CHAPTER 4

Population Change

Topics 2.4–2.9

Topic 2.4 Population Dynamics

Learning Objective: Explain factors that account for contemporary and historical trends in population growth and decline. (IMP-2.A)

Topic 2.5 The Demographic Transition Model

Learning Objective: Explain theories of population growth and decline. (IMP-2.B)

Topic 2.6 Malthusian Theory

Learning Objective: Explain theories of population growth and decline. (IMP-2.B)

Topic 2.7 Population Policies

Learning Objective: Explain the intent and effects of various population and immigrant policies on population size and composition. (SPS-2.A)

Topic 2.8 Women and Demographic Change

Learning Objective: Explain how the changing role of females has demographic consequences in different parts of the world. (SPS-2.B)

Topic 2.9 Aging Populations

Learning Objective: Explain the causes and consequences of an aging population. (SPS-2.C)

A finite world can support only a finite population; therefore, population growth must eventually equal zero.

—Garrett Hardin, "The Tragedy of the Commons," 1968

Source: Getty Images

Educating women and children plays an important role in population dynamics. (See Topic 2.8 for the changing role of women.)

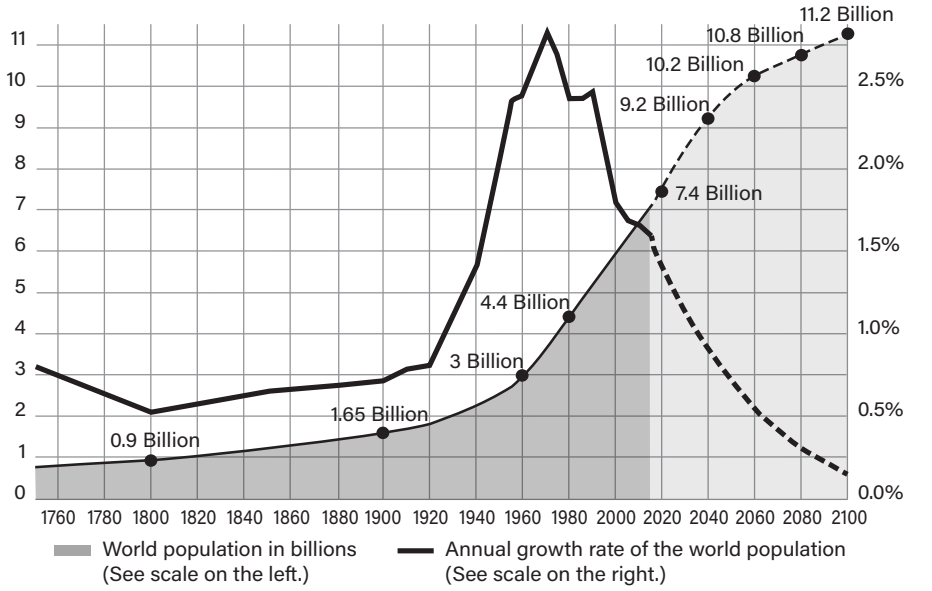
2.4

Population Dynamics

Essential Question: What are the factors that account for contemporary and historical trends in population growth and decline?

Before the 19th century, the total human population grew very slowly. By making small improvements in farming techniques, clearing forested areas to expand land for crops, and finding new regions of the ocean dense in fish, people became more efficient at extracting energy from the environment. Around 1800, the population reached 1 billion. In the 200-plus years since then, world population has exploded—it is around 7.4 billion today. The United Nations predicts it will reach nearly 11 billion by 2100. What problems—and what opportunities—will this growth present?

WORLD POPULATION GROWTH SINCE 1760



Source: Population projections come from "World Population Prospects: The 2015 Revision," UN Department of Economic and Social Affairs, 2015.

Compare the relationship between the population growth rate and the total population. What does the line representing the total population do when the growth rate line spikes? What is the relationship between the two dotted (predicted) lines after 2060?

Population Change

Populations always change—sometimes they shrink, but more often than not, they grow. For example, the population of the United States has grown steadily since the first census was taken in 1790.

UNITED STATES POPULATION GROWTH	
Year	**Population (in millions)**
1790	3.9
1900	76.2
2020	332.6

Prior to 1910, U.S. population grew 20 percent to 40 percent per decade, even during the 1860s, which included the American Civil War. Since 1980, it has increased 7 percent to 14 percent per decade.

Measuring and predicting population change over time is key to understanding the world. Geographers use a simple equation, the **demographic balancing equation**, to describe the future population of a region of any scale:

Future population = Current population + (number of births – number of deaths) + (number of immigrants – number of emigrants)

Figuring the demographic balancing equation takes several variables into account. The number of births and deaths are only part of a country's total population change. Migration also plays a part. To calculate a country's total population change, the number of **immigrants**—people who moved into the country—and the number of **emigrants**—people who moved out of the country—must be added to the equation.

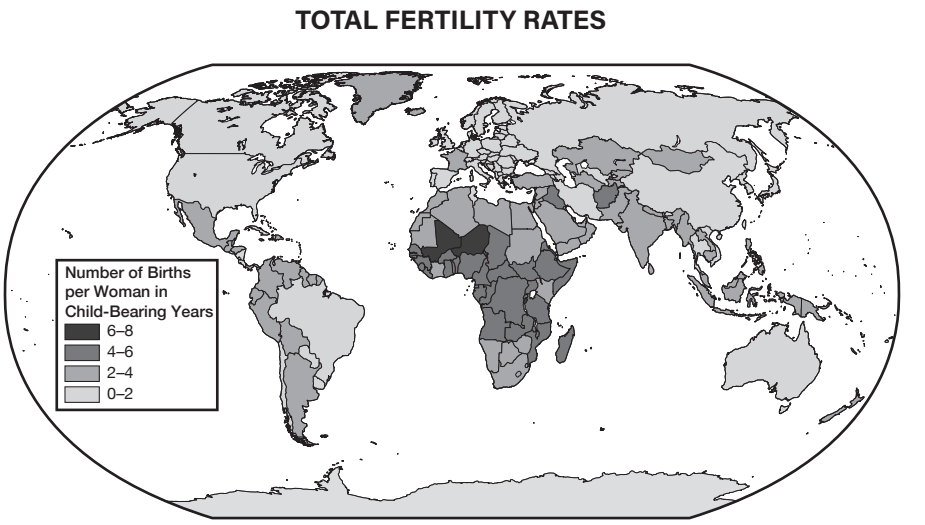
The challenge for geographers is to understand and predict births, deaths, immigration, and emigration accurately. This chapter and the next will examine the concepts associated with population change and explore the ways that geographers use them to understand human populations.

Measuring the Number of Births

Geographers commonly use two different statistics to describe the rate at which children are born:

- The **crude birth rate (CBR)** is the number of live births per year for each 1,000 people.
- In contrast, the **total fertility rate (TFR)** focuses on women in their childbearing years of ages 15 to 49. TFR is the average number of children who would be born per woman of that group in a country, assuming every woman lived through her childbearing years.

Of the two statistics, the TFR more accurately reflects cultural norms—such as how people weigh the costs and benefits of having a child and how people perceive the role of women in society. The CBR is simpler to calculate and clearly relects the total population change within a country.



The total fertility rates (TFR) vary widely among different regions of the world. TFR varies among countries and it generally declines as countries become wealthier.

In most of the world, the TFR was higher in the past than it is today. In parts of Europe before 1800, the TFR averaged 6.2 children. In those days, most people lived on farms and having more children meant more people to work the land. However, because so many children died as infants, the average life span was only about 40 years. Despite the high TFR, population growth was slow.

Life Expectancy

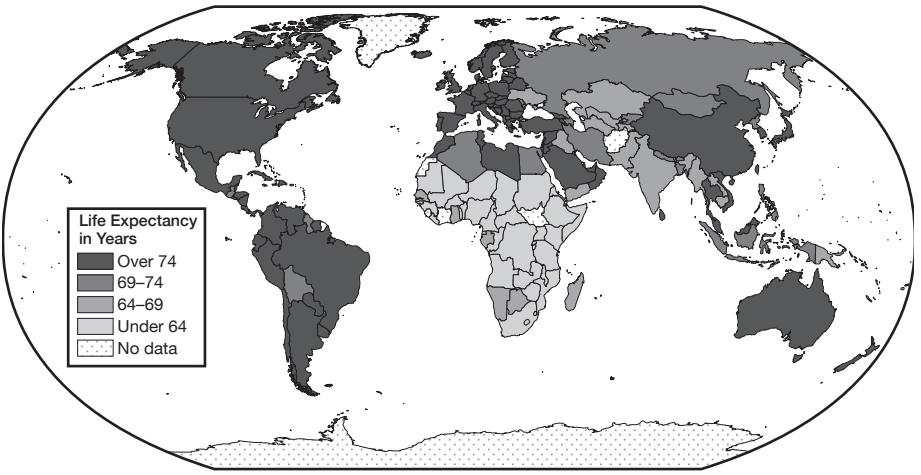
Even though the total fertility rate worldwide has been decreasing, the world's population continues to grow. This growth reflects a decrease in the death rate and an increase in how long people live.

Global Population Increase

The most important factor in the increase in global population is the rise in **life expectancy**, the average number of years people live. It is commonly expressed from the time of a person's birth, but it can be calculated at any point in his or her lifetime. A century ago, the global life expectancy was about 34 years at birth; today it is nearly 70 years. In most of Europe, life expectancy at birth is more than 80 years. However, in less-developed areas, such as many sub-Saharan African countries, life expectancy at birth is less than 50 years.

One of the most important factors that affects increasing life expectancy is the drop in the **infant mortality rate**, the number of children who die before their first birthday. For example, in Massachusetts, the infant mortality rate per 1,000 live births dropped from 130 in 1850, to about 4 today.

LIFE EXPECTANCY BY COUNTRY, 2015



What regions of the world have the highest and lowest life expectancies? What is the scale of analysis used on the map? Note: Some regions on the map have no data because of political instability.

The decrease in infant mortality rate and increase in life expectancy can be explained by economic, political, and technological changes. Economic development has increased wealth and increased the amount and quality of food available to millions of people. Political stability has allowed for improved sanitation infrastructure, and advances in technology have greatly improved healthcare.

Better Food Production and Nutrition

Over the past 250 years, several advances in agriculture have helped increase life expectancy:

- mechanizing food production, such as replacing horses with tractors
- improving seeds, fertilizers, and farming techniques through research by state universities and private companies
- transporting products more efficiently in trucks, trains, and ships, often on roads, rail lines, or canals built with government support

In the United States in 1800, most of the population farmed. Today farmers make up less than 3 percent of the population, yet they produce enough food to feed everyone in the country and export vast quantities. Advances in agriculture such as the following had effects that rippled through society:

- Greater farming efficiency freed people to work in nonfarm industries, easing the transition to industrialization.
- Food security improved around the world. Hunger and famines still occurred because people were too poor to purchase food or because of political issues or distribution problems, not because of food shortage.
- As farms depended less on manual labor, farm families became smaller.

- The use of machinery meant that one person could farm more acres. Many small farms were consolidated into larger farms, and the former owners of those farms moved to urban areas.
- As the population of rural areas decreased, and cars and better roads allowed people to travel farther and more easily, many small towns that had served farmers disappeared.

Advances in Public Sanitation

As early industrial cities grew, so did the problems of large concentrated populations. One problem was the spread of disease. Cholera, for example, was spread through water contaminated by human waste, and the plague was carried by fleas that live on rodents.

Sewer Systems One of the most important advances in reducing mortality was the creation of public sewer systems. Before the Industrial Revolution and in its early years, people in cities dumped human waste into streets and rivers. The waste often reached the water supply, which contaminated the drinking water and made people sick. Children and the elderly were especially vulnerable to disease. Then cities began to install sewer systems, protecting water supplies from contamination and thus increasing life expectancy.

Water and Waste Systems People also learned that boiling water before they used it could prevent transmission of waterborne illnesses. That worked before citizens decided to pay for systems that provide clean water through taxes. Communities began to install water treatment plants that transported clean water to the homes in the cities. Cities also created departments of public sanitation and started to collect garbage and other waste produced by city residents. By doing this, cities reduced the number of rodents that fed on the waste and often carried disease.

Improvements in Healthcare

Improved medical care coincided with improvements in food production and sanitation. The development of vaccines to prevent diseases, antibiotics to cure diseases, and improved medical procedures boosted life expectancy.

Vaccines Prior to the 1800s, smallpox killed as many as 400,000 people each year. However, in the 1700s, British doctor Edward Jenner figured out that if he infected people with cowpox, a much milder disease related to smallpox, those people would be immune to smallpox. Jenner's work led to a smallpox vaccine. Today, efforts by the United Nations, national governments, and private organizations to vaccinate people around the world have been so successful that no case of smallpox has been reported since 1977. Jenner's work was also the basis for vaccines against other serious diseases, such as polio, tuberculosis, and rabies.

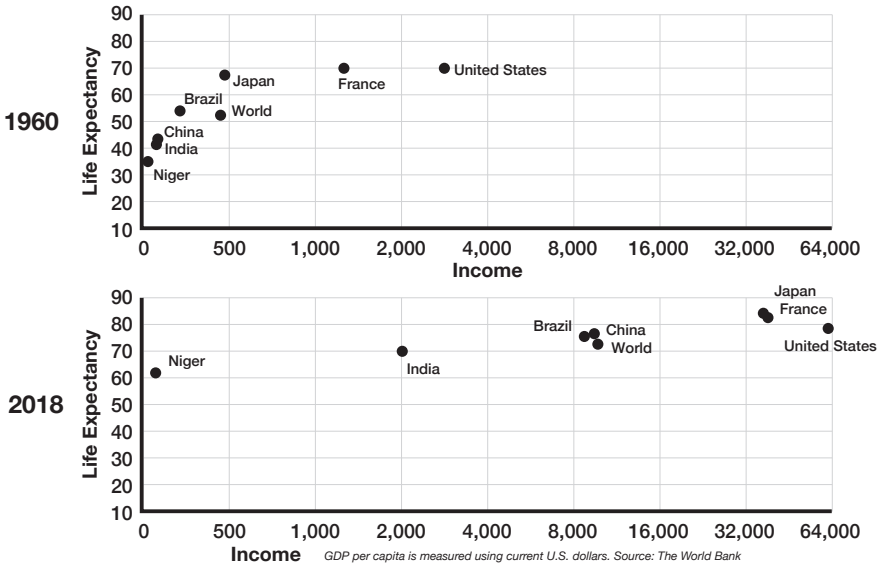
Antibiotics While vaccines helped prevent people from getting ill, antibiotics helped cure people who had bacterial infections. The first widely used antibiotic was penicillin, which came into use in the mid-1900s. Before

penicillin, deadly bacterial infections killed many people. The deadliest epidemic in history was the plague, which was spread by flea bites. During the mid-1300s, the plague killed about 20 million people in Europe alone—about one-third of the continent's total population. Other common bacterial infections include parasitic infections, strep, and staph—which commonly killed people who got wounded in battle or suffered a deep cut.

Better Medical Care Improved medical procedures have also extended life expectancy. Among these procedures was advancements in surgery, which was often deadly before antibiotics. Now surgery is safe enough that it can help an individual suffering from a heart attack, stroke, cancer, or other ailments. Doctors have also saved the lives of pregnant women and their newborn children through the use of caesarean section surgeries.

RELATIONSHIP BETWEEN INCOME AND LIFE EXPECTANCY

(of selected countries)



GDP per capita is measured using current U.S. dollars. Source: The World Bank

Rate of Population Increase

The natural increase or natural decrease in a population is measured by subtracting the number of deaths from the number of births. To compare countries of different sizes, demographers use rates rather than total numbers. The crude birth rate (CBR) and the **crude death rate** (CDR) of an area are measured per 1,000 population. The percentage at which a country's population is growing or declining, without the impact of migration, is the **rate of natural increase** (RNI).

Calculate it with this formula: *RNI = (CBR – CDR) ÷ 10*, and then add a percent sign. For the entire world, the CBR is about 20 and the CDR is about 8.

Since (20 – 8) ÷ 10 equals 1.2, the RNI for the world is about 1.2 percent. RNI tends to be less than 1.0 percent in more-developed countries and greater than 1.0 percent in less-developed countries.

Population Doubling Time

Demographers describe population growth in two ways:

- Arithmetic growth is when the increase is a constant number each period. Arithmetic growth by the addition of 1 would be 1, 2, 3, 4, etc. Arithmetic growth by 5 would be 1, 6, 11, 16, etc.
- Exponential growth is when the increase is a constant factor each period. If the factor is 2, then the number doubles each period: 1, 2, 4, 8, etc. Exponential growth by 5 would be 1, 5, 25, 125, etc.

Since the early 1800s, global population has been growing exponentially. For any quantity growing exponentially, the time it takes to double in size, or **population doubling time**, can be estimated using an equation known as the Rule of 70 (some people use the Rule of 72). Assuming the growth rate remains steady, the approximate doubling time in years will be 70 divided by the growth rate per year.

For example, in 2014, the West African country of Ivory Coast had a population growth rate of about 2.0. Since 70 divided by 2 equals 35, and assuming the growth rate remains about 2.0, the population of Ivory Coast will double in 35 years. The United States had a much lower growth rate: 0.77. If the U.S. growth rate remains at 0.77, the U.S. population will double in about 91 years.

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *What are the factors that account for contemporary and historical trends in population growth and decline?*

Current Trends in Population Growth and Decline	Historic Trends in Population Growth and Decline

KEY TERMS

demographic balancing equation
immigrants
emigrants
crude birth rate (CBR)
total fertility rate (TFR)
life expectancy
infant mortality rate
crude death rate (CDR)
rate of natural increase (RNI)
population doubling time

2.5

The Demographic Transition Model

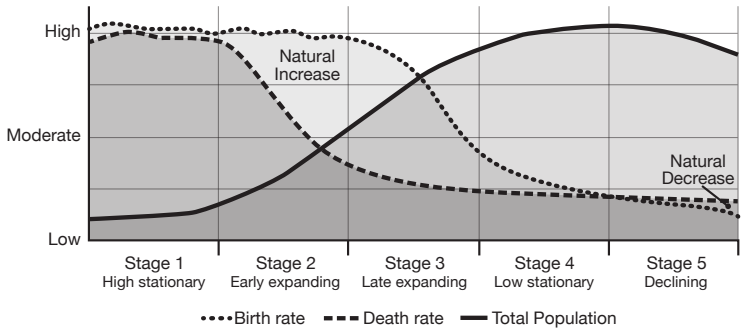
Essential Question: How does the demographic transition model explain population growth and decline?

Populations change over time. One way they change is in size, usually growing but sometimes shrinking. Recall that a population pyramid is a type of graph used by geographers to represent the composition of a population. Geographers use another specific tool—a model—to represent and calculate, analyze, and display the change in total population size over time. This is the demographic transition model, which shows how the decline in death rates produced a growth in population and eventually a decline in birth rates.

The Demographic Transition Model

Changes in the birth rate and death rate in a country are shaped by how a country changes from an agrarian to an industrial society. The **demographic transition model** (DTM) shows five typical stages of population change that countries experience as they modernize. Each stage lasts for a period of indeterminate length. The developed countries of the world passed through these stages first, while the underdeveloped areas of the world are still passing through the early and middle stages.

THE DEMOGRAPHIC TRANSITION MODEL AND POPULATION DYNAMICS



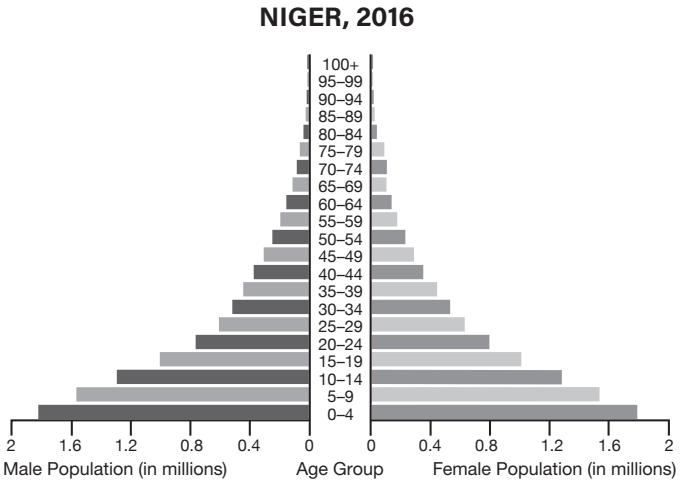
As a country passes through the stages, its total population increases. A country's death rate begins to decrease when it moves into Stage 2. Also, when a country reaches Stage 3, its birth rate starts to drop.

CHARACTERISTICS OF THE DTM STAGES					
Factor	**1. High Stationary**	**2. Early Expanding**	**3. Late Expanding**	**4. Low Stationary**	**5. Declining**
Birth Rate	High but fluctuating as need for farm labor changes	High but fluctuating to reflect desires for big families	Declining as urbanization decreases the need for child labor	Low but enough to keep the population stable	So low it falls below the death rate
Death Rate	High but fluctuating to reflect diseases and poor sanitation	Rapidly declining as nutrition, sanitation, and medicine improve	Declining but not as fast as in previous stage	Low and stable	Low, sometimes increasing as the population ages
Natural Increase (yearly rate)	0 to .5%	.5 to 4%	4 to .8%	.8 to 0%	0% to (-1%)
Population Change	Very low growth because births and deaths are both high	Rapid growth as death rates fall faster than birth rates	Rapid but slowing growth as birth rates decline	Very low growth because births and deaths are both low	Very low decline as births fall below deaths
Population Structure	Very young	Very young	Young, with rising life expectancy	Balanced, with more aging	Very old
Examples Today	▪ Scattered isolated groups	▪ Mali ▪ South Sudan	▪ Mexico ▪ Turkey ▪ Indonesia	▪ United States ▪ China	▪ Japan ▪ Germany
Economy and Society	▪ Subsistence agriculture ▪ Hunter gathering	▪ Rural agricultural society ▪ Less developed	▪ Large movement of people from farms to cities ▪ Emerging/ industrializing economies	▪ Urbanized service economy ▪ Highly developed ▪ Rising gender equity	▪ Urbanized service economy ▪ Highly developed

Demographic Transition and Population Pyramids

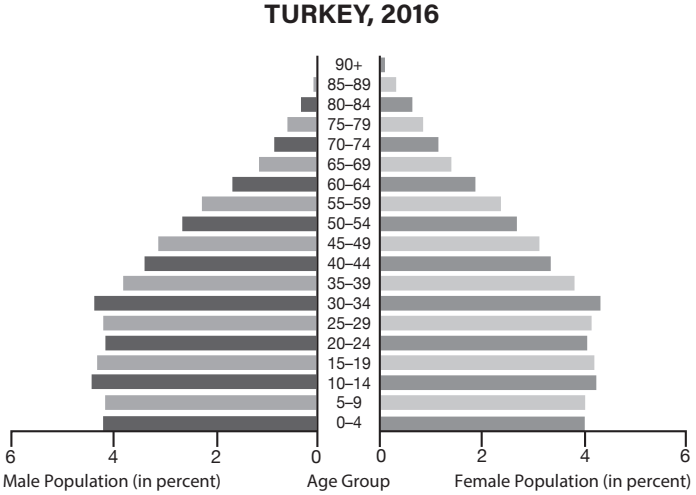
Only a few isolated groups are in Stage 1 and they are typically subsistence farmers or hunters and gathers. Societies in this stage have high birth rates and high fluctuating death rates based on Stages 2 to 5 of the Demographic Transition Model. Each tend to produce a different-shaped population pyramid.

Stage 2 Niger represents a Stage 2 country with an expansive population pyramid, one with a high birth rate—which produces a wide base—and a low life expectancy—which leads to narrowing in the upper years. Because the younger generations are larger than the older ones, the result is rapid population growth. This is typical of a less-developed region.

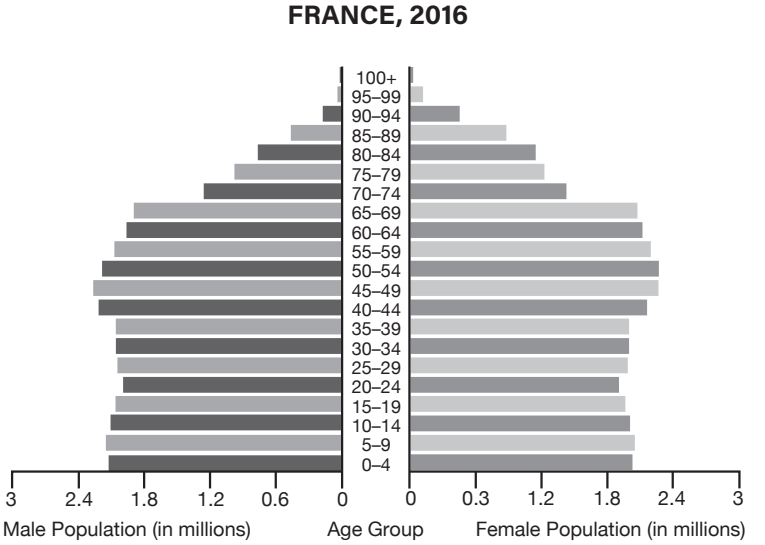


It is common to see population pyramids with either percentages or total population as above. Using percentages makes it easier to see differences between cohorts while using total population allows a better understanding of the number of people in a cohort of a certain age group.

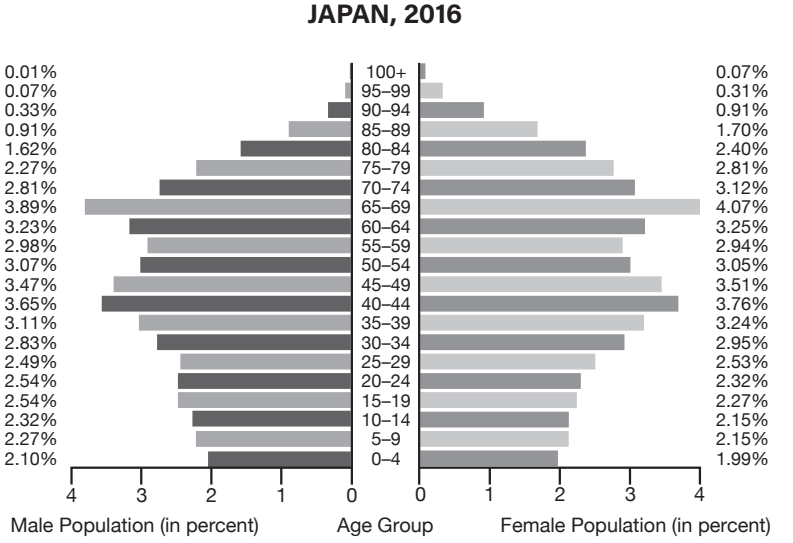
Stage 3 Turkey represents an urbanizing Stage 3 nation with a declining birth rate and a more slowly declining death rate. Notice that the majority of the population is under the age of 34. The society is still young, but the percentage of elderly is increasing as life expectancy goes up. The transition from Stage 2 to Stage 3 has the fastest population growth. Countries attempt to navigate through Stage 3 as quickly as possible to avoid long-term exponential population growth. As countries transition from early Stage 3 into Stage 4, population will continue to grow for at least one generation because of **demographic momentum**. This process occurs because even though fertility rates have declined, people are living longer, and this results in population continuing to grow for another 20–40 years.



Stage 4 France's pyramid, representing Stage 4, is typical of the shape known as a stationary population pyramid. It indicates a population that is not significantly growing or shrinking. The birth rate is low but steady. The death rate is also low, indicating a high life expectancy and an increased percentage of older people. This graph shape is usually associated with more-developed countries.



Stage 5 Japan's pyramid represents Stage 5. The narrow base reflects a decreasing birth rate. The population is aging and declining slightly overall. The largest age group is 65–69.



Policy Implications

As countries move from stage to stage, they face different challenges. A country in Stage 2 or 3, with a relatively high percentage of young people, often lacks the resources to educate all children. A country in Stage 4 or 5, with a relatively high percentage of old people, often faces problems funding healthcare. However, since the elderly can vote while children cannot, the elderly often have more political influence.

DTM at Different Scales of Analysis

Just as population pyramids can be created to illustrate the population of an entire country or a smaller portion of the population (like a province, state, or city), the demographic transition model can be used to analyze changes at a smaller scale. For example, birth rates and death rates of a particular region or subregion within a country, can differ from that of the larger society. They can also change at a different rate or in a different way. This will indicate a stage of demographic transition for the region that is different from that of the total population of the country.

Evaluation of the Demographic Transition Model

The demographic transition model helps explain, describe, and predict spatial activity and phenomena related to population increase and decline. It explains well the experiences of Western Europe, the United States, and Japan, mostly because it is based on these countries' experiences. However, it is less useful in explaining the experiences of all countries, particularly the less-developed countries of the world today:

- Citizens of countries in Stage 2 and 3 do not have as many options to migrate out of the country to help release some of the population pressure.
- Governments often place severe restrictions and limitations on migration.
- Today, birth control and government policies play a much larger role in reducing birth rates than previously.
- Economic changes in less-developed countries today are much different than the experiences of the United States and Western Europe in the past.

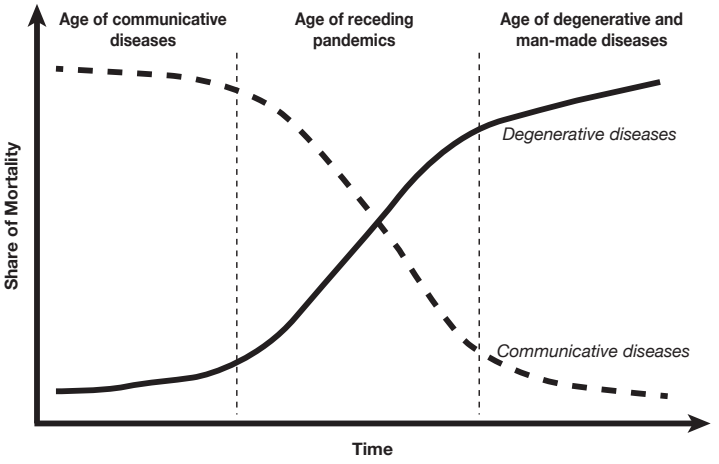
The DTM is a population change model and changes in the economy or society can have multiple reasons that cause the changes to occur. Just because changes in demographics and the economy occur at similar stages does not mean that they necessarily are the cause of the change. However, the DTM does assume that urbanization and industrial development help propel countries through each stage.

Each stage has demographic challenges and benefits, and the model is designed to help gain insight to those. Countries in later stages of the model are not necessarily more successful than countries in earlier stages; they simply have different demographic characteristics.

Epidemiological Transition Model

The world's countries develop industrially and economically at their own pace, so there is a large discrepancy in the types of diseases found across the world. In the early 1970s, epidemiologist Abdel Omran identified predictable stages in disease and life expectancy that countries experience as they develop. Omran's work is known as the **epidemiological transition model**. This model is an extension of the demographic transition model and explains the changing death rates and more common causes of death within societies.

EPIDEMIOLOGICAL TRANSITION MODEL



EPIDEMIOLOGICAL TRANSITION MODEL STAGES		
Stage	**Description**	**Effects on Population**
1. Disease and Famine	Parasitic or infectious diseases, accidents, animal attacks, or human conflicts cause most deaths. Food insecurity makes famine more common and more devastating.	A high death rate and low life expectancy.
2. Receding Pandemics	The number of pandemics (widespread diseases that affect large populations) declines as a result of improved sanitation, nutrition, and medicine.	A decreasing death rate and increasing life expectancy.
3. Degenerative and Human-Created Diseases	Infectious and parasitic diseases continue to decrease, but diseases associated with aging—such as heart disease and types of cancer—increase as people live longer.	Death rate stabilizes at a low level and life expectancy increases.
4. Delayed Degenerative Diseases	Stage 4 is an extension of Stage 3, but the age-related diseases are put off as medical procedures delay the onset of these diseases through advanced procedures. Diseases such as Alzheimer's and dementia increase.	Death rate reaches its lowest level and life expectancy reaches a peak.

EPIDEMIOLOGICAL TRANSITION MODEL STAGES		
Stage	**Description**	**Effects on Population**
5. Reemergence of Infectious and Parasitic Diseases	Infectious and parasitic diseases increase as some bacteria and parasites become resistant to antibiotics and vaccines.	Life expectancy decreases.

The COVID-19 pandemic in 2020 challenged some of the theories of the epidemiological transition model. Pandemics are usually a part of Stage 1 or 2, but as the world becomes more urbanized and globally connected, the threat of pandemics seems to be increasing. The model assumes that pandemics will decrease as countries develop economically. The extensive consequences of the virus illustrate the importance of studying and understanding the spread of diseases. According to Johns Hopkins University, by March 2021, approximately 120 million people were infected and more than 2.6 million people worldwide died from COVID-19. A factor supporting the effectiveness of the model is that advanced medicine and science limited the impacts as compared to historic pandemics, such as the 1918 influenza outbreak.

One criticism of the model is that it does not take into account the impact of lifestyle choices nor local environmental factors in extending or shortening life expectancy. Eating healthier food, drinking less alcohol, and exercising more have enabled many people to live longer and more active lives. One of the biggest lifestyle changes has been in smoking. In the United States, the percentage of adults who smoke has declined in the last five decades from approximately 40 percent to under 15 percent, which partly explains an increase in life expectancy in the United States. In some regions of the world, high levels of industrial pollution or exposure to pesticides and chemicals has resulted in localized higher death rates that are not captured in the model.

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *How does the demographic transition model explain population growth and decline?*

Demographic Transition Model's Explanation of Population Change	Epidemiological Transition Model's Explanation of Changing Death Rates

KEY TERMS

demographic transition model
demographic momentum
epidemiological transition model

2.6

Malthusian Theory

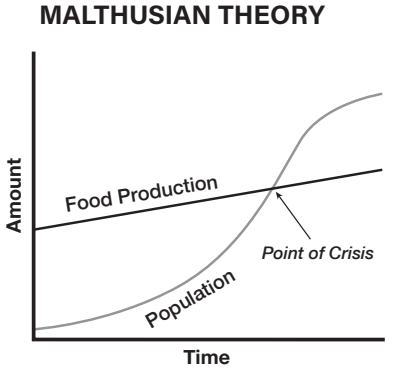
Essential Question: How does Malthusian theory explain population growth and decline?

In 1798, Thomas Malthus published one of the most provocative books on population growth ever written, *An Essay on the Principle of Population*. Malthus, a member of the clergy and an early economist, focused on one of the underlying concerns of geography: the relationship between people and the earth.

Food Production and Population Growth

Malthus lived during a period when people were optimistic that new technology would make life better—but Malthus feared it would not. He analyzed the relationship between natural resource use, particularly agricultural output, and the growing population and concluded that society was on a path toward massive starvation. Geographers and other social scientists have debated the usefulness of Malthus's ideas about population growth, known as **Malthusian theory**, since he first published them.

He believed that food production would increase arithmetically—growing steadily by a similar amount each generation. In contrast, he believed that people would not limit the number of children they had, so the population would increase exponentially—growing steadily by a similar percentage each generation. Since population would grow faster than food production, the world's population would soon be unsupportable or referred to by Malthus as **overpopulation**. If people could not limit population growth voluntarily, Malthus believed famine, or widespread and massive starvation, would limit population growth. Additionally, he argued that the likelihood of war, plagues, and economic struggles would increase.



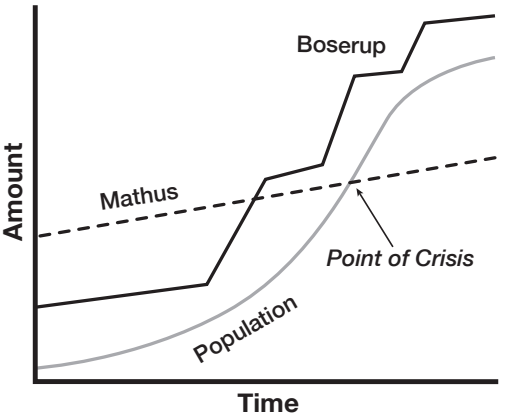
The j-shaped population curve grows faster than resources. At the point of crisis, the population exceeds carrying capacity. What types of challenges does exceeding carrying capacity create for a region?

Alternative Views

The famines predicted by Malthus did not and have not occurred for several reasons. The first is that food production increased dramatically faster than he predicted. Malthus did not live to see the dramatic improvements in agricultural technologies that have revolutionized food production. Also, Malthus was incorrect in his prediction that population would continue on its steady growth path. In the years since he wrote his essay, fertility rates have dropped in all regions of the world.

Additionally, some scientists believed that an increasing population could improve the situation. In contrast to Malthus, Ester Boserup (1910–1999), a Danish economist, emphasized the positive aspects of a large population. In simple terms, the **Boserup theory** suggested that the more people there are, the more hands there are to work, rather than just more mouths to feed. Boserup also argued that as population increases, more pressure is placed on the existing agricultural system, which stimulates invention resulting in more food production.

BOSERUP AND MALTHUSIAN THEORIES

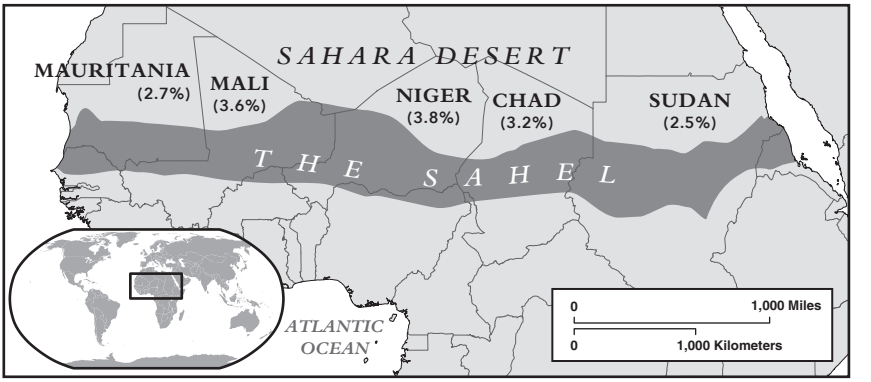


Malthusian Theory Today

The widespread starvation that Malthus feared has not happened. Yet, there are those who still accept his fundamental premise as correct today, they are known as **neo-Malthusians**. They argue that population growth is a serious problem currently and an even greater threat for the future. On a regional scale, places like the Sahel region in Africa, the transition between the Sahara and the grasslands, could represent a Malthusian scenario. The region's population is expected to triple over the next 30 years and is suffering with political instability, poverty, food shortages, and dramatic climate change.

Neo-Malthusians point out continued population growth will lead to the depletion of nonrenewable resources such as petroleum and metals, pollution of air and water, and shortages of food. These issues could lead to social, political, economic, and environmental catastrophe.

SAHEL REGION OF AFRICA WITH NATURAL INCREASE RATES, 2020



Source: PRB.org

The natural increase rates of the countries of the Sahel indicate what stage of the demographic transition model? How could countries of the Sahel region avoid a Malthusian crisis?

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *How does Malthusian theory explain population growth and decline?*

Malthus's Concerns About Population Growth	Checks or Impacts at the Point of Crisis

KEY TERMS

Malthusian theory
overpopulation
Boserup theory
neo-Malthusians

2.7

Population Policies

Essential Question: What are the intent and the effects of population and immigration policies on population size and composition?

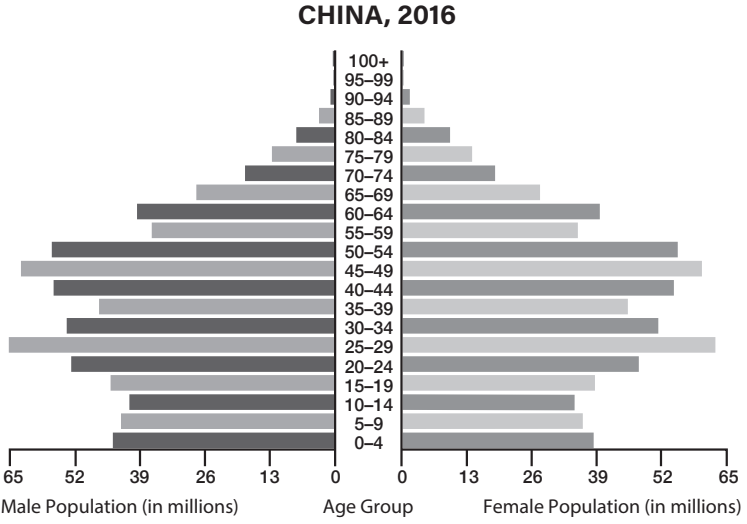
Population growth rates can also be influenced by political factors. Many countries in the world today have adopted national policies intended to either slow the growth of their populations or to increase it.

Government Programs to Reduce Population Growth

Concerns about population growth have led to **antinatalist policies**. These policies attempt to decrease the number of births in a country and are often used by developing countries.

The Chinese government introduced two different antinatalist policies in the 1970s. The first, known as "later, longer, fewer," was introduced in 1972. It encouraged parents to get married later in life, wait longer between children, and as a result, have fewer children.

The impact of the "later, longer, fewer" policy can be seen in China's pyramid for 2016 in the relatively shorter bars for the 40–44 and 35–39 cohorts. The expansion in births in the 25–29 and 30–34 cohorts is the result of the large number of women who entered childbearing age in the mid-1980s.



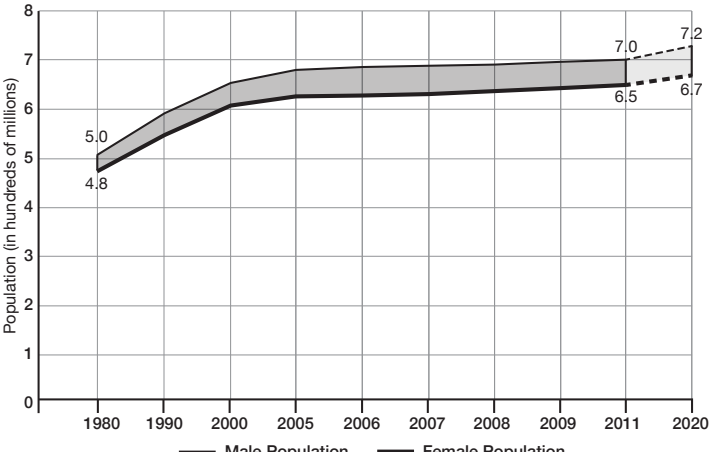
Review the 5-year cohorts for 24 years and under. Describe the pattern of boys compared to girls using quantitative data.

"Later, longer, fewer" resulted in reduced fertility but not as quickly as officials wanted. In response, China instituted its One-child policy in 1979. Parents who had more than one child were subject to fines, although the law made exceptions for rural couples and ethnic minorities. The policy remained in effect until 2016. During that period, China's fertility rate decreased. However, researchers disagree on how much of the decline resulted from the policy and how much from other factors, such as increased education for women.

Gender Preference Chinese culture has long preferred male children over females, so the One-child policy contributed to an unbalanced gender ratio. By 2010, China had 118 males born for every 100 females. The gender imbalance was so great that Chinese leaders feared it would lead to greater crime and civil unrest among young men who felt they had no prospects to get married and have children.

Gender preference is not unique to just China. Many countries have unbalanced gender ratios at birth, such as India, which has a similar sex ratio to China. Demographers estimate that upwards of 100 million Indian girls are missing from the population because of a gender preference for males. Sons are required economically to care for their elderly parents, while girls are viewed as a financial burden with less economic potential than boys. According to the World Health Organization changing structural elements of gender inequality by promoting equal education and pay, allowing women to own property, and changing attitudes about gender roles are essential to increase the perceived value of girls.

CHINA'S MALE AND FEMALE POPULATIONS



Source: United Nations Development Programme

Males outnumber females in the total world population. China's antinatalist policy is the reason for about half of these "extra" males. Why might a couple have had a preference for a male child to be their first?

Revision of One-Child Policy One effect of China's One-child policy was a change in the dependency ratio. Chinese government officials reevaluated the policy because of concerns that, in the future, the economically active workforce will not be large enough to sustain economic growth and support the

elderly. In 2016, the Chinese government modified the controversial program and allowed families to have two children.

While China's One-child policy was the most comprehensive population-control plan, other countries used more targeted programs. In European nations, birth-education decreased teenage pregnancy. In parts of Africa and South Asia, laws banning child marriage raised the average marriage age and the average age that a woman had her first child.

Policies to Encourage Population Growth

Throughout history, some governments have encouraged large families. Those governments believed that a growing population stimulated economic growth and increased military power.

In recent decades, a variation of this reasoning has emerged in some highly developed countries. As fertility rates dropped but people lived longer, the percentage of elderly people increased. To keep the economy vibrant, countries such as France, Sweden, and Japan instituted **pronatalist policies**, or programs designed to increase the fertility rate. For example, they have provided paid time off from jobs held by mothers, free childcare, and family discounts on government services. Other countries like Denmark, Singapore, Russia, and Italy have advertising campaigns to encourage families to have more children and express family and national pride. These campaigns have had mixed results.

The island city-state of Singapore has engaged in both pronatalist and antinatalist policies. In 1966, the official policy was "Stop at Two" and "Boy or Girl, Two is Enough," and by 1987, the policy changed to "Have Three or More, If You Can Afford It." In 2000, "Work-Life Harmony" and "Family-Friendly Work" were added as new policies. Policies included paid leave, cash bonuses, and tax rebates for working mothers who had a baby.

Restricting or encouraging immigration through national policies is another political tool that a country can use to promote or discourage population growth. Remember that the **demographic balancing equation** includes both immigration and emigration when predicting future populations.

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *What are the intent and the effects of population and immigration policies on population size and composition?*

Policies Encouraging Population Growth	Policies Discouraging Population Growth

KEY TERMS

antinatalist policies

pronatalist policies

2.8

Women and Demographic Change

Essential Question: What are the demographic consequences due to the changing role of women in different parts of the world?

The changing roles of females has had profound effects on the demographics worldwide. The goals, responsibilities, and opportunities of women are different today than in the past. The effects of these changes can be seen in both the developing and the developed world.

Changes in Fertility

Beginning in the mid-18th century, Europeans began having fewer children. Part of the lower fertility rate was unintentional. During this time, countries began keeping larger standing armies, so more men were away from home for longer periods.

However, most of it was intentional. With the Industrial Revolution (see Topic 7.1), people began to rely more on machines than on human labor to produce goods, so couples felt they needed fewer children to support their families. Additionally, people were migrating from rural agricultural regions into more urban city centers where an increasing number of jobs were located. In cities, raising children was often more expensive, further reducing the fertility rate. Yet, industrialization contributed to a lower death rate and also enabled people to live longer. So even though total fertility rate (TFR) declined, population growth increased. **Total fertility rate** is the average number of children who would be born per woman of that group in a country, assuming every woman lived through her childbearing years.

Role of Women in Society

Cultural, economic, political, and environmental realities have always shaped decisions about whether to have children. Since these conditions have varied across time and cultures, so have birth rates. The changing way that people view the role of women in a society has been a particularly important factor influencing TFR.

Over the past 250 years, as countries industrialized, people moved from rural areas to urban areas and found work in factories. Many women found work in textile mills, so they often began families later and sometimes not at all. Families lived in small apartments or small houses in cities, which were more suitable for small families.

As the number of factories grew in the early 19th century, children worked there alongside adults. Later that century, governments passed laws prohibiting child labor and began opening public schools. As young women obtained more schooling, they began to expand their work opportunities. The longer they stayed in school, the fewer children they had—a trend that continues to the present day, as the chart on Ghana shows.

TFR AND SCHOOLING FOR GIRLS IN GHANA		
Years of Schooling	**TFR, 1990**	**TFR, 2007**
0	7.0	6.1
4	6.4	5.0
8	5.6	3.7
12	2.7	2.0

Source: worldbank.org

What are the differences in the trends of TFR and schooling for girls from 1990 and 2007? What are some possible causes for the differences?

In Ghana, between 1990 and 2007, as young women gained more education, the number of children they had decreased. This suggests that young women who spent more time in school chose to delay marriage and childbirth.

The United States showed a similar pattern of delayed marriage. As educational opportunities increased for women between 1950 and 2010, the median marriage age of women increased from just over 20 years of age to nearly 27. As a result, the average age at which women gave birth to their first child increased as well.

Family Planning

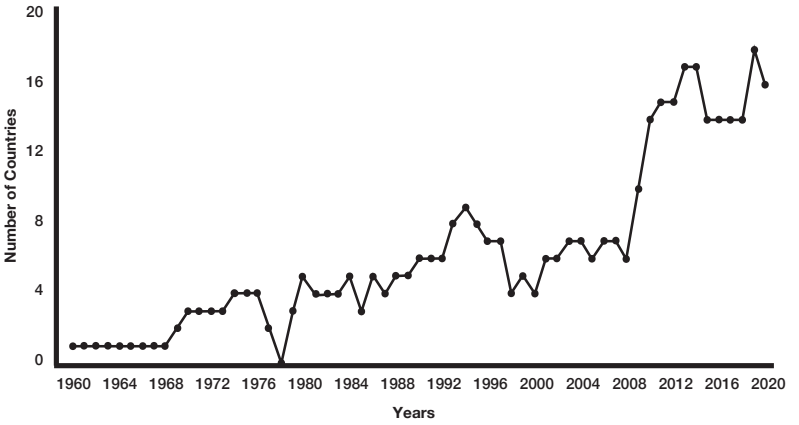
Throughout the 20th century, the spread of family planning information and changes in technology aided people who wanted to choose the number of children they had. In countries with wide access to family planning methods, including the United States and many countries in Europe, couples gave birth to their first child later in life, had fewer children, had fewer unintended pregnancies, and had larger intervals between having children. In these places, the total fertility rate continued a decline that began with the Industrial Revolution.

Religious and cultural values also shape attitudes toward having children. Some religious traditions oppose certain forms of family planning. Women who follow traditional religious beliefs have higher fertility rates than those who do not. These women are less likely to use birth control and less likely to be employed outside the home. The combination of access to family planning, educational attainment of girls, and the resulting gains in economic wealth for women, is powerful in reducing total fertility rates.

Political Changes

Women have been expanding their participation in politics and government across the world in the last 50 years. Although females are still underrepresented in government positions, their presence and involvement there has never been greater. These political changes have coincided with the expanded opportunities for women to gain education, access jobs and leadership roles, and make decisions about family size. Family planning is a political topic in many countries, including the United States, and the voice of women in prominent political and cultural positions can have significant influence.

NUMBER OF COUNTRIES WITH A WOMAN IN THE HIGHEST GOVERNMENT POSITION, 1960 TO 2020



Source: statista.com

The graph shows changes from 1960 to 2020. In 2021, only 12 of the 193 countries (6 percent) in the United Nations had a woman as leader.

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *What are the demographic consequences due to the changing role of women in different parts of the world?*

Reasons for Reduced Fertility Rates	Effect of Social, Economic, and Political Roles for Women

KEY TERM

total fertility rate (TFR)

2.9

Aging Populations

Essential Question: What are the causes and consequences of an aging population?

Across the world, the populations are getting older. This is most evident in highly seveloped countries such as Japan and much of Europe. However, the processes that cause the average age of a population to increase are occurring in all parts of the world. There are numerous significant effects on a society with an aging population.

Causes of Aging Populations

There are two primary reasons for the increasing average ages in populations: longer life expectancy and lower crude birth rates.

Improvements in healthcare and eldercare have allowed for life expectancies to increase in developed countries. In many of these countries, people routinely live well into retirement.

In less-developed societies, life expectancies have also been increasing due to much simpler, but effective, improvements. Building better sewage treatment facilities and improving drinking water quality have helped tremendously. Mitigation of diseases such as malaria, dysentery, AIDS, and influenza have greatly improved chances of living not only to adulthood but into old age. The presence of basic medical services, trained midwives, and available antibiotics are now much more common in many countries and have resulted in increasing life expectancies worldwide.

Crude birth rates are also dropping as a result of changes attitudes about family size. (See Topic 2.4.) When fewer children are born, there will eventually be fewer adults to create families. In many places, this process has tended to reinforce itself with each successive generation becoming slightly smaller than the one that proceeded it. Consequently, as the percentage of younger people in a population decreases and the number of people living into old age increases, the average age of a population increases.

Effects of Aging Populations

As populations age, their needs change. Japan's population has an average age of 49 years and has different priorities than Iraq where the average age is 21 years. The average age in the United States in 2020 was 40 years, but in 2000, it was only 35.

Political Impacts

Older people may vote differently than younger people. Many older people are on a fixed income and may not support tax increases for things such as parks that they won't likely use and may not be able to afford the taxes to support. Potentially political tensions can rise over differing political issues and age-specific viewpoints, such as increasing the retirement age or changing funding levels for education or Social Security.

Retirees are very likely to vote, and as the percentage of elderly rise, they have become a powerful voting bloc. The importance of the senior voting bloc is partly because of the number of seniors, but even more because of the willingness to vote. Between 1986 and 2018, voter turnout among people over the age of 60 was consistently about 30 percent higher than among people 18 to 29 years old.

Social Impacts

Traditionally, in many countries, families lived in multigenerational homes with children and aging parents. Increasingly, married couples have moved away from the region where they were raised to seek jobs and opportunities. As people live longer, families face increasing social and economic challenges to care for elderly members. Positive impacts include retired grandparents assisting in raising grandchildren and maintaining a strong family unit for working parents.

Economic Impacts

An aging country will often invest in additional services for the elderly, which might result in a reduction of spending in other areas or tax increases. One of the great challenges is the increased economic expense of caring for the elderly, especially the cost of medical care and retirement income. Increasingly as a society ages, these costs are being incurred by the government and paid for by the younger generation who are working. In Stage 4 and 5 countries, like the United States and Japan, there are decreasing numbers of young people compared to retirees.

The economic benefits of a graying society are numerous. If the aging population stays healthy, they often will volunteer, continue working, and spend money in the economy, resulting in increased jobs and services for other workers. Additionally, many jobs are created in healthcare and caring for the elderly.

Dependency Ratio

Another result of an aging population is a change in the **dependency ratio** (DR), a value comparing the working to the nonworking parts of a population. Demographers consider people ages 15–64 the potential workforce, the group expected to be the society's labor force. Everyone else—people under 15 or over 64—are the **dependent population**, because they are considered too young or too old to work full-time. Put simply, the dependency ratio is a consideration

of the number of people in a population who are economically supporting the rest of the population. Dividing the potential workforce by the dependent population results in the dependency ratio. Remember, however, that because many people who are 15 to 64 do not work for pay and since many people under 15 and over 64 do work, this number is only a rough estimate. Nevertheless, it is an important reality for aging populations that fewer people will inevitably be supporting more people. (See Geographic Perspectives on page 70 for more on interpreting dependency ratio.)

CALCULATING DEPENDENCY RATIO

Country	Population by Age Group	Dependent Population (under 15 + over 64)	Dependency Ratio Calculation
United States	▪ under 15: 19% ▪ 15 to 64: 66% ▪ over 64: 15%	34%	$\frac{19 + 15}{66} = 0.52$
Niger	▪ under 15: 49% ▪ 15 to 64: 48% ▪ over 64: 3%	52%	$\frac{49 + 3}{48} = 1.08$

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *What are the causes and consequences of an aging population?*

Causes for Population Aging	Political, Economic, and Social Consequences of an Aging Population

KEY TERMS

dependency ratio

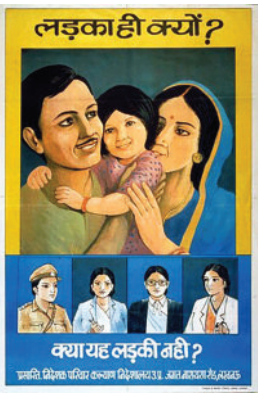
dependent population

GEOGRAPHIC PERSPECTIVES: *CHANGING THE PERCEPTION OF GIRLS*

Many countries have engaged in policies to decrease population growth and to highlight the value of a having a girl. As discussed in Topic 2.7, many countries have a gender gap in their overall population primarily because some cultures believe that boys are more valuable than girls. One of the strategies that countries employ to counter this belief is to use advertisement campaigns and create posters that illustrate the benefits of girls. The images often have visuals and symbols that represent the benefits of girls to society and to families. Visually showing people the benefits and the potential opportunities of girls is a necessity in many communities to change the perception that many people have about girls. Use the photos below to complete the directions that follow.

China

Jordan



India

Sources: pbs.org, Wikimedia Commons

China-English translation: "It's better to marry and have children at a mature age." The poster is from the Shanghai Center of Communication and Education for Family Planning.

Jordan-A photo of young girls reading at a government primary school in Amman, Jordan, from 2011.

India-English translation: "Why only a boy? Are these not girls?" The image was created by India Directorate of Family Welfare in 1993.

1. Using the images from China, describe three benefits of having a girl.
2. Using the image from Jordan, describe why showing young girls reading is an effective strategy to improve the value of girls in society.
3. Using the image from India, explain the main point that the poster conveys about girls.
4. Explain the social factors that make it necessary to show the value of girls.

THINK AS A GEOGRAPHER: *PREDICTING POPULATION CHANGE*

Geographers study patterns and trends to help them make predictions about the future. This often has very practical uses. For example, knowing where people will be living in 30 years helps communities plan their investments in roads and schools. But making predictions is very difficult because they are always based on assumptions about how much the future will look like the past.

Use data from this unit and from this chart to answer the questions that follow about how much the world population will grow.

EXAMPLES OF POPULATION GROWTH AND DECLINE

Region	Time Period	Important Event or Trend	Population Change
World	1800 to 2000	Industrialization	Total increase of about 600 percent
Europe	Late 14th century	Disease epidemic	Total decrease of about 25 percent
Americas	1492 to late 1800s	Disease epidemic	Total decrease among indigenous population of 70 to 90 percent
Russia	1987 to 1999	Political turmoil	Birthrate decrease of about 45 percent
United States	1929 to 1941	Economic depression	Birthrate decrease of about 30 percent
World	2000 to 2019	Globalization	Birthrate decrease

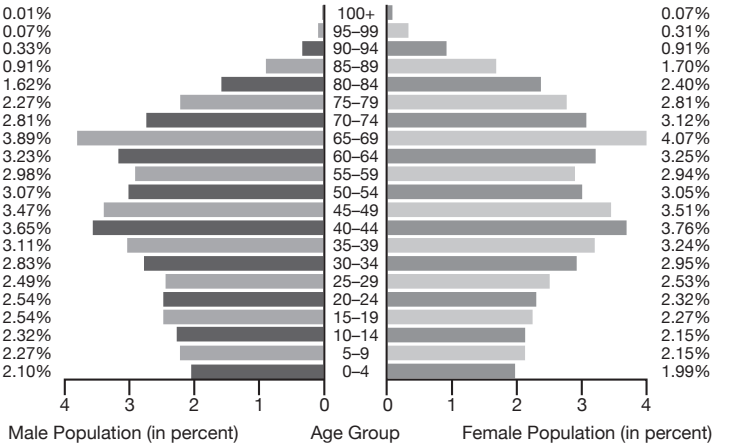
1. What evidence from this unit supports a prediction that the world population will increase at a decreasing rate for the next 100 years and then level out?
2. What evidence from the chart above supports a prediction that the growth of the world population will slow in the future?
3. How does evidence in the chart both support and disprove Malthus's theory?

CHAPTER 4 REVIEW:
Population Change

Topics 2.4–2.9

MULTIPLE-CHOICE QUESTIONS

Questions 1 through 3 refer to the population pyramid below.



1. Which stage of the demographic transition model does the population pyramid represent?

(A) Stage 1

(B) Stage 2

(C) Stage 3

(D) Stage 4

(E) Stage 5

2. Which is most likely a bigger concern for the country represented in the pyramid than for countries in other DTM stages?

(A) A greater demand for government spending on pensions and healthcare for the elderly

(B) A greater demand for government spending on education and daycare for children

(C) A higher rate of unemployment among people of working age

(D) A higher rate of emigration by people in search of jobs

(E) A faster overall population growth than in previous decades

3. What concept is illustrated by the graph's "peaks" at ages 40–44 and 65–69?
   (A) An unbalanced dependency ratio
   (B) Increasing crude birth rates over time
   (C) Increasing life expectancy
   (D) A baby boom and echo
   (E) A need for more effective family planning in certain years

4. Which change most reduced fertility rates in less-developed countries?
   (A) Building hospitals and healthcare facilities
   (B) Providing more education for girls
   (C) Implementing pronatalist policies
   (D) Discouraging the use of birth control
   (E) Promoting fundamentalist religious values

5. How do the concerns of an aging population differ from those of a population with a younger average age?
   (A) Increased concern with childcare
   (B) Increased need for pharmacies and care facilities
   (C) Less worry about a higher dependency ratio
   (D) Less worry about the need for health services
   (E) Increased need for family planning

Questions 6 and 7 refer to the chart below.

BIRTH RATES AND DEATH RATES BY LEVEL OF DEVELOPMENT

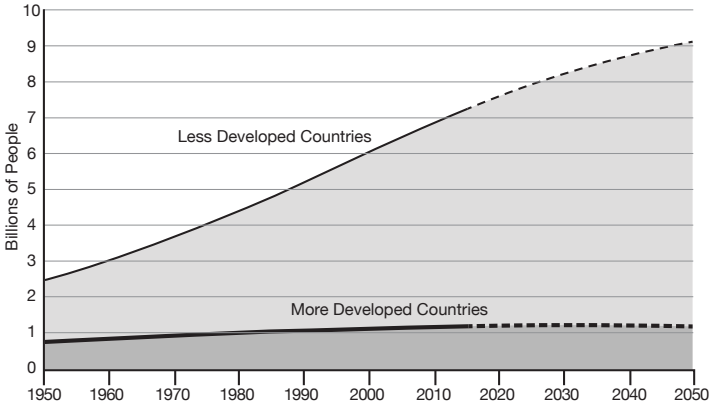
Country	Level of Development	Crude Birth Rate/ 1,000 People	Crude Death Rate/ 1,000 People
Niger	Less developed	45.5	12.4
Bangladesh	Less developed	20.0	5.7
Mexico	Developing	18.8	5.3
Australia	More developed	13.2	6.4
France	More developed	12.4	9.2

6. Which country's population has the highest rate of natural increase?
   (A) Niger
   (B) Bangladesh
   (C) Mexico
   (D) Australia
   (E) France

7. France's crude death rate is higher than Bangladesh's because
   (A) France is involved in more wars
   (B) France has more natural disasters
   (C) France has a higher percentage of elderly people
   (D) Bangladesh has a better healthcare system
   (E) Bangladesh has a higher life expectancy

FREE-RESPONSE QUESTION

POPULATION GROWTH AND DEVELOPMENT, 1950–2050



Source: Population Reference Bureau

1. Since 1950, population has grown fastest in less-developed countries, and the total fertility rate is an important indicator of population growth. Use the graph above and the map about total fertility rates on page 78 to answer the following questions.
   (A) Describe the population growth patterns of more-developed countries shown on the graph.
   (B) Explain ONE reason why the pattern in A is occurring.
   (C) Using both sources, explain ONE reason why population is growing faster in less-developed countries than in more-developed countries.
   (D) Explain ONE social consequence of uneven population growth between less- and more-developed countries.
   (E) Explain ONE economic consequences of uneven population growth between less- and more-developed countries.
   (F) Explain ONE political way that countries have attempted to lower their total fertility rate.
   (G) Describe ONE unintended consequence of the political policy in F.