



## Population: Current State and Future Prospects

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World population size increased at a slow and uneven pace for centuries before the onset of the Industrial Revolution, and did not reach 1 billion until about 1800. The modern expansion of human numbers started then, but its pace was still modest for the next 150 years with the world total rising to 2.5 billion in 1950. During the second half of the 20th century, however, population growth rates accelerated to historically unprecedented levels, especially in Africa, Asia, and Latin America. As a result, world population size nearly tripled to 7.3 billion by 2015. This ongoing population expansion is expected to continue for several more decades reaching 11.2 billion at the end of this century. The future addition of four billion more people to the planet will have wide-ranging and potentially adverse implications for human welfare and the natural environment.

This study consists of three parts. First, population trends for the world and its main regions will be summarized, including projections of population size, growth, fertility, mortality, urbanization and age distribution. The second part summarizes policy options in aging societies. The third part discusses the role of responsible parenthood in improving human welfare.

### I. Population trends

#### *Population size*

Long-range trends in population size typically show a logistic pattern. For much of human history, population growth was absent or very slow. In the more recent past, waves of countries have gone through socio-economic and demographic transitions. Countries' population growth rates first accelerated, then declined, until population size leveled off at its likely maximum. This process is referred to as the *demographic transition* which usually takes place over the course of a century or more and is accompanied by a development process that transforms agricultural societies into industrial ones. Before the transition's onset, population growth fluctuated near zero as high birth rates more or less offset the high death rates typical of traditional agrarian societies that preceded the industrial revolution. After the completion of the transition, population growth was again near zero as birth and death rates both reached low levels. During the intervening transition period, population growth was positive as the death rate dropped before the birth rate. Over the course of the transition, population size of countries multiplied many times.

The first demographic transitions began in the early 19th century with declines in death rates in the now economically developed parts of the world (e.g., Europe, North America). Large declines in birth rates followed in the late 19th and early part of the 20th century. The transitions in these countries are now more or less complete.

Figure 1 and Table 1 present estimates of the population size of the world and major regions from 1950 to 2015 and projections made by the UN to 2100. The population of the developed world (Europe, North America, Japan, and Australia/New Zealand), which are referred to as the more developed countries, or MDCs, today stands at 1.25 billion, up from 0.81 billion in 1950. The population of these countries is expected to remain virtually the same size over the remainder of this century as the continued population growth in North America offsets the declines expected in Europe and Japan. The MDCs are a shrinking part of the world population. In 1950 the MDCs represented 32% of the world population; today this proportion stands at 17% and by 2100 it is expected to be just 11%.

The demographic transitions in Africa, Asia, and Latin America (called the less developed countries or LDCs) started later and are still underway, but they are expected to end over the coming decades. Aside from the differences in timing between the more and less developed regions, the transitions in the LDCs have produced more rapid population growth rates in mid-transitions.

In 2015 the population of the LDCs stood at 6.1 billion, representing the large majority of the world population of 7.3 billion. The population of Asia (4.4 billion) is much larger than that of Africa (1.2 billion) or Latin America (0.6 billion). Since 1950, growth in LDCs has been very rapid with population size nearly quadrupling from 1.7 to 6.1 billion. Projections to 2100 see the LDCs adding a further 3.8 billion people (95% of all projected population

growth). Populations in Asia, Latin America and North Africa are approaching the end of their transitions and will therefore experience only limited further growth. In contrast, the population of sub-Saharan Africa is expected to quadruple again by 2100 (from 0.96 to 3.93 billion). Fully 3 billion of the 4 billion future growth in the world population will therefore occur in sub-Saharan Africa, which is the region least prepared to meet the needs of their citizens (e.g. health clinics, infrastructure, school facilities) from an immense population increase over such a short period of time.

All population projections contain a degree of uncertainty. The UN has a consistent track record of making accurate projections. However, the further out the projections go into the future, the greater the likelihood that the assumptions underlying the projections will deviate from the eventual reality. The results presented in Table 1 and Figure 1 are for the medium – or most likely – projection variant, which assumes convergence of regional fertility levels to around two births per woman and continuing declines in mortality resulting in a global population of 11.2 billion by 2100. The uncertainty surrounding these median trajectories is summarized by the 95% probability interval around this median. For example, there is a 95% probability that the global population will be between 9.5 and 13.3 billion in 2100.

### *Population growth rate*

The rate at which populations around the world are growing varies widely among regions and countries. As shown in Figure 2 in 2015 the highest growth rates were found in Sub-Saharan Africa where rates exceed 3% per year in a number of countries, while the lowest rates are negative in a number of East European and East Asian countries. Growth rates are highest in the least developed countries and near or below zero in the most developed countries. This is as expected because many LDCs have not yet reached the end of their demographic transitions, while most MDCs are post-transitional. A constant population growth rate of 3% per year will result in a doubling of the population size about every 25 years.

By definition a country's growth rate at a given point in time equals the birth rate minus the death rate plus (a usually small) net immigration rate. Birth and death rates are in turn largely determined by levels of fertility and mortality in the population. The projections of population size of the world and its major regions are driven by assumptions made about future trends in fertility and mortality which are discussed next.

### *Fertility*

For most of human history before the Industrial Revolution, women did not deliberately regulate their fertility. As a result, average fertility was high, typically around six or seven births per woman, and women bore children throughout their reproductive lives. This high fertility was necessary to offset high mortality and to insure population survival.

Declines in fertility first began in the more developed countries in the 19th century as societies experienced rapid economic and social changes such as industrialization, urbanization, changing occupational structure, increased education and improved healthcare. These changes raised the cost of children (e.g. for education) and reduced their economic value (e.g. for labor and old age security), and couples began to self-regulate family size. The declines in mortality that preceded declines in fertility were a precondition for fertility decline because parents needed to be assured that children would survive. The fertility transition in the MDCs was complete by the 1970s when fertility fell to around two births per woman.

The fertility transitions in the LDCs started later as shown in Figure 3 which presents estimates from 1950 to 2015 and projections to 2050 as measured by the total fertility rate (TFR) i.e. the average number of births over a woman's life time assuming current conditions. In the 1950s the TFRs in Asia, Latin America, and across Africa were high and virtually stable at around 6 to 7 births per woman on average. This high level of natural fertility was similar to the levels observed in the pre-transitional MDCs. In the late 1960s, rapid declines in fertility started nearly simultaneously in Asia and Latin America. In contrast, sub-Saharan Africa has experienced only limited reproductive change. As a result of these divergent past trends, fertility levels in 2010-2015 differed widely among regions from a high TFR of near 5 births per woman in Africa, to 2.2 in Asia and Latin America. Average TFRs in Europe and North America reached relatively low levels in the early 1950s and (aside from a brief baby boom in the 1950s and early 1960s) has since declined to 1.9 in North America and to 1.6 in Europe. The decline in TFRs from 6 to just over 2 births per women in Asia and Latin America in the past half century has been very rapid by historical standards.

UN projections for fertility in coming decades assume that TFRs will eventually stabilize at around 2 births per woman in all regions (see Figure 3). The TFRs in Asia and Latin America are now close to this level, but Africa's fertility transition is on a much slower trajectory. High fertility therefore remains the main driver of future population growth in Africa. In contrast, the already low TFRs of Europe and North America is expected to remain slightly below 2 births per woman and this is the main driver of population decline in a number of MDCs.

### *Mortality and life expectancy*

Before the 18th century, mortality crises – epidemics, famines, wars – were frequent, average life expectancy was only about 30 years, and half of newborns failed to survive the first few years of life. One of the most notable achievements of modern industrial societies is the decline in preventable mortality resulting in the large rise in human longevity to about 80 years today.

The mortality transition started in Northern Europe early in the 19th century, and life expectancy rose to around 50 years by 1900. Several factors contributed to this improvement in longevity: public health measures reduced exposure to water- and food-borne diseases, better nutrition improved resistance to disease, and inoculation and vaccination prevented certain infectious diseases. Mortality decline accelerated after 1900 driven by a new set of factors: the institutional acceptance of the germ theory of disease led to measures to reduce exposure and transmission, and the development of antibiotics brought most infectious diseases under control. By the 1950s life expectancy in the most advanced countries had risen to 70 years and all but few percent of infants survived the first years of life. Today, life expectancy is 77 years in Europe and 80 years in North America. Infectious diseases are now rare and deaths are mostly due to chronic diseases among the old – for example, heart disease, cancer, diabetes. Progress is being made in the treatment of these diseases and innovations in medicine, biotechnology, and drug development will likely continue. Nevertheless, it is likely that future improvements in life expectancy will be less rapid than over the past century.

The mortality transition occurred later in the LDCs. Mortality declines were modest during the first half of the 20th century and by the early 1950s life expectancy was only 38 years in Africa and 42 years in Asia (Fig. 4). Latin America fared better with a life expectancy of 51 years. Over the past half century mortality conditions in large parts of the developing world have improved rapidly due to rising incomes, improved nutrition levels, access to medical care, and especially the implementation of public health measures and the availability of antibiotics and other drugs. Today, life expectancy in Latin America (75) and Asia (72) is similar to that of Europe in the 1970s. Africa still lags even though life expectancy has risen to 60 over the past half century. Low incomes, lack of access to adequate health care and the still substantial burden of infectious diseases (including HIV/AIDS) are largely responsible.

Projections for life expectancy to 2100 assume continued improvements in all regions. The MDC trajectory is expected to reach near 90 years. Advances in life expectancy in the LDCs are expected to be more rapid than in the MDCs, thus slowly closing the gap between these regions.

### *Urbanization*

The development of agriculture and the domestication of plants and animals about 12,000 years B.C. led to the growth of urban centers for trading surplus agricultural products, goods and services. Most people, however, continued to live in rural settings and engaged largely in subsistence agriculture for local consumption. The current era of rapid urbanization began with the onset of the Industrial Revolution. Employment opportunities in the expanding manufacturing and service sectors were often located in towns and surplus labor from the rural areas moved to cities in search of jobs and a better life. Urban areas were also attractive because they provided higher incomes, better access to schools, health care, social services and cultural opportunities.

Driven by these multiple forces, urbanization proceeded at a steady pace during the 19th and 20th centuries in the MDCs, but little changed in the rest of the world until the second half of the 20th century. In 1950 the percentage of the world population living in urban areas reached 29%, ranging from over 50% in the MDCs, to just 15% in Africa and Asia. Over the past half century urbanization has proceeded at a record pace with the world average reaching 54% in 2014, and the proportions urban more than doubled in Africa and Asia. These trends are expected to continue in coming decades with the proportion urban reaching 85% in the MDCs. Africa and Asia remain less urban but nevertheless are expected to reach around 60% by 2050. By the end of this century the global rural-to-urban transition should be nearly complete with a large majority of people living in urban areas.

In recent decades the combined effects of overall population growth and rising urbanization produced extremely rapid growth in the size of urban populations of the less developed countries. This expansion has been difficult to absorb in the poorest countries where urban infrastructure has not kept pace with population growth, resulting in continuous traffic jams, lack of public transportation, clean water and sanitation, and overcrowded schools and health facilities. The chronic paucity of housing has led to the explosive growth of slum areas where the poor and marginalized live in extremely difficult conditions with limited access to infrastructure and services.

The rapid expansion of urban areas has conversely contributed to a reduction in the growth of the rural population due to outmigration. In fact, the size of the rural population of the world is projected to remain stable

for the next few decades; despite rural women typically having a higher TFR than urban women. This trend will reduce direct population pressures on some rural environments, but not those required to produce food for urban consumption. This trend also implies that a large majority of the 3.8 billion people expected to be added to the less developed world in future decades will end up in cities that are often poorly prepared to absorb this large influx of new inhabitants.

### *Population aging*

Population aging is a relatively new demographic phenomenon because for most of human history populations were young and lives were short. Population aging is in part caused by increases in life expectancy which allows individuals to live to higher ages. But an even more important cause of population aging is a decline in fertility. With fewer births, younger generations are smaller relative to older generations, thus raising the average age of the population. This aging has important socio-economic consequences as discussed below.

The pattern of aging can be examined by dividing the population into three age groups: the young (aged 0-14), the working-ages (15-64), and the old (65+). Figure 5 plots regional estimates of the proportions of the population in each of these age groups from 1950 to 2015 and projections to 2100. Differences between regions in 2015 are related to the stage of the demographic transition and in particular to levels and trends in fertility in recent decades. For example, Africa, which is still in mid-transition, has a much larger proportion under age 15 (41%) than Europe (16%). At the other end of the age spectrum the proportion aged 65+ ranges from 18% in Europe to 3% in Africa. These differences are largely explained by the higher level of fertility in the latter than in the former.

The main trend evident in Figure 5 is that the proportion of the old rises over time and the proportion of the young declines. In all regions except Africa the proportion of 65+ is expected to reach about 30% in 2100. In some countries with low fertility and high life expectancy the proportion 65+ could reach over 35%.

The young and the old tend not to be economically active and are therefore dependent on the working population for income, food, shelter, education, healthcare and social security. As a result, increases in the proportion of the population that is dependent has significant social and economic consequences. A simple indicator – called the age-dependency ratio (ADR) – summarizes this. The ADR in a given year equals the ratio of the dependent population (those aged below 15 years and those aged 65 years and above) to the working-age population (aged 15–64). This ratio aims to measure how many ‘dependents’ there are for each person in the ‘productive’ age group. The ratio is rather crude because not every person below 15 or aged 65 and over is a dependent and not every person between ages 15 and 64 is productive, but it has been widely used to summarize trends in the age composition.

Over the course of a demographic transition, the ADR shows a characteristic pattern of change. Figure 6 presents this pattern for different regions from 1950 to 2015 and projections from 2015 to 2100. The figure does not capture the full transition for each region, because Europe and North America were already in their late demographic transition stage before 1950 and Africa is still early. However, the patterns for Asia and Latin America capture the critical central transition period. Early in the transition the ADR typically rises slightly, as improvements in health increase child survival and raise the number of young people. Next, the ADR falls sharply as declines in fertility reduce the proportion of the population under age 15. A few decades later the ADR rises again when the older population rises.

These fluctuations in the ADR over time have important economic consequences. The drop in the ADR in mid-transition (following the onset of the fertility decline) leads to a boost of GDP/capita growth rate. This effect is often referred to as the ‘demographic dividend’. Economic growth is stimulated by an increase in the size of the labor force relative to dependents and by increased savings, provided the right conditions are in place (e.g. investments in education and job creation). Asia and Latin America benefited from this decline in the ADR between 1970 and 2015. A study of the East Asian tiger economies concluded that fully a third of the rapid economic growth in these countries was due to their ability to harness the demographic dividend.

Towards the end of the transition the age structure turns economically unfavorable as the proportion of the population aged 65 and over rises. In Europe and North America the dependency ratio started rising around 2010 and is expected to rise substantially further over the next few decades. This trend is also evident in Asia and Latin America after 2025.

These trends in the ADR are sufficiently important in terms of socio-economic development, that governments try to encourage the demographic dividend by lowering the ADR in countries with high fertility and to minimize the effects of population aging in the MDCs as discussed next.

## **II. Policy options in aging societies**

The potential adverse effects of population aging came to the attention of policy makers when TFRs in most MDCs dropped below 2 births per woman in the 1970s and 1980s. This trend was unexpected. The conventional wisdom, that TFRs at the end of the transition would stabilize at just above 2 (which would lead to a stable population size), proved to be wrong. Even a small deviation below this level leads to substantially more population aging. By the 1990s the OECD, World Bank, and IMF prepared influential reports calling for action to counteract the adverse effects from population aging.

The rapid ongoing and projected increase in the elderly population is of concern because it threatens the sustainability of public pension and health care systems. This is especially the case because most of these systems are pay-as-you-go, i.e. current benefits are paid for by contributions from current workers. As noted above, the proportion aged 65+ is projected to reach near one in three in the most rapidly aging societies. This implies fewer than two persons between 15 and 65 for everyone aged 65 and above.

The first response of governments has been to make the pension and health care systems more sustainable. A wide range of measures are available, including reducing benefits, raising taxes or contributions, increasing the age at eligibility, and reducing incentives for early retirement. Most MDCs have now implemented at least some of these adjustments. As a result, sustainability prospects have improved, but the situation remains highly precarious, especially in countries with the lowest fertility e.g. Japan and Italy.

Since population aging is in large part due to low levels of fertility, MDC governments also have strengthened their family policies. These policies were encouraged by the fact that a substantial proportion of women have fewer children than they want. This gap between actual and desired family size is largely the consequence of difficulties women face in combining childbearing with participation in the paid labor force. Family policies therefore implement measures to address this issue including subsidized childcare, reduced taxes for families with children, and paid parental leave.

The effects of such policies on fertility have been relatively modest (up to a few tenths of a birth per woman) but even small increases in fertility lead to substantial reductions in population aging. The scope and generosity of family policies differ widely between countries. The countries with the highest fertility in Europe (France, Netherlands, and Scandinavia) have the most generous family policies.

Another demographic option to offset aging is to allow higher levels of immigration. This option will not be discussed further here.

### **III. Responsible Parenthood**

Responsible parenthood is a central concept in the teachings of the Catholic Church on marriage and the family. In a 1994 letter to the United Nations Saint John Paul II explained that responsible parenthood "...is not a question of unlimited procreation or lack of awareness of what is involved in rearing children, but rather the empowerment of couples to use their inviolable liberty wisely and responsibly, taking into account social and demographic realities as well as their own situation and legitimate desires." The letter further asks that more attention be given to "securing for husband and wife the liberty to decide responsibly, free from all social or legal coercion, the number of children they will have and the spacing of their births". During a recent visit to Asia, Pope Francis said: "responsible parenthood requires that couples regulate the births of their children". The centrality of the couple as the decision-making unit regarding procreation is also noted the Final Report of the Synod of Bishops *Relatio Finalis* "... family planning fittingly takes place as the result of consensual dialogue between the spouses." These principles regarding the planning of family size and the spacing of births are widely shared in the international development community and, if universally accepted, would lead to many global health and development advances.

Social scientists have undertaken extensive studies of the preferences of couples about their families. A few relevant findings from this research are provided below.

#### *Preferences regarding family size*

In recent decades demographic and health surveys have been conducted in a majority of less developed countries. In these surveys large numbers of women are asked a range of questions about childbearing and the health and well-being of their children. One question relates to the desired or ideal family size. Figure 7 gives the average desired family size reported by women in different regions of the less developed world. The desired size ranges from an average of 2.7 in Asia and Latin America to 4.7 in sub-Saharan Africa. These findings are consistent with the stages of the demographic transitions reached by these regions: Asia and Latin America are much further along in their transitions than sub-Saharan Africa. In more developed countries at the end of the transitions, women typically want two children.

Note that these desired family sizes are well short of the six to seven births women have when they do not regulate their fertility. In other words, in most countries women need only part of their reproductive years between ages 15 and 45 to achieve their desired family size. During the remaining years of their reproductive lives women would need to practice family planning to avoid unintended pregnancies.

#### *The implementation of family size preferences*

Given these findings on desired family size it is not surprising that large proportions of women in the developing world report not wanting to become pregnant at the present time.

This proportion varies among countries and regions. Generally, it is highest in countries with a low desired family size and vice-versa. Figure 8 provides estimates of the regional average proportions not wanting to become pregnant which range from 83% in Latin America to 78% in Asia and 53% in sub-Saharan Africa.

Women who do not wish to become pregnant desire to regulate their fertility. However, the implementation of this desire is incomplete in all countries and substantial proportions of women wanting to avoid pregnancy report not practicing family planning. These women are considered to have an *unmet need* for family planning and are at risk of experiencing unplanned pregnancies and related health complications. As shown in Figure 8, unmet need is much higher in sub-Saharan Africa than in Asia and Latin America.

These indicators also differ among socioeconomic groups within countries. Proportions not wanting to become pregnant at this time are lower and unmet need is higher among poor, rural, and uneducated women than among their well-off, urban, and educated counterparts.

The UN estimates that 130 million married women in the developing world have an unmet need for family planning (United Nations 2016) The associated risk of pregnancy results in an estimated 74 million unplanned pregnancies, 36 million abortions and 88000 maternal deaths (Singh et al. 2014). These unplanned pregnancies, abortions and maternal deaths and injuries could be averted if women with an unmet need practice family planning.

#### *Obstacles to family planning and unplanned pregnancies*

Why do some women who wish to avoid pregnancy not practice family planning? Research on the causes of unmet need has identified a range of social, health, and economic factors that pose barriers to women and men who desire to regulate their family size. These factors include lack of knowledge, lack of availability of methods, costs, health concerns, objections from family members and concerns about moral and social acceptability. These obstacles lead some women to forgo family planning despite their intention not to become pregnant.

Additional statistics on pregnancy outcomes in the less developed world in 2014 are presented in Table 2. The total annual number of pregnancies in LDCs is estimated at 192 million, of which 74 million are unplanned (i.e. about two out of five). The highest proportions of unplanned pregnancy are among the youngest, poorest and most vulnerable women; directly impacting women's health and the wellbeing of their families.

Half of these unplanned pregnancies result in unplanned births (28 million) or miscarriages (9 million). It is estimated that about a quarter of all births in the less developed world are unplanned.

The remaining half of the unplanned pregnancies end in abortion (36 million) – the majority of which are unsafe. Unsafe abortion leads to around 22 thousand maternal deaths per year and high levels of maternal morbidity.

#### *Assisting couples to be responsible parents*

Many governments have developed services to assist women to implement their reproductive preferences. Research shows that these services are welcomed by women and men in countries at all stages of economic development. The best-documented demonstration of the demand for these services was provided by a large trial – the Family Planning and Health Services Project (FPHSP) – started in the late 1970s in Matlab, Bangladesh. At that time Bangladesh was one of the poorest and most highly agricultural countries in the world, and there was widespread skepticism that family planning would be accepted in such a traditional society. The FPHSP divided the Matlab district (population of 173,000 in 1977) into intervention and control areas of approximately equal size. The control area received the same very limited services as the rest of the country, while in the intervention area comprehensive, voluntary, high-quality reproductive health services were provided. The impact of these services on reproductive behavior is summarized in Figure 9. Within two years from the start of the project, the proportion of women practicing family planning in the intervention area rose from less than 5% to 33%. In contrast, very little change occurred in the control area or in the rest of Bangladesh during the first few years.

A follow-up study in the Matlab district in the early 1990s measured family welfare outcomes including women's health, earnings and household assets, use of preventive health inputs, and effects on the health and schooling

of the woman's children. The intervention area scored significantly better than the control area on many of these indicators of the welfare of women and their children, demonstrating how access to high-quality, voluntary family planning services can lead to multi-sectoral and multigenerational health and wellbeing benefits.

#### *The multi-sectoral impacts of family planning*

When couples implement their own decisions about family size, their actions lead to a range benefits:

- Women's empowerment: Women have greater freedom to determine the number and spacing of children and have more freedom to participate in the formal labor force and civic life;
- Health: The reduction in unintended pregnancies and the wider spacing of pregnancies reduce maternal mortality and morbidity and improve infant and child survival and health;
- Economy: A decline in unplanned births reduces the ratio of dependents to workers, raises investment in human capital, and leads to greater participation of women in the formal labor force. These trends are the cause of the demographic dividend (discussed earlier) which boosts GDP per capita and helps developing countries to accelerate poverty reduction;
- Government: Less pressure on education and health care sectors and on the country's infrastructure (e.g. transportation, communication, energy, water and sanitation);
- Environment: Reduced pressure on natural resources on which peoples' lives depend (fresh water, soil, forest, agriculture, energy, etc.) and reduces air, water, and soil pollution; and
- Social/Political stability: With a slower-growing youth population there is less competition for jobs and fewer unemployed youth, thus making political environments more stable.

#### **Conclusion**

Assisting couples to achieve their reproductive preferences is a compassionate act that promotes responsible parenthood and improves the lives of women, their children, and their communities, especially among the poor and most vulnerable sections of societies. The resulting decline in unplanned births also enhances prospects for poverty reduction and moderates the increasingly harmful impact of human activities on the natural environment.

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