Economic & Social Affairs

World Population Prospects
The 2006 Revision

Executive Summary

United Nations

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Department of Economic and Social Affairs
Population Division

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NOTE

The designations employed in this report and the material presented in it do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The term "country" as used in the text of this report also refers, as appropriate, to territories or areas. The designations "more developed", "less developed" and "least developed" countries, areas or regions are intended for statistical convenience and do not necessarily express a judgement about the stage reached by a particular country or area in the developing process.

PREFACE

This report presents the executive summary of the results of the *2006 Revision* of the official world population estimates and projections prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. The *2006 Revision* is the twentieth round of global demographic estimates and projections undertaken by the Population Division since 1950.

The full results of the *2006 Revision* will be presented in a series of three volumes currently under preparation. The first volume[1] will provide the comprehensive tables presenting the major demographic indicators for each country for 1950-2050; the second volume[2] will contain the distributions by age and sex of the population of each country for the period 1950-2050, and the third volume[3] will be devoted to an analysis of the results obtained.

Data are also available in digital form and can be consulted at the Population Division's web site at www.unpopulation.org. Users requiring the complete results of the *2006 Revision* can purchase them on CD-ROM. A description of the data contained in the different CD-ROMs available and an order form will be posted on the web site of the Population Division.

Responsibility for the *2006 Revision* rests with the Population Division. Preparation of the *2006 Revision* was facilitated by the collaboration of the regional commissions, especially the Economic Commission for Latin America and the Caribbean, and of UNAIDS, the specialized agencies and other relevant bodies of the United Nations with the Population Division.

A major source of official national population statistics used in the preparation of these estimates and projections is the *United Nations Demographic Yearbook* and its accompanying databases, produced and maintained by the Statistics Division of the Department of Economic and Social Affairs of the United Nations Secretariat. The Population Division is grateful to the Statistics Division for its continuing cooperation.

For further information about the *2006 Revision*, please contact Ms. Hania Zlotnik, Director, Population Division, United Nations, New York, NY 10017, USA (Fax: 1 212 963 2147).

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[1] *World Population Prospects: The 2006 Revision*, vol. I, *Comprehensive Tables* (United Nations publication, forthcoming).

[2] *World Population Prospects: The 2006 Revision*, vol. II, *Sex and Age Distribution of the World Population* (United Nations publication, forthcoming).

[3] *World Population Prospects: The 2006 Revision*, vol. III, *Analytical Report* (United Nations publication, forthcoming).

EXECUTIVE SUMMARY

The *2006 Revision* is the twentieth round of official United Nations population estimates and projections prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. These are used throughout the United Nations system as the basis for activities requiring population information. The *2006 Revision* builds on the *2004 Revision* and incorporates both the results of the 2000 round of national population censuses and of recent specialized surveys carried around the world. These sources provide both demographic and other information to assess the progress made in achieving the internationally agreed development goals, including the Millennium Development Goals (MDGs). The comprehensive review of past worldwide demographic trends and future prospects presented in the *2006 Revision* provides the population basis for the assessment of those goals.

According to the *2006 Revision*, the world population will likely increase by 2.5 billion over the next 43 years, passing from the current 6.7 billion to 9.2 billion in 2050. This increase is equivalent to the size that the world population had in 1950 and it will be absorbed mostly by the less developed regions, whose population is projected to rise from 5.4 billion in 2007 to 7.9 billion in 2050. In contrast, the population of the more developed regions is expected to remain largely unchanged at 1.2 billion and would have declined were it not for the projected net migration from developing to developed countries, which is expected to average 2.3 million persons a year after 2010.

As a result of declining fertility and increasing longevity, the populations of a growing number of countries are ageing rapidly. Between 2005 and 2050, half of the increase in the world population will be accounted for by a rise in the population aged 60 years or over, whereas the number of children (persons under age 15) will decline slightly. Furthermore, in the more developed regions, the population aged 60 or over is expected nearly to double (from 245 million in 2005 to 406 million in 2050) whereas that of persons under age 60 will likely decline (from 971 million in 2005 to 839 million in 2050).

The *2006 Revision* confirms the diversity of demographic dynamics among the different world regions. While the population at the global level is on track to surpass 9 billion by 2050 and hence continues to increase, that of the more developed regions is hardly changing and will age markedly. As already noted, virtually all population growth is occurring in the less developed regions and especially in the group of the 50 least developed countries, many of which still have relatively youthful populations that are expected to age only moderately over the foreseeable future. Among the rest of the developing countries, rapid population ageing is expected.

Underlying these varied patterns of growth and changes in the age structure are distinct trends in fertility and mortality. Below-replacement fertility prevails in the more developed regions and is expected to continue to 2050. Fertility is still high in most of the least developed countries and, although it is expected to decline, it will remain higher than in the rest of the world. In the rest of the developing countries, fertility has declined markedly since the late 1960s and is expected to reach below-replacement levels by 2050 in the majority of them.

Mortality in the established market economies of the developed world is low and continues to decline, but it has been stagnant or even increasing in a number of countries with economies in transition, largely as a result of deteriorating social and economic conditions and, in some cases, because of the spread of HIV. Mortality is also decreasing in the majority of

developing countries, but in those highly affected by the HIV/AIDS epidemic, mortality has been increasing.

The HIV/AIDS epidemic continues to spread. The number of countries with a significant number of infected people in the *2006 Revision* is 62, up from 60 in the *2004 Revision* and 53 in the *2002 Revision*. Although HIV prevalence in some countries has been revised downward since 2004 on the basis of newly available nationally representative data, the toll of the disease continues to be high and is expected to remain so, despite projected reductions in the prevalence of HIV/AIDS.

Lower projected levels of HIV prevalence depend on the realization of the commitments made by Governments in the 2000 Millennium Declaration[4] and the 2001 United Nations Declaration of Commitment on HIV/AIDS[5]. In particular, the projected population trends depend on achieving a major increase in the proportion of AIDS patients who get antiretroviral therapy to treat the disease and on the success of efforts to control the further spread of HIV. In the *2006 Revision*, the 62 countries considered to be highly affected by the HIV/AIDS epidemic include 40 located in Africa. In projecting the effect of the disease, it is assumed that 31 of the most affected countries will manage to provide by 2015 antiretroviral treatment to 70 per cent or more of the persons suffering from AIDS. In the rest of the affected countries, treatment levels are expected to be lower, reaching between 40 per cent and 50 per cent by 2015. It is further assumed that persons receiving treatment survive, on average, 17.5 years instead of the 10 years expected in the absence of treatment. Mainly as a result of these assumptions and owing to the downward revision of the prevalence of HIV/AIDS in countries where nationally representative data on the epidemic have become available, an estimated 32 million fewer deaths are projected to occur during 2005-2020 in the 62 countries most affected by the epidemic according to the *2006 Revision* than would have occurred if death rates were the same as in the *2004 Revision*. These changes also contribute to make the population projected to 2050 larger according to the *2006 Revision* than according to the *2004 Revision* (9.2 billion vs. 9.1 billion).

Realization of the medium variant projections contained in the *2006 Revision* is also contingent on ensuring that fertility continues to decline in developing countries. According to the *2006 Revision*, fertility in the less developed countries as a whole is expected to drop from 2.75 children per woman in 2005-2010 to 2.05 in 2045-2050. The reduction expected in the group of 50 least developed countries is even sharper: from 4.63 children per woman to 2.50 children per woman. To achieve such reductions it is essential that access to family planning expands in the poorest countries of the world. The urgency of realizing the reductions of fertility projected is brought into focus by considering that, if fertility were to remain constant at the levels estimated for 2000-2005, the population of the less developed regions would increase to 10.6 billion instead of the 7.9 billion projected by assuming that fertility declines. That is, without further reductions of fertility, the world population could increase by twice as many people as those who were alive in 1950.

[4] See General Assembly Resolution A/Res/55/2.
[5] See General Assembly Resolution A/Res/S-26/2.

Other key findings resulting from the comprehensive review of past worldwide demographic trends and future prospects presented in the *2006 Revision* are summarized below.

1. In July 2007 the world population will reach 6.7 billion, 547 million more than in 2000 or a gain of 78 million persons annually. Assuming that fertility levels continue to decline, the world population is expected to reach 9.2 billion in 2050 and to be increasing by about 30 million persons annually at that time, according to the medium variant (table 1).

TABLE 1. POPULATION OF THE WORLD, MAJOR DEVELOPMENT GROUPS AND MAJOR AREAS, 1950, 1975, 2007 AND 2050 ACCORDING TO DIFFERENT VARIANTS

	Population (millions)			*Population in 2050 (millions)*			
Major area	*1950*	*1975*	*2007*	*Low*	*Medium*	*High*	*Constant*
World	2 535	4 076	6 671	7 792	9 191	10 756	11 858
More developed regions	814	1 048	1 223	1 065	1 245	1 451	1 218
Less developed regions	1 722	3 028	5 448	6 727	7 946	9 306	10 639
Least developed countries	200	358	804	1 496	1 742	2 002	2 794
Other less developed countries	1 521	2 670	4 644	5 231	6 204	7 304	7 845
Africa	224	416	965	1 718	1 998	2 302	3 251
Asia	1 411	2 394	4 030	4 444	5 266	6 189	6 525
Europe	548	676	731	566	664	777	626
Latin America and the Caribbean	168	325	572	641	769	914	939
Northern America	172	243	339	382	445	517	460
Oceania	13	21	34	42	49	56	57

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

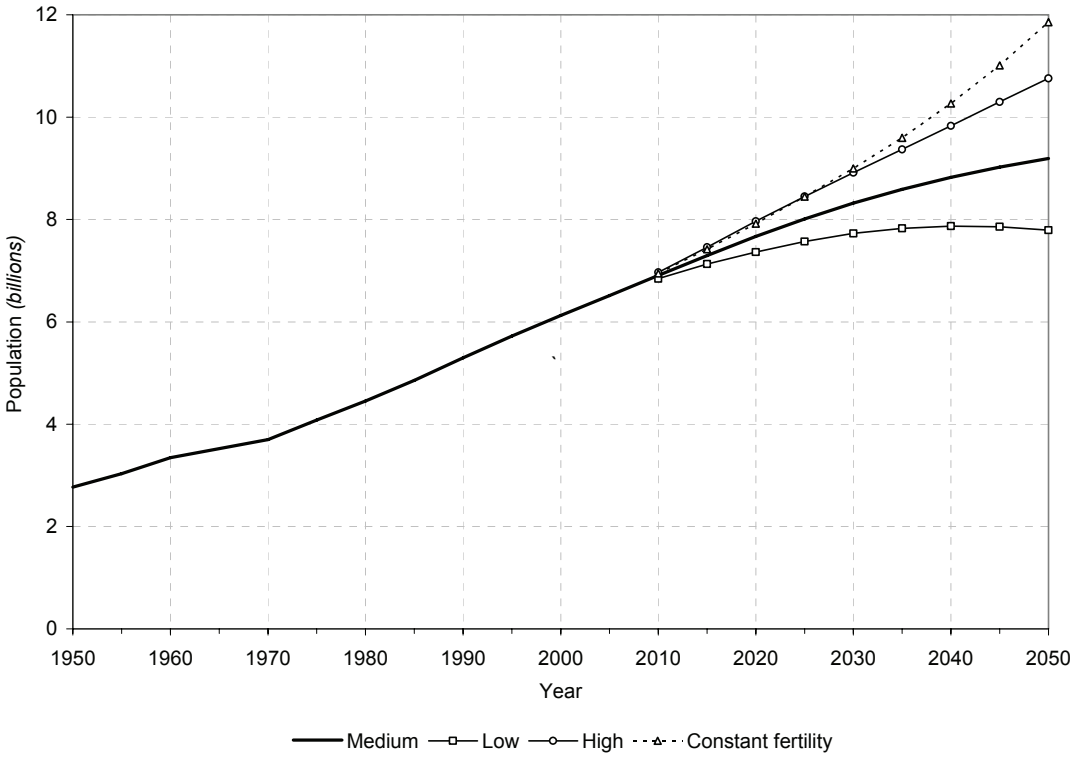
2. Future population growth is highly dependent on the path that future fertility takes (figure 1). In the medium variant, fertility of the world declines from 2.55 children per woman today to slightly over 2 children per woman in 2050. If fertility were to remain about half a child above the levels projected in the medium variant, world population would reach 10.8 billion by 2050. A fertility path half a child below the medium variant would lead to a population of 7.8 billion by mid-century. That is, at the world level, continued population growth until 2050 is inevitable even if the decline in fertility accelerates.

3. Because of its low and declining rate of population growth, the population of developed countries as a whole is expected to remain virtually unchanged between 2007 and 2050, at about 1.2 billion, according to the medium variant. In contrast, the population of the 50 least developed countries will likely more than double, passing from 0.8 billion in 2007 to 1.7 billion in 2050. Growth in the rest of the developing world is also projected to be robust, though less rapid, with its population rising from 4.6 billion to 6.2 billion between 2007 and 2050 according to the medium variant.

4. Slow population growth brought about by reductions in fertility leads to population ageing, that is, it produces populations where the proportion of older persons increases while that of younger persons decreases. In the more developed regions, 20 per cent of the population is already aged 60 years or over and that proportion is projected to reach 33 per cent in 2050 (table 2). In developed countries as a whole, the number of older persons (persons aged 60 or

over) has already surpassed the number of children (persons under age 15) and by 2050 the number of older persons is expected to be more than double the number of children in developed countries.

Figure 1. Population of the world, 1950-2050, according to different projection variants



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

5. Population ageing is less advanced in developing countries. Nevertheless, the populations of a majority of them are posed to enter a period of rapid population ageing. In developing countries as a whole, just 8 per cent of the population is today aged 60 years or over but by 2050, 20 per cent of their population is expected to be in that age range (table 2).

6. Globally, the number of persons aged 60 years or over is expected nearly to triple, increasing from 673 million in 2005 to 2 billion by 2050. Over the same period, the share of older persons living in developing countries is expected to rise from 64 per cent in 2005 to nearly 80 per cent in 2050.

7. A feature of ageing populations is that the numbers of older persons increase faster the higher the age range considered. Thus, whereas the number of persons aged 60 or over is expected to triple, that of persons aged 80 or over (the oldest-old) is projected to increase nearly five-fold, from 88 million in 2005 to 402 million in 2050. Today, about half of the oldest-old live in developing countries but that share is expected to reach 71 per cent in 2050.

TABLE 2. PERCENTAGE DISTRIBUTION BY BROAD AGE GROUP FOR THE WORLD, DEVELOPMENT GROUPS AND MAJOR AREAS, 2005 AND 2050, MEDIUM VARIANT, 2005-2050

	Percentage distribution in 2005				*Percentage distribution in 2050*			
Major area	*0-14*	*15-59*	*60+*	*80+*	*0-14*	*15-59*	*60+*	*80+*
World	28.3	61.4	10.3	1.3	19.8	58.3	21.8	4.4
More developed region	17.0	62.9	20.1	3.7	15.2	52.2	32.6	9.4
Less developed regions	30.9	61.0	8.1	0.8	20.6	59.3	20.1	3.6
Least developed countries	41.5	53.4	5.1	0.4	28.2	61.5	10.3	1.1
Other less developed countries	29.1	62.3	8.6	0.9	18.4	58.7	22.9	4.3
Africa	41.4	53.4	5.2	0.4	28.0	61.7	10.4	1.1
Asia	28.0	62.7	9.2	1.0	18.0	58.3	23.7	4.5
Europe	15.9	63.5	20.6	3.5	14.6	50.9	34.5	9.6
Latin America and the Caribbean	29.8	61.2	9.0	1.2	18.0	57.8	24.3	5.2
Northern America	20.5	62.7	16.7	3.5	17.1	55.6	27.3	7.8
Oceania	24.9	61.0	14.1	2.6	18.4	56.9	24.8	6.8

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

8. Although the populations of all countries are expected to age over the foreseeable future, the populations of countries where fertility is still high will remain relatively young and will increase rapidly. High population growth rates prevail in a number of developing countries, the majority of which are least developed. Between 2005 and 2050, the populations of Afghanistan, Burundi, the Democratic Republic of the Congo, Guinea-Bissau, Liberia, Niger, Timor-Leste and Uganda are projected to increase at least threefold.

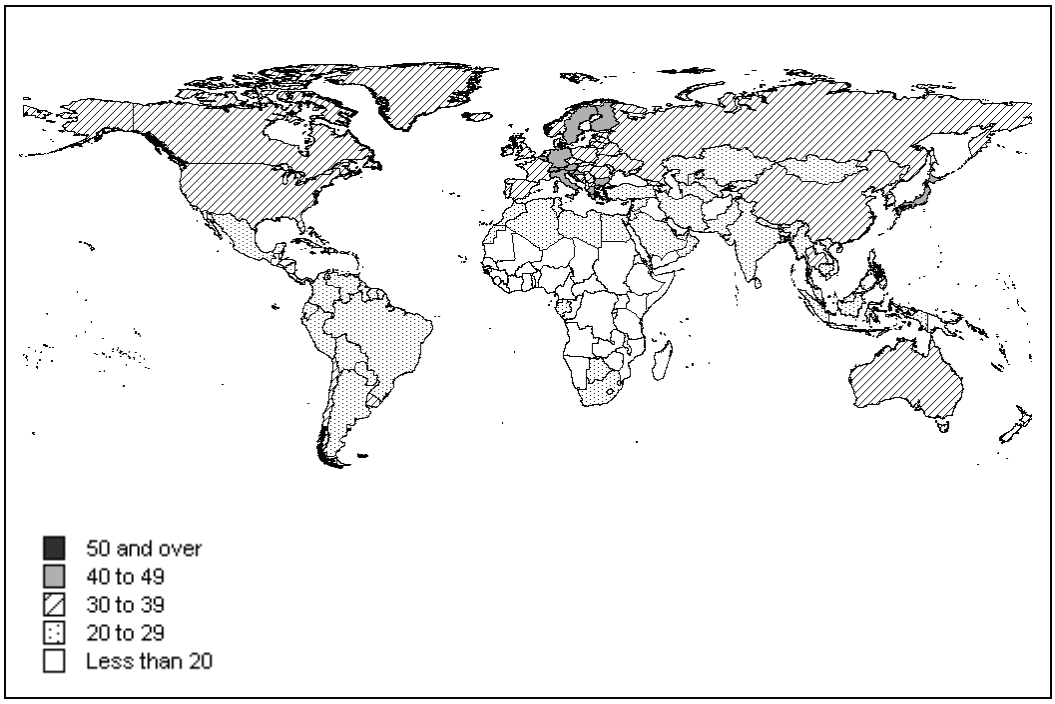
9. In sharp contrast, the populations of 46 countries or areas, including Germany, Italy, Japan, the Republic of Korea, most of the successor States of the former USSR and several small island States are expected to be smaller in 2050 than in 2005.

10. Population growth remains concentrated in the populous countries. During 2005-2050, eight countries are expected to account for half of the world's projected population increase: India, Nigeria, Pakistan, the Democratic Republic of the Congo, Ethiopia, the United States of America, Bangladesh and China, listed according to the size of their contribution to global population growth.

11. The median age, that is, the age that divides the population in two halves of equal size, is an indicator of population ageing. At the world level, the median age is projected to increase from 28 to 38 years between 2005 and 2050. Europe has today the oldest population, with a median age of nearly 39 years that is expected to reach 47 years in 2050.

12. The median age is higher in countries having low fertility for long periods. In 2005, the median age in 13 developed countries or areas was higher than 40 years. The pervasiveness of population ageing is reflected by the fact that 93 countries are projected to have median ages above 40 years in 2050, 48 of which are developing countries (map 1).

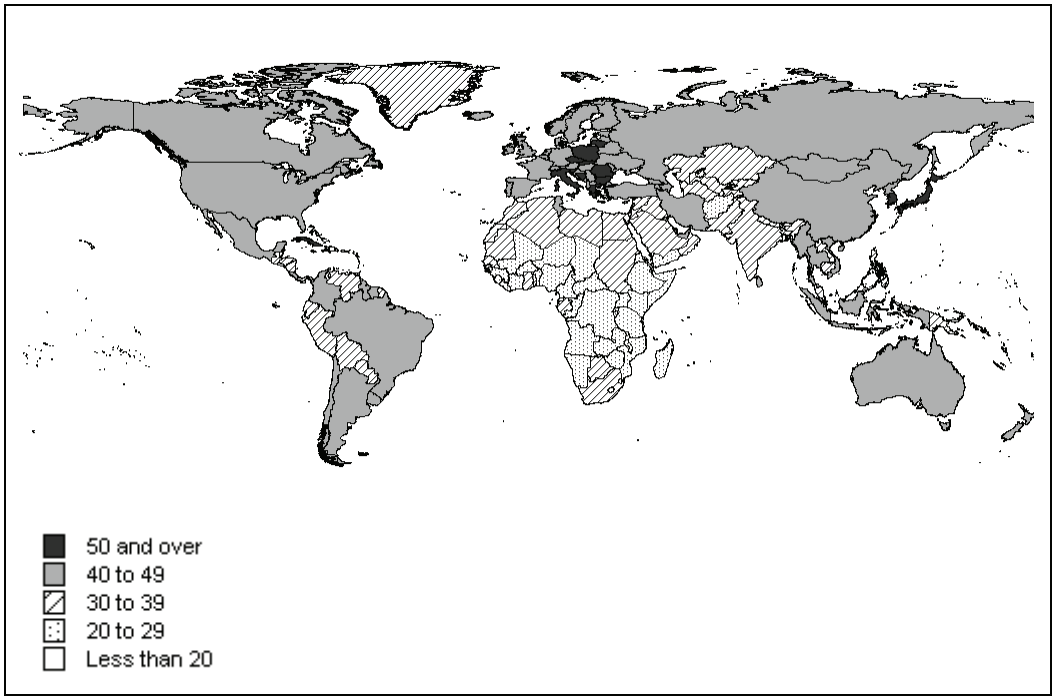
Map 1. Median age in 2005, medium variant



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

NOTE: The boundaries shown on the present map do not imply official endorsement or acceptance by the United Nations.

Map 2. Median age in 2050, medium variant



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

NOTE: The boundaries shown on the present map do not imply official endorsement or acceptance by the United Nations.

13. Countries where fertility remains high and has declined only moderately will experience the slowest population ageing. By 2050, about one in five countries is projected to have a median age below 30 years. The least developed countries will have the youngest populations, with eight of them having median ages below 24 years in 2050, namely, Afghanistan, Angola, Burundi, the Democratic Republic of the Congo, Guinea-Bissau, Liberia, Niger and Uganda (map 2).

14. As noted above, fertility reductions are the main cause of population ageing. At the world level, fertility is estimated to be 2.55 children per woman, about half the level it had in 1950-1955 at 5 children per women (table 3). In the medium variant, global fertility is projected to decline further to 2.02 children per woman. Average world levels result from quite different trends in the major development groups. In developed countries as a whole, fertility is currently 1.60 children per woman and is projected to increase slowly to 1.79 children per woman in 2045-2050. In the least developed countries, fertility is 4.63 children per woman and is expected to drop by about half, to 2.50 children per woman by 2045-2050. In the rest of the developing world, fertility is already moderately low at 2.45 children per woman and is expected to decline further to 1.91 children per woman by mid-century, thus nearly converging to the fertility levels by then typical of the developed world.

TABLE 3. ESTIMATED AND PROJECTED TOTAL FERTILITY FOR THE WORLD, MAJOR DEVELOPMENT GROUPS AND MAJOR AREAS, 1970-1975, 2005-2010 AND 2045-2050 ACCORDING TO PROJECTION VARIANT

	Total fertility (average number of children per woman)					
			2045-2050			
Major area	*1970-1975*	*2005-2010*	*Low*	*Medium*	*High*	*Constant*
World	4.47	2.55	1.54	2.02	2.51	3.49
More developed regions	2.13	1.60	1.29	1.79	2.28	1.68
Less developed regions	5.41	2.75	1.57	2.05	2.54	3.69
Least developed countries	6.61	4.63	2.02	2.50	2.99	5.49
Other less developed countries	5.25	2.45	1.42	1.91	2.41	3.07
Africa	6.72	4.67	1.97	2.46	2.95	5.47
Asia	5.04	2.34	1.40	1.90	2.39	2.94
Europe	2.16	1.45	1.26	1.76	2.26	1.47
Latin America and the Caribbean	5.04	2.37	1.36	1.86	2.36	2.67
Northern America	2.01	2.00	1.35	1.85	2.35	1.99
Oceania	3.23	2.30	1.43	1.93	2.43	2.83

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

NOTE: Only countries or areas with 100,000 persons or more in 2007 are included.

15. In 2005-2010, fertility remains above 5 children per woman in 27 of the 150 developing countries, and those 27 countries account for 9 per cent of the world population. Most countries with very high fertility are poor and belong to the group of least developed countries. In contrast, fertility has reached below-replacement levels in 28 developing countries, which account for 25 per cent of the world population. This group includes China whose average fertility during 2005-2010 is estimated at 1.73 children per woman.

16. Fertility is also below replacement level in all 45 developed countries or areas, which account for 19 per cent of the world population. In 27 of them, including Japan and most of the countries located in Southern and Eastern Europe, fertility remains below 1.5 children per woman. Since 1990-1995, fertility decline has been the rule among the vast majority of developed countries and is leading to rapid population ageing.

17. Another factor contributing to population ageing is the reduction of mortality at adult ages. Global life expectancy at birth, which is estimated to have risen from 58 years in 1970-1975 to 67 years in 2005-2010, is expected to keep on rising to reach 75 years in 2045-2050 (table 4). In the more developed regions, the projected increase is from 77 years today to 82 years by mid-century, and in the less developed regions life expectancy is projected to rise from 65 years in 2005-2010 to 74 years in 2045-2050.

TABLE 4. LIFE EXPECTANCY AT BIRTH FOR THE WORLD, MAJOR DEVELOPMENT GROUPS AND MAJOR AREAS, 2005-2010 AND 2045-2050

Major area	*2005-2010*	*2045-2050*
World	67.2	75.4
More developed regions	76.5	82.4
Less developed regions	65.4	74.3
Least developed countries	54.6	67.2
Other less developed countries	67.9	76.4
Africa	52.8	66.1
Asia	69.0	77.4
Europe	74.6	81.0
Latin America and the Caribbean	73.3	79.6
Northern America	78.5	83.3
Oceania	75.2	81.0

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

18. Life expectancy remains low in the least developed countries, at just 55 years, and although it is projected to reach 67 years in 2045-2050, achieving such an increase is contingent on reducing the spread of HIV and combating successfully other infectious diseases. Similar challenges must be confronted if the projected increase of life expectancy in the rest of the developing countries, from under 68 years today to 76 years by mid-century, is to be achieved.

19. Among the more developed regions, Eastern Europe has the lowest life expectancy at birth and has had a declining life expectancy since the late 1980s. In 2005-2010 life expectancy in the region, at 68.6 years, is lower than it was in 1960-1965 (69.3 years). The Russian Federation and Ukraine have experienced serious increases in mortality, partly because of the spread of HIV.

20. Despite the advances made in treating people infected with HIV and in controlling the spread of the epidemic, its impact in terms of morbidity, mortality and slower population growth continues to be evident in many countries. In Southern Africa, the region with the highest prevalence of the disease, life expectancy has fallen from 62 years in 1990-1995 to 49 years

in 2005-2010 and is not expected to regain the level it had in the early 1990s before 2045. As a consequence, the growth rate of the population in the region has plummeted, passing from 2.5 per cent annually in 1990-1995 to 0.6 per cent annually in 2005-2010 and is expected to continue declining for the foreseeable future.

21. The contribution of international migration to population growth in the more developed regions has increased in significance as fertility declines. During 2005-2050, the net number of international migrants to more developed regions is projected to be 103 million, a figure that counterbalances the excess of deaths over births (74 million) projected over the period.

22. In 2005-2010, the net migration more than doubled the contribution of natural increase (births minus deaths) to population growth in eight countries or areas, namely, Belgium, Canada, Hong Kong (China SAR), Luxembourg, Singapore, Spain, Sweden and Switzerland. In a further eight countries or areas, net migration counterbalanced the excess of deaths over births. These countries are: Austria, Bosnia and Herzegovina, the Channel Islands, Greece, Italy, Portugal, Slovakia and Slovenia.

23. In terms of annual averages during 2005-2050, the major net receivers of international migrants are projected to be the United States (1.1 million annually), Canada (200,000), Germany (150,000), Italy (139,000), the United Kingdom (130,000), Spain (123,000) and Australia (100,000). The countries with the highest levels of net emigration are projected to be: China (-329,000 annually), Mexico (-306,000), India (-241,000), Philippines (-180,000), Pakistan (-167,000) and Indonesia (-164,000).

ASSUMPTIONS UNDERLYING THE *2006 REVISION*

The preparation of each new revision of the official population estimates and projections of the United Nations involves two distinct processes: (a) the incorporation of all new and relevant information regarding the past demographic dynamics of the population of each country or area of the world; and (b) the formulation of detailed assumptions about the future paths of fertility, mortality and international migration. The data sources used and the methods applied in revising past estimates of demographic indicators (i.e., those referring to 1950-2005) are presented in volume III of *World Population Prospects: The 2006 Revision* (forthcoming).

The future population of each country is projected starting with an estimated population for 1 July 2005. Because population data are not necessarily available for that date, the 2005 estimate is derived from the most recent population data available for each country, obtained usually from a population census or a population register, projected to 2005 using all available data on fertility, mortality and international migration trends between the reference date of the population data available and 1 July 2005. In cases where recent data on the components of population growth are not available, estimated demographic trends are projections based on the most recent available data. Population data from all sources are evaluated for completeness, accuracy and consistency, and adjusted as necessary[6].

To project the population until 2050, the United Nations Population Division uses assumptions regarding future trends in fertility, mortality and international migration. Because future trends cannot be known with certainty, a number of projection variants are produced. The following paragraphs summarize the main assumptions underlying the derivation of demographic indicators for the period starting in 2005 and ending in 2050. A more detailed description of the different assumptions is available in volume III of *World Population Prospects: The 2006 Revision* (forthcoming).

A. FERTILITY ASSUMPTIONS: CONVERGENCE TOWARD TOTAL FERTILITY BELOW REPLACEMENT LEVEL

The fertility assumptions are described in terms of the following groups of countries:

- *High-fertility countries*: Countries that until 2005 had no fertility reduction or only an incipient decline;
- *Medium-fertility countries*: Countries where fertility has been declining but whose level was still above 2.1 children per woman in 2000-2005;
- *Low-fertility countries*: Countries with total fertility at or below 2.1 children per woman in 2000-2005.

1. Medium-fertility assumption

Total fertility in all countries is assumed to converge eventually toward a level of 1.85 children per woman. However, not all countries reach this level during the projection period, that is, by 2045-2050. Projection procedures differ slightly depending on whether a country had a total fertility above or below 1.85 children per woman in 2000-2005.

Fertility in high- and medium-fertility countries is assumed to follow a path derived from models of fertility decline established by the United Nations Population Division on the basis of

[6] For a general description of the procedures used in revising estimates of population dynamics, see "Chapter VI. Methodology of the United Nations population estimates and projections" (pp. 100-104) in *World Population Prospects: The 2004 Revision*, vol. III, *Analytical Report* (United Nations publication, Sales No. E.05.XIII.7).

the past experience of all countries with declining fertility during 1950-2000. The models relate the level of total fertility during a period to the average expected decline in total fertility during the next period. If the total fertility projected by a model for a country falls to 1.85 children per woman before 2050, total fertility is held constant at that level for the remainder of the projection period (that is, until 2050). Therefore, the level of 1.85 children per woman represents a floor value below which the total fertility of high- and medium-fertility countries is not allowed to drop before 2050. However, it is not necessary for all countries to reach the floor value by 2050. If the model of fertility change produces a total fertility above 1.85 children per woman for 2045-2050, that value is used in projecting the population.

In all cases, the projected fertility paths yielded by the models are checked against recent trends in fertility for each country. When a country's recent fertility trends deviate considerably from those consistent with the models, fertility is projected over an initial period of 5 or 10 years in such a way that it follows recent experience. The model projection takes over after that transition period. For instance, in countries where fertility has stalled or where there is no evidence of fertility decline, fertility is projected to remain constant for several more years before a declining path sets in.

Fertility in low-fertility countries is generally assumed to remain below 2.1 children per woman during most of the projection period and reach 1.85 children per woman by 2045-2050. For countries where total fertility was below 1.85 children per woman in 2000-2005, it is assumed that over the first 5 or 10 years of the projection period fertility will follow the recently observed trends in each country. After that transition period, fertility is assumed to increase linearly at a rate of 0.05 children per woman per quinquennium. Thus, countries whose fertility is currently very low need not reach a level of 1.85 children per woman by 2050.

2. High-fertility assumption

Under the high variant, fertility is projected to remain 0.5 children above the fertility in the medium variant over most of the projection period. By 2045-2050, fertility in the high variant is therefore half a child higher than that of the medium variant. That is, countries reaching a total fertility of 1.85 children per woman in the medium variant have a total fertility of 2.35 children per woman in the high variant at the end of the projection period.

3. Low-fertility assumption

Under the low variant, fertility is projected to remain 0.5 children below the fertility in the medium variant over most of the projection period. By 2045-2050, fertility in the low variant is therefore half a child lower than that of the medium variant. That is, countries reaching a total fertility of 1.85 children per woman in the medium variant have a total fertility of 1.35 children per woman in the low variant at the end of the projection period.

4. Constant-fertility assumption

For each country, fertility remains constant at the level estimated for 2000-2005.

5. Instant-replacement assumption

For each country, fertility is set to the level necessary to ensure a net reproduction rate of 1 starting in 2005-2010. Fertility varies over the rest of the projection period in such a way that the net reproduction rate always remains equal to unity thus ensuring, over the long-run, the replacement of the population.

B. MORTALITY ASSUMPTIONS: INCREASING LIFE EXPECTANCY EXCEPT WHEN AFFECTED BY HIV/AIDS

1. Normal-mortality assumption

Mortality is projected on the basis of models of change of life expectancy produced by the United Nations Population Division. These models produce smaller gains the higher the life expectancy already reached. The selection of a model for each country is based on recent trends in life expectancy by sex. For countries highly affected by the HIV/AIDS epidemic, the model incorporating a slow pace of mortality decline has generally been used to project a certain slowdown in the reduction of general mortality risks not related to HIV/AIDS.

2. The impact of HIV/AIDS on mortality

In the *2006 Revision*, all countries with a HIV prevalence among persons aged 15 to 49 equal to or greater than one per cent are considered as seriously affected by the HIV/AIDS epidemic and their mortality is projected by modelling explicitly the course of the epidemic and projecting the yearly incidence of HIV infection. Also considered among the affected countries are those where HIV prevalence is lower than one per cent but whose population is so large that the number of individuals infected is large, such as Brazil, China or the United States of America. In total, 62 countries are considered to be highly affected by the HIV/AIDS epidemic in the *2006 Revision*.

The model developed by the UNAIDS Reference Group on Estimates, Modelling and Projections[7] is used to fit past estimates of HIV prevalence provided by UNAIDS for each of the affected countries so as to derive the parameters determining the past dynamics of the epidemic for each of them. For most countries, the model is fitted assuming that the relevant parameters have remained constant in the past. Beginning in 2005, the parameter PHI, which reflects the rate of recruitment of new individuals into the high-risk or susceptible group, is projected to decline by half every twenty years. The parameter R, which represents the force of infection, is projected to decline by half every thirty years. The reduction in R reflects the assumption that changes in behaviour among those subject to the risk of infection, along with increases in access to treatment for those infected, will reduce the chances of transmitting the virus.

In the *2006 Revision*, prevention of mother-to-child transmission is modelled using estimated country-specific coverage rates that average 13 per cent in 2005 among the 62 affected countries, but vary from 0 to 90 per cent among them. These coverage rates are projected to reach 60 per cent on average by 2015, varying between 40 per cent and 100 per cent among the affected countries.[8] After 2015, the coverage rate is assumed to remain constant at the level reached in each of the affected countries until the end of the projection period. Among women receiving treatment, the probability of transmission from mother to child is assumed to be 1 per cent. These assumptions produce a reduction in the incidence of HIV infection among children born to HIV-

[7] UNAIDS Reference Group on Estimates, Modelling and Projections (2002). Improved methods and assumptions for estimation of the HIV/AIDS epidemic and its impact: Recommendations of the UNAIDS Reference Group on Estimates, Modelling and Projections. *AIDS,* vol. 16, pp. W1-W14. URL: http://www.epidem.org.

[8] UNAIDS, UNICEF, WHO (2007). *Children and AIDS - A Stocktaking Report. Actions and Progress during the First Year of Unite for Children, Unite against AIDS* (with Statistical Annexes). See Table 1. Preventing mother-to-child transmission of HIV (pp. 29-31) and Table 2. Providing paediatric treatment (pp. 32-34). URL: www.unicef.org/uniteforchildren.

positive women, but the size of the reductions varies from country to country depending on the level of coverage that treatment reaches in each country.[9]

The survivorship of infected children[7] takes account of varying access to paediatric treatment.[9] In the *2006 Revision*, HIV-infected children are divided into two groups: (*i*) for those infected in-utero, among whom the disease progresses rapidly, average survival is modelled to be 1.3 years, and (*ii*) for those infected after birth through breastfeeding, among whom the disease progresses slowly, average survival is 14 years without treatment.[10] Explicit inclusion of paediatric treatment is done via country-specific coverage rates which average 9 per cent in 2005 but vary between 0 and 99 per cent among the 62 affected countries. By 2015, the projected coverage is expected to reach 60 per cent on average varying from 40 per cent to 100 per cent among the affected countries.[8] Coverage levels remain constant from 2015 to 2050 at the level reached in each country by 2015. The annual survival of children receiving treatment is 95 per cent, so that their mean survival time is 19.5 years and the median survival time is 13.5 years in the absence of other causes of death.[9]

The *2006 Revision* incorporates a longer survival for persons receiving treatment with highly active antiretroviral therapy (ART). The proportion of the HIV-positive population receiving treatment in each country is consistent with estimates prepared by the World Health Organization,[11] which average 25 per cent in 2005 but varied between 0 and 100 per cent among the 62 affected countries. Coverage is projected to reach between 40 per cent and 100 per cent by 2015, averaging 60 per cent for the affected countries. Between 2015 and 2050, coverage levels remain constant at the level reached in each country by 2015. It is assumed that adults receiving treatment have, on average, a 90 per cent chance of surviving each year in the absence of other causes of death. Under this assumption, mean survival time after the initiation of therapy is 9.5 years and the median survival time is 6.6 years, in the absence of other causes of death. Therapy is assumed to start at the time full-blown AIDS develops. Without treatment, infected adults have a mean survival time of two years after the onset of full-blown AIDS.[10]

3. Constant-mortality assumption

Under this assumption, mortality is maintained constant in each country at the level estimated for 2000-2005.

C. INTERNATIONAL MIGRATION ASSUMPTIONS

1. Normal migration assumption

Under the normal migration assumption, the future path of international migration is set on the basis of past international migration estimates and consideration of the policy stance of each country with regard to future international migration flows. Projected levels of net migration are generally kept constant over most of the projection period.

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[9] Stover, J., N. Walker, N.C. Grassly, and M. Marston (2006). Projecting the demographic impact of AIDS and the number of people in need of treatment: Updates to the Spectrum projection package. *Sexually Transmitted Infections*, vol. 82, Supplement 3: iii, pp. 45-50. URL: http://sti.bmj.com/cgi/content/abstract/82/suppl_3/iii45.

[10] Boerma, J.T., K.A. Stanecki, M.L. Newell, C. Luo, M. Beusenberg, G.P. Garnett, K. Little, J.G. Calleja, S. Crowley, J.Y. Kim, E. Zaniewski, N. Walker, J. Stover, and P.D. Ghys (2006). Monitoring the scale-up of antiretroviral therapy programmes: methods to estimate coverage. *Bulletin of the World Health Organization,* vol. 84, No. 2, pp. 145-150. URL: http://www.who.int/bulletin/volumes/84/2/145.pdf.

[11] World Health Organization and UNAIDS (2006). *Progress on Global Access to HIV Antiretroviral Therapy. A Report on "3 by 5" and Beyond*. See Annex 1. Estimated number of people receiving antiretroviral therapy, people needing antiretroviral therapy, percentage coverage and numbers of antiretroviral therapy sites in low- and middle-income countries (pp. 71-76). URL: http://www.who.int/hiv/fullreport_en_highres.pdf.

2. Zero- migration assumption

Under this assumption, for each country, international migration is set to zero starting in 2005-2010.

D. EIGHT PROJECTION VARIANTS

The *2006 Revision* includes eight different projection variants (table 5). Five of those variants differ among themselves only with respect to the level of fertility in each, that is, they share the assumptions made with respect to mortality and international migration. The five fertility variants are: low, medium, high, constant-fertility and instant-replacement fertility. A comparison of their results allows an assessment of the effects that different fertility paths have on other demographic parameters.

In addition to the five fertility variants, a constant-mortality variant, a zero-migration variant and a constant variant have been prepared. The constant-mortality variant and the zero-migration variant both have the same fertility assumption (i.e., medium fertility). Furthermore, the constant-mortality variant has the same international migration assumption as the medium variant. Consequently, the results of the constant-mortality variant can be compared with those of the medium variant to assess the effect that changing mortality has on other demographic parameters. Similarly, the zero-migration variant differs from the medium variant only with respect to the underlying assumption regarding international migration. Therefore, the zero-migration variant allows an assessment of the effect that non-zero net migration has on other demographic parameters. Lastly, the constant variant has the same international migration as the medium variant but differs from the latter by having constant fertility and mortality. When compared to the medium variant, therefore, its results shed light on the effects that changing fertility and mortality have on the results obtained.

TABLE 5. PROJECTION VARIANTS IN TERMS OF ASSUMPTIONS FOR FERTILITY, MORTALITY AND INTERNATIONAL MIGRATION

	Assumptions		
Projection variant	*Fertility*	*Mortality*	*International migration*
Low	Low	Normal	Normal
Medium	Medium	Normal	Normal
High	High	Normal	Normal
Constant-fertility	Constant	Normal	Normal
Instant-replacement fertility	Instant-replacement	Normal	Normal
Constant-mortality	Medium	Constant	Normal
Constant	Constant	Constant	Normal
Zero-migration	Medium	Normal	Zero

E. METHODOLOGICAL CHANGES INTRODUCED IN THE 2006 REVISION

The following changes and adjustments were made in the *2006 Revision* in relation to procedures followed in the *2004 Revision*.

- In the medium variant, the fertility of countries with a total fertility below 1.85 children per woman in 2000-2005 is projected first by continuing recent trends and then by increasing fertility linearly by 0.05 children per woman per quinquennium instead of an increase of 0.07 children as in the *2004 Revision*. These countries do not necessarily reach a level of 1.85 children per woman by 2045-2050.
- The models of the incidence of HIV infection by age have been modified. In the new models, mean age at infection is generally higher than in the models used in previous revisions, particularly for males. A delay in contracting the disease reduces the impact of AIDS-related mortality on life expectancy.
- The survival of HIV-positive children increased with respect to previously used models not only for those receiving treatment but also for those living without treatment.
- For HIV-positive adults receiving ART, survival after becoming infected has also increased in relation to previously used models.
- The effects of receiving ART have been modelled explicitly among both children and adults. In addition, the effects of mother-to-child transmission are projected to decline as access to treatment among women expands.