

## KEY ISSUE 4

# Why Do Some Regions Face Health Threats?

- Epidemiologic Transition
- Infectious Diseases
- Health Care

### Learning Outcome 2.4.1

Summarize the four stages of the epidemiologic transition.

As world NIR slows and the threat of overpopulation recedes, at least at a worldwide scale, geographers increasingly turn their attention to the health of the record number of people who are alive. Medical researchers have identified an **epidemiologic transition** that focuses on distinctive health threats in each stage of the demographic transition. Epidemiologists rely heavily on geographic concepts such as scale and connection because measures to control and prevent an epidemic derive from understanding its distinctive distribution and method of diffusion.

## Epidemiologic Transition

The term *epidemiologic transition* comes from **epidemiology**, which is the branch of medical science concerned with the incidence, distribution, and control of diseases that are prevalent among a population at a special time and are produced by some special causes not generally present in the affected locality. The concept was originally formulated by epidemiologist Abdel Omran in 1971.

### STAGE 1: PESTILENCE AND FAMINE (HIGH CDR)

In stage 1 of the epidemiologic transition, infectious and parasitic diseases were principal causes of human deaths, along with accidents and attacks by animals and other humans. Malthus called these causes of deaths “natural checks” on the growth of the human population in stage 1 of the demographic transition.

History’s most violent stage 1 epidemic was the Black Plague (bubonic plague), which was probably transmitted to humans by fleas from migrating infected rats:

- The Black Plague originated among Tatars in present-day Kyrgyzstan.
- It diffused to present-day Ukraine when the Tatar army attacked an Italian trading post on the Black Sea.

- Italians fleeing the trading post carried the infected rats on ships west to the major coastal cities of Southeastern Europe in 1347.
- The plague diffused from the coast to inland towns and then to rural areas.
- It reached Western Europe in 1348 and Northern Europe in 1349.

About 25 million Europeans—at least one-half of the continent’s population—died between 1347 and 1350. Five other epidemics in the late fourteenth century added to the toll in Europe. In China, 13 million died from the plague in 1380.

The plague wiped out entire villages and families, leaving farms with no workers and estates with no heirs. Churches were left without priests and parishioners, schools without teachers and students. Ships drifted aimlessly at sea after entire crews succumbed to the plague.

### STAGE 2: RECEDING PANDEMICS (RAPIDLY DECLINING CDR)

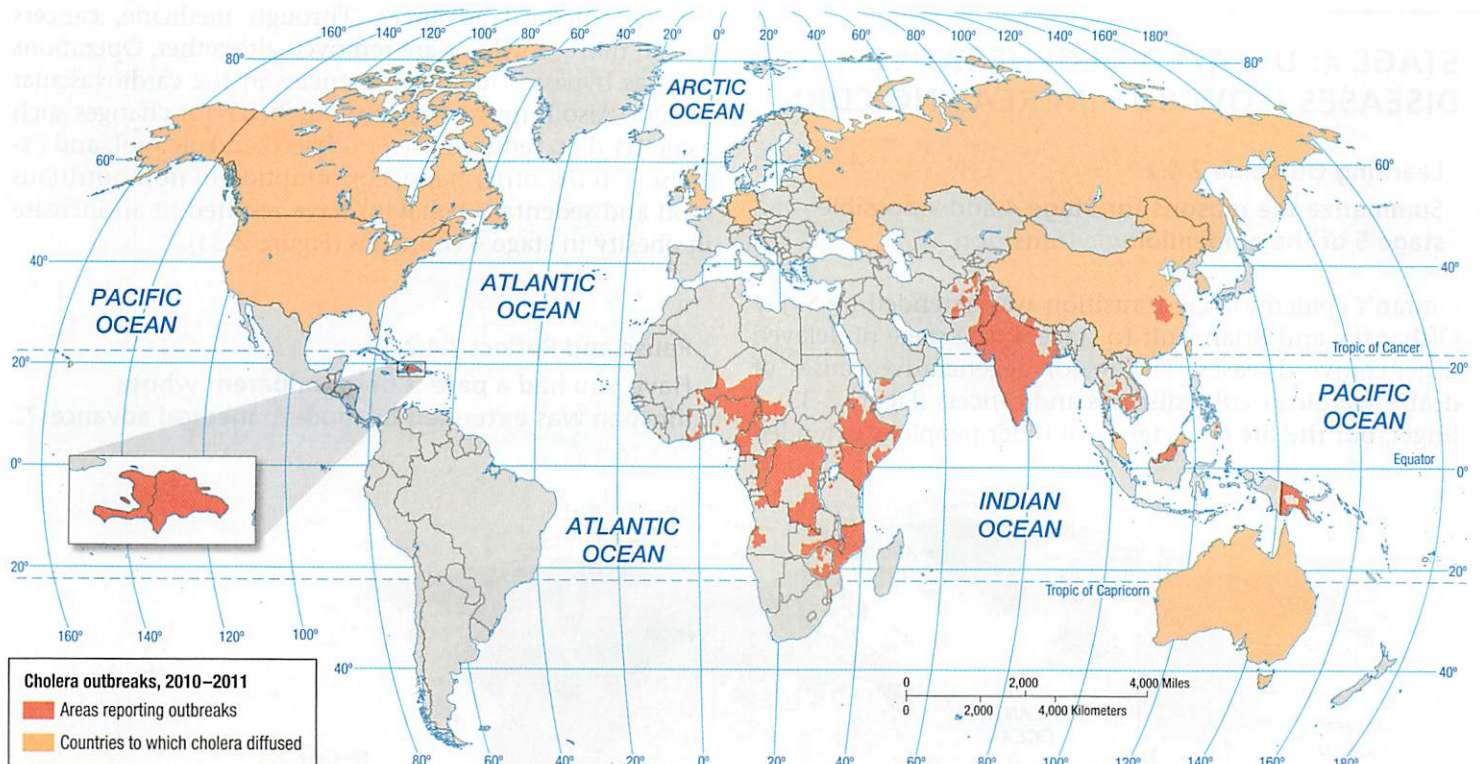
Stage 2 of the epidemiologic transition has been called the *stage of receding pandemics*. A **pandemic** is disease that occurs over a wide geographic area and affects a very high proportion of the population. Improved sanitation, nutrition, and medicine during the Industrial Revolution reduced the spread of infectious diseases. Death rates did not decline immediately and universally during the early years of the Industrial Revolution. Poor people crowded into rapidly growing industrial cities had especially high death rates. Cholera—uncommon in rural areas—became an especially virulent epidemic in urban areas during the Industrial Revolution.

Construction of water and sewer systems had eradicated cholera by the late nineteenth century. However, cholera persists in several developing regions in stage 2 of the demographic transition, especially sub-Saharan Africa and South and Southeast Asia, where many people lack access to clean drinking water (Figure 2-31). Cholera has also been found on Hispaniola, the island shared by Haiti and the Dominican Republic, especially in the wake of an earthquake in 2010 that killed 200,000 and displaced 1 million.

A computer-based Geographic Information System was invented in the twentieth century, but the idea of overlaying maps to understand human and natural patterns is much older. A century before the invention of computers, GIS helped to explain and battle stage 2 pandemics.

Dr. John Snow (1813–1858) was a British physician, not a geographer. To fight one of the worst nineteenth century pandemics, cholera, Snow created a hand-made GIS in 1854. On a map of London’s Soho neighborhood, Snow overlaid two other maps, one showing the addresses of cholera victims and the other the location of water pumps—which for the poor residents of Soho were the principal source of water for drinking, cleaning, and cooking (Figure 2-30).

The overlay maps showed that cholera victims were not distributed uniformly through Soho. Dr. Snow showed that

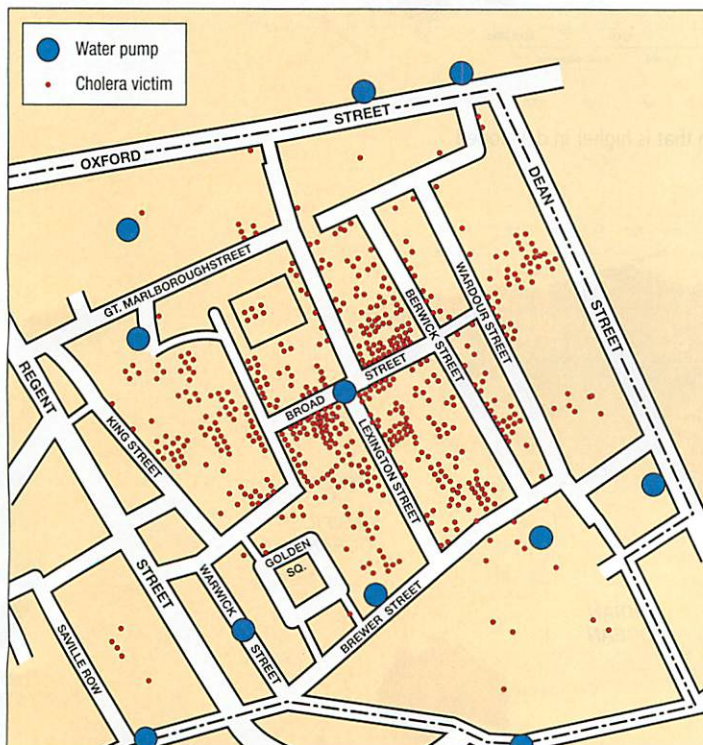


▲ **FIGURE 2-31 CHOLERA** Countries reporting cholera in recent years are found primarily in sub-Saharan Africa and South Asia.

a large percentage of cholera victims were clustered around one pump, on Broad Street. Tests at the Broad Street pump subsequently proved that the water there was contaminated. Further investigation revealed that contaminated

sewage was getting into the water supply near the pump. Although no longer operative, the contaminated pump still stands in London and can be seen in the photo on page 42.

Before Dr. Snow's geographic analysis, many believed that epidemic victims were being punished for sinful behavior and that most victims were poor because poverty was considered a sin. Now we understand that cholera affects the poor because they are more likely to have to use contaminated water.



▲ **FIGURE 2-32 SIR JOHN SNOW'S CHOLERA MAP** In 1854, Dr. John Snow mapped the distribution of cholera victims and water pumps to prove that the cause of the infection was contamination of the pump near the corner of Broad and Lexington streets.

### STAGE 3: DEGENERATIVE DISEASES (MODERATELY DECLINING CDR)

Stage 3 of the epidemiologic transition, the stage of degenerative and human-created diseases, is characterized by a decrease in deaths from infectious diseases and an increase in chronic disorders associated with aging. The two especially important chronic disorders in stage 3 are cardiovascular diseases, such as heart attacks, and various forms of cancer. The global pattern of cancer is the opposite of that for stage 2 diseases; sub-Saharan Africa and South Asia have the lowest incidence of cancer, primarily because of the relatively low life expectancy in those regions.

#### Pause and Reflect 2.4.1

In what climate zone are most of the countries that have experienced cholera recently?

## STAGE 4: DELAYED DEGENERATIVE DISEASES (LOW BUT INCREASING CDR)

### Learning Outcome 2.4.2

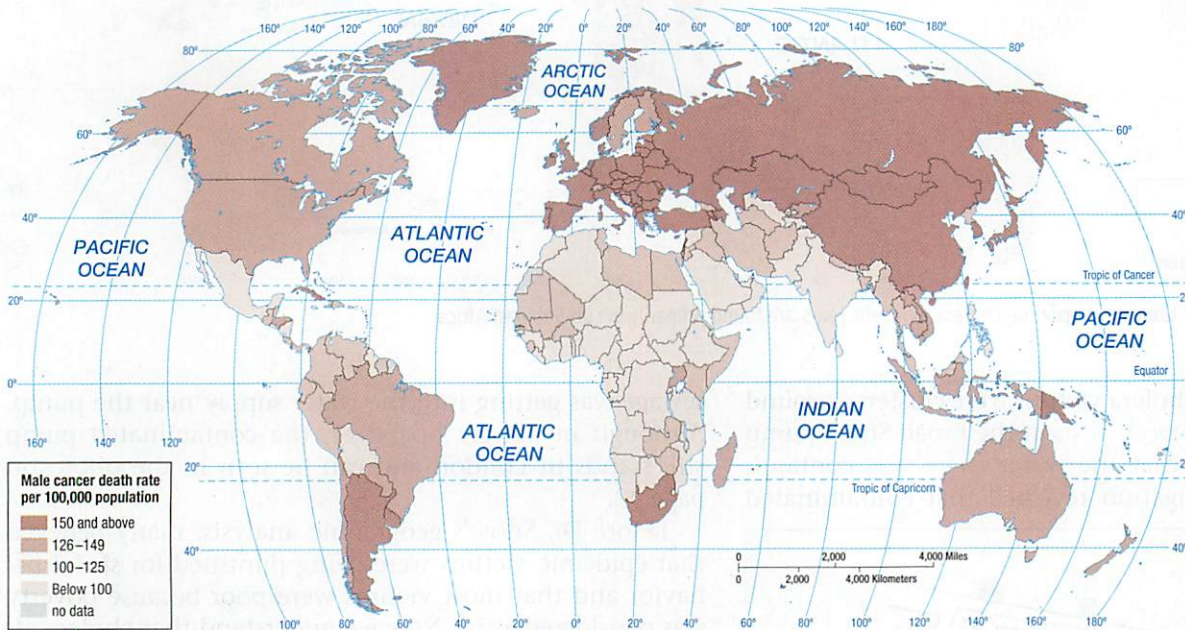
Summarize the reasons for Stage 4 and a possible stage 5 of the epidemiologic transition.

Omran’s epidemiologic transition was extended by S. Jay Olshansky and Brian Ault to stage 4, the stage of delayed degenerative diseases. The major degenerative causes of death—cardiovascular diseases and cancers (Figure 2-33)—linger, but the life expectancy of older people is extended

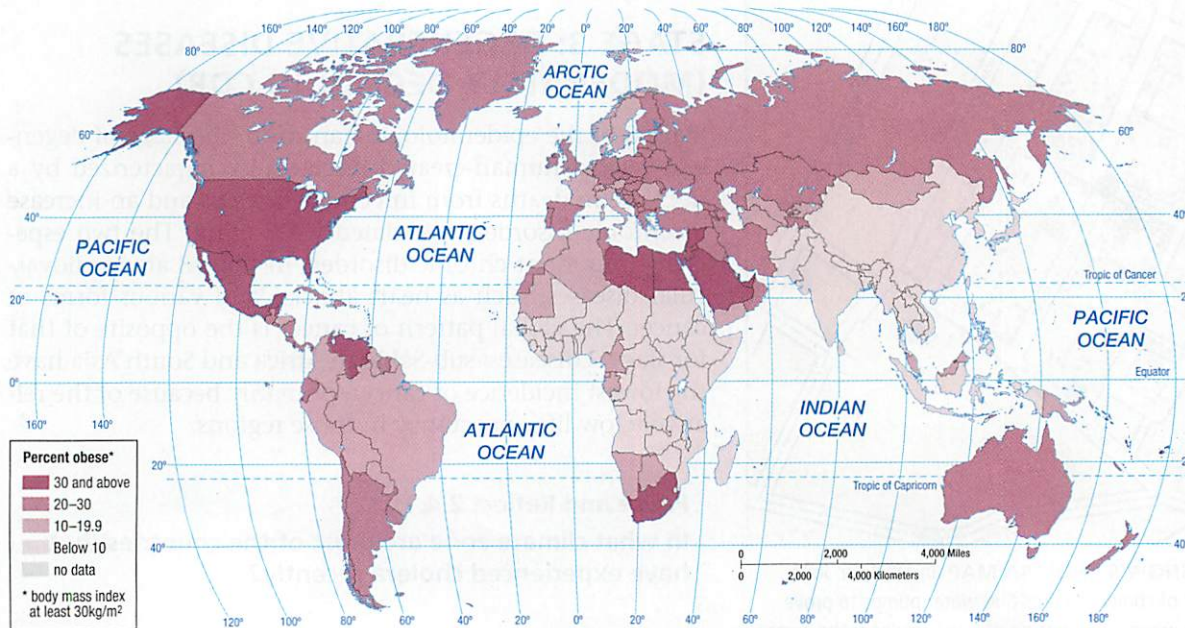
through medical advances. Through medicine, cancers spread more slowly or are removed altogether. Operations such as bypasses repair deficiencies in the cardiovascular system. Also improving health are behavior changes such as better diet, reduced use of tobacco and alcohol, and exercise. On the other hand, consumption of non-nutritious food and sedentary behavior have resulted in an increase in obesity in stage 4 countries (Figure 2-34).

### Pause and Reflect 2.4.2

Have you had a parent or grandparent whose lifespan was extended by modern medical advances?



▲ FIGURE 2-33 MALE CANCER Cancer is an example of a cause of death for men that is higher in developed countries than in developing ones.



▲ FIGURE 2-34 OBESITY Obesity is a health problem in the United States and in Southwest Asia.

## Infectious Diseases

Recall that in the possible stage 5 of the demographic transition, CDR rises because more of the population is elderly. Some medical analysts argue that the world is moving into stage 5 of the epidemiologic transition, brought about by a reemergence of infectious and parasitic diseases. Infectious diseases thought to have been eradicated or controlled have returned, and new ones have emerged. A consequence of stage 5 would be higher CDRs. Other epidemiologists dismiss recent trends as a temporary setback in a long process of controlling infectious diseases.

In a possible stage 5, infectious diseases thought to have been eradicated or controlled return, and new ones emerge. Three reasons help to explain the possible emergence of a stage 5 of the epidemiologic transition: evolution, poverty, and increased connections.

### REASON FOR POSSIBLE STAGE 5: EVOLUTION

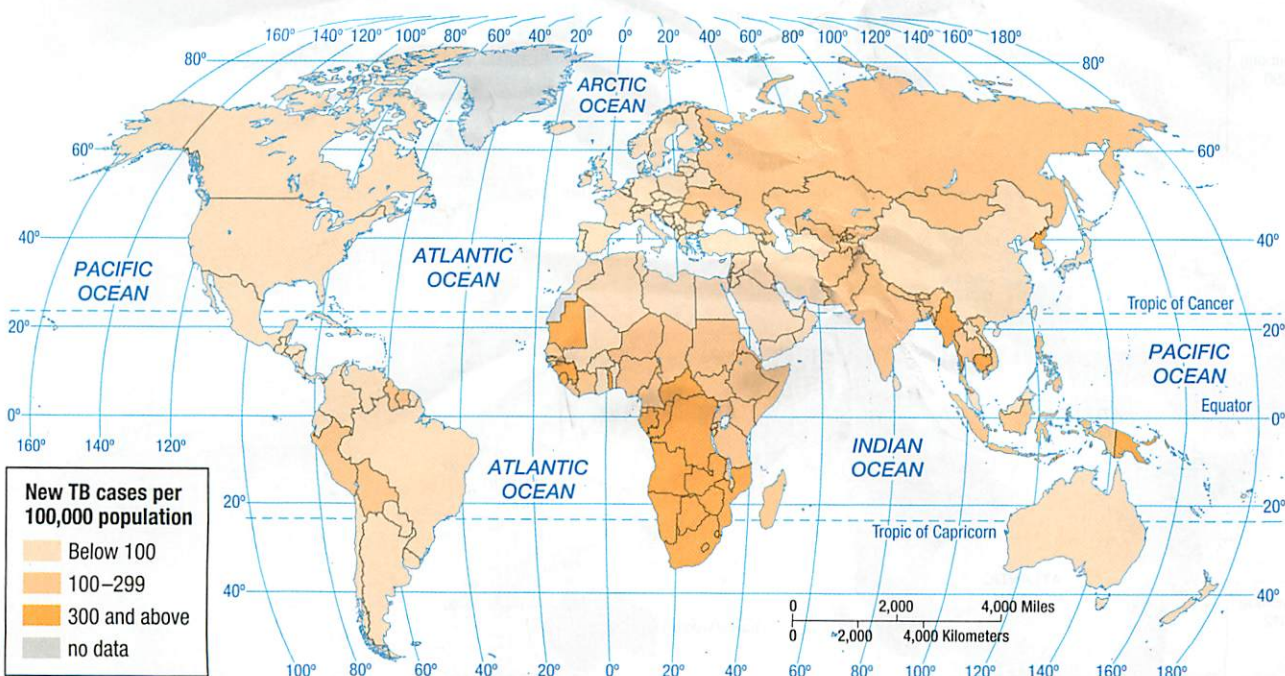
Infectious disease microbes have continuously evolved and changed in response to environmental pressures by developing resistance to drugs and insecticides. Antibiotics and genetic engineering contribute to the emergence of new strains of viruses and bacteria.

Malaria was nearly eradicated in the mid-twentieth century by spraying DDT in areas infested with the mosquito that carried the parasite. For example, new malaria cases in Sri Lanka fell from 1 million in 1955 to 18 in 1963. The disease returned after 1963, however, and now causes more than 1 million deaths worldwide annually. A major reason was the evolution of DDT-resistant mosquitoes.

### REASON FOR POSSIBLE STAGE 5: POVERTY

Infectious diseases are more prevalent in poor areas than other places because unsanitary conditions may persist, and most people can't afford the drugs needed for treatment. Tuberculosis (TB) is an example of an infectious disease that has been largely controlled in developed countries but remains a major cause of death in developing countries (Figure 2-35). An airborne disease that is often called "consumption" and that damages the lungs, TB spreads principally through coughing and sneezing. TB was one of the principal causes of death among the urban poor in the nineteenth century during the Industrial Revolution.

The death rate from TB declined in the United States from 200 per 100,000 in 1900 to 60 in 1940 and 4 today. However, in developing countries, the TB rate is more than 10 times higher than in developed countries, and nearly 2 million people worldwide die from it annually. TB is more prevalent in poor areas because the long, expensive treatment poses a significant economic burden. Patients stop taking the drugs before the treatment cycle is completed.



▲ **FIGURE 2-35 TUBERCULOSIS (TB) CASES** Death from tuberculosis is a good indicator of a country's ability to invest in health care, because treating the disease is expensive.

## REASON FOR POSSIBLE STAGE 5: INCREASED CONNECTIONS

### Learning Outcome 2.4.3

Describe the diffusion of AIDS.

Several dozen “new” pandemics, such as H1N1 (swine) flu and severe acute respiratory syndrome (SARS), have emerged over the past three decades and have spread through the process of relocation diffusion, discussed in Chapter 1. Motor vehicles allow rural residents to have greater connections with urban areas and for urban residents to easily reach rural areas. Airplanes allow residents of one country to easily connect with people in other countries. As they travel, people carry diseases with them and are exposed to the diseases of others.

The most lethal pandemic in recent years has been AIDS (acquired immunodeficiency syndrome). Worldwide, 30 million people died of AIDS from the beginning of the epidemic through 2010, and 34 million were living with HIV (human immunodeficiency virus, the cause

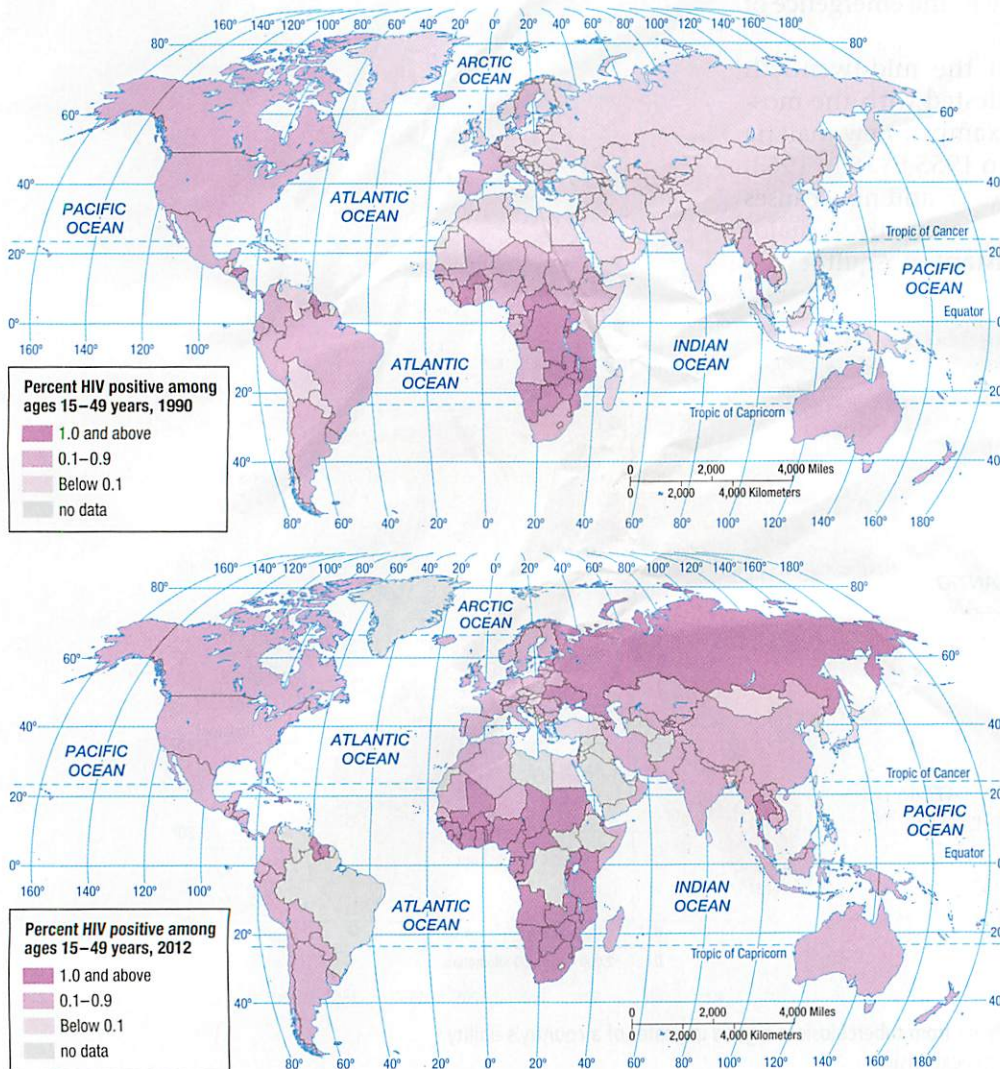
of AIDS). The impact of AIDS has been felt most strongly in sub-Saharan Africa, home to 23 million of the world’s 34 million HIV-positive people (Figure 2-36).

AIDS diffused from sub-Saharan Africa through relocation diffusion, both by Africans and by visitors to Africa returning to their home countries. AIDS entered the United States during the early 1980s through New York, California, and Florida (Figure 2-37). Not by coincidence, the three leading U.S. airports for international arrivals are in these three states (Figure 2-38). Though AIDS diffused to every state during the 1980s, these three states, plus Texas (a major port of entry by motor vehicle), accounted for half of the country’s new AIDS cases in the peak year of 1993.

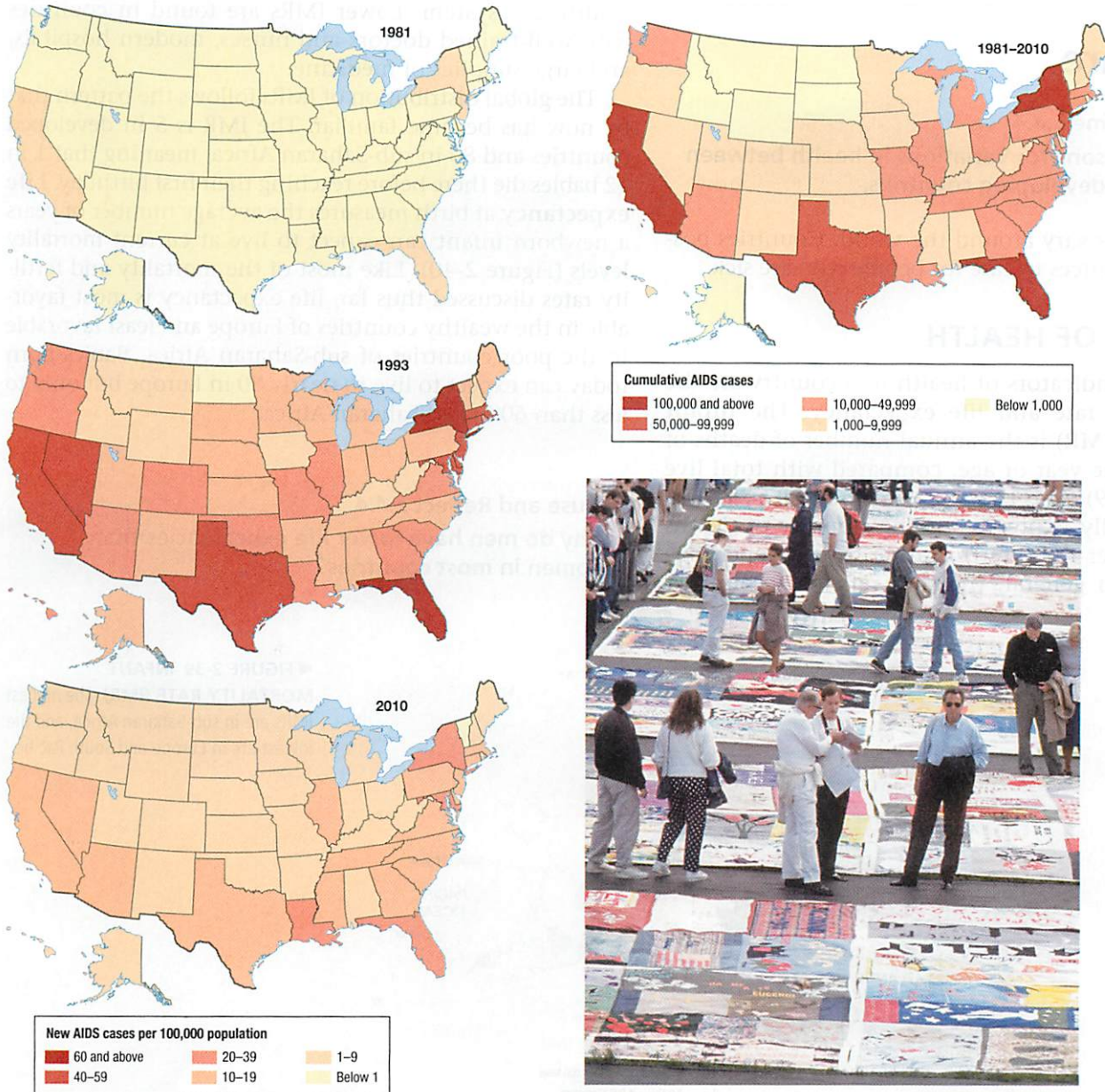
The number of new AIDS cases dropped rapidly in the United States during the 1990s and in sub-Saharan Africa in the 2000s. The decline resulted from the rapid diffusion of preventive methods and medicines such as AZT. The rapid spread of these innovations is an example of expansion diffusion rather than relocation diffusion.

### Pause and Reflect 2.4.3

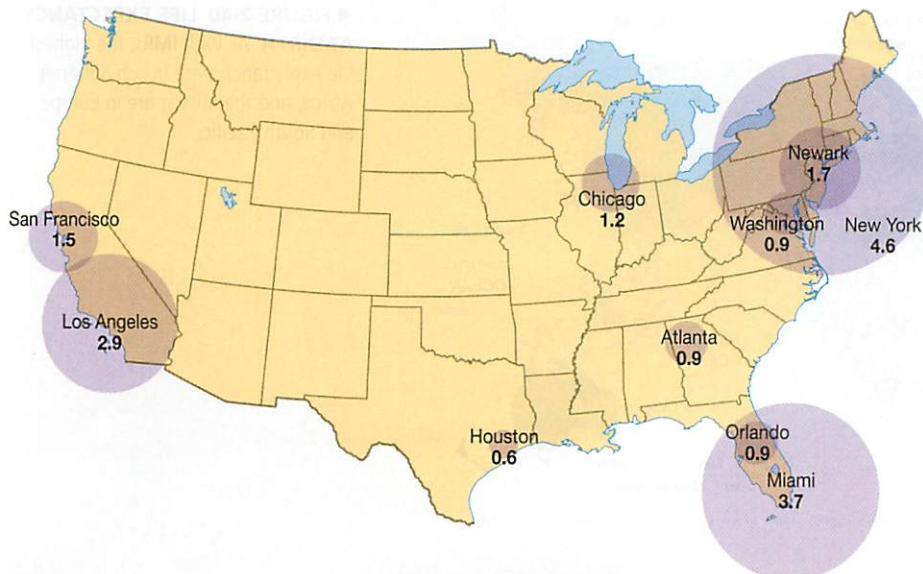
Have other pandemic diseases diffused rapidly in recent years?



◀ **FIGURE 2-36 DIFFUSION OF HIV/AIDS** The highest rates of HIV infection are in sub-Saharan Africa and Russia.



▲ **FIGURE 2-37 DIFFUSION OF HIV/AIDS IN THE UNITED STATES** AIDS diffused from states with relatively high immigration rates, such as California, Florida, and New York. The AIDS Memorial Quilt was assembled as a memorial to people who have died of AIDS.



◀ **FIGURE 2-38 INTERNATIONAL PASSENGER ARRIVALS AT U.S. AIRPORTS 2011** Because AIDS arrived in the United States primarily through air travelers, the pattern of diffusion of AIDS in Figure 2-37 closely matches the distribution of international air passenger arrivals.

## Health Care

### Learning Outcome 2.4.4

Understand reasons for variations in health between developed and developing countries.

Health conditions vary around the world. Countries possess different resources to care for people who are sick.

### INDICATORS OF HEALTH

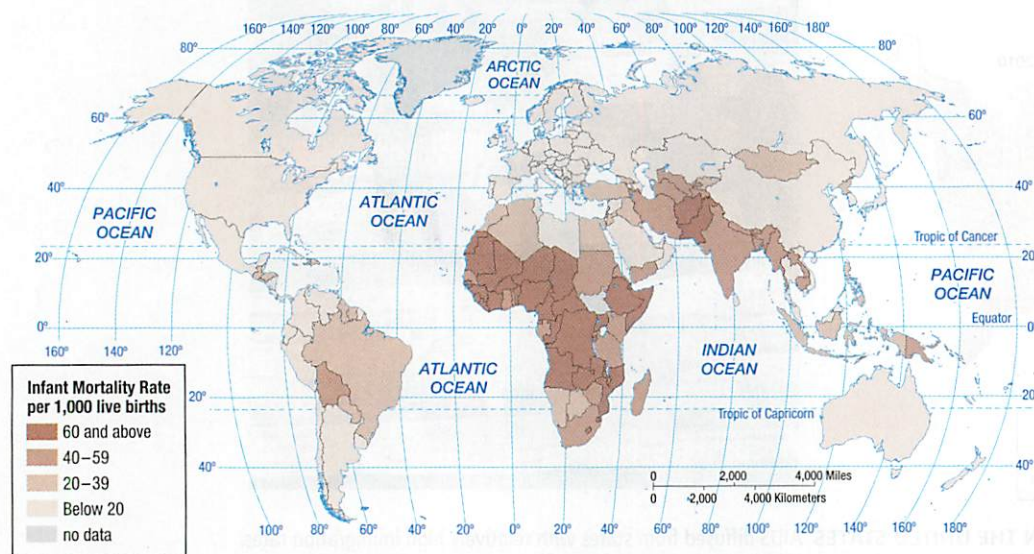
Two important indicators of health in a country are the infant mortality rate and life expectancy. The **infant mortality rate (IMR)** is the annual number of deaths of infants under one year of age, compared with total live births (Figure 2-39). As is the case with the CBR and CDR, the IMR is usually expressed as the number of deaths among infants per 1,000 births rather than as a percentage (per 100). In general, the IMR reflects a country's

health-care system. Lower IMRs are found in countries with well-trained doctors and nurses, modern hospitals, and large supplies of medicine.

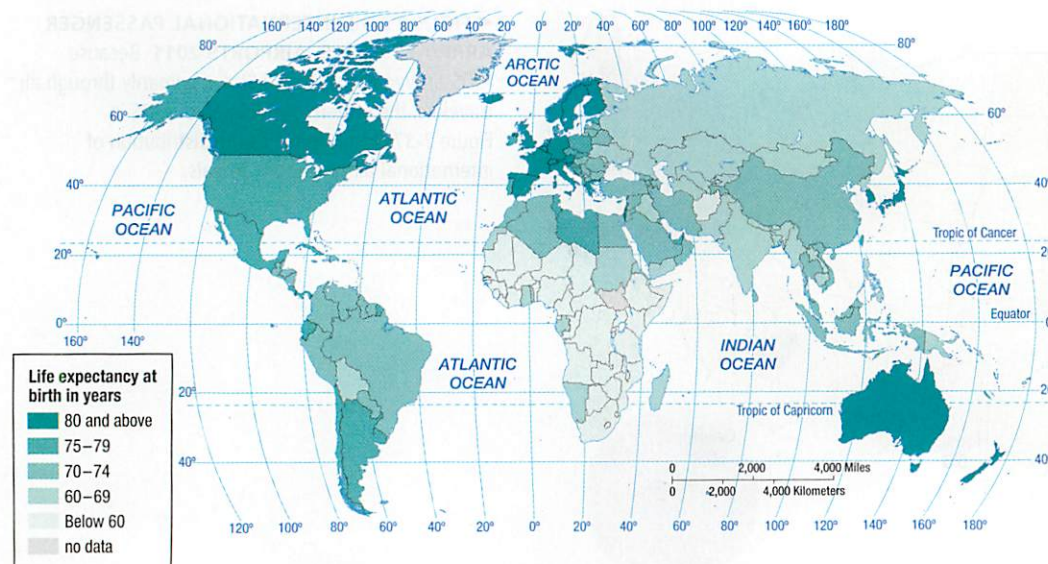
The global distribution of IMRs follows the pattern that by now has become familiar. The IMR is 5 in developed countries and 80 in sub-Saharan Africa, meaning that 1 in 12 babies die there before reaching their first birthday. **Life expectancy at birth** measures the average number of years a newborn infant can expect to live at current mortality levels (Figure 2-40). Like most of the mortality and fertility rates discussed thus far, life expectancy is most favorable in the wealthy countries of Europe and least favorable in the poor countries of sub-Saharan Africa. Babies born today can expect to live to nearly 80 in Europe but only to less than 60 in sub-Saharan Africa.

### Pause and Reflect 2.4.4

Why do men have lower life expectancies than women in most countries?



◀ **FIGURE 2-39 INFANT MORTALITY RATE (IMR)** The highest IMRs are in sub-Saharan Africa, and the lowest are in Europe and South Pacific.



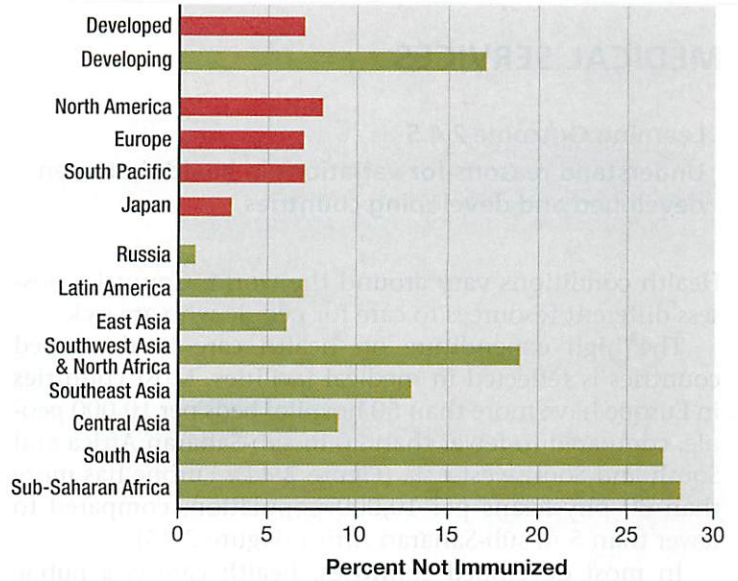
◀ **FIGURE 2-40 LIFE EXPECTANCY AT BIRTH** As with IMRs, the highest life expectancies are in sub-Saharan Africa, and the lowest are in Europe and South Pacific.

## PROVISION OF HEALTH CARE

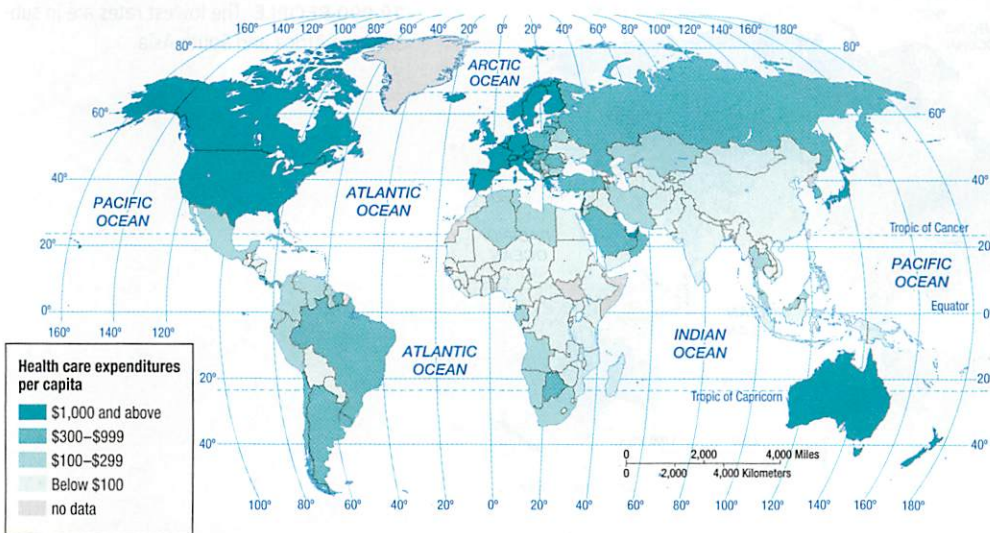
Even if they survive infancy, children remain at risk in developing countries. For example, 17 percent of children in developing countries are not immunized against measles, compared to 7 percent in developed countries. More than one-fourth of children lack measles immunization in South Asia and sub-Saharan Africa (Figure 2-41).

Developed countries use part of their wealth to protect people who, for various reasons, are unable to work. In these countries, some public assistance is offered to those who are sick, elderly, poor, disabled, orphaned, veterans of wars, widows, unemployed, or single parents. Annual per capita expenditure on health care exceeds \$1,000 in Europe and \$5,000 in the United States, compared to less than \$100 in sub-Saharan Africa and South Asia (Figure 2-42).

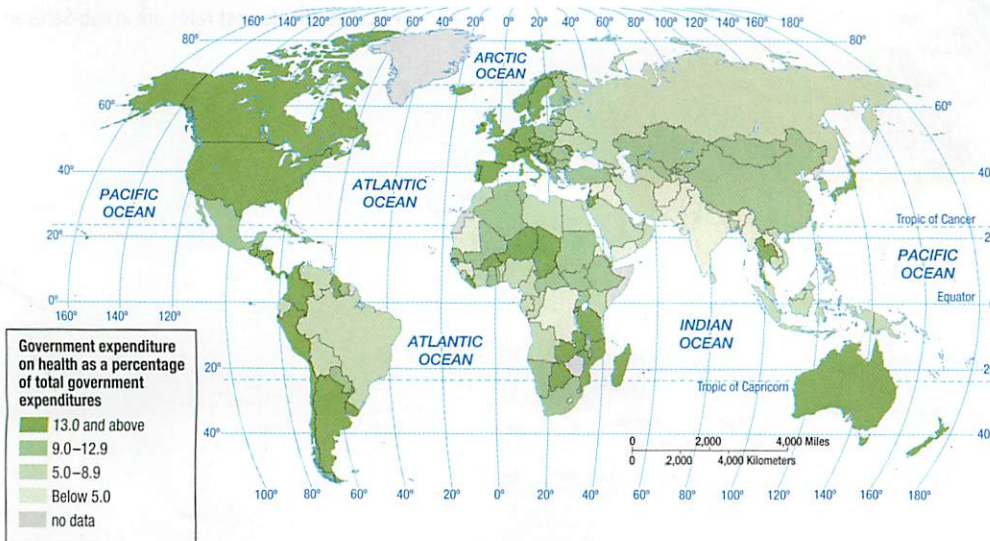
Expenditures on health care exceed 15 percent of total government expenditures in Europe and North America compared to less than 5 percent in sub-Saharan Africa and South Asia (Figure 2-43). Countries in Northern Europe, including Denmark, Norway, and Sweden, typically provide the highest level of public-assistance payments. So not only do developed countries spend more on health care, they spend a higher percentage of their wealth on health care.



**▲ FIGURE 2-41 CHILDREN LACKING MEASLES IMMUNIZATION**  
The lowest rates of immunization are in sub-Saharan Africa and South Asia.



**◀ FIGURE 2-42 HEALTH CARE EXPENDITURES** The lowest levels of per capita health care expenditure are in sub-Saharan Africa and South Asia.



**◀ FIGURE 2-43 GOVERNMENT EXPENDITURES ON HEALTH CARE** The lowest levels of government expenditures are in Africa and Asia.



## MEDICAL SERVICES

### Learning Outcome 2.4.5

Understand reasons for variations in health between developed and developing countries.

Health conditions vary around the world. Countries possess different resources to care for people who are sick.

The high expenditure on health care in developed countries is reflected in medical facilities. Most countries in Europe have more than 50 hospital beds per 10,000 people, compared to fewer than 20 in sub-Saharan Africa and South and Southwest Asia (Figure 2-44). Europe has more than 30 physicians per 10,000 population, compared to fewer than 5 in sub-Saharan Africa (Figure 2-45).

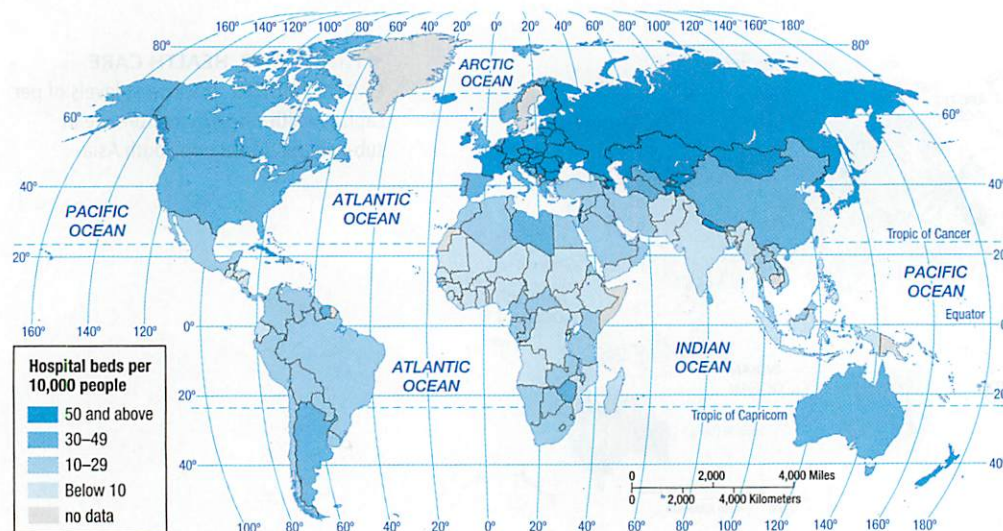
In most developed countries, health care is a public service that is available at little or no cost. Government programs pay more than 70 percent of health-care costs in most European countries, and private individuals pay less than 30 percent. In developing countries, private individuals must pay more than half of the cost of health

care (Figure 2-46). An exception to this pattern is the United States, a developed country where private individuals are required to pay an average of 55 percent of health care, more closely resembling the pattern in developing countries.

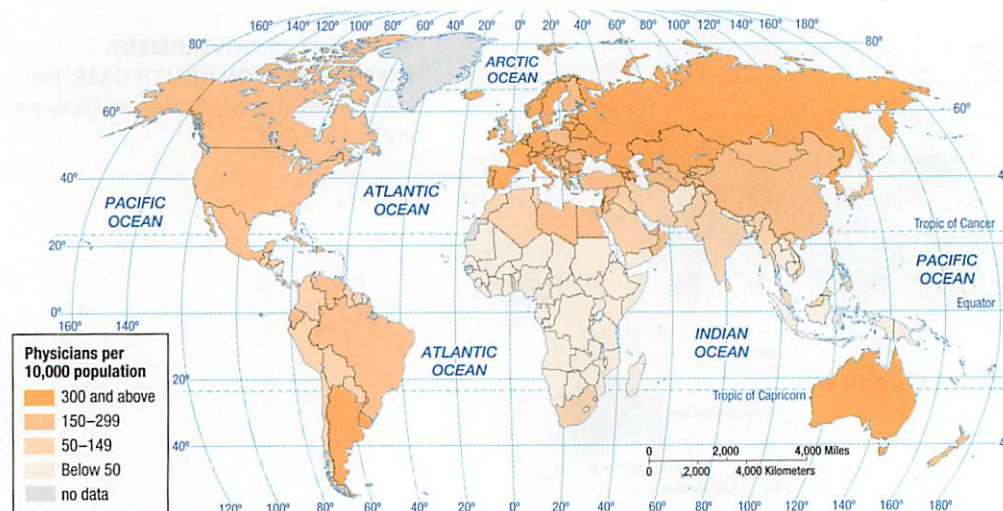
Developed countries are hard-pressed to maintain their current levels of public assistance. In the past, rapid economic growth permitted these states to finance generous programs with little difficulty. But in recent years economic growth has slowed, while the percentage of people needing public assistance has increased. Governments have faced a choice between reducing benefits and increasing taxes to pay for them. In some of the poorest countries, threats to health and sustainability are not so much financial as environmental. For a case in point, read the following Sustainability and Inequality in Our Global Village feature.

### Pause and Reflect 2.4.5

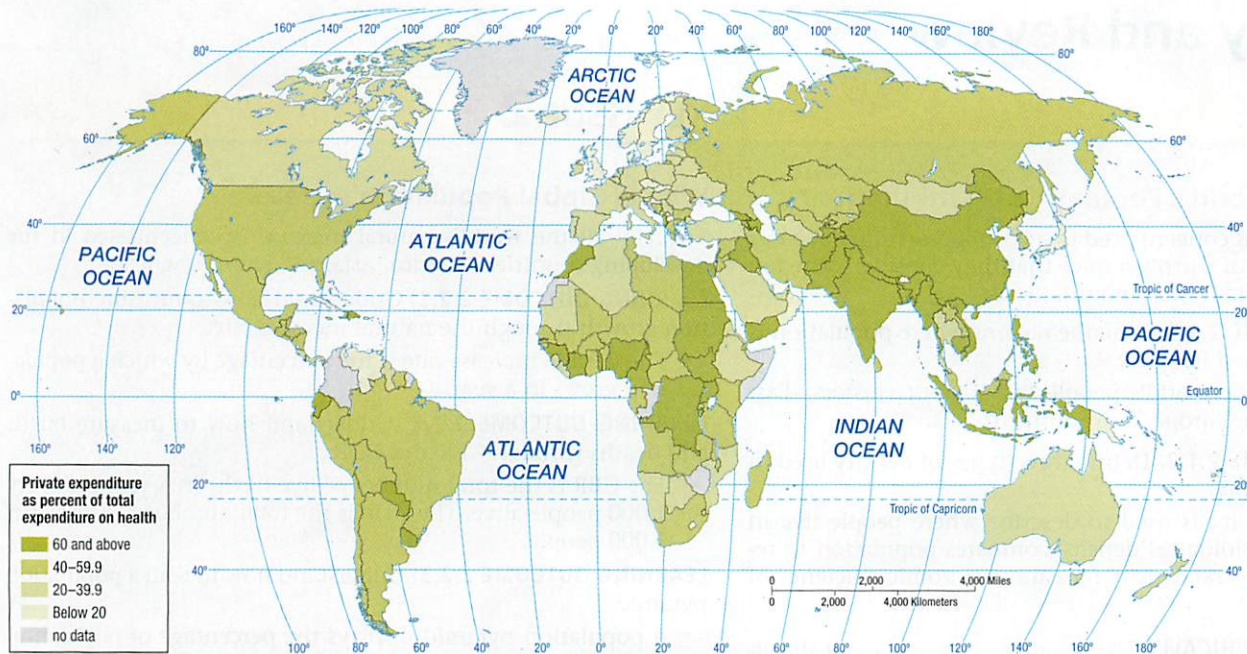
Why might levels of hospital beds and physicians be lower in North America than in other developed countries?



◀ FIGURE 2-44 HOSPITAL BEDS PER 10,000 PEOPLE The lowest rates are in sub-Saharan Africa and South Asia.



◀ FIGURE 2-45 PHYSICIANS PER 10,000 PEOPLE The lowest rates are in sub-Saharan Africa.



**▲ FIGURE 2-46 PUBLIC EXPENDITURES ON HEALTH CARE AS A SHARE OF TOTAL HEALTH CARE EXPENDITURES** The highest percentages are in Europe.

## SUSTAINABILITY AND INEQUALITY IN OUR GLOBAL VILLAGE

# Overpopulation in Sub-Saharan Africa

Overpopulation—too many people for the available resources—does not appear to be an immediate threat to the world, even in India, where the seven billionth human was said to have been born on October 31, 2011 (Figure 2-47). However, it does threaten areas within sub-Saharan Africa.

Sub-Saharan Africa was not classified in Key Issue 1 as one of the world's population concentrations. Geographers caution that the size, density, or clustering of population in a region is not an indication of overpopulation. Instead, overpopulation is a relationship between population and a region's level of resources. The capacity of the land to sustain life derives partly from characteristics of the



**▲ FIGURE 2-47 THE WORLD'S SEVEN BILLIONTH HUMAN**

Nargis Kumar, born October 31, 2011, to Vinita and Ajay Kumar, of Lucknow, India, was declared the world's seven billionth person by Plan International, a nongovernmental organization for children's welfare.

natural environment and partly from human actions to modify the environment through agriculture, industry, and exploitation of raw materials. See for example, the image of Mali on page 44.

The track toward overpopulation may already be irreversible in Africa. Rapid population growth has led to the inability of the land to sustain life in parts of the region. As the land declines in quality, more effort is needed to yield the same amount of crops. This extends the working day of women, who have the primary responsibility for growing food for their families. Women then regard having another child as a means of securing additional help in growing food.

### CHECK IN: KEY ISSUE 4

#### Why Do Some Regions Face Health Threats?

- ✓ The epidemiologic transition has four stages of distinctive diseases.
- ✓ A resurgence of infectious diseases may signal a possible stage 5 of the epidemiologic transition.
- ✓ The provision of health care varies sharply between developed and developing countries.