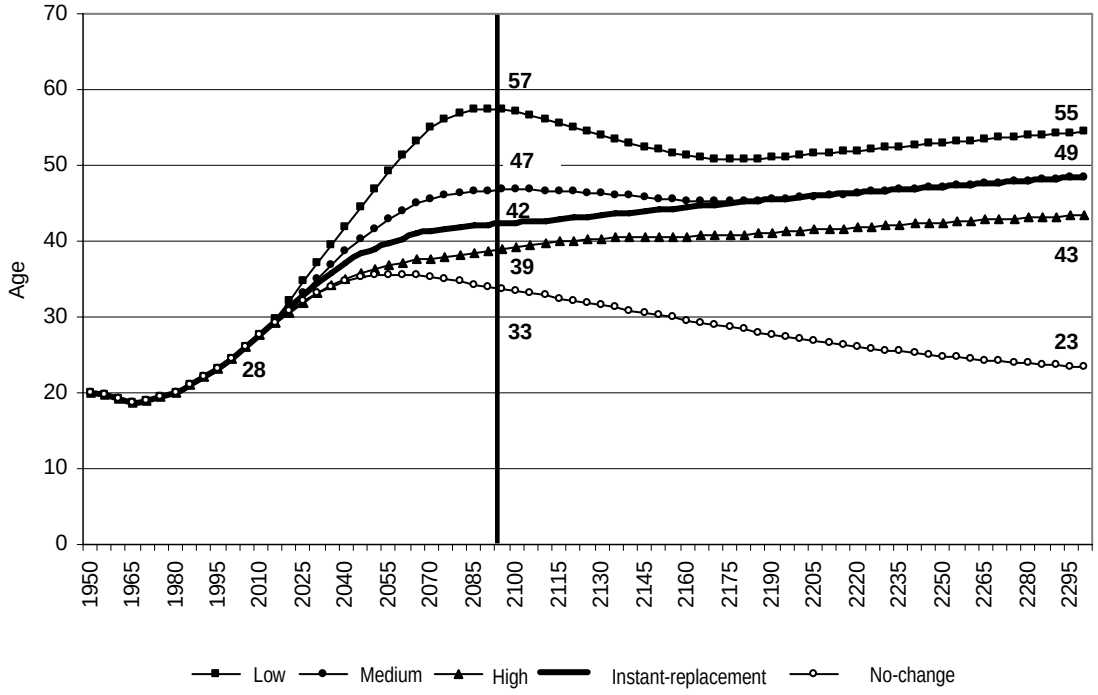
B. Africa



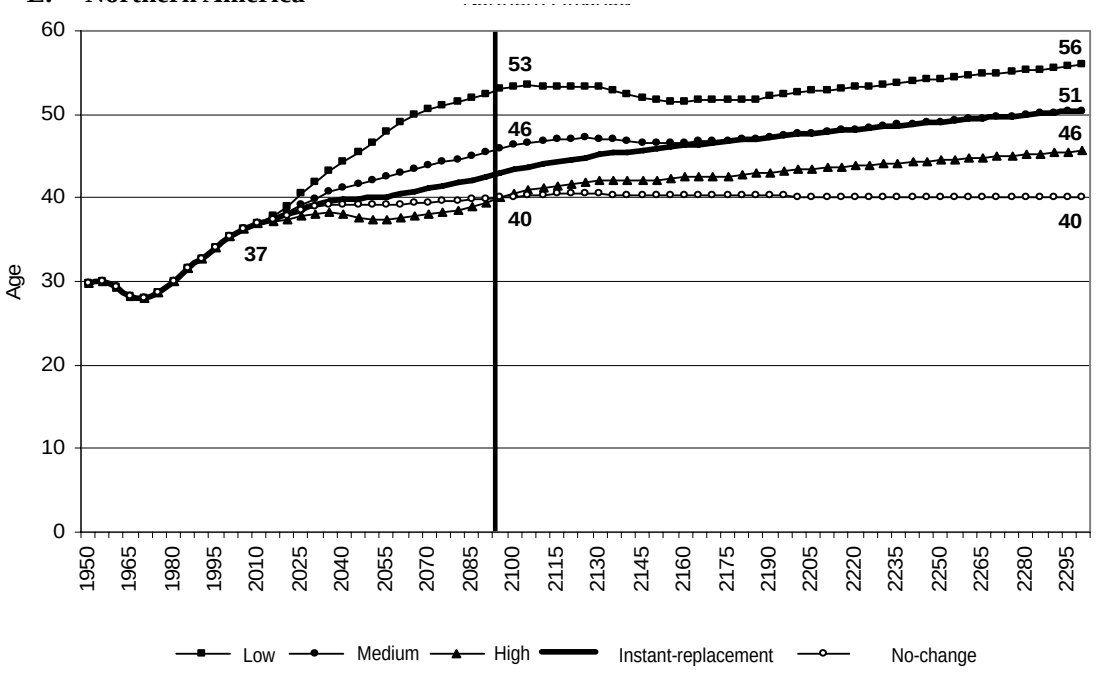
C. Asia



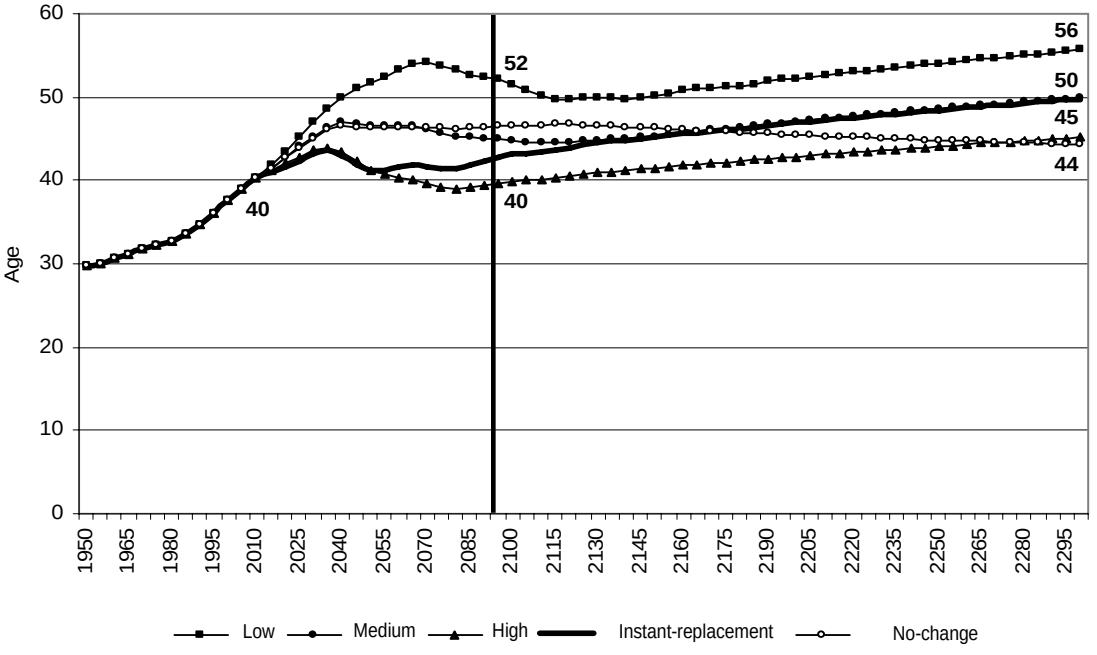
D. Latin America and the Caribbean



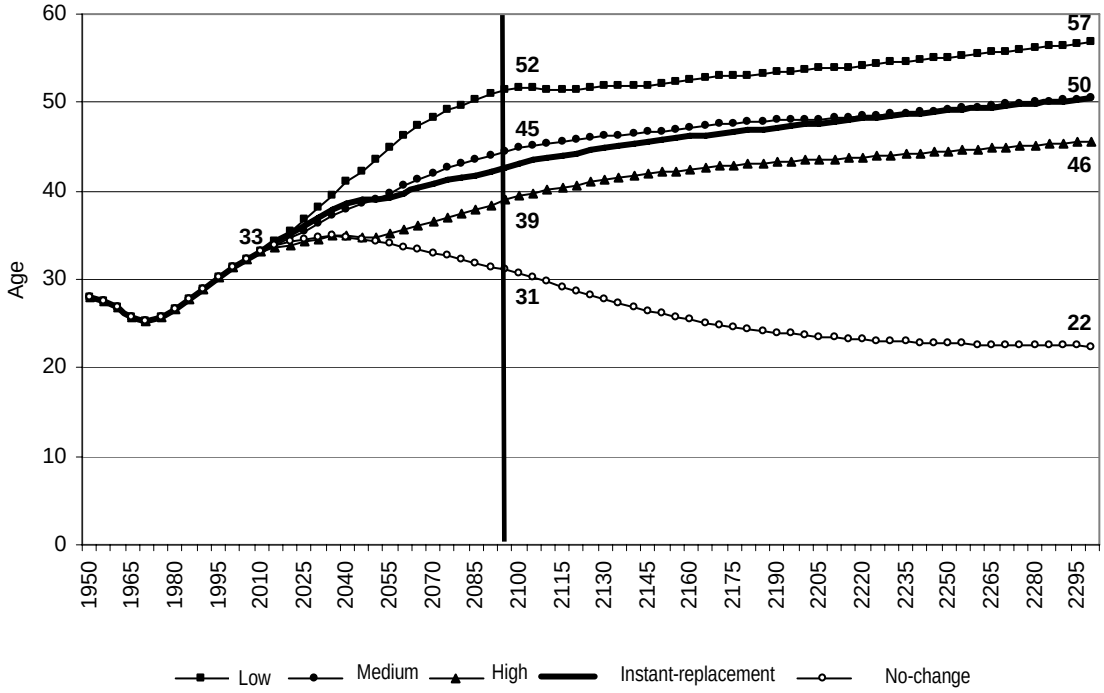
E. Northern America



F. Europe



G. Oceania



57. An exception is the no-change scenario which, by maintaining fertility and mortality constant, produces younger populations over time when fertility is above replacement level. Consequently, according to the no-change scenario, the populations of Africa, Asia, Latin America and the Caribbean, and Oceania become younger over the projection period even if, initially, the median age increases slightly in some major areas owing to the influence of populous countries that have below-replacement fertility. For Europe and Northern America, the no-change scenario produces slowly ageing populations until the first decades of the twenty-second century, before a weak trend towards rejuvenation sets in. Globally, the regional trends produce a population whose median age rises from 29.1 years in 2010 to 32.4 years in 2040 and then declines steadily to 25.9 years in 2100 and 17 years in 2300.

58. None of the other scenarios shown in figure VII results in a rejuvenation of the population over the long run. In all major areas, the low scenario produces the most pronounced population ageing and the high scenario leads to the least pronounced. The medium scenario produces an intermediate level of population ageing. With the exception of Africa, the instant-replacement scenario produces slower ageing than the medium scenario over a prolonged period but its median age eventually converges to that of the medium scenario. For Africa, the instant-replacement scenario produces a more rapid ageing of the population than the medium scenario from 2010 to 2080, after that date, however, it produces slower ageing than the medium scenario until the median ages of both converge around 2240.

59. Globally, the median age rises from 29 years in 2010 to 44 in 2100 in the medium scenario, an increase of 15 years. However, ageing slows down considerably thereafter, with the median age rising only 4 years more by 2300, to

48 years. Because Europe is already far advanced in the ageing process, the medium scenario produces a relatively slow increase in its median age: from 40 to 45 years between 2010 and 2100, an increase of only 5 years. The same increase is projected over the next 200 years, so that the median age in Europe reaches 50 years in 2300.

60. In Northern America, ageing is also not as fast after 2010 as in other major areas. In the medium scenario, its median age rises from 37 to 46 years between 2010 and 2100, an increase of just 9 years. By 2300, the median age increases another 5 years, to reach 51 years. Population ageing is also projected to be relatively slow in Oceania over the next century. According to the medium scenario, the median age increases from 33 to 45 years between 2010 and 2100, and reaches 50 years by 2300.

61. By contrast, all other major areas in the developing world experience rapid ageing. In Asia, the median age increases by 17 years from 2010 to 2100, rising from 29 to 46 years, and reaches 48 years in 2300. In Latin America and the Caribbean, the increase in the median age is very rapid until 2100, amounting to 19 years (from 28 to 47 years), and then slows down markedly so that the median age reaches a relatively low 49 years in 2300. Africa experiences the fastest ageing of all major areas according to the medium scenario. Its median age increases by 21 years, rising from 20 to 41 years from 2010 to 2100. It then gains another 5 years, to reach 46 years in 2300.

62. Consequently, by 2300 all major areas have populations with high median ages according to the medium scenario. Africa has the youngest population, with a median age of 46 years, while Northern America has the oldest, with a median age of 51 years. Had the low scenario prevailed in all major areas, the median ages in 2300 would be approximately 5 years higher in each major area. The high scenario would produce median ages approximately 5 years lower than those yielded by the medium scenario for each major area.

63. In sum, all scenarios that produce low to moderate population growth in the future also yield ageing populations. In all cases, population ageing is expected to be fastest during the twenty-first century and to slow down considerably thereafter because longevity increases very slowly and fertility changes little after 2100. With the exception of Africa, which has the youngest population in the world in all scenarios, all other major areas expect to have median ages close to 45 years in 2100 and to 50 years in 2300 according to the medium scenario.

VII. Conclusion

64. According to the projection scenarios discussed above, current population dynamics would produce excessive population growth if maintained over the long run. In order to have a reasonable chance to stabilize world population, fertility has to drop to below-replacement level and maintain that level for a lengthy period in order to counterbalance the expected increases in longevity. Eventually, fertility has to regain replacement level. Such a path underpins the medium scenario, whose world population peaks at 9.4 billion in 2070, declines to 7.9 billion in 2195 and rises to 8.3 billion in 2300. There is no guarantee, however, that this scenario will become a reality because high-fertility countries may not reduce their fertility sufficiently fast or those with intermediate fertility levels may see them stagnate above replacement level.

65. The high scenario, which produces a world population of nearly 30 billion in 2300, even though its fertility remains mostly between 2.2 and 2.3 children per woman, validates the imperative of continuing to reduce fertility to replacement level or below in all countries whose fertility is still above replacement level. Efforts to reduce fertility rapidly are especially needed in the fast-growing countries of Africa and Asia. In both major areas, but particularly in Africa, current fertility levels, if maintained, would lead to unsustainable numbers of people in the long run. Even with significant fertility reductions, Africa's population will likely increase by 150 per cent by 2100, and many of its countries will see their populations increase four-fold or more.

66. Even countries with intermediate fertility need to reduce it to replacement level or below if they wish to avert continuous population increases to unsustainable levels, and low fertility countries need to achieve comparatively small increases in fertility in order to avert rapid reductions of the population. Although such changes are expected to happen, there is no certainty that they will.

67. The rapid population increases in recent decades are occurring on a planet that is increasingly showing signs of strain. If a population increase that adds 1 billion new inhabitants every 12 or 15 years is to be averted, global fertility must eventually reach and maintain replacement level. According to Justice Oliver Wendell Holmes: "The way in which the inevitable comes to pass is through effort". In this regard, the reduction of fertility may be inevitable, but considerable effort is nonetheless required to make it a reality over the next few decades.