## Population:
## A Lively Introduction

5TH EDITION

by Joseph A. McFalls Jr.

- Our fascination with population stems from an interest in our own lives.

- Change is a fundamental aspect of any population.

- Demographic forces have a profound impact on society.

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### 5TH EDITION

## About the Author

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Most people think demography is just math in disguise—a sort of dry social accounting. Once exposed to the subject, many change their minds. They come to appreciate the profound impact demographic forces have on societies. This has never been more true than during the past half-century, a period in which the United States and other societies have experienced unprecedented social and demographic change. Since these demographic forces have not been stilled, they will continue to cause social change and to shape social programs for the balance of our lives and beyond.

People also find demography fascinating because it deals with so many personally relevant topics. Nearly all the major events of people's lives have demographic implications: birth, schooling, marriage, occupational choices, childbearing, retirement, and death. Consider the following questions:

- When and where were you born? How many others were born the same year?
- What is your probability of getting married or divorced?
- Do you have children or do you ever plan to? How many, and how far apart?
- What kind of job will you have? How often will you change jobs? What are your chances of promotion? When will you retire?
- How many times will you move? Will you move around the block or overseas?
- How long will you live? What are the chances of your dying within a year? Within 10 years? What is likely to kill you?

These are all in part demographic questions. Indeed, if people are not interested in demographic phenomena, they are not interested in themselves.

Demography, or population studies, is a discipline, an "interdiscipline," and a subdiscipline. It is clearly a discipline because it is a field with its own body of interrelated concepts, techniques, journals, departments, and professional associations. Demography is also an interdisciplinary field because it draws its subject matter and methods



*When and where people are born; whether and whom they marry; how many children they have; when and how they die—all major life events have demographic implications.*

from many disciplines, including sociology, economics, biology, geography, history, and the health sciences. Finally, demography is also considered a subdiscipline within some of these same major disciplines. In most universities, demography courses are taught within the sociology curriculum, perhaps because population phenomena have so long been linked to social processes.[1]

Demography is defined as the study of human populations: their size, composition, and distribution, as well as the causes and consequences of changes in these characteristics. Populations are never static. They grow or decline through the interplay of three demographic processes: birth, death, and migration. If some groups within a population grow or decline faster than others, the composition of the whole is altered.

This *Population Bulletin* presents the basic what, why, and how of the study of demography. It is not a comprehensive treatment of the subject, but it does provide an overview of demographic processes and the basic measures used to assess them. In addition, it traces population trends in the world and the United States, surveys the

demographic differences among population groups, and examines broad social issues linked to population change. The first three sections of this *Bulletin* provide the framework for studying the dynamics of population. Fertility, mortality, and migration are at the root of all demographic change. The fourth section reveals how changes in fertility, mortality, and migration affect a population's size and growth rate, and how population projections are calculated. The fifth section delves into the composition of population according to common variables: age, sex, and race or ethnicity. The sixth section describes how the geographic distribution of population changes, primarily through migration. The final sections discuss issues and problems associated with population growth.

## Fertility: Adding New People

The study of population dynamics must begin with fertility. Fertility refers to the number of births that occur to an individual or in a population. In 2006, national fertility rates ranged from an average of 1.2 children per woman in the former Soviet republics of Georgia and Ukraine to 8.0 children per woman in the West African country of Niger. The average for the United States was

2.1, and for the world, 2.7. More than 4 million babies were born in the United States in 2006, and about 27 million in India. Worldwide, 137 million human beings were born in 2006, or 261 babies per minute.

## Fecundity: Physiological Limits to Childbearing

Fertility must be distinguished from its sister term, fecundity, which refers to the physiological ability of individuals or couples to have children. Some individuals are infecund—unable to bear children because of disease or genetic dysfunction. Mothers who are breastfeeding their babies often are temporarily infecund because of natural hormones released by their bodies. There is documented evidence of women giving birth to 30 or more children (usually including twins, triplets, and other multiple births).[2] Thus, for individuals, fecundity probably ranges from zero to about 30 children.

The maximum fecundity of a population, which is composed of individuals with varying levels of fecundity, is thought to be about 15 children per woman.[3] This is the theoretical maximum number of children a population of women could produce if they engaged in regular sexual intercourse from menarche, at around age 12, until they reached menopause, at around age 50, and never used any form of birth control. The theoretical maximum of 15 children is a far cry from real-life levels. Even in the world's highest-fertility countries, the average has rarely exceeded eight children per woman. What accounts for this large gap? In every society a variety of cultural, economic, and health factors interfere with the process of human reproduction. These factors include cultural values regarding childbearing (Does the society value large or small families?); social roles (Is the wife primarily a childbearer and childrearer?); economic realities (Do parents rely on children to look after them in old age?); and the prevalence of diseases such as gonorrhea that impair fecundity.

## Proximate Determinants of Fertility

Cultural and economic factors do not affect fertility directly; they influence another set of variables that determine the rate and level of childbearing. In 1956, demographers Kingsley Davis and Judith Blake isolated the factors that control the probability that a woman of reproductive age (roughly ages 15 to 49) will produce a child. These intermediate fertility variables affected a society's fertility level through their impact on fecundity, sexual unions (including marriage), or birth control (see Box 1). The factors operate in every society, but the relative importance of each varies tremendously. In the 1980s, demographer John Bongaarts demonstrated that four of

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Box 1

**The Intermediate Variables That Affect Fertility**

**Fecundity**
- Ability to have intercourse
- Ability to conceive
- Ability to carry a pregnancy to term

**Sexual Unions***
- The formation and dissolution of unions
- Age at first intercourse
- Proportion of women who are married or in a union
- Time spent outside a union (separated, divorced, or widowed, for example)
- Frequency of intercourse
- Sexual abstinence (religious or cultural customs, for example)
- Temporary separations (military service, for example)

**Birth Control**
- Use of contraceptives
- Contraceptive sterilization
- Induced abortion

*Includes marriage as well as long-term and casual relationships.

**References**
Kingsley Davis and Judith Blake, "Social Structure and Fertility: An Analytic Framework," *Economic Development and Cultural Change* 4, no. 3 (April 1956); and Joseph A. McFalls Jr. and Marguerite McFalls, *Disease and Fertility* (New York: Academic Press, 1984).

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these variables explain nearly all the variation in fertility levels among populations.

These "proximate determinants of fertility," as he termed them, could be quantified and expressed as a simple formula, creating a versatile method for statistical analysis. The four proximate determinants are: (1) the proportion of women married or in a sexual union, (2) the percent of women using contraception, (3) the proportion of women who are infecund (because they are breastfeeding, for example), and (4) the level of induced abortion.[4]

The proximate determinants have a direct biological effect on fertility. The importance of each depends on social, economic, and health factors within a population. Contraceptive use and abortion are the key proximate determinants of fertility levels in the United States and most developed countries. In 2001, Ukraine achieved one of the lowest fertility rates on record for a nation—1.08 births per woman—largely because of relatively high rates of contraceptive use and abortion.[5] The rate has edged upward, but has remained below 1.3.

Where contraceptive use and abortion are rarely used, the postpartum infecundity and marriage determinants are more important. The Hutterites, a North American religious sect, averaged 12 children per woman in the 1930s—the highest fertility on record for any population—by promoting early and universal marriage and eschewing contraception and abortion.

The importance of the intermediate variables differs around the world because of cultural practices and beliefs that affect people's behavior. In many African countries today, women marry young and rarely use contraceptives, yet cultural factors limit fertility to a six-child average. In accordance with ancient traditions and beliefs, women in many African societies breastfeed their babies until age 2 or 3, thus prolonging the infecund period following childbirth (postpartum amenorrhea). In some African societies, mothers are expected to abstain from sex for up to two years after childbirth, especially while they are breastfeeding. Polygamy, or having more than one wife at the same time, is another cultural practice that affects fertility. Some African men have more than one wife, and husbands often work away from home for months at a time, further reducing the time their wives are, in demographers' terms, "exposed to the risk of pregnancy."

## Measuring Fertility

The national fertility rates discussed above are total fertility rates (TFRs). The TFR is commonly used because it is easy to visualize what it stands for: the average total number of children a woman will have. But the TFR is a synthetic rate; it does not measure the fertility of any real group of women. The TFR measures the fertility of an imaginary group of women who pass through their fictitious reproductive lives subject to the rates of childbearing experienced by real women in a given year. Although the TFR concept is not intuitively obvious, it is straightforward and easy to calculate from age-specific birth rates (see Box 2, page 6). The TFR is a valuable measure for gauging fertility trends or comparing different populations.

### Two-Child Replacement Level

Another attraction of the TFR is that it allows us to explore the concept of replacement-level fertility. This is the level of childbearing at which couples have an average of two children—just replacing themselves in the population. A population with replacement-level fertility eventually will stop growing (as discussed in the section on population growth). Actually, replacement-level fertility requires a TFR slightly above 2.0, primarily because some children will die before they grow up to have their own two children. In a country with low mortality, such as the United States, a TFR of 2.1 produces replacement-level fertility. In a high-mortality country such as Sierra Leone, replacement-level fertility would require a TFR greater than 3.

### Crude Birth Rate

The crude birth rate is the most easily obtained and most often reported fertility measure. It is calculated from the number of babies born in a given year (or any other time period) divided by the mid-year population, and it is expressed as the number of births per 1,000 people. In 2006, the estimated crude birth rate was 14 births per 1,000 in the United States and 21 births per 1,000 for the world. National crude birth rates ranged from around 9 in Bulgaria and several European countries to 55 in Niger.

As the name implies, this rate is an imprecise measure of a society's childbearing patterns. The crude birth rate is highly sensitive to the age structure of a population. The crucial factor is the percentage of young women of reproductive age, because these women produce most of the babies. Thus, a population with a relatively high proportion of young people will have a higher crude birth rate than a population with a large proportion of older people.

More refined rates attempt to minimize the effects of age structure. In addition to the TFR, these include the general fertility rate, which measures the number of births per woman of childbearing age (ages 15 to 49), and the net reproduction rate, which measures the number of daughters born to a woman given current birth rates and her chances of living to the end of her child-

Box 2
**Fertility Measures**

Demographers use a variety of rates, ratios, and other statistics to measure fertility within a country or a population group. They often refine these measures to examine the levels and trends within a specific group—teenagers or college-educated women, for example—or to reduce the effect of different age structures on the crude birth rate. Most refined fertility measures zero in on women of childbearing age (usually ages 15 to 49). The general fertility rate, for example, tracks the number of births per 1,000 women ages 15 to 49 (or sometimes ages 15 to 44). Rates are refined even more to measure the number of births to women in a smaller age group. Teen birth rates generally refer to women ages 15 to 19, and may be dissected further to refer to teens 16 to 17 or ages 18 to 19.

Demographers use similar techniques to examine other variables. Age-specific rates may be calculated for deaths, migration, marriage, college attendance, and other social phenomena. Similarly, rates may be calculated separately for individuals with specific characteristics, such as birth rates for married women, or death rates for white teenagers. Death rates may be calculated separately for each cause of death, as shown in Table 1, page 11.

Age-specific birth rates are also used to calculate the total fertility rate (TFR), one of the most valuable rates for comparing fertility among countries and tracking changes over time. The TFR is often cited as a measure of the average number of children in a family, but this definition is not really correct. The TFR is a "synthetic" measure that does not apply to any specific woman or group of women. The U.S. TFR for 2005 (2.05), measures the average number of children American women would have, assuming that, at every age, they have children at the same rate as women did in 2001. The TFR is

**Calculating the U.S. Total Fertility Rate (TFR) for 2005**

| Age of women | (1) Number of women (thousands) | (2) Births to women in age group (thousands) | (3) Age-specific birth rate (column 2/ column 1) |
|---|---|---|---|
| 15-19 | 10,249 | 421[a] | 0.041 |
| 20-24 | 10,181 | 1,040 | 0.102 |
| 25-29 | 9,798 | 1,132 | 0.116 |
| 30-34 | 9,924 | 952 | 0.096 |
| 35-39 | 10,439 | 483 | 0.046 |
| 40-44 | 11,484 | 111[b] | 0.010 |

Sum = 0.411
TFR = Sum x 5 = 2.05

[a] Includes 6,717 births to women under age 15.
[b] Includes 6,546 births to women age 45 or older.

Sources: B.E. Hamilton, J.A. Martin, and S.J. Ventura, "Births: Preliminary Data for 2005" (www.cdc.gov/nchs, accessed Jan. 22, 2007): table 1; and 2005 population estimates (www.cdc.gov/nchs, accessed Jan. 23, 2007).

the sum of the rates for each five-year age group multiplied by five, as illustrated in the table above.

**References**

John R. Weeks, *Population: An Introduction to Concepts and Issues*, 8th ed. (Belmont, CA: Wadsworth/Thompson Learning, 2002): 193-99; and Arthur Haupt and Thomas T. Kane, *Population Handbook, 5th ed.* (Washington, DC: Population Reference Bureau, 2004).

bearing years.[6] These and other refined rates allow demographers to compare the fertility of different countries more accurately.

## Lifetime Fertility: Cohort Rates

What if we want to measure the fertility of a certain group of women, for example, women born between 1940 and 1945? For women who are past their reproductive years, say above age 50, a completed fertility rate can be estimated from the average number of children they bore from the time they experienced menarche in their early teens until they reached menopause in their 40s or 50s.

Completed fertility is a useful measure for comparing the fertility levels of different generations. In the United States, women born between 1906 and 1910 (the 1906-1910 birth cohort) produced what was then the smallest number of children per family in U.S. history, an average of 2.2 children per woman. Women from the 1931-1935 cohort, who became parents during the baby boom, produced the century's highest fertility—a completed fertility rate of 3.2 children per woman. Baby boomers—Americans born between 1946

and 1964—will probably average fewer children than the 1906-1910 cohort, but we will have to wait to find out until about 2010, when these women have completed their childbearing years.

Completed fertility is a cohort measure because it describes the fertility of a specific cohort of women. The TFR and crude birth rate are period rates because they measure fertility for a given period of time. Cohort rates tell us nothing about current fertility. Likewise, period rates, such as the TFR, cannot predict future fertility. The difference between cohort and period rates explains how it is possible that, during the height of the U.S. baby boom (1957), the TFR reached 3.7 children per woman, yet no cohort of women born in the 20th century has recorded a completed fertility rate of more than 3.2 children.

## U.S. Fertility Rates and Trends

American women averaged more than seven children each until the early decades of the 19th century. Average fertility declined gradually thereafter, interrupted only by the baby boom following World War II. The TFR reached an all-time low of 1.74 children per woman in

1976, and then crept up to 2.08 by 1990. Between 1990 and 2005, the TFR varied between 1.97 and 2.08.

The baby bust of the 1970s came about in large part because of delayed marriage, widespread contraceptive use, and abortion. Judging by the long-term fertility trend and the current social trends favoring low fertility—including postponement of marriage and childbearing to older ages, high divorce rates, and the large proportion of women in the labor force—we are not likely to see U.S. birth rates rise very far.[7]

Although most American women say they expect to have at least two children, many women have delayed marriage and childbearing so long that they will have only one child or no children at all. Nineteen percent of women who were ages 40 to 44 in 2004 never had children, and most of these women never will.[8]

## Who Has More Children?

The overall fertility rate in the United States has remained fairly stable since the late 1970s, but American women vary considerably in when and how many children they have. Among all women ages 15 to 44 in 2004, only 22 percent conformed to the two-child average; 45 percent had not had any children, and 16 percent had three or more children. What accounts for these differences? The most predictable and obvious fertility differential is age, but income, race, religion, and many other social, economic, and cultural factors also influence childbearing.

**Mothers' Age**

Biotechnology and medical advances are expanding the ages at which women can have children. But few women give birth before age 15 or after age 50. Over this roughly 35-year span, birth rates vary substantially by age. Birth rates by the age of the mother follow the same general pattern in most societies regardless of the level of fertility: Rates are low in the teens, peak in the 20s, and decline thereafter. But comparisons of the age-specific rates in different countries reveal significant variations, as shown in Figure 1. The peak does not begin until the late 20s in Japan, where childbearing is highly concentrated in the late 20s and early 30s.

In the United States, birth rates are high for women throughout their 20s and into their early 30s. Rates are higher for women of every age in Chad, where the TFR was an estimated 6.7 in 2006. Birth rates also peak in the early 20s, but childbearing occurs throughout the reproductive ages.

The postponement of childbearing is portrayed by the steep drop in the U.S. birth rate for women ages 20 to 24 during the 1960s and the 1970s. After 1975,

Figure 1

**Age Patterns of Fertility: Chad, Japan, and the United States, 2005**



Births per 100,000 women
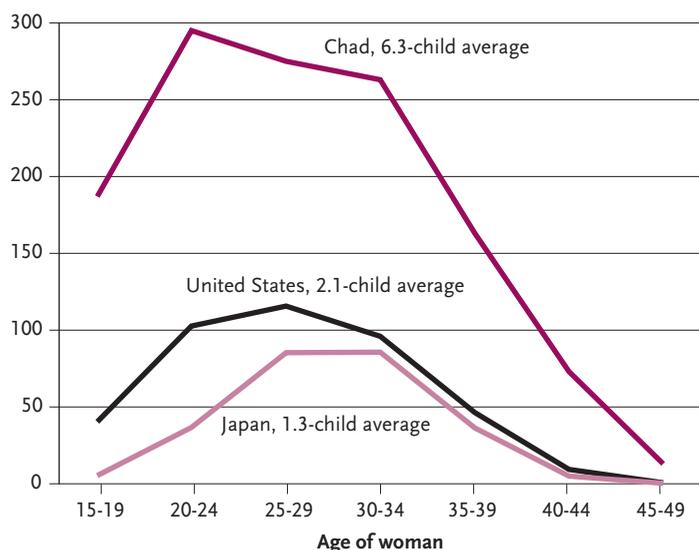
Sources: B.E. Hamilton, J.A. Martin, and S.J. Ventura, *Births: Preliminary Data for 2005* (www.cdc.gov/nchs, accessed Jan. 22, 2007): table 1; Japan, Ministry of Health, Labour and Welfare, *Vital Statistics, 2005* (www.mhlw.go.jp/toukei/index.html, accessed Jan. 24, 2007); and ORC Macro, *Final Report: Chad Demographic and Health Survey, 2004* (www.measuredhs.com, accessed Jan. 22, 2007).

the rate leveled off for women in their 20s, while it rose for women ages 30 to 34. Many of these older mothers were having the children they had postponed earlier in life. Despite considerable media attention about increases in the number of American women becoming mothers in their 40s, the birth rate for women ages 40 to 44 is lower in 2005 than it was in the 1960s. Finally, Figure 2 (page 8) reveals that teen birth rates remained relatively low in the 1970s and 1980s, despite large increases in the proportion of teenagers who were sexually active. The teenage birth rate edged up around 1990, but increases in contraceptive use and a leveling of the share of teens who are sexually active helped lower the teen birth rate to its lowest level ever in 2005.[9]

**Parents' Race and Ethnicity**

In many countries, racial and ethnic minorities have higher fertility than the majority. Often these differences arise from religious beliefs and cultural traditions. Immigrants often maintain the childbearing patterns of their homelands when they arrive, but they and their children tend to incorporate the fertility patterns of their adopted country over time. Hispanics born in the United States have lower fertility than U.S. Hispanics who were born abroad, for example. Likewise, fertility differences among European ethnic groups in the United States

Figure 2
**U.S. Birth Rates By Age of Mother, 1955–2005**

Births per 1,000 women
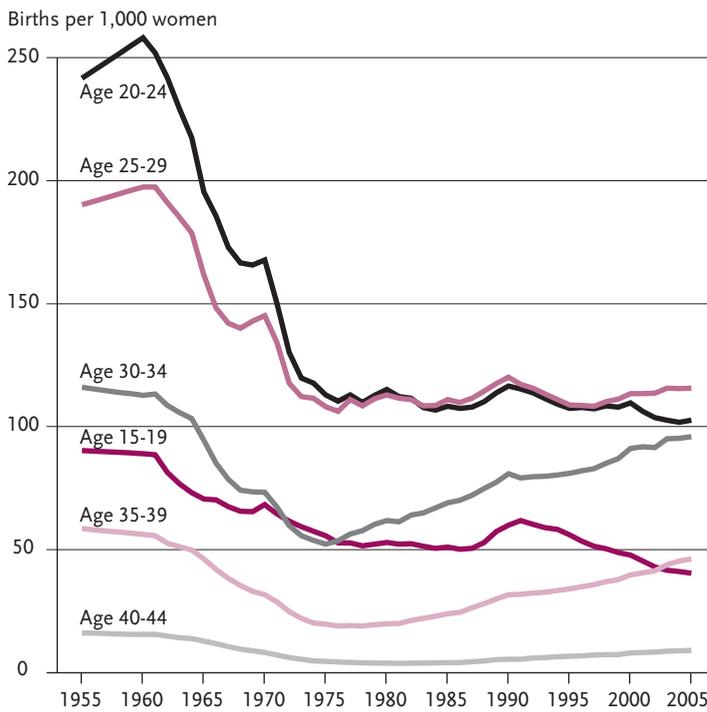


Sources: J.A. Martin et al., "Births: Final Data for 2004," *National Vital Statistics Reports* 55, no. 1 (2006); NCHS, *Live Births by Age of Mother and Race, United States, 1933-1998* (www.cdc.gov/nchs, accessed Jan. 19, 2007); and B.E. Hamilton, J.A. Martin, and S.J. Ventura, *Births: Preliminary Data for 2005* (www.cdc.gov/nchs, accessed Jan. 22, 2007): table 1.

(including Irish, German, and Italian American) have greatly diminished.[10]

A minority group's fertility differences also are linked to its socioeconomic status. The fertility of African Americans has always been higher than the rates for non-Hispanic white Americans, although the gap has narrowed in recent years. This persistent difference likely reflects African Americans' lower socioeconomic status relative to whites. In 2005, the TFR was 1.8 for non-Hispanic white women, 1.7 for Asian and Pacific Islander women, 2.0 for black women, and 2.9 for Hispanic women.[11] Arabs in Israel and Asians in Russia are other examples of minority ethnic or religious groups whose fertility remains higher than the average for the country. But minorities do not always have above-average fertility. In the United States, Asian American fertility is lower than that of non-Hispanic whites.

**Socioeconomic Status: Parents' Income, Education, and Occupation**
In nearly every contemporary society, the poor have more children than the rich. This also holds true for the United States within all major racial and ethnic groups. Income is closely related to educational attainment,

which is often easier to measure. Individuals who have completed more schooling tend to have higher-paying jobs. In general, fertility declines as the income and educational attainment of women increase. In 2004, for example, American women ages 40 to 44 with a graduate or professional degree had an average of 1.6 children, compared with 1.9 children for women with just a high school diploma, and 2.5 children for women without a high school diploma.[12]

Numerous other social, religious, and cultural factors are associated with fertility differences. Most of these can be explained by age, income, or educational differences among these groups. In just about every culture, women who work outside the home have fewer children than those who do not, and rural women have more children than urbanites. People who actively practice a religion tend to have higher fertility than nonreligious people.[13]

## Mortality: Subtracting People

Mortality, the counterpoint to fertility, is the second cause of population change. The death rate for a population is usually expressed as the number of deaths per 1,000 people in a given year. In 2006, an estimated 56 million people died throughout the world. With a global population of 6.6 billion, these deaths produced a death rate of 8.6 per 1,000. Worldwide, death rates ranged from less than 3 in Kuwait, Qatar, and the United Arab Emirates to 28 in Swaziland. Nearly 2.5 million people died in the United States, yielding a rate of 8.2.

The death rate measures the proportion of a population that dies each year, but comparing death rates among populations does not show whether one population is healthier or lives longer than another. The death rate is strongly influenced by the age structure of the population. Death rates often are higher in more developed countries such as Sweden than in less developed countries such as Nicaragua, even though more developed countries tend to offer healthier environments and better medical services.

A large proportion of the population of more developed countries is in the older ages—the ages at which most deaths occur—while a relatively small proportion of the population of less developed countries is in the older ages. In 2006, only 3 percent of the population of Swaziland was age 65 or older, while 19 percent of Germans were age 65 or older. When death rates are plotted by age on a graph, they form the characteristic J-shaped curve of mortality (see Figure 3). The J-pattern is found in all societies, but it is most pronounced where mortality is high, as it was in the United States in 1900. The death rates for U.S. males were higher in

1900 than they are today in many less developed countries. The death rate is relatively high during an infant's vulnerable first year of life, then it declines throughout childhood and early adolescence before starting an inexorable climb to a towering peak after age 85. From the point of view of the mythical Grim Reaper, Americans are most elusive at ages 10 and 11 when only one in every 5,000 people dies, and most vulnerable at age 122 when virtually everyone is harvested.

## Life Expectancy: How Long Do We Live?

To better gauge the life chances of individuals in a population and to better compare mortality conditions among countries, we must look at the average life expectancy. Both biological and social factors influence how long individuals live, and by extension, the average life expectancy within a population. In 2004, the average life expectancy at birth in the United States was 78 years. Japan had the world's highest life expectancy—82 years. The lowest estimates for the early 2000s were in HIV/AIDS-plagued countries in sub-Saharan Africa: Life expectancy ranged between 34 years and 37 years in Botswana, Lesotho, Swaziland, Zambia, and Zimbabwe.

Life expectancy is a concept many people use but few understand. What does the U.S. life expectancy of 78 years really mean, and to whom does it apply? The term life expectancy usually is used as a shorthand way of expressing "life expectancy at birth." Can we conclude that a child born in the United States in 2004 can expect to live to age 78, on average? Not really. As an infant born that year proceeds through life, mortality conditions will change. Individual lives may be cut short by war or a devastating plague of some new disease, or may be extended through fantastic medical advances.

Life expectancy at birth in 2004 applies to no real group, not even to real people born that year. Like the TFR, life expectancy applies to a hypothetical group of people who pass through their imaginary lives subject to the 2004 death rates at each age. Age-specific death rates refer to the number of deaths of people within a specific age group divided by the total number of people in that age group. This can also be expressed as the probability of dying at a given age. These probabilities are used to construct a life table, or actuarial table, which is used to calculate life expectancy at birth or at any other age.[14]

Once she reaches age 65, for example, a Japanese woman has 23 additional years of life remaining, on average, so she may well celebrate her 88th birthday (see Figure 4). Having survived the major causes of death at younger ages, she has already demonstrated that she is likely to live longer than the average life expectancy at birth.

Figure 3

**Death Rates for U.S. Males, by Age, 1900 and 2004**

Deaths per 1,000 males
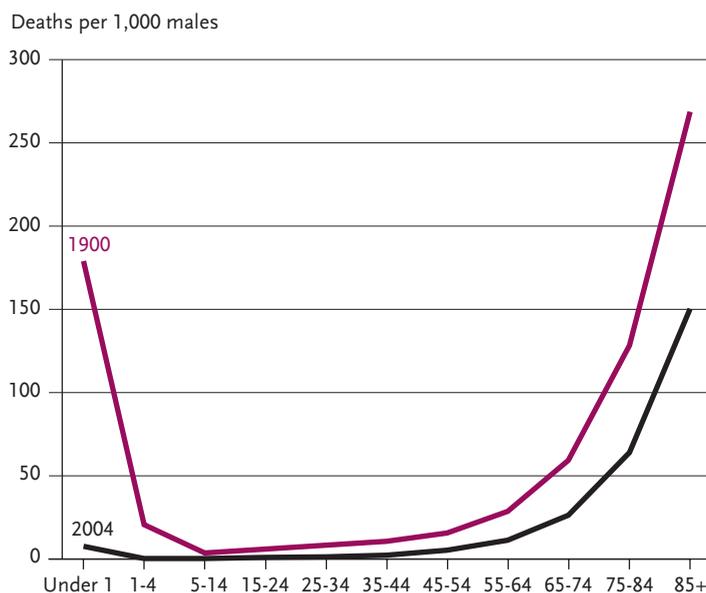
Source: U.S. Bureau of the Census, *Sixteenth Census of the United States: 1940, Vital Statistics Rates in the United States 1900-1940,* (1943): table 5; and National Center for Health Statistics, National Vital Statistics System, *Mortality, 2004* (forthcoming).

Figure 4

**Life Expectancy at Selected Ages by Sex: Japan, 2004**

Additional years of life
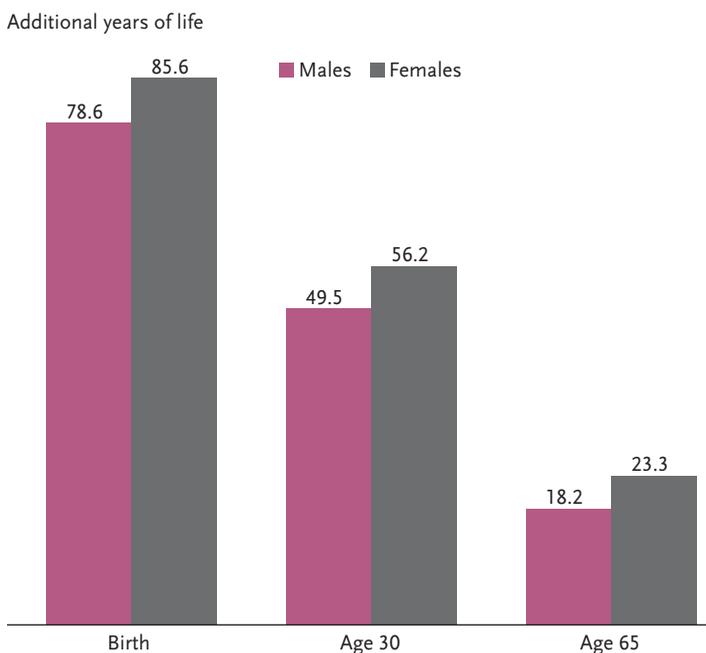
Source: Japan, Ministry of Health, Labour and Welfare, *Trends of Average Expectation of Life by Age, 1891-2004* (www.stat.go.jp, accessed Jan. 23, 2007).

## Life Span: How Long Could We Live?

How high can life expectancy get? The upper limit is governed by the maximum life span for the human species. Although the two terms are often confused, life expectancy reflects the real-life conditions in a population, while maximum potential life span is a theoretical number: the highest age the most robust humans could reach.[15] Many individuals outlive the average life expectancy for their society (about 12 million Americans were older than 78 in 2004), but no one outlives the maximum human life span. Experts disagree about the upper limit of the human life span and about whether it is possible to push it to higher levels through medical technology or bioengineering.[16]

The longest anyone is known to have lived is 122 years, five months. This was the authenticated age of Frenchwoman Jeanne Calment when she died in 1997. There have been reports of people living much longer, but these claims are unsubstantiated and are highly suspect. The very old often exaggerate their age, and the ages are difficult to authenticate because birth dates were not recorded systematically 90 or more years ago, even in more developed countries. The number and percentage of elderly who become centenarians is increasing, and eventually, someone is likely to break Madame Calment's record. In February 2007, the reputed oldest living person was 115.[17]

### High Toll From Preventable Diseases

Many world regions still have extremely high mortality from easily curable diseases, but in nearly all countries people live much longer now than in the past. The average life expectancy in the world around 1900 was less than 30 years of age; in 2006, it was about 67 years. Thus, since the origin of modern humans some 100,000 years ago, the vast majority of progress in conquering mortality has taken place in the minute slice of time since 1900. Much of the increased life expectancy worldwide reflects the accumulation of knowledge about how diseases spread as well as improvements in personal hygiene and public health practices. A large share of the remaining gap in mortality between more developed and less developed countries can be attributed to preventable diseases that strike children particularly hard, including diarrhea, respiratory infections, measles, and neonatal tetanus. Antibiotics, immunization, and clean drinking water have drastically reduced the incidence and severity of these diseases in the United States and many other countries. If adequate health services were available throughout the less developed world, mortality could fall quite rapidly.[18]

### Life Expectancy Can Decline

National mortality levels can increase when health systems break down or when diseases spread to new populations. Life expectancy in Russia declined by more than six years after the breakup of the Soviet Union left public health systems in chaos and many Russians in poverty. Average life expectancy in Russia recovered after 1994 but suffered another setback toward the end of the decade.[19] HIV, the virus that causes AIDS, is spreading rapidly in many world regions. More than 25 million people are living with HIV in sub-Saharan Africa, 8 million in South/Southeast Asia, and 2 million in Latin America and the Caribbean. AIDS mortality has caused life expectancy at birth to fall in several sub-Saharan African countries, reversing the gains in infant and childhood health achieved before the epidemic.[20]

The HIV/AIDS epidemic is a grim reminder that the battle against communicable diseases will probably never be over. Many aspects of modern life—international air travel, importation of fruits and vegetables, migration, and even changes in climate—favor the spread of communicable diseases.[21] Natural disasters and widespread violence can also produce a spike in the number of deaths, but they usually have little long-term effect on mortality rates at the national level. Earthquakes, wars, fires, terrorism, hurricanes, and other disasters claim the most lives in less developed areas, where many people live in low-quality housing and where the public health and emergency response systems are limited.

## Mortality in the United States

Life expectancy in the United States—age 78 in 2004—has seen spectacular improvement over an average life expectancy of only age 47 in 1900, but it is still less than in Japan, Iceland, and a number of other countries.

How can mortality be reduced further in the United States? We need first to look at what causes deaths. Table 1 lists the 15 leading causes of death in the United States, which account for 83 percent of all deaths. Heart disease and cancer are the two biggest killers. Indeed, these two diseases are in a league by themselves; they are responsible for one-half of all deaths. Heart disease, cancer, and most of the other major causes of death strike primarily after age 50 rather than during childhood. But no one is immortal. All the progress in life expectancy has, after all, only postponed death.

## Mortality Differentials: Who Dies First?

The Grim Reaper does not bring death to all on an equal basis. Death rates vary by common social categories such as age, sex, socioeconomic status, race,

ethnicity, and religion. Cultural, political, and other social factors help explain the gap in life expectancy among different groups of people.[22] Genetic factors also explain why individuals with similar background characteristics die of very different causes and at different ages. Individuals can inherit a predisposition for developing a potentially lethal disease such as breast cancer. Demographic factors—especially age, sex, and ethnicity—are also closely tied to mortality rates.

### Deaths Highest Among the Youngest and Oldest

Death in the first year of life (infant mortality) is an important demographic variable and is often used as a key measure of a society's quality of life. The infant mortality rate (IMR)—the number of deaths among infants under age 1 per 1,000 live births—declined tremendously in the United States during the 20th century. In 1900, about 120 newborns died out of every 1,000 babies born alive. In 2005, the U.S. infant mortality rate was 7, low by world standards but still higher than in many European countries. In countries where health care systems are inadequate and infectious diseases are rampant, the IMR often exceeds 100 deaths per 1,000 live births.

Once children survive that crucial first year and the next few years of childhood, their life chances improve substantially. Young Americans have less than a 1 percent chance of dying between ages 15 and 24. But that 1 percent attrition means that about 40,000 15-year-olds will never reach their 25th birthdays. Most of these deaths are preventable.

The rank order of causes of death for 15-to-24-year-olds is very different from that shown in Table 1 for the entire population. Injuries, homicide, and suicide are ranked one, two, and three and accounted for nearly three-fourths of the deaths in that age group in 2002.

### Women Less Likely to Die at Every Age

Women have lower death rates than men at every age, probably because of a combination of social, behavioral, and genetic influences. Even before birth, fewer female than male fetuses die in the womb. The net result of this female advantage is that women live longer than men, as illustrated for Japanese women in Figure 4 (page 9), and that the oldest old are predominantly women. In the United States, female life expectancy was 80 years in 2004, five more years than that of men, and about four-fifths of American centenarians are women.

The sex differential in mortality rates is greatest for young adults. The death rate for 15-to-24-year-old males is more than twice that of their female counterparts. Notice first that all but one of the leading causes of death listed in Table 1 kill males at a higher rate than

Table 1

**The 15 Leading Causes of Death: United States, 2004**

| Rank | Cause of death | Deaths per 100,000 | Percent of all deaths | Male to female | Black to white | Hispanic to non-Hispanic white |
|---|---|---|---|---|---|---|
| | | | | | Ratio of rates | |
| 1 | Heart disease | 222.2 | 27 | 1.5 | 1.3 | 0.7 |
| 2 | Cancer | 188.6 | 23 | 1.4 | 1.2 | 0.6 |
| 3 | Stroke | 51.1 | 6 | 1.0 | 1.5 | 0.8 |
| 4 | Chronic lower respiratory disease (emphysema, bronchitis) | 41.5 | 5 | 1.4 | 0.7 | 0.4 |
| 5 | Accidents (unintentional injuries) | 38.1 | 5 | 2.1 | 0.9 | 0.8 |
| 6 | Diabetes mellitus | 24.9 | 3 | 1.3 | 2.2 | 1.5 |
| 7 | Alzheimer's disease | 22.5 | 3 | 0.7 | 0.8 | 0.6 |
| 8 | Influenza and infectious pneumonia | 20.3 | 3 | 1.4 | 1.1 | 0.9 |
| 9 | Kidney diseases* | 14.5 | 2 | 1.4 | 2.3 | 0.9 |
| 10 | Septicemia (blood poisoning) | 11.4 | 1 | 1.2 | 2.2 | 0.8 |
| 11 | Suicide | 11.0 | 1 | 4.0 | 0.4 | 0.5 |
| 12 | Liver disease and cirrhosis | 9.2 | 1 | 2.2 | 0.9 | 1.6 |
| 13 | Chronic high blood pressure (hypertension) and related disease | 7.9 | 1 | 1.0 | 2.8 | 1.0 |
| 14 | Parkinson's disease | 6.1 | 1 | 2.3 | 0.4 | 0.6 |
| 15 | Homicide | 5.9 | 1 | 3.7 | 5.6 | 2.7 |

\* Except hypertension-related.

Source: A.M. Minino et al., *Deaths: Final Data for 2004, Health E-Stats* (www.cdc.gov/nchs, accessed Jan. 24, 2007): table 2.

females. Which causes have the highest male-to-female ratio? They are accidents, which tend to befall more young men because they are more likely to engage in risky behavior; suicide, which claims four times as many male as female lives; and homicide, which kills nearly four times as many men as women. In short, the sex differential in mortality is greatest between ages 15 and 24 because the major causes of death in those ages are also the ones with the highest male-to-female ratio.

### Socioeconomic Status: The Wealthy Live Longer

Higher-status individuals live healthier and longer lives than their lower-status counterparts in virtually every society. The United States is no exception. All the major indexes of social status—occupation, income, and education—show a negative relationship between status and mortality.[23]

### Race and Ethnicity: Some Surprising Differences

Racial and ethnic minorities often suffer greater premature mortality than others, usually because they are also economically disadvantaged. African Americans have

Table 2

**Percent of Americans Who Moved by Type of Move, 1995–2000 and 2004–2005**

| Type of move | Within 1 year (2004–2005) | Within 5 years (1995–2000) |
|---|---|---|
| Total number (millions) | 287.1[a] | 262.4[b] |
| Nonmovers | 86 | 54 |
| Moved to new home | 14 | 46 |
| Within same county | 8 | 25 |
| Different county, same state | 3 | 10 |
| Different state | 3 | 8 |
| From abroad | 1 | 3 |

[a] Age 1 or older in 2005.
[b] Age 5 or older in 2000.

Sources: B. Berkner and C.S. Faber, "Geographical Mobility: 1995 to 2000," *Census 2000 Brief* (2003): table 1; and U.S. Census, *Geographic Mobility: 2004 to 2005, Detailed Tables* (www.census.gov, accessed Jan. 24, 2007): table 1.

always had higher mortality and lower life expectancy than whites in the United States. The gap in life expectancy between the two races was about 15 years in 1900 and five years in 2004 (78 for whites versus 73 for blacks). Black female life expectancy was more than four years lower than that of white females. Similarly, black male life expectancy was six years below that of white males, placing black males at the bottom of the mortality totem pole. African Americans die at younger ages than whites because they are more vulnerable to nine of the 15 leading causes of death shown in Table 1. Note especially the ratio of black to white homicide death rates—the rate is more than five times higher for blacks than for whites.

Minorities do not always have higher mortality. Hispanics had lower mortality than non-Hispanics on most of the 15 leading causes. And, although Hispanic deaths may be underreported, the infant mortality rate for Hispanics is at least as low as the rate for non-Hispanic whites.[24]

# Migration: Adding and Subtracting People

The third component of population change is migration, the movement of people into or out of a specific geographic area. Migration adds to or subtracts from an area's population depending on whether more people move in or out. Migration usually has the greatest impact on population change in small geographic areas and where there is little or no natural increase from the excess of births over deaths. Migration trends can also shift the population distribution within a country.

Migration is the most complex and volatile demographic variable. It can occur in great waves in response to major events—such as the mass exodus from East to West Germany after these countries were reunited in 1990—or as a slow trickle, such as the attrition of young adults from small towns in the rural Midwest.

Migration is selective. More-educated and more-adventuresome people are more likely than other people to move, for example.

Migration is closely tied to the life cycle. People are most likely to move at certain stages of their lives, especially when they marry, divorce, or retire.

Migration is also more difficult to measure than fertility and mortality. Most countries do not have an easy and accurate way to track population movements. Every year, millions of Americans move to a new home, but not all such residential mobility is classified as migration. Neither are temporary moves for work or leisure.

Migration refers only to the movement of people across a territorial boundary for the purpose of changing their place of usual residence. International migration involves movement across a national border. The terms immigration and emigration describe whether people are moving into (im-) or out of (e-) a country. Internal migration describes moves within a country. In the United States, people must move across a county line to be an official migrant.

Other countries define migration differently—as movement to another municipality, for example. The terms in-migration and out-migration refer to movement into or out of a specific county, state, or other political jurisdiction within a country. Net migration, the difference between the number of people moving in and the number moving out, may be positive or negative. Between 2000 and 2006, Florida had a net gain of 1.2 million people through migration from abroad and from other states, while New York suffered a net loss of 1.2 million people from migration.[25]

The United States as a whole experienced a net immigration of 7.6 million people from abroad between 2000 and 2006. In the less developed world, where internal migration is dominated by moves from the countryside to the cities, rural areas often experience high net out-migration while urban areas undergo high rates of net in-migration.

## Types of Moves: Local to Long-Distance

Most moves are local, short-distance moves. International moves are the least common. Between 1995 and 2000, nearly one-half of Americans moved to another residence, but only 8 percent moved from another state, and 3 percent moved from another country (see Table 2). Less than 14 percent moved within a single year.

Americans are more mobile than residents of most other countries. In Japan, for example, only 28 percent

of the population age 5 or older moved to a new residence between 1995 and 2000. Local, or intracounty movers, generally are making housing adjustments or responding to life-cycle changes such as leaving the parental home or getting married or divorced. Longer distance moves are primarily for economic reasons such as seeking a new job or accepting a corporate transfer. People also move long distances to attend school, to find a more amenable climate, to adopt a new lifestyle, or to live closer to family members. High levels of residential mobility can foment social problems, especially if the moves dramatically change the age, racial, ethnic, or socioeconomic characteristics of the population in the place of origin or destination.[26]

## Who Moves Most Often?

In the United States and most other countries, residential mobility is relatively high for children under age 5; relatively low during the mid-teens; and extraordinarily high for people in their early 20s. Thereafter mobility rates decline with age, rapidly at first, and then more gradually until about age 85, when there is a slight upturn (see Figure 5). Mobility is highest between the late teens and the early 30s as individuals leave their parents' homes to attend college, find jobs, get married, and build families. The children of these young parents have high mobility as well. As these parents buy homes and settle into neighborhoods and careers, their mobility and that of their children (by this time, in their teens) declines. Most of the elderly stay put, but a sizable minority trade their homes for smaller residences or eldercare facilities, or move to faraway retirement areas.[27]

### Mobility Among Men and Women

U.S. women are about as likely as U.S. men to move, but the rapid increase in mobility in the young adult years starts earlier for women than for men because women tend to marry at younger ages than do men. In many Latin American countries, young women are at least as likely as young men to leave home in search of jobs elsewhere. In African countries, however, men are more likely to move to the city to find work, often leaving wives and children behind.

### Income, Education, and Ethnicity Affect Mobility

Non-Hispanic whites tend to move less often than African Americans, Hispanics, and other racial groups. Between 1995 and 2000, 43 percent of non-Hispanic whites moved, compared with 49 percent of blacks, 54 percent of Asians, and 56 percent of Hispanics.[28] One reason blacks and Hispanics move more often than whites is that they are more likely than whites to rent rather than own their

Figure 5

**Percent of Americans Who Moved Last Year, by Age, 2005**
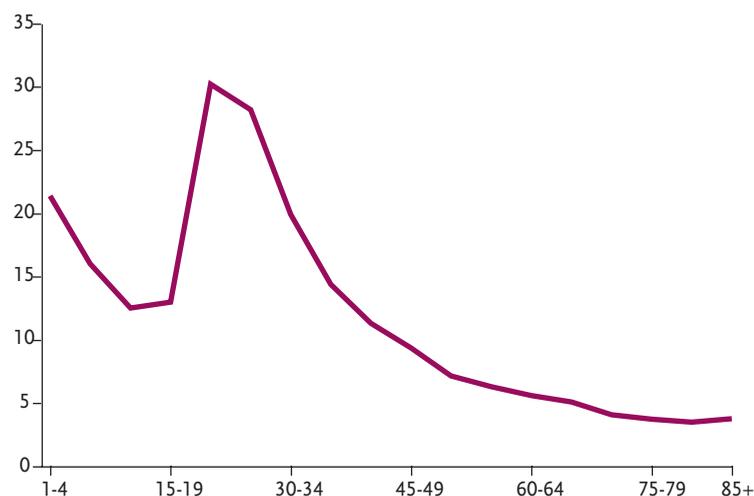


Source: U.S. Census Bureau, *Table 1. General Mobility, by Region, Sex, and Age: 2004 to 2005* (www.census.gov, accessed Jan. 24, 2007).

residences, and renters tend to move more often than homeowners. It is not surprising, then, that blacks and Hispanics are most likely to move short distances—to another home in the same county. There is no simple link between residential mobility and income. The propensity to move depends more on the type of jobs people hold. Doctors, lawyers, and others who rely on local bases of operation have low rates of mobility, for example, while business executives are highly mobile. Educational attainment is also related to mobility. The most frequent movers are individuals at the educational extremes—the high school dropouts and the college educated. Those in the middle, people who complete high school but do not go on to college, have the lowest mobility rate. Hispanics have higher high school dropout rates than other major ethnic and racial groups, a factor that helps explain their higher average mobility rates. The distance of moves differs by education. The best educated make relatively more long-distance moves; the least educated tend to make more local moves. This also helps explain why U.S. Hispanics and African Americans, who have lower average educational attainment than whites, make more short-distance moves than do whites.

## International Migration: Crossing National Borders

In recent decades, international migration streams of one sort or another have made headlines around the world—the dramatic influx of Rwandan refugees into Zaire and Tanzania, Haitians sailing to the United States in flimsy boats, and Bosnians fleeing to Germany and other parts of Europe. An estimated 190 million people

lived outside their country of birth in 2000—about 3 percent of the world's population.[29]

These migrations occurred for the traditional reasons—the migrants either wanted to upgrade their lot in life or escape from harsh, often intolerable circumstances. Migration experts often describe the process as a push-pull process: Migrants are "pushed" from their homeland by difficult conditions and "pulled" to a new country where conditions appear to be better. But there are a number of theories about what forces affect migration. Migrants who leave home to avoid persecution because of their political, religious, or ethnic backgrounds are classified as refugees or asylees. These "involuntary" migrants are protected by international law, although they are not always welcomed by the countries in which they seek protection. National governments must decide who is or is not a legitimate refugee or asylee, and they sometimes send such foreigners home. In 2006, there were an estimated 21 million refugees or displaced people around the world, according to the United Nations High Commissioner for Refugees.[30]

The United States is traditionally a country of immigrants, and receives twice as many immigrants as all other countries combined. More than 1 million newcomers have immigrated to the United States annually over the past few years—the highest level since the mass immigration of Europeans in the early 20th century. During the 1990s, about 900,000 people a year entered the United States as legal immigrants. Another 525,000 a year were illegal immigrants.[31] The numbers seeking to enter the United States are not likely to abate in the near future because of continuing population and economic pressures in the less developed world.

People also move out of the United States. At least 200,000 U.S. residents emigrated each year in the early 2000s. Most are immigrants returning to their countries of origin or moving on to other countries. Some are U.S. citizens taking jobs abroad or retirees moving to countries with lower costs of living.

## Immigrants Differ From Those Who Stay Behind

International migrants differ from the compatriots they leave behind and from the residents of the countries in which they settle. They differ from one another depending on why and how they arrived in a new homeland.

### The Young Are More Likely to Immigrate

Young adults and their children are more likely than older individuals to immigrate to a new country. The immigrant flows to the United States traditionally have been dominated by young adults. The present U.S. immigration policy, with its guiding principle of family reunification (giving preference to relatives of previous immigrants), has reduced the proportion of young adults among recent immigrants. Refugees can be much more varied in age—they may include more families with small children, elderly individuals, or young men—depending on the circumstances that brought them here.

### Whether More Men Than Women Immigrate Depends on Destination

Males have traditionally outnumbered females among immigrants. An extreme example of this phenomenon was the 27-to-1 male-to-female ratio among Chinese immigrants to the United States in the early 1900s. Today that ratio is about 1-to-1 for immigrants.[32] The sex ratio of immigrants varies throughout the world, depending on the types of jobs available in the country of destination and the cultural climate in the country of origin. Labor immigrants to the Middle East are predominantly men, for example, in part because there are few jobs for women in Islamic Middle Eastern countries.

### Immigration Often Adds Racial and Ethnic Diversity

The vast majority of immigrants to the United States between the early 1800s and the mid-1960s were Europeans; but Europeans accounted for only about 13 percent of legal immigrants in the 1990s, with the majority coming from Asia and Latin America. Immigration has helped increase the Hispanic share of the U.S. population from 5 percent in 1970 to 14 percent in 2006.[33] Immigration is also changing the ethnic composition of Australia, Canada, Germany, and many other countries.

### Immigrants Often More Educated and Ambitious

Often, the more ambitious and adventuresome people in a poor society are the ones who migrate. Migrants tend to be more educated than others in their home community, but less educated than the residents of the country to which they are moving. Immigration laws can affect the types of people who come in, for example, by restricting visas for unskilled workers, encouraging the entry of highly educated professionals, or accepting refugee families from a specific country. The educational and socioeconomic status of immigrants varies greatly among individuals and groups. In 2005, 68 percent of recently arrived foreign-born Americans had at least a high school education, compared with 89 percent of the

U.S.-born population age 25 or older.[34] The proportion of the foreign-born completing high school was much greater for immigrants from Africa and Asia than it was for immigrants from Latin America. Legal immigrants tend to have higher educational attainment than illegal immigrants; and refugees tend to have lower average attainment than other legal migrants.[35]

### The 'Brain Drain'

When educated and highly skilled people emigrate to a new country, their home country loses. Not only does the home country lose its investment in raising and educating those expatriates, it also loses their potential social and economic contributions.[36] This "brain drain" is not just a problem for less developed countries such as India and Nigeria. Many scientists, engineers, and college professors from Great Britain and other more developed countries have immigrated to the United States for higher salaries and greater professional opportunities.

### Social Networks Determine Where Migrants Move

Individuals usually do not uproot themselves and their families at random to move to another area; nor do they choose their place of destination by flipping a coin.[37]

Migration is a social process involving networks that connect the place of origin to the place of destination. The movement of individuals takes place through chain migration, defined as movement in which prospective migrants learn about job opportunities, transportation, and housing in the place they want to move to from relatives or friends from their home area who have migrated ahead of them. Chain migration operates in both international and internal migration. In the former, a few bold immigrants blaze a trail to a new country, establish a foothold, and then send for friends and family to join them. These individuals form small ethnic communities, such as the Chinatowns in cities throughout the world, which act as magnets (or pull factors) for others in the place of origin. Most immigration to the United States has followed this pattern. Hispanic and Asian immigrants often join established communities of their compatriots, such as Little Saigon in Southern California's Orange County.

U.S. immigration policy strengthens migration networks by granting entrance visas to close relatives of current U.S. residents. Chain migration also plays an important role in rural-to-urban migration. The presence of a network of relatives and friends in a particular city attracts rural out-migrants to that city. These networks help ease the financial and social problems associated with relocation. While chain migration is not as important in the United States today as it was in the past, many Americans cite family-related reasons for moving to a new residence.[38] When it comes to social networks, migration is a two-edged sword. While it may provide new opportunities for the migrants, migration often tears individuals away from a network of relatives and lifelong friends who provided valuable financial, health care, and other support.[39] It is no wonder that migrants seek neighborhoods in their new countries that bring them back to the embrace of familiar social networks.

## Population Size = Fertility – Mortality ± Migration

Whether a population grows or wanes, the changes can be traced to the net effects of the three demographic processes already discussed: fertility, mortality, and migration. Fertility adds members to the population and mortality removes them. Thus, the annual number of deaths in a population can be subtracted from the annual number of births to find the net number of people added through natural increase as summarized by the demographic balancing equation (see Box 3, page 16). In 2005, there were 1.7 million more births than deaths in the United States. The death rate can be subtracted from the birth rate to find the rate of natural increase. The estimated crude death rate for the United States in 2006 was 8.2 deaths per 1,000 inhabitants. Subtracting this from the 2006 crude birth rate of 14.1 yields a rate of natural increase of 5.9 additional people per 1,000 inhabitants, or as it is more commonly expressed, 0.6 percent. The birth rate and the death rate for the world were 20.9 and 8.6, respectively, which produced a rate of natural increase of 1.2 percent, twice the U.S. rate.

The rate of natural increase is added to the rate of net migration to yield the overall population growth rate. Populations increase through migration and natural increase in most places; but populations may also decline, as they have in Russia and Washington, D.C. Births, deaths, and in- and out-migrants sometimes cancel each other out and produce neither growth nor decline. The rate of growth can be used to estimate a population's hypothetical doubling time, which is the number of years until the population will double if the rate of growth remains constant. Doubling time can be estimated by dividing the number 70 by the growth rate multiplied by 100. A population growing at 2 percent annually, for example, would double in 35 years; one growing at 1 percent would double in 70 years. When the rate of population growth is negative or zero, of course, the population will never double.

Box 3
**The Demographic Balancing Equation**

Populations grow or decline as the result of three processes: birth, death, and migration. These three variables are the components of population change and often are depicted in the population balancing equation. To show population change between 2005 and 2006, the equation would look like this:

**Population in 2005**
+ Births
– Deaths
+ Immigrants
– Emigrants

= **Population in 2006**

Births minus deaths constitute natural increase. When deaths exceed births, as they do in Germany, the result is natural decrease. Subtracting emigrants from immigrants yields net migration, which also can be either positive or negative.

Births – deaths = natural increase/decrease
Immigrants – emigrants = net migration

The balancing equation for the United States is shown below:

| | |
|---|---|
| **Starting population, July 1, 2005** | **296,507,061** |
| + Births | 4,151,889 |
| – Deaths | 2,464,633 |
| *Natural increase* | *1,687,256* |
| + Immigrants | 1,429,167 |
| – Emigrants | 225,000 |
| *Net migration* | *1,204,167* |
| **Ending population, July 1, 2006** | **299,398,484** |

Note: The number of immigrants and emigrants are PRB estimates.

Source: U.S. Census Bureau, *Population Estimates: Annual Population Estimates* (Table 1) and *Components of Change* (Table 5) (www.census.gov, accessed Jan. 24, 2007).

## World and National Populations

World population in 2006 was 6.6 billion and was growing at a rate of about 1.2 percent annually. World population is growing today because births exceed deaths by a wide margin—by 81 million in 2006. Net migration, of course, is not a factor in world population growth, and it never will be unless colonizing other planets becomes a reality. The actual world population in 2050 or thereafter is unknown. But demographers can project the future population of the world or a country. Beginning with current estimates of popula-tion size and growth rates (see Box 4), they make assumptions—really educated guesses—about how much fertility, mortality, and migration rates will change. A country's projected population in 2050, for example, equals its current size plus the total births and immigrants expected from now until 2050 (under the assumed rates), minus the expected deaths and emigrants. Using these basic principles, the United Nations recently projected that world population will be about 9.1 billion by 2050, assuming continued declines in fertility and mortality rates.[40] China is the world's most populous nation, with a 2006 population of 1.3 billion. Its population is increasing by 0.5 per-cent each year assuming minimal net emigration. India has fewer inhabitants (1.1 billion) but a higher annual growth rate (about 1.6 percent, including net emigra-tion). India is likely to surpass China as the world's most populous country before the middle of the 21st century.

Most of the world's fastest-growing countries are in the Middle East and Africa. Yemen's 2006 population of 21.6 million is growing by about 3.1 percent per year. At that rate, the population will double in 23 years unless there is a significant decline in fertility or increase in emigration. The population of sub-Saharan Africa is growing at 2.4 percent, yielding a doubling time of 29 years. In contrast, many countries are expe-riencing extremely slow growth and even natural decrease because death rates have risen above birth rates. Deaths exceeded births in 16 European countries (including Germany, Italy, and Russia) in 2006. In some countries, net immigration provides the only population growth.

## U.S. Population Ranks Third

The United States is the third most populous nation in the world, trailing only China and India, and is likely to remain so for the foreseeable future. The U.S. Census Bureau estimated that the U.S. population increased by 2.9 million between 2005 and 2006 because the number of births and immigrants exceed-ed the number of deaths and emigrants. Note the rela-tive contribution made to growth by natural increase and net migration in Box 3. Net migration of legal and illegal migrants accounted for as much as one-half of population growth between 2005 and 2006.

Because fertility and mortality are expected to remain at relatively low levels in the United States, the most volatile demographic variable driving future growth is immigration. It will pull U.S. population to a projected 420 million by 2050.[41] But we should remember that these projections are based on educated

guesses about future trends in fertility, mortality, and migration.

## Population Composition: Age, Sex, Race/Ethnicity

People have many characteristics with demographic dimensions—including their sex, age, race, ethnicity, occupation, education, religion, marital status, and living arrangements (see Box 5, page 18). A population has corresponding characteristics constructed from personal traits of individual members. The age composition of a population, for example, is determined from the collective ages of all its members. This *Population Bulletin* focuses on age, sex, race, and ethnicity because these characteristics

are fashioned solely by the prime demographic forces of fertility, mortality, and migration.

## Age Structure Determines the Shape of Societies

The age composition of a society can be depicted by a population pyramid, a figure that shows the proportion of the population in each age group (see Figure 6, page 19). In 2005, about 17 percent of Ethiopians were under age 5, while only about 3 percent were age 65 or older. The sum of the proportions in all age groups equals 100 percent of the population.

There are three general types of population pyramids: those depicting rapid growth, slow growth, and population decline.

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Box 4

### Where Do Demographic Data Come From?

Demographers use a variety of rates, ratios, and other measures to study population. But these measures are only as accurate as the data from which they are calculated. Where do these demographic data come from? How accurate are they?

Most demographic measures are based on counts of people or demographic events (for example, births) in a specific area during a specific time period. There were 281,422,509 residents in the United States in April 2000, for example, and 1,730,000 births recorded in Iran during 1990. Counts come from population censuses, vital registration systems, national registers, and surveys. Their accuracy varies greatly by country and even by region within countries.

### Censuses: The Most Basic Source

The population census forms the cornerstone of demographic analysis. In many countries the census—an enumeration of all households—is the main source of national population data. More than 90 percent of the world's population was covered in a national census conducted during the 1990s. But censuses usually miss a small percentage of the population, especially in hard-to-enumerate areas such as the mountains of Turkey or low-income neighborhoods within some U.S. cities.

The population characteristics that censuses record also are subject to error. Residents may lie about their income or forget the exact ages of some household members.

### Vital Registration Systems

Vital events—births, deaths, marriages, and divorces—are usually recorded in national vital registration systems. These are the source of the counts used to calculate fertility, mortality, marriage, and divorce rates. But in countries in which mothers give birth at home, or where many residents are illiterate, a large proportion of vital events are never recorded. Less than half of the world's population lives in countries that have "complete" vital registration systems. Even "complete" systems may miss up to 10 percent of a country's vital events.

A few countries have comprehensive registration systems, or national population registers, that track individuals from birth to death and record changes in their residence or marital status.

### Sample Surveys

Surveys often provide estimates of demographic events where registration systems are inadequate. They also aid in developing estimates of population size during the long interval between censuses. Surveys usually collect data for a sample group within a specific geographic area. In the United States, a monthly national survey is used to track the unemployment rate as well as many demographic indicators. But surveys suffer from many of the same accuracy problems as censuses and registration systems, and their data are subject to varying degrees of error.

### Statistical Techniques

Demographers have developed statistical techniques to overcome some of the shortcomings of the basic data with which they work. They apply these techniques to the best data available to compute estimates of the actual population counts and measures. Although estimates based on good data can be quite accurate, users of these estimates should not forget that estimates are only approximations of the true number.

Likewise, users of demographic data always should question the source and quality of the data that underlie the rates, ratios, and proportions they cite. Judging the quality of data is one of the most important skills demographers must learn. Indeed, everyone would benefit from taking a hard look at the myriad statistics we encounter daily.

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Box 5
## Households and Families

Individuals relate to society through their families and households. When these units add or lose members—or when the household members grow older, divorce, or marry—there can be profound social and economic consequences. Divorce can bring financial hardship. Marriage can add additional income, as well as stepchildren or mothers-in-law. The birth of a child can bring new financial expenses, but it also can encourage stability. Households and families are basic units of analysis in demography. They are not the same thing. A household is composed of one or more people who occupy a housing unit.[1]

### Defining Families
Not all households contain families. Under the U.S. Census Bureau definition, family households consist of two or more individuals who are related by birth, marriage, or adoption, although they also may include other unrelated people. Nonfamily households consist of people who live alone or who share their residence with unrelated individuals. These official definitions do not necessarily reflect changing attitudes about marriage, childbearing, and the roles of men and women. Households that consist of unmarried couples living together and gay and lesbian couples, for example, would be counted as nonfamily households even though they might share many characteristics of a family. If these couples live with children from their current or a previous relationship, the household moves into the family category.

### Life Stage Determines Living Arrangements
An individual's living arrangements usually change at different stages of life. In the traditional scenario, a person starts out in a family household, leaves to create a new household alone or with friends, then forms a family household with a spouse and eventually children. In old age, an individual may live in a single-person household again because of divorce or death of the spouse. Of course, not everyone follows this pattern; many people skip or repeat stages. The average size and composition of households are highly sensitive to the age structure of the population. But they also reflect social and economic changes. An economic squeeze may prolong the time adult children live at home; a rise in the divorce rate may increase the number of single-person households. Relaxed social rules about marriage may boost the number of unmarried couples setting up house.

### Americans Forming Smaller Households/Families
In the United States, the mix of household types has changed enormously over the last three decades.[2] One of the most notable changes is the decline in the proportion of family households and the rise in single-person households. In 1970, 81 percent of all households were family households, but this was down to 68 percent by 2005.

The retreat from marriage and the general aging of the population are increasing the number of single-person households. Americans are waiting longer to get married, if they choose to marry at all. Married couples are more likely to get divorced than they were in the 1970s. More of America's elderly live alone after the death of a



**U.S. Household Types, 1970 and 2005**
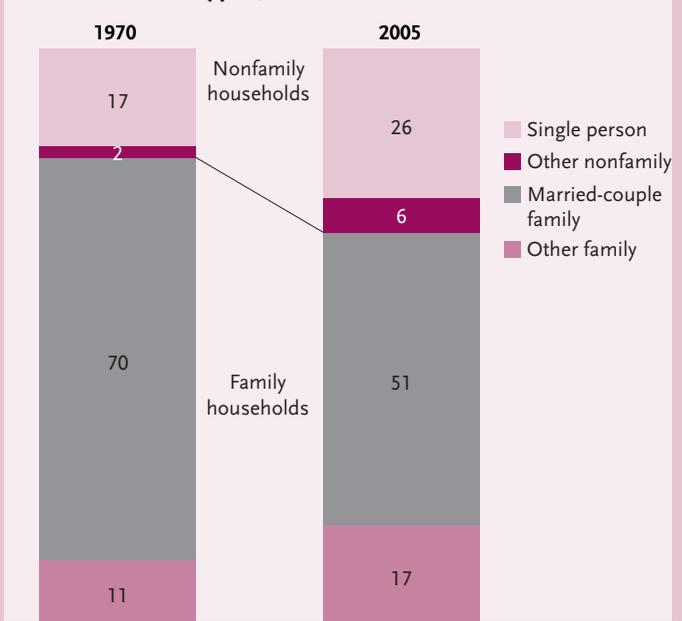
Sources: U.S. Census Bureau, *Households by Size: 1960 to Present* and *Households by Type: 1940 to Present* (released June 12, 2003; www.census.gov, accessed Sept. 30, 2003); and U.S. Census Bureau, *Households, by Type, Tenure, and Race and Hispanic Origin of Householder: 2005* (released Sept. 21, 2006; www.census.gov, accessed Jan. 24, 2007).

spouse. In 2005, 26 percent of all U.S. households consisted of just one person, compared with 17 percent in 1970 (see figure). Many European countries have seen a similar rise in single-person households for similar reasons.

The U.S. baby-boom generation hastened many of the changes in the makeup of U.S. households. When the first of the baby-boom generation entered their late teens and early 20s in the 1960s, they moved out of their parents' homes and set up their own households, often alone or with housemates. They waited longer to marry than the previous generation, and they were more likely to divorce.

Americans born after the baby boom are delaying marriage even longer. In 1970, 89 percent of women ages 25 to 29 had been married at least once. In 2005, only 58 percent of women ages 25 to 29 had been married.[3] The choices these women make about marriage and childbearing help determine the present and future makeup of U.S. families and households.

**References**
1. Jason Fields, "America's Families and Living Arrangements: 2003," *Current Population Reports* P50-553 (2004): 2.
2. Lynne M. Casper and Suzanne M. Bianchi, *Continuity and Change in the American Family* (New York: Russell Sage Foundation, 2002).
3. U.S. Census Bureau, *Marital Status of People 15 Years and Over, by Age, Sex, Personal Earnings, Race, and Hispanic Origin: 2005* (released Sept. 21, 2006), accessed online at www.census.gov, on Feb. 7, 2007.

### High Fertility, Declining Mortality, Broadens Young Ages

A rapid-growth population is the only one that really looks like a pyramid because each age cohort is larger than the one born before it. This pyramid shape results primarily from sustained high fertility. If couples in one generation average eight children, for example, their children's generation will be about four times larger than their own. The pyramid's base would be about four times as wide as its middle.

The distinctive pyramid shape also results from declines in mortality. Because of high mortality in the past, older age groups have relatively few surviving members and occupy a small section of the pyramid. The base is broadened by the fact that mortality, particularly infant mortality, is declining. This increases the proportion of the younger birth cohort that will survive to enter the next age group.

### Momentum for Future Growth

The majority of people in rapid-growth societies are young. This creates tremendous momentum for future growth because that large pool of young people makes up the parents of the future. Even if they have only four children apiece (the average for some less developed countries), their children's generation would be twice the size of their own. Ethiopia's population age structure is typical of a young, rapid-growth society.

### Low Fertility Narrows Base

A population that is not growing, or is decreasing, produces a very different shape. The base of Italy's population "pyramid" is narrowing because its birth rate has been falling. The 1995-1999 birth cohort was barely one-half the size of the 1965-1969 cohort. If fertility remains below replacement, the pyramid's base will continue to constrict, and Italy will undergo natural decrease. If Italy's TFR rises to the replacement level of 2.1, its age and sex structure would eventually assume a rectangular shape because similar numbers of births would occur each year.

Because mortality is low, this shape would be maintained until the older ages, when mortality would eat away at the top bars. At the very top, the female bar is almost always longer because women live longer than men. A slow-growth population is generally in the process of changing from a rapid-growth to a near-zero growth shape in response to changes in fertility and mortality. The United States is typical of these "middle-age," slow growth societies.

Population pyramids also can be shaped by migration. Because migration is age selective, it alters the shape of age-sex pyramids in both the place of origin and destination. Migrants tend to be young adults; a steady migration stream is likely to make the place-of-origin population older, and the place-of-destination population younger. There are plenty of exceptions to this pattern.

Figure 6

**Population Pyramids: Ethiopia, United States, and Italy, 2005**



Sources: UN, *World Population Prospects: The 2004 Revision, Online Data* (www.un.org/esa/population/unpop.htm, accessed Jan. 29, 2007); and U.S. Census Bureau, *National Population Estimates for the 2000s* (www.census.com, accessed Jan 29, 2007).

Figure 7
**Germany's Population by Age and Sex, 2006**



| Age | Males | Females | Birth Year |
|-----|-------|---------|-----------|

Labels within figure:
- Deficit of men, World War I war casualties
- Deficit of men, World War II war casualties
- Post-World War II baby boom
- Decline in births, World War I
- Decline in births, economic crisis
- Decline in births, World War II
- Long-term fertility decline

X-axis: 800 600 400 200 0 200 400 600 800
Population in thousands

Birth Year values: 1907, 1912, 1917, 1922, 1927, 1932, 1937, 1942, 1947, 1952, 1957, 1962, 1967, 1972, 1977, 1982, 1987, 1992, 1997, 2002, 2006

Source: Germany, Federal Statistical Office (www.destatis.de/, accessed Feb. 1, 2007).

Figure 8
**Population of the United Arab Emirates, by Age and Sex, 2000**



Age groups: 80+, 75-79, 70-74, 65-69, 60-64, 55-59, 50-54, 45-49, 40-44, 35-39, 30-34, 25-29, 20-24, 15-19, 10-14, 5-9, 0-4

Males / Females

X-axis: 10 8 6 4 2 0 2 4 6 8 10
Percent of population
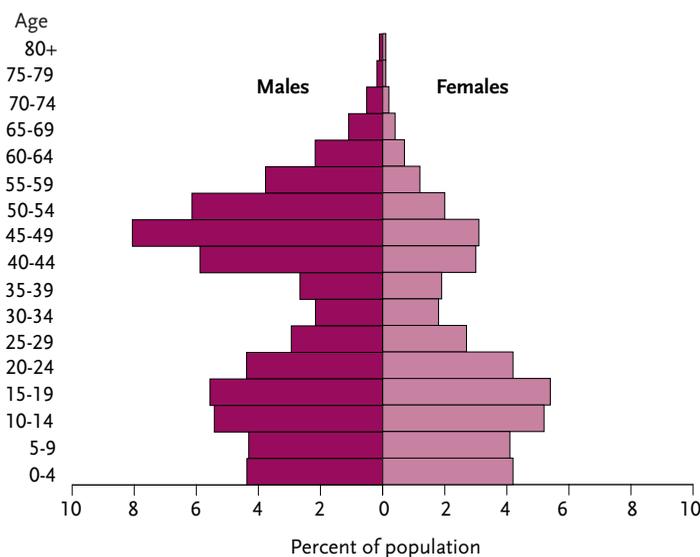
Source: U.S. Census Bureau, International Data Base (updated July 17, 2003; www.census.gov/ipc/www/idbpyr.html, accessed Sept. 20, 2003).

Pyramids reflect historical events—wars, famines, baby booms or busts, and changes in immigration policies—that have affected one of the three demographic variables. Consider the tumultuous events portrayed in the pyramid for Germany in Figure 7. Births plummeted during the two world wars and a severe economic crisis, for example. Migration streams that are predominately male—as is labor migration to Middle Eastern countries—create an unbalanced pyramid, illustrated by Figure 8.

**Median Age**

Population pyramids depict the general shape of a population's age structure, but they do not provide rates or measures that can be compared over time or with other populations. One such measure of age composition is the median age—the age at which exactly half the population is younger and half is older. In general, less developed countries have rapidly growing populations with low median ages, while more developed countries have slow-growing or declining populations with higher median ages. The UN calculated the median age of Ethiopia at 17 in 2005, compared with 42 for Germany and 43 for Japan. More than four-fifths of the world's population lives in less developed countries, and the world's overall median age is young—about 28 years.

**U.S. Age Structure**

The age structure of the United States looks more like a bowling pin than a pyramid (see Figure 6, page 19). This shape was created by drastic swings in the number of births—from the historic low of the 1930s, to the baby-boom peak of 1957, down to the baby-bust low of the mid-1970s, and back to the baby boomlet of the 1980s and early 1990s. The pyramid's middle-age bulge is composed of the baby-boom cohort, which has been likened to a swallowed pig moving through a python.[42] The narrower base is made up of the baby-bust cohorts born since the late 1960s. Each year the U.S. population gets older, primarily because of the aging of the baby boomers and low fertility. Increases in average life expectancy also have contributed to the aging of the population. The U.S. median age was 36 in 2005, up from 28 in 1970. The U.S. median age could reach 39 years by 2050.[43]

## Why Age Structure Matters—The Baby Boom Example

The age structure of a society has a profound impact on its demographic and social character. Some of these impacts have been noted already—for example, the effect of age structure on population growth and on the average age of a society. But age structure is relevant to many

seemingly unrelated social problems.[44] The U.S. baby-boom generation provides a vivid example of the varied effects of changing age structure on society. The 78 million baby boomers, born between 1946 and 1964, were more numerous than the cohorts that preceded and followed them. They produced the bulge in the age pyramid for the United States seen in Figure 6, page 19. As they passed through each stage of the life cycle, the baby boomers faced shortages—in elementary schools, colleges, housing, and employment. The baby-boom generation often left excess supply in its wake because, by the time enough schools or houses were built, teachers were trained, and colleges were expanded, the baby boomers no longer needed them. The 1980s found colleges scrambling to find students to fill slots created for this large cohort. Real estate prices soared when baby boomers began to buy homes, then dropped as they settled down to raise families. As more baby boomers retire in coming decades, they may generate more social and economic stress.[45]

Some analysts see the dramatic change in the age structure as responsible for many social changes that accelerated during the 1960s and 1970s when the baby boomers reached adulthood. Crime is also affected by age structure because young adults—ages 18 to 24—are most likely to be involved in crime. The aging of the U.S. population is one reason cited for a welcome decline in violent crime rates in the late 1990s. Young adults may be just as likely as ever to engage in crime, but crime rates have fallen because these youths make up a smaller share of the population. This illustrates how changes in age composition can alter the severity of a social problem even if there is no change in the underlying conditions.

### Aging Can Strain Health and Retirement Systems

Similarly, population aging eventually increases the proportion of the population that is disabled or chronically ill. The aging of the large baby-boom population, along with improvements in longevity, are expected to put increasing strains on the nation's health and pension systems over the next half century. Although the number of children is about the same in the early 2000s as it was during the baby boom, children now make up a smaller percentage of the population. The population under age 18 was about 25 percent of the 2005 U.S. population, compared with 36 percent of the 1960 population.

## The Ratio of Men to Women

Population pyramids also show the relative proportion of men and women in each age group. Small differences are difficult to discern, but some are obvious. Consider the bite out of the male side of Germany's pyramid for people over age 65 (Figure 7). This indentation reflects the mili-

tary casualties of World War I and World War II as well as the longer life expectancy for women than for men.

The sex composition of a population can be summarized by the sex ratio—the ratio of males to females. This ratio is usually expressed as the number of males for every 100 females. The world's sex ratio in the 1990s was 102. The ratio for more developed countries was 95; for less developed countries, 104. Sex ratios are determined by the now familiar forces—fertility, mortality, and migration.

### Migration Affects Sex Ratio in the Working Ages

The influence of migration on the sex ratio is easy to assess. The unbalanced sex ratio of the United Arab Emirates (UAE) came about because the UAE brought in thousands of foreigners from Asia and other parts of the Middle East to work in the country's oil fields and construction sites. The majority of these labor migrants were men without their families. The host governments did not want the immigrants to settle permanently and reasoned that the foreigners were less likely to stay if they had families waiting for them back home. The effects of this extremely unbalanced immigration pattern are evident in the population pyramid for the UAE shown in Figure 8. The sex ratio for the UAE was estimated at 151 in 2000.

Mortality influences the sex ratio because males have higher death rates than females at nearly every age, beginning with conception. It is possible that as many as 150 male fetuses are conceived for every 100 female fetuses. But a large percentage of pregnancies spontaneously abort within the first few weeks, and a woman is more likely to miscarry a male fetus than a female fetus, which produces the usual sex ratio at birth of 105.

### Higher Death Rates for Men Skew Sex Ratio at Older Ages

In the United States, the ratio of men to women is about equal (a sex ratio of 100) between ages 30 and 39, then it begins to fall. By age 85, there are nearly two women for every man. Among centenarians, there are four women per man. This preponderance of women at the older ages can be seen in the pyramids for Italy and the United States on page 19. Fertility affects the sex ratio by influencing the proportion of young people in a population. Any force that increases the relative proportion of young people in a society—as does a high fertility rate—raises the overall sex ratio of the society because the sex ratio is higher in the younger ages. A rapid drop in infant and child mortality, for example, in response to large-scale inoculation campaigns or the importation of modern medical technology, also contributes to the "younging" of a population. Conversely, any force that decreases the

relative proportion of young people—such as high mortality or low fertility—lowers the overall sex ratio.

In some nations cultural factors override the biological advantage that women usually have. In Indian society, for example, women are accorded low status. Girls receive less food, medical care, and familial attention than boys.[46] This discrimination is reflected in the sex ratio of India— estimated at 105 in 2005. Sons are highly valued in many other Asian countries as well, often to the detriment of daughters. The sex ratio for all of Asia was 104 in 2005, compared with 100 in Africa and 97 in Latin America and the Caribbean.

### Why the Sex Ratio Matters
Why does the sex ratio matter? It affects the availability of marriage partners, for one thing. An unbalanced sex ratio in the young adult years—because of migration, fertility swings, or war casualties, for example—means that there may not be enough men or women for everyone to find a spouse. The scarcity of potential marriage partners is not merely a personal disappointment for individuals who really want to get married; it also affects the social and economic structure of a society.[47]

*Surplus of Men or Women Alters Marriage Chances*
Marriage rates, childbearing practices, family stability, crime rates, and even the comparative status and power of women and men can be influenced by the sex ratio. In the United States, for example, the annual increases in the number of births during the baby boom created a "marriage squeeze" in the 1970s and 1980s by producing more women than men in the prime marrying ages. This phenomenon, along with the continued mortality gap between the sexes, has been linked to many of the social and economic changes since the 1960s—greater percentages of women remain single or delay marriage, bear a child out of wedlock, or work outside the home.[48]

William Julius Wilson and other sociologists have speculated that a shortage of marriageable black males in ghetto areas may have fostered the dramatic increase in the proportion of births to unmarried women and in families headed by single women among African Americans in recent decades.[49] In poor neighborhoods, the pool of black men who could support a family has been depleted by higher than average rates of unemployment, incarceration, and even death.

*Unbalanced Sex Ratio Can Hinder Immigrant Assimilation*
Similarly, the sex composition of immigrant groups has a bearing on the speed and ease with which they adjust to their new society. An immigrant group that contains more men than women, for instance, may compete with native men for marriage partners. This possibility, even if it does not happen, invites resentment against immigrants and even social disorganization. Also, men are far more likely than women to engage in crime, especially men in the young adult ages when most people migrate. Higher crime rates can create negative stereotypes that impair immigrants' relations with other Americans.[50]

## Race and Ethnicity: Socially Defined Characteristics
Many population characteristics are fluid. A person's age increases constantly, and educational attainment and marital status can change over time. Other characteristics are fixed at birth, like sex. Race and ethnicity appear to fall into the second category. An individual cannot change his or her ancestors; they are accidents of birth. But how societies evaluate and classify them is highly variable. Race and ethnicity are defined differently by different societies. These definitions, as well as their political and social significance, change over time.

What are race and ethnicity? They are not scientific terms. There is no consensus about how many races there are or about exactly what distinguishes a race from an ethnic group. Many social scientists agree that, while race may have a biological or genetic component, it is defined primarily by society, not by genetics. There are no universally accepted categories. Physical characteristics, such as facial features, hair texture, and skin color, are often used to identify racial groups, but these are highly subjective identifiers.[51]

Ethnicity is usually defined by cultural practices, language, cuisine, and traditions rather than biological or physical differences. In the United States, ethnicity often refers to the national origin of immigrant groups. The United Nations (UN) publishes data on ethnic composition reported by individual countries, but the UN warns that the categories are "not uniform in concept or terminology. They represent a variety of characteristics or attributes, variously designated by countries or areas as race, color, tribe, ethnic origin, ethnic group, ethnic nationality, and so forth ... By the nature of the subject, these groups vary from country to country—no internationally relevant criteria can be recommended."[52]

### Evolution of U.S. Race and Ethnic Categories
The U.S. Census Bureau collects and publishes information by race and ethnicity in accordance with federal guidelines from the Office of Management and Budget (OMB). In 1997, OMB recommended that data be presented for five racial groups and two ethnic groups. The race groups are: (1) white, (2) black or

African American, (3) Asian, (4) American Indian and Alaska Native, and (5) Native Hawaiian and Other Pacific Islander. The U.S. Census Bureau also includes an "other race" option for people who do not identify with the OMB categories.

The two ethnic groups are Hispanics (or Latinos) and non-Hispanics. Hispanics are considered an ethnic group, not a race, but this distinction confuses many Americans. The Census Bureau classifies as Hispanic anyone who traces his or her ancestry to Spain, the Spanish-speaking countries of Latin America and the Caribbean, or any other Spanish culture. Hispanics may be of any race. Most report themselves as white, but a large number report their race as "other," which underscores the confusion about race and ethnic definitions. In the 2000 Census, 42 percent of Hispanics checked the "other" race box. A small number of Hispanics report themselves as black, Asian, or American Indian. Many Dominican Americans and Puerto Ricans have African ancestry, for example, and might choose black and Hispanic. Some Filipino Americans with Spanish surnames identify themselves as Hispanic but also as Asian.

Many Americans have parents from different racial backgrounds—a white mother and a black father, for example, or an Asian mother and a white father. Previously, mixed-race Americans were asked to indicate the race they most closely identified with, thus rejecting the ancestry of one of their parents. The 2000 U.S. Census form allowed Americans to check more than one race, but they still must choose one ethnic group. About 2.4 percent of the U.S. population—6.8 million Americans—identified as multiracial.

Although exact definitions are elusive, race and ethnicity are important variables in the United States and most other countries. The relative size of individual groups sometimes determines their political power and socioeconomic status. Shifts in racial and ethnic composition can alter the social structure and generate prejudice and social unrest. Such problems often arise from a basic concern that some other group will grow faster than one's own and, consequently, increase its importance within the society.

### Shifts in Racial/Ethnic Composition Affect Society

Changes in racial and ethnic composition come about through differences in the fertility, mortality, and migration of racial and ethnic groups. Major shifts in racial and ethnic composition are occurring in countries throughout the world. In South Africa, whites are becoming an ever smaller minority, owing to a lower birth rate and a higher emigration rate than those for black or colored South Africans. And in many European countries, immigrant groups from less developed countries are growing faster than their hosts, leading to anti-immigrant backlashes.[53]

Racial and ethnic diversity has been a hallmark of the United States since colonial times. Waves of immigrants from different parts of the globe have kept the racial and ethnic composition in flux. This uneven growth continues, driven by differences in fertility, mortality, and migration discussed earlier. In 2000, three of every four U.S. residents traced their ancestry to Europe. Hispanics and African Americans are the nation's largest minority groups, but Hispanics are growing much faster because of immigration and higher fertility rates. U.S. Asians are growing from a trace element to a sizable minority. By 2050, the U.S. population is likely to consist of several large racial and ethnic minority groups. Non-Hispanic whites will be the largest but not necessarily the majority racial/ethnic group. The racial and ethnic categories in common parlance are almost certain to be different.

The evolving ethnic composition has a profound impact on almost every aspect of American society, from social values and culture to education, politics, and industry. More public schools than before teach non-English-speaking students from a wide variety of cultural backgrounds. In most big-city school districts, white non-Hispanics are already a racial minority. Because minorities have a younger age structure and higher fertility than non-Hispanic whites, minorities will make up an increasing share of the new job entrants in the U.S. labor force.

## Population Distribution: Where People Live

Where do the world's 6.6 billion inhabitants live? Demographers answer the question by keeping tabs on the distribution of population by world region, by country, by province or state within countries, by urban and rural area, and by neighborhood within cities. The geographic distribution of population is determined by fertility, mortality, and migration.

### Most of the World Lives in Developing Countries

Population is unevenly distributed among the world's regions and, because some regions are growing much faster than others, the geographic distribution of population is becoming more unbalanced. The less developed regions encompassed 68 percent of the world population in 1950 and 82 percent in 2005 (see Figure 9). These regions are projected to contain 86 percent of world population by 2050.

Figure 9
**World Population by Region, 1950, 2005, and 2050**
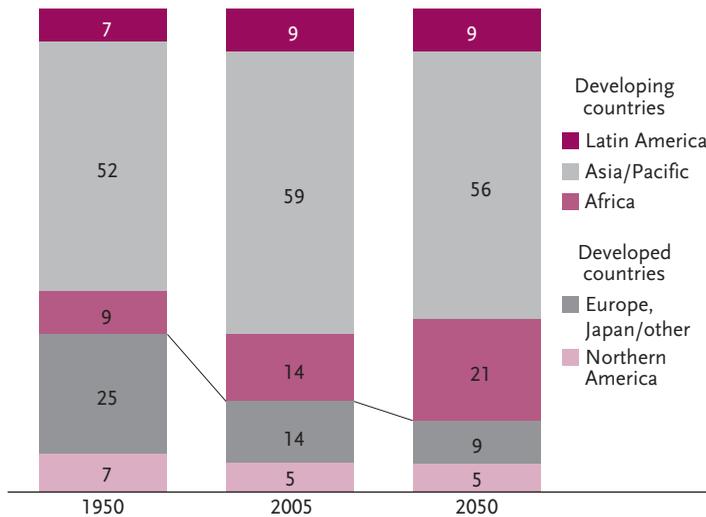


Source: UN, *World Population Prospects: The 2004 Revision, Online Data* (www.un.org/esa/population/unpop.htm, accessed Jan. 29, 2007).

Fertility is the primary cause of the uneven population growth rates among world regions, but migration also plays a role. Indeed, international migration is at an all-time high. Migrants move from the less-affluent developed nations to the more-affluent ones (for example, from Poland to Germany) and from the poorer less developed nations to relatively prosperous ones (from Colombia to Venezuela), as well as from less developed countries to more developed countries (from El Salvador to the United States, for example).

A major feature of population redistribution within less developed countries is urban growth. The urban population of these nations rose from 304 million to 2.2 billion between 1950 and 2006.[54] In many cities, rapid population growth quickly overwhelms the public services and housing supply, not to mention the supply of jobs. Millions of residents cope by building makeshift shelters on open land and by trying to make a living on the streets, often creating their own informal economic and social systems. Gigantic slums or shanty towns have sprung up around major cities throughout the less developed world, a testament to the explosive growth in these cities.

## Most Americans Live Near a Coast

Like world population, the U.S. population is unevenly distributed. More than half the U.S. population lives within 50 miles of a coastal shoreline. Mountains, deserts, and long distances, in conjunction with unrelated economic factors, have limited population growth in many other parts of America. Population density, the

number of inhabitants per square mile, ranges from 1,176 in highly urban New Jersey to one in Alaska. Many sections of America's heartland are sparsely populated. In 2006, Wyoming had only 515,000 inhabitants—about five people per square mile.[55] Yet the Midwestern states of Illinois, Ohio, and Michigan are among the eight most populous.

The distribution of the U.S. population is always changing because of geographic differences in natural increase and net migration. The western and southern states have increased the fastest in recent decades, while the northeastern states stagnated or declined. The South is the most populous region of the country, with 36 percent of the population, followed by the West (23 percent), the Midwest (22 percent), and the Northeast (18 percent).

### Migration Redistributing U.S. Population

International and internal migration are the main determinants of population redistribution in the United States, but natural increase also plays a role. Ohio had net out-migration between 2000 and 2006—more people moved out of the state than moved in. Yet the state had more births than deaths, which made up for the exodus.

Within the United States, migrants tend to follow several long-established migration streams. The first stream flows from the Eastern Seaboard states westward, a demographic process that has occurred since colonial times and that ultimately pushed the American frontier out to the Pacific Coast. The second stream runs from rural to urban areas. In 1910, 38 percent of the U.S. population lived in metropolitan areas. In 2003, about 83 percent of the U.S. population lived in metropolitan areas.

A third major migration stream, which accelerated during the Great Depression of the 1930s, led from economically depressed areas in the South to the cities of the Northeast and North Central states. This southern exodus brought millions of African Americans to Chicago, Detroit, New York, Philadelphia, Washington, D.C., and other cities that have large African American populations today. Since the 1970s, however, there has been return migration to the South. There is net in-migration of blacks and an even greater influx of other Americans. This phenomenon is part of a fourth and now major stream: the movement from the Snowbelt states to the Sun Belt states.

### Urban Areas Transformed by Migration Out of Cities

More dramatic and more rapid than regional shifts in population is the redistribution of population within

and around metropolitan areas. Within a decade, city neighborhoods can change from middle-class family homes to densely populated ghettos of non-English-speaking immigrants. Rolling farmland 30 miles from downtown can quickly sprout dense townhouse developments. Because these changes affect a community's tax base, public school enrollment, student body composition, traffic congestion, and public services, they often spark contentious political battles. Metropolitan areas consist of central cities, suburbs, and combinations of these parts. As growth patterns and socioeconomic relationships among the components of metropolitan areas change, definitions change. After each decennial census, some metropolitan areas in the United States are redefined, usually by expanding them to include adjacent counties. In 2000, OMB introduced the term core based statistical areas (CBSA) to refer collectively to metropolitan and micropolitan statistical areas.[56] In every metropolitan area, however, suburban areas grow more rapidly than central cities. Many central cities, such as Philadelphia, have been losing population for several decades, although some other U.S. cities bucked this trend and gained population in the 1990s.[57]

Metropolitan areas grow outward from original central cities, gobbling up additional cities and counties in their paths. Los Angeles, for instance, has more incorporated cities within its sprawl than do some states. More recently, transportation and communications advances, restructuring of jobs, and other changes are transforming urban lifestyles, giving rise to colorful new terms to describe the new patterns, including: leapfrog development, reverse commuting, consumer cities, edge cities, and boomburbs.[58]

**Social Consequences of Area Populations Change**
Population distribution and redistribution affect the demographic composition of the areas involved and can generate many social and economic consequences. Heavy migration into Florida from abroad and other states in the 1980s and 1990s not only moved that state's ranking in population size from seventh to fourth, but also fundamentally altered the state's age, racial, and ethnic composition.

In many metropolitan areas, middle- and upper-income Americans are leaving central cities and low-income suburbs for wealthier suburbs or neighboring rural counties. They leave behind groups that are disproportionately poor. This concentrates the negative social and economic consequences of poverty and further segregates the poor from the middle and upper classes. Demographer Douglas Massey predicts these

trends will be self-perpetuating. The geographic distance and concentration of poverty will foster the evolution of incompatible cultures, and it will be increasingly hard for the poor and wealthy to interact on the job, in the classroom, or in social situations. William Julius Wilson suggests that the African American poor in urban areas lost an important source of social and economic support as middle- and upper-class blacks moved out of central cities. This perpetuated the unemployment and unstable family lives common among blacks in low-income areas.[59]

# Why Population Numbers and Growth Matter

For most of human history, world population never exceeded 10 million people (see Figure 10). The death rate was about as high as the birth rate, and the rate of population growth was scarcely above zero. Significant population growth began about 8000 B.C., when humans began to farm and raise animals. By 1650, world population had expanded about 50 times—from 10 million to 500 million. Then world population shot up another 500 million people in just 150 years, reaching its first billion around 1800. It achieved its second billion by 1930, 130 years later; a third billion by

Figure 10
**World Population Growth Through History**
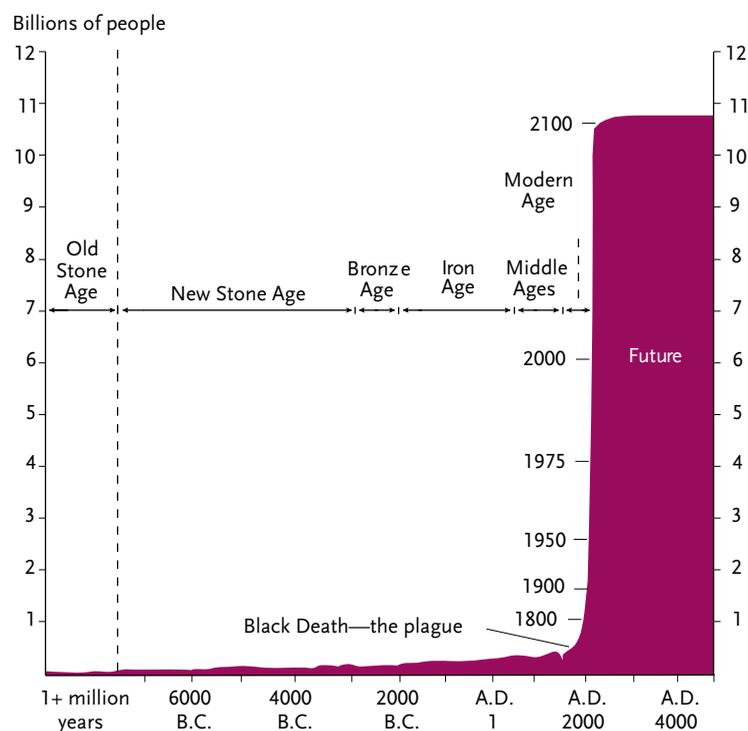
Sources: Population Reference Bureau; and United Nations, *World Population Projections to 2100* (1998).

1960, only 30 years later; and a fourth billion by 1975, just 15 years later. But the last fifth and sixth billion (attained in 1987 and 1999), took just over a decade each. Although the pace of world population growth has slowed, we still expect to reach the 7th billion before 2015.

But the population explosion, as it is often termed, is not just an awe-inspiring demographic phenomenon. It has many demographic and societal consequences, such as international and internal migration and the emergence of gigantic cities and shanty towns.

While some analysts downplay the negative impact of population growth,[60] many believe that population growth multiplies the damage created by other world problems,[61] degrading the environment, depleting resources, and overwhelming government institutions, national economies, and all other resources. Population growth is not solely responsible for these social problems. Environmental degradation, for example, is brought about not only by the number of people, but by how much and what they consume. Poverty is often produced by the uneven distribution of income within a country, not just by large numbers of people. Solving these social and economic ills often requires direct action by policymakers. Just slowing population growth cannot solve such problems, but it can contribute to their solution.

## Demographic Transition to Lower Fertility and Mortality

The unprecedented growth of world population in the modern era arose because births began to outnumber deaths. In ancient times, the birth rate and the death rate fluctuated around a relatively high level, and essentially cancelled each other out. This formed the first stage of a process described by the theory of the demographic transition (see Figure 11). This theory evolved from the history of population growth in Europe and the United States and has been applied to populations everywhere.

### High Birth and Death Rates

In Stage 1 of the classic demographic transition, the death rate was extremely high because of poor health and harsh living conditions. Life expectancy at birth was less than 30 years. If birth rates had not also been high, societies would simply have died out—and many did. The cultures in these societies encouraged high birth rates through religious teachings and social pressure, essentially encouraging people to "be fruitful and multiply." Socially, a man's virility and a woman's status often were linked to the number of children they

had. But large families also served a practical function in these societies. Children furnished labor for family farms and supported elderly parents. Large families also increased the economic, political, and military power of their tribe or nation.

### Falling Death Rates

Stage 2 of the demographic transition began when the death rate began to drop, probably because of improved living conditions and health practices. The birth rate remained high and may even have increased because women were healthier. The excess of births over deaths in the second stage of the transition ignited a population explosion. Why didn't the birth rate fall in tandem with the death rate? Most societies eagerly accept technological and medical innovations, as well as other aspects of modernization, because of their obvious utility against the universal enemy: death. Social attitudes, such as the high value attached to having many children, are slower to change.

It also takes time for people to recognize that rapid population growth creates pressures on food and land and that the pressure can be eased by having fewer children. It can take generations for people accustomed to high childhood mortality to recognize that low mortality means that they no longer need to have eight children to ensure that four will survive to adulthood.

### Falling Birth Rates

In Stage 3 of the demographic transition, the birth rate moves downward, eventually catching up with the death rate. Population growth remains relatively high during the early part of the third stage, but falls to near zero in the later part. In Stage 4 of the demographic transition, the birth rate and the death rate are close together again, but they fluctuate around a relatively low level. More developed countries in Europe and elsewhere have completed the four stages of demographic transition. Most less developed nations are still in Stage 2 or the early part of Stage 3 of the transition. Excluding China, the growth rate for less developed countries was 1.7 percent in 2006. If growth were to continue at that rate, the population of these countries would double in about 40 years.

### Various Paths to Transition

Will less developed countries eventually complete the demographic transition to low fertility and mortality? They already have deviated from the path followed by Europe and the United States. The importation of medical supplies and technology caused death rates to plummet in many parts of the less developed world

after World War II; in contrast, mortality declines in Europe had occurred slowly. The rapid decline in death rates, but not in birth rates, caused unprecedented rates of natural increase in these countries beginning in the 1950s and accelerating in the 1960s. Growth slowed in many countries in the 1980s and 1990s. Brazil, Mexico, South Korea, and Thailand, for example, experienced dramatic declines in birth rates. Fertility rates dropped in many African countries as well, but they are still high enough to keep the region's growth rate well above 2 percent annually.

Many demographers question whether Europe's demographic transition is a realistic model for less developed countries in this century. Even if all countries eventually undergo a demographic transition (and most population experts assume they will), it is clear that individual countries are following very different timetables and paths for achieving it. The HIV/AIDS pandemic has derailed the transition to low mortality in some areas, and no one knows for how long. But the timing of fertility declines in less developed countries is probably the key to the ultimate size of the world's population. Population and policy experts debate just which actions or policies, such as improving the educational levels of women or making contraceptives easily available, will contribute most to further declines in the birth rate.[62]

## How Large Will the World Population Grow?

If the present rate of population growth were to continue, world population would rocket to 12 billion by 2050, 24 billion by 2100, and so on. Humanity would outweigh the Earth and then the solar system in a remarkably short period of time if the present growth rate continued indefinitely. But no rate of growth can be sustained indefinitely. A positive growth rate of +0.00001 ultimately would yield a population whose mass would expand at the speed of light, while a negative rate of -0.00001 ultimately would carry humanity back past Adam and Eve.[63]

Zero population growth, which characterized human population for more than 99 percent of its history, must be achieved once again, at least as a long-term average, if the human species is to survive. In order for world population growth to slow or stop (assuming that mortality declines over the long term), the global TFR would need to drop from its present 2.8-child per woman average to a 2-child average. The global TFR will not fall to replacement level immediately for two reasons. First, the fundamental social beliefs and cultural practices that produce high fertility

Figure 11
**The Classic Stages of Demographic Transitions**
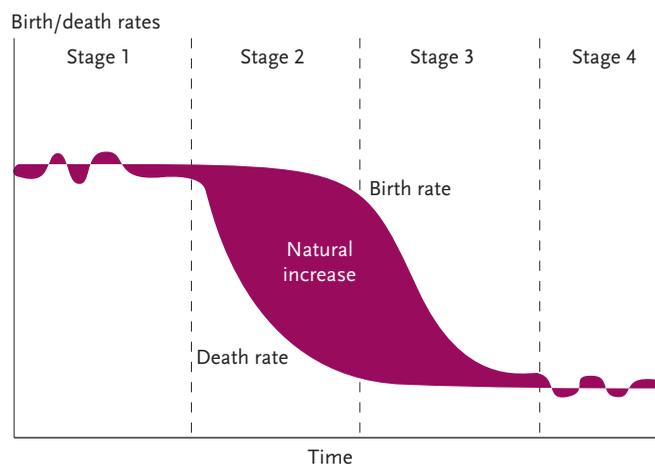


Note: Natural increase or decrease is produced from the difference between the number of births and deaths.

in many countries do not change quickly. Second, the world's current age structure will generate massive growth even if a relatively small family size becomes the norm in the near future. Almost one-third of the world's inhabitants are below age 15, and they inevitably will become the parents of the largest birth cohorts in history. But, like any explosion, the population explosion will eventually fizzle, probably around the middle of this century. By then, the demographic transition will have run its course in most countries of the world and the world growth rate will probably be near zero.

Recent estimates of how large world population will actually be when it stops growing are in the 8.5 billion to 12 billion range. Can the Earth support such huge populations?[64] As new technologies are devised and as resource management techniques are improved, the carrying capacity of the Earth expands, making it impossible to predict the ultimate number of people the world can support. But many experts think that a world population of 10 billion may be the maximum that could be supported comfortably. Other scholars believe that the world's basic biological systems—its forests, grasslands, croplands, and fisheries—and energy resources cannot support even 10 billion. Whatever the peak carrying capacity of the Earth, world population might stabilize and remain uncomfortably close to that maximum level once population growth has ceased. Or, world population might decline to a lower, more manageable level for both humans and the environment.

## Facing Population Decline

There is no homeostatic mechanism that maintains a society at near zero growth. Societies can easily slip into population decline. Indeed, some population experts and interest groups would welcome such a population implosion. But zero growth or population decline has its own problems. One is that the proportion of the population made up of older people rises dramatically. Older people consume a disproportionate share of medical and other costly public services. Labor force shortages also may develop.[65] If population declines rapidly, severe social and economic problems can result. Natural decrease (fewer births than deaths) is already a reality in Germany, Italy, Russia, Sweden, and most former Soviet republics. The rate of decline is slow, but many European leaders fear that their falling populations eventually will threaten their economies, their defense systems, and even their national identities. Some European governments have tried various economic incentives to encourage couples to have more children, including housing benefits, stipends, and lengthy paid maternity and paternity leaves. But these financial incentives are expensive for national governments, and they have not boosted birth rates enough to ward off population decline. Massive immigration is not an acceptable solution to population decline in most countries either. European countries have imposed strict controls against immigration, and some have encouraged immigrants to leave. Long-term population decline appears inevitable for most of Europe, but it will occur very slowly.[66] Were it not for high immigration levels, the United States also would face population decline in the 21st century because of low mortality and below-replacement fertility.

## Concern About Population Growth

The reader no doubt has noticed that many social problems emanate from the population processes of fertility, mortality, and migration. These include the scarcity and waste of social resources caused by baby booms and busts; premature death, especially in certain demographic subgroups; the heavy concentration of population in some urban areas and depopulation in rural areas; social disturbances caused by changes in a population's racial and ethnic composition; and the threat of declining quality of life for present and future generations because of world population growth. The damage such problems produce is indisputable. Americans are somewhat interested in population problems. They have very general opinions on such issues as the desirability of population growth, the appropriate amount of immigration, and the "ideal" racial and ethnic composition of the population. Intense concern about such issues flares up occasionally. In recent years, Americans have become concerned about the flow of legal and illegal immigrants into the United States. Polls have indicated that Americans strongly favor imposing limitations on immigration and completely terminating illegal movements into the country.[67]

Yet, most Americans do not view population issues as among our most serious social problems. Population problems lack the dramatic event—the startling calamity or outrageous incident—that galvanizes attention and action. Rather, they develop inconspicuously through the processes of birth, death, and migration. Experts often disagree about the severity of population problems. Debate about population has been going on at least since Aristotle, who cautioned that populations could outstrip their subsistence base, leading to poverty and social discord.[68] Thomas Malthus reached a similar conclusion in the late 18th century. He argued that the natural consequences of population growth are poverty and misery because the population will eventually exceed the food supply. In the 19th century, Karl Marx and Friedrich Engels rejected this Malthusian view. They blamed poverty not on the poor or on overpopulation, but on the evils of social organization in capitalist societies. Overpopulation in their view was a natural feature of capitalism, and it would not exist in socialist societies because the latter would provide enough resources for each person. When resources were scarce, the hard times would provide the motivation to reduce family size.

Today, the debate over overpopulation continues. Media articles on world population growth vacillate from doomsday hysteria to complacent unconcern, depending on which experts are used as a source. Concern about environmental problems has brought more attention to the consequences of world population growth. Commitment to the environment is a deeply and widely held value among Americans, according to Gallup research. This commitment increasingly is being extended to population issues.

Expectations also play a role in determining the level of public concern about population problems. For example, when concern about a population explosion or about depopulation flares up, people tend to believe that the rate of growth—whether positive or negative—will continue until people are standing on each other's shoulders or until no one is left. Such expectations, however, underestimate a society's ability to solve problems through social change.

# Population Dynamics and Our Future

The study of population dynamics involves the interplay among the three sources of population change: fertility, mortality, and migration. These variables determine the most basic characteristics of a population, as well as its demographic future. The effects of demographic variables extend far beyond the growth or decline in the number of people. As demographer Samuel Preston has so eloquently written: "The study of population offers something for everyone: the daily dramas of sex and death, politics and war; the interlacings of individuals in all their collectivities; the confrontations of nature and civilization, [of] statistics and diaries, [of] self-interest and altruism." [69]

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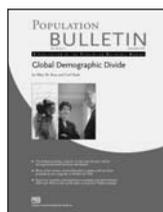
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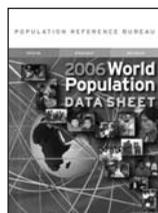
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## Population: A Lively Introduction

The study of population is not just a sort of dry social accounting: It involves issues that touch every aspect of our lives. Where we were born, whether and whom we are likely to marry; whether we have will have children; what jobs we will have; how long we will live:  These are at the root of demography. Students of population also come to appreciate the profound impact that demographic forces have on societies.

   This *Population Bulletin* discusses the basic forces of demographic change—fertility, mortality, and migration—and how they can be tracked. Also covered are how these three forces affect a population's size and growth rate, and how population projections are calculated; common demographic variables such as age, sex, and race/ethnicity; and issues and problems associated with population growth.