

CHAPTER 2

Health Determinants, Measurements, and Trends

LEARNING OBJECTIVES

By the end of this chapter the reader will be able to:

- Describe the determinants of health
- Define the most important health indicators
- Discuss the differences between incidence and prevalence; morbidity, disability, and mortality; and noncommunicable and communicable diseases
- Discuss the concepts of health adjusted life expectancy (HALE), disability adjusted life years (DALYs), and the burden of disease
- Describe the leading causes of death in low-, middle-, and high-income countries
- Describe the demographic and epidemiological transitions

VIGNETTES

Shawki is a 60-year-old Jordanian man who lives in Jordan's capital of Amman. Unfortunately, Shawki's health has deteriorated in the last year. His blood pressure and cholesterol are too high. He has developed diabetes. He is sometimes short of breath. What are the causes of his ill and declining health? Do these problems stem from any genetic issues? Could they come from a lack of understanding about a healthy lifestyle and diet? Could it be that Shawki lacks the income he needs to eat properly and to ensure that he gets health checkups when he needs them?

Life expectancy in Botswana prior to the spread of HIV/AIDS was about 65 years.¹ In 2009, life expectancy in Botswana was 49 years.² Life expectancy in Russia in 1985 was about 64 years for males and 74 years for females. By 2001, however, it had fallen to about 59 years for males and

72 years for females, although by 2009 it had risen to 61 for males and 74 for females.²

What does life expectancy measure? What are the factors contributing to its decline in both of these countries? What has happened to trends in life expectancy in other countries? Which countries have the longest and shortest life expectancies, and why?

In Cambodia in 2008, families had, on average, 2.9 children³ and their life expectancy was about 61 years.⁴ Thirty years ago, the demographic and epidemiological profile of Thailand looked a lot like Cambodia looks today. Today, however, Thai families have on average about 1.8 children⁵ and those children on average will live 69 years. Children in Thailand rarely die, and when they do, 50 percent of them die from injury.⁶ What causes these shifts in fertility and mortality? Do they occur consistently as countries develop economically? How long will it take before Cambodia has the same fertility and disease burden that Thailand has today?

In Peru, poor people tend to live in the mountains, and be indigenous, less educated, and have worse health status than other people. In Eastern Europe, the same issues occur among their ethnic groups that are of lower socioeconomic status, such as the Roma people. In the United States, there are also enormous health disparities, as seen in the relative health status of African Americans and Native Americans. If one wants to understand and address differences in health status among different groups, then how do we have to measure health status? Do we measure it by age? By gender? By socioeconomic status? By level of education? By ethnicity? By location?

THE IMPORTANCE OF MEASURING HEALTH STATUS

If we want to understand the most important global health issues and what can be done to address them, then we must understand what factors have the most influence on health status, how health status is measured, and what key trends in health status have occurred historically. We must, in fact, be able to answer the questions that are posed in the narratives above.

This chapter, therefore, covers four distinct, but closely related topics. The first section concerns what are called “the determinants of health.” That section examines the most important factors that relate to people’s health status. The second section reviews some of the most important indicators of health status and how they are used. The third section discusses the burden of disease worldwide and how it varies across countries. The last section looks at how fertility and mortality change as countries become more developed and what this means for the types of health problems countries face.

THE DETERMINANTS OF HEALTH

Why are some people healthy and some people not healthy? When asked this question, many of us will respond that good health depends on access to health services. Yet, as you will learn, whether or not people are healthy depends on a large number of factors, many of which are interconnected, and most of which go considerably beyond access to health services.

There has been considerable writing about the “determinants of health,” and one way of depicting these determinants is shown in Figure 2-1. The next section largely follows the approach to the determinants of health that is discussed in “What Determines Health” by the Public Health Agency of Canada⁶

The first group of factors that helps to determine health relates to the personal and inborn features of individuals. These include genetic makeup, sex, and age. Our genetic makeup has much to do with what diseases we get and how healthy we live. One can inherit, for example, a genetic marker for a particular disease, such as Huntington’s disease, which is a neurological disorder. One can also inherit the genetic component of a disease that has multiple causes, such as breast cancer. Sex also has an important relationship with health. Men and women are physically different, for example, and may get different diseases. Women face the risk of childbearing. They also get cervical and uterine cancers that men do not get. Women also have higher rates of certain health conditions, such as thyroid and breast cancers. For similar reasons, age is also an important determinant of

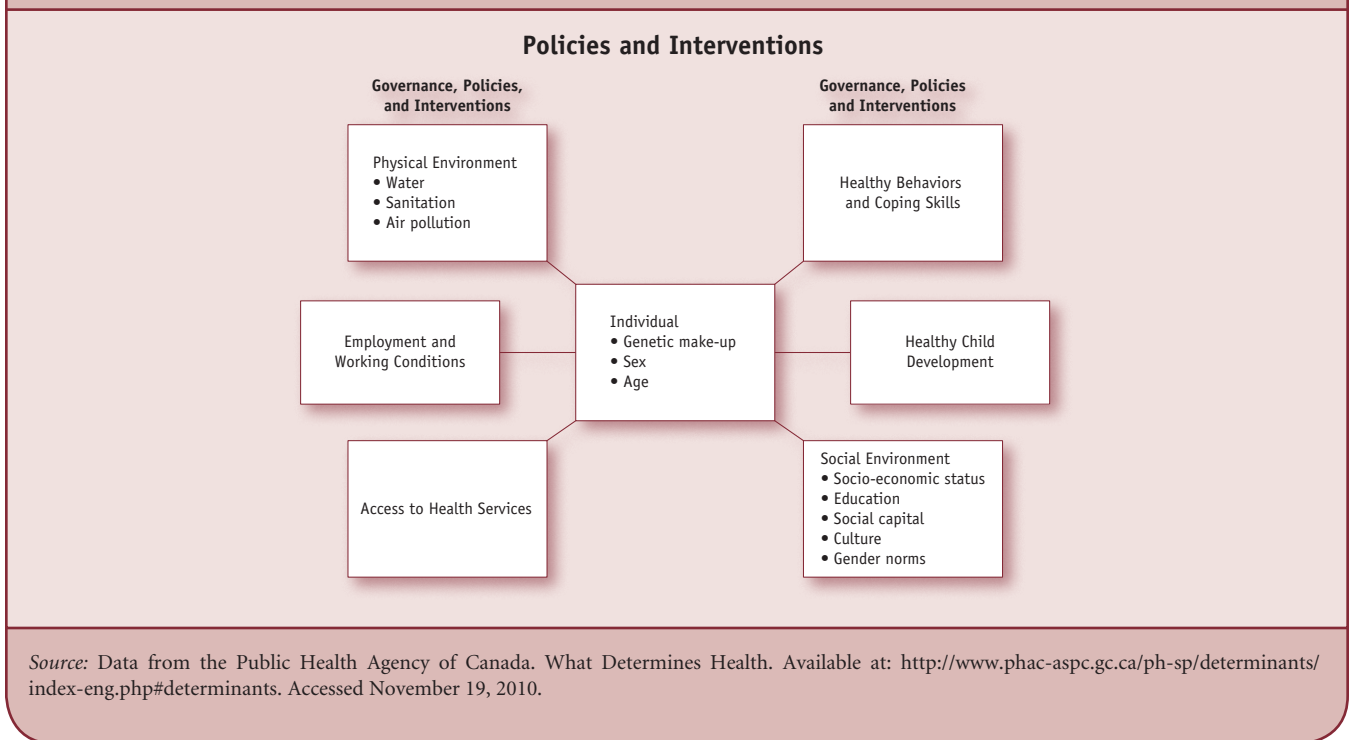
health. Young children in developing countries often die of diarrheal disease, whereas older people are much more likely to die of heart disease, to cite one of many examples of the relationship between health and age.

Social and cultural issues also play important roles in determining health. Social status is an important health determinant. There is good evidence that people of higher social status have more control over their lives than people of lower status, and people of higher social status also tend to have higher incomes and education, both of which are strongly correlated with better health⁷ In addition, the gender roles that are ascribed to women in many societies also have an important impact on health. In such environments, women may be less well treated than men and this, in turn, may mean that women have less income, less education, and fewer opportunities to engage in safe employment. All of these militate against their good health.

The extent to which people get social support from family, friends, and community has also been shown to have an important link with health.⁷ The stronger the social networks and the stronger the support that people get from those networks, the healthier people will be. Of course, culture is also an extremely important determinant of health.⁷ Culture helps to determine how one feels about health and illness, how one uses health services, and the health practices in which one engages.

The environment, both indoor and outdoor, is also a powerful determinant of health. Related to this is the safety of the environment in which people work. Although many people know about the importance of outdoor air pollution to health, few people are aware of the importance of indoor air pollution to health. In many developing countries, women cook indoors with very poor ventilation, thereby creating an indoor environment that is full of smoke and that encourages respiratory illness and asthma. The lack of safe drinking water and sanitation is a major contributor to ill health in poor countries. In addition, many people in those same countries work in environments that are very unhealthy. Because they lack skills, social status, and opportunities, they may work without sufficient protection with hazardous chemicals, in polluted air, or in circumstances that expose them to occupational accidents.

Education is a powerful determinant of health for several reasons. First, it brings with it knowledge of good health practices. Second, it provides opportunities for gaining skills, getting better employment, raising one’s income, and enhancing one’s social status, all of which are also related to health. Studies have shown, for example, that the single best predictor of the birth weight of a baby is the level of

FIGURE 2-1 Key Determinants of Health

educational attainment of the mother.⁸ Most of us already know that throughout the world, there is an extremely strong and positive correlation between the level of education and all key health indicators. People who are better educated eat better, smoke less, are less obese, have fewer children, and take better care of their children's health than do people with less education. It is not a surprise, therefore, that they and their children live longer and healthier lives than do less well educated people and their children.

Of course, people's own health practices and behaviors are also critical determinants of their health. Being able to identify when you or a family member is ill and needs health care can be critical to good health. As noted previously, however, one's health also depends on how one eats, or if one smokes, drinks too much alcohol, or drives safely. We also know that being active physically and getting exercise regularly is better for one's health than is being sedentary.

Another important determinant of future health is the way in which families nourish and care for infants and young children. Being born premature or of low birthweight can have important negative consequences on health. There is a strong correlation between the nutritional status of infants and young children and the extent to which they meet their

biological potentials, enroll in school, or stay in school. In addition, poor nutritional status in infancy and young childhood may be linked with a number of chronic diseases, including diabetes and heart disease.⁹

Of course, one's health does depend on access to appropriate healthcare services. Even if one is born healthy, raised healthy, and engages in good health behaviors, there will still be times when one has to call on a health system for help. The more likely you are to access services of appropriate quality, the more likely you are to stay healthy. To address the risk of dying from a complication of pregnancy, for example, one must have access to health services that can carry out an emergency cesarean section if necessary. Even if the mother has had the suggested level of prenatal care and has prepared well in all other respects for the pregnancy, in the end, certain complications can only be addressed in a healthcare setting.

The approach that governments take to different policies and programs in the health sector and in other sectors has an important bearing on people's health. People living in a country that promotes high educational attainment, for example, will be healthier than people in a country that does not promote widespread education of appropriate quality,

because better educated people engage in healthier behaviors. A country that has universal health insurance is likely to have healthier people than a country that does not insure all of its people, because the uninsured may lack needed health services. The same would be true, for example, for a country that promoted safe water supply for all of its people, compared to one that does not.

In fact, increasing attention is being paid to the “social determinants of health.” From 2005 to 2008 WHO constituted a Commission on the Social Determinants of Health. WHO also published the commission’s report in 2008. Some of the important themes related to the report are:

- Health status is improving in some places in the world but not in others.
- There are enormous differences in the health status of individuals within countries, as well as across countries.
- The health differences within countries are closely linked with “social disadvantage.”
- Many of these differences should be considered “avoidable,” and they relate to the way in which people live and work and the health systems that should serve them.
- In the end, people’s life circumstances, and therefore their health, are profoundly related to political, social, and economic forces.
- Countries need to ensure that these forces are oriented toward improving the life circumstances of the poor, thereby enabling them to enjoy a healthier life, as well. The global community should also work toward this end.¹⁰

The discussion of health and equity later in the book will further touch on these points, which are also referred to throughout the book in a variety of ways.

KEY HEALTH INDICATORS

It is critical that we use data and evidence to understand and address key global health issues. Some types of health data concern the health status of people and communities, such as measures of life expectancy and infant and child mortality, as discussed further hereafter. Some concern health services, such as the number of nurses and doctors per capita in a country or the indicators of coverage for certain health services, such as immunization. This book will discuss health service data only briefly, mostly in Chapter 5 on health systems. Other data concern the financing of health, such as the amount of public expenditure on health or the share of national income represented by health expenditure. This book also provides only a limited dis-

ussion of health financing, which is also primarily in the chapter on health systems.

There are a number of very important uses of data on health status, which we shall explore further and discuss throughout the book.¹¹ We need data, for example, to know from what health conditions people suffer. We also need to know the extent to which these conditions cause people to be sick, to be disabled, or to die. We need to gather data to carry out disease surveillance. This helps us to understand if particular health problems such as influenza, polio, or malaria are occurring, where they are infecting people, who is getting these diseases, and what might be done to address them. Other forms of data also help us to understand the burden of different health conditions, the relative importance of them to different societies, and the importance that should be attached to dealing with them.

If we are to use data in the previously mentioned ways, then it is important that we use a consistent set of indicators to measure health status. In this way, we can make comparisons across people in the same country or across different countries. There are, in fact, a number of indicators that are used most commonly by those who work in global health and in development work, as well, as noted later. These are listed and defined in Table 2-1 and are discussed briefly below.

Among the most commonly used indicators of health status is *life expectancy at birth*. Life expectancy at birth is “the average number of additional years a newborn baby can be

TABLE 2-1 Key Health Status Indicators

Life expectancy at birth—The average number of years a newborn baby could expect to live if current mortality trends were to continue for the rest of the newborn’s life

Maternal mortality ratio—The number of women who die as a result of pregnancy and childbirth complications per 100,000 live births in a given year

Infant mortality rate—The number of deaths of infants under age 1 per 1000 live births in a given year

Neonatal mortality rate—The number of deaths to infants under 28 days of age in a given year per 1000 live births in that year

Under 5 mortality rate (child mortality rate)—The probability that a newborn baby will die before reaching age 5, expressed as a number per 1000 live births.

Source: Adapted from Haupt A, Kane TT. Population Handbook. Washington, DC: Population Reference Bureau; 2004; World Bank. Beyond Economic Growth: Glossary. <http://www.worldbank.org/depweb/english/beyond/global/glossary.html>. Accessed April 15, 2007.

expected to live if current mortality trends were to continue for the rest of that person's life."¹² In other words, it measures how long a person born today can expect to live, if there were no change in their lifetime in the present rate of death for people of different ages. The higher the life expectancy at birth, the better the health status of a country. In the United States, life expectancy at birth is about 78 years; in a middle-income country, such as Jordan, life expectancy is 73 years; in a very poor country, such as Mali, the life expectancy is 48 years. Figure 2-2 shows life expectancy at birth by region.⁴

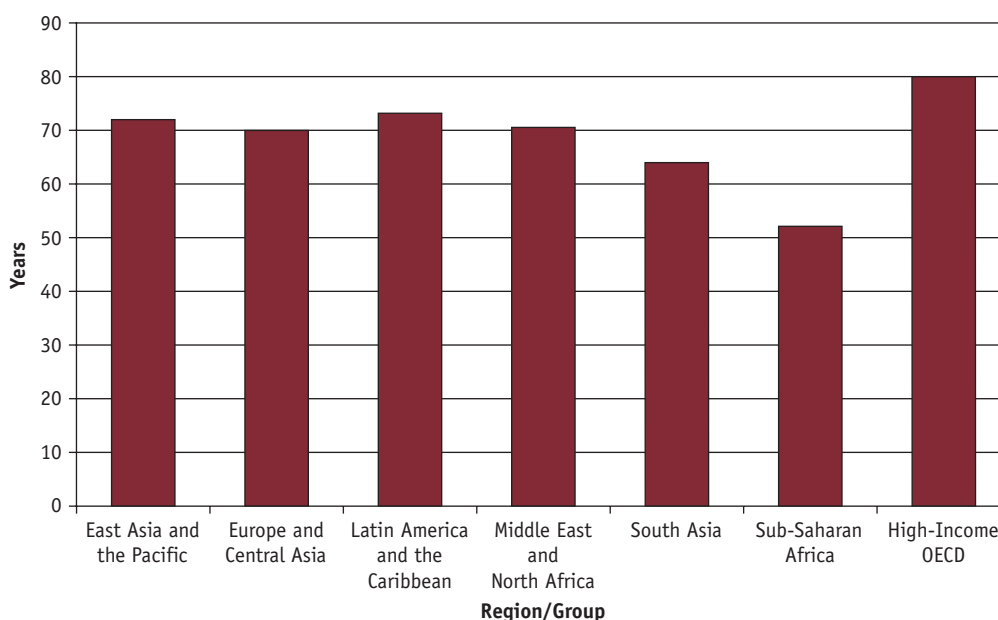
Another important and widely used indicator is the *infant mortality rate*. The infant mortality rate is "the number of deaths of infants under age 1 per 1000 live births in a given year."¹² This rate is expressed in deaths per 1000 live births. In other words, it measures how many children younger than 1 year of age will die for every 1000 who were born alive that year. Each country seeks as low a rate of infant mortality as possible, but we will see that the rate varies largely with the income status of a country. Afghanistan, for example, has an infant mortality rate of 135 infant deaths for every 1000 live births, whereas in Sweden only about 2 infants die for every 1000 live births.¹³ (See Figure 2-3).

Although the infant mortality rate is a powerful indicator of health status of a country, most children younger

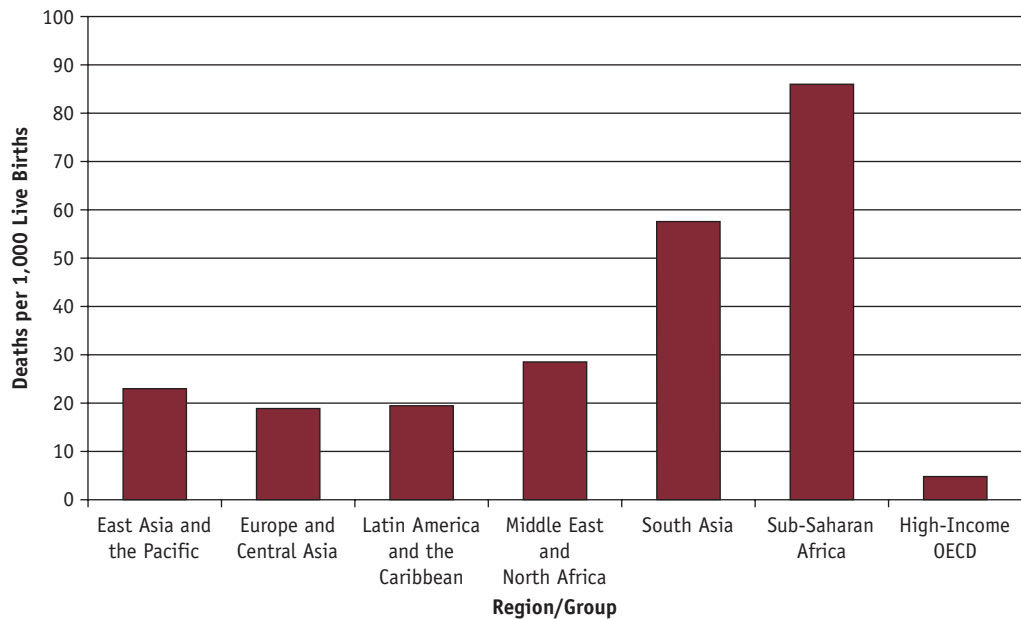
than 1 year of age who die actually die in the first month of life. Thus, the *neonatal mortality rate* is also an important health status indicator. This rate measures "the number of deaths to infants younger than 28 days of age in a given year, per 1000 live births in that year."¹² Like the infant mortality rate, this rate will generally vary directly with the level of income of different countries. Poorer countries will have a much higher neonatal mortality rate than the richer countries. The neonatal mortality rate is about 40 per 1000 live births in sub-Saharan Africa but about 5 per 1000 live births in developed countries.¹⁴ The neonatal mortality rate by region is portrayed in Figure 2-4.

The under-5 child mortality rate is also called the *child mortality rate*. This is "the probability that a newborn will die before reaching age five, expressed as a number per 1000 live births."¹² Like the infant mortality rate, this rate is also expressed per 1000 live births. Of course, this rate is very similar to the infant mortality rate, and here, too, the lower the rate the better. This rate also varies largely with the wealth of a country. In the developed countries the rate is generally about 3–5 per 1000 live births. However, in the poorest countries, the rate can be as high as 200 per 1000 live births.¹⁶ The under-5 child mortality rate is depicted in Figure 2-5. As infant mortality declines, the under-5 child mortality rate becomes a more

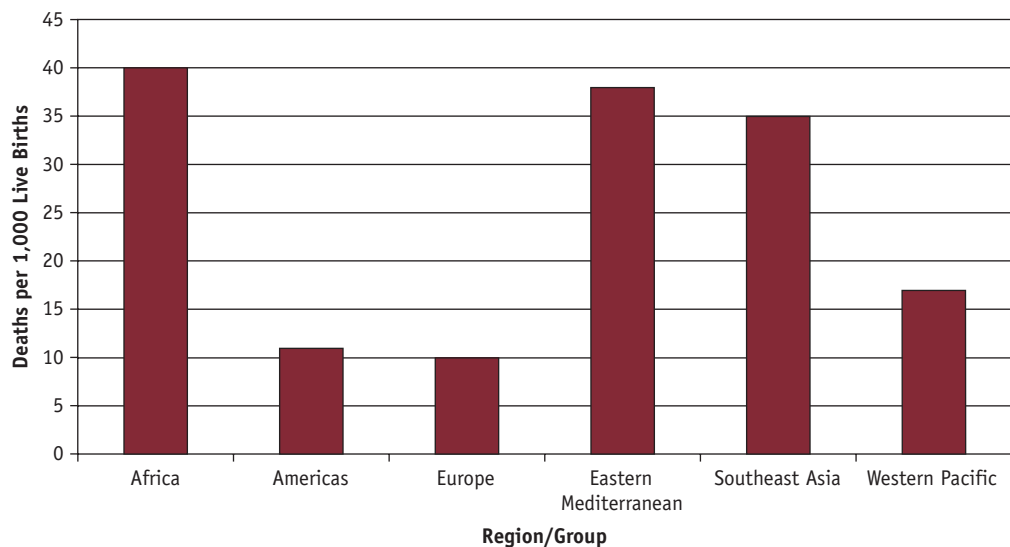
FIGURE 2-2 Life Expectancy at Birth, by World Bank Region, 2008



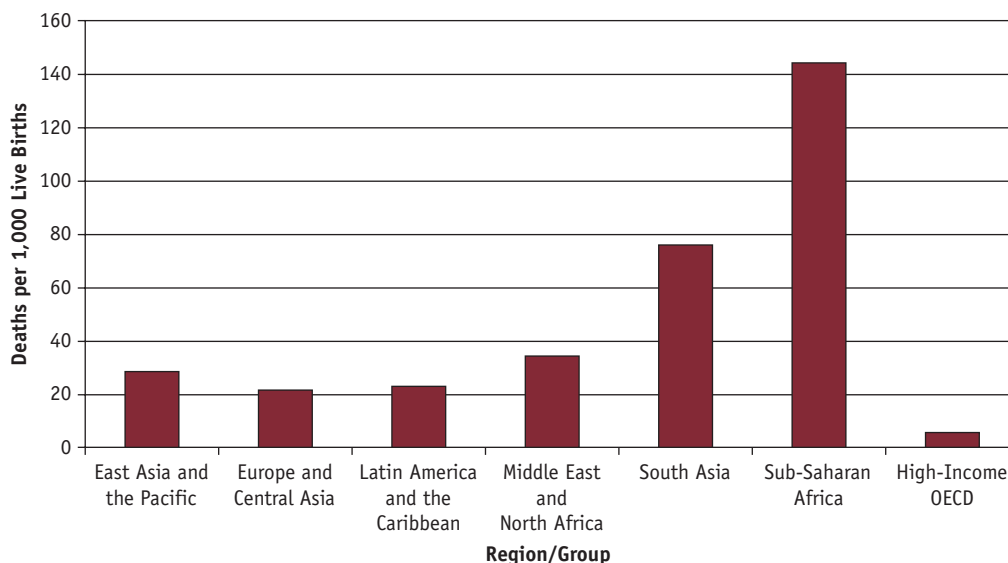
Source: Data from the World Bank. World Development Indicators, Data Query. Available at: <http://databank.worldbank.org>. Accessed June 29, 2010.

FIGURE 2-3 Infant Mortality Rate, by World Bank Region, 2008

Source: Data from the World Bank. World Development Indicators, Data Query. Available at: <http://databank.worldbank.org>. Accessed June 29, 2010.

FIGURE 2-4 Neonatal Mortality Rate, by WHO Region, 2004

Source: Data from World Health Organization. Neonatal and Perinatal Mortality: Country, Regional, and Global Estimates 2004. Geneva: WHO; 2007: Table 2.

FIGURE 2-5 Under-5 Child Mortality, by World Bank Region, 2008

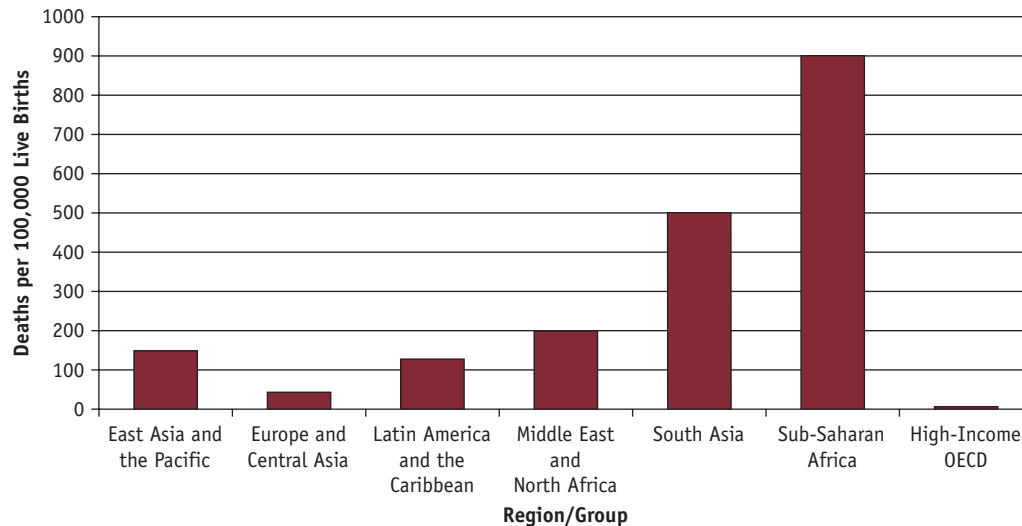
Source: Data from the World Bank. World Development Indicators, Data Query. Available at: <http://databank.worldbank.org>. Accessed June 29, 2010.

important health indicator. The relative standing of different regions in under-five child mortality, as shown in Figure 2-5, looks very similar to that for infant mortality.

The maternal mortality ratio is a measure of the risk of death that is associated with childbirth. Because these deaths are more rare than infant and child deaths, the maternal mortality ratio is measured as “the number of women who die as a result of pregnancy and childbirth complications per 100,000 live births in a given year.”¹² The rarity of maternal deaths and the fact that they largely occur in low-income settings also contributes to maternal mortality being quite difficult to measure. Very few women die in childbirth in rich countries; for example, the maternal mortality rate in Sweden is 3 per 100,000 live births. On the other hand, in very poor countries, in which women have low status and there are few facilities for dealing with obstetric emergencies, the rates can be over 1000 per 100,000 live births, as they are, for example, in Afghanistan, Angola, and Burundi.¹⁸ As you can see in Figure 2-6, the maternal mortality ratio is also very strongly correlated with a country’s income.

There are a few other concepts and definitions that are important to understand as we think about measuring health status, and they are summarized in Table 2-3. The first is *morbidity*. Essentially, this means sickness or any departure, subjective or objective, from a psychological or physiological state of well-being. Second is *mortality*, which refers to death. A *death rate* is the number of deaths per 1000 population in a given year.¹⁰ The third is *disability*. Although some conditions cause people to get sick or die, they might also cause people to suffer the “temporary or long-term reduction in a person’s capacity to function.”²¹

There will also be considerable discussion in this book and most readings on global health of the *prevalence* of health conditions. This refers to the number of people suffering from a certain health condition over a specific time period. It measures the chances of having a disease. For global health work, one usually refers to “point prevalence” of a condition, which is “the proportion of the population that is diseased at a single point in time.”¹⁸ The point prevalence of HIV/AIDS among adults in South Africa, for example, is estimated to be about 18%. This means that today about 18% of all adults

FIGURE 2-6 Maternal Mortality Ratio, by World Bank Region, 2005

Source: Data from the World Bank. World Development Indicators, Data Query. Available at: <http://databank.worldbank.org>. Accessed June 29, 2010.

between the ages of 15 and 49 in South Africa are HIV positive.¹⁹

The *incidence rate* is also a very commonly used term. This refers to the rate at which new cases of a disease occur in a population. Incidence measures the chances of getting a disease. Incidence rate is “the number of persons contracting a disease per 1000 population at risk, for a given period of time.”¹² It is usually specified as the number of people getting the disease over a year, per 100,000 people at risk. In India, for example, the incidence rate for TB in 2007 was 168 per 100,000.²⁰ This means that for every 100,000 people in India, 168 in the last year got TB in 2007.

Many people confuse incidence rate and prevalence rate. It may be convenient to think of prevalence as the pool of people with a disease at a particular time and incidence as the flow of new cases of people with that disease each year into that pool. You should note, of course, that the size of the pool will vary as new cases flow into the pool and old cases flow out, as they die or are cured.

Finally, one needs to be familiar with how diseases get classified. When you read about health, there will be

discussions of communicable diseases, noncommunicable diseases, and injuries. Communicable diseases are also called infectious diseases. These are illnesses that are caused by a particular infectious agent and that spread directly or indirectly from people to people, animals to people, or people to animals.²¹ Examples of communicable diseases include influenza, measles, and HIV. Noncommunicable diseases are illnesses that are not spread by any infectious agent, such as hypertension, coronary heart disease, and diabetes. Injuries usually include, among other things, road traffic injuries, falls, self-inflicted injuries, and violence.²²

VITAL REGISTRATION

The quality of data on population and health depends in many ways on the extent to which countries maintain a system of vital registration that can accurately record births, deaths, and the causes of death. Unfortunately, this is not the case in many low- and lower-middle-income countries.²³ They generally have only rudimentary systems for vital registration, which cannot fulfill either their statistical or their

legal purposes. In addition, access to vital registration systems is highly inequitable, with higher income groups enjoying much better access than less well off people (Figure 2-7).

There are also cultural barriers to timely vital registration, because people in many countries wait until a child is a certain age before registering the birth. Coupled with the lack of access to vital registration, this means the existence of some children is never officially known, because they die before their births are registered. There are also enormous difficulties with accurate indications of causes of death in countries that have weak health systems and a limited number of well-trained physicians. This is especially so for causes of death of adults.

The former Director-General of WHO, Lee Jong-Wook, noted in a speech to his colleagues that: “To make people count, we first need to be able to count people.”²³ To overcome the lack of effective vital registration systems in many developing countries, a number of tools, such as surveys and projection models, have been developed. Some, like the Demographic and Health Surveys, have become a backbone of information about health, population, and nutrition, and now HIV, in low-income countries.

In the longer term, however, the world would be better served by helping countries further develop their own vital registration systems. This would allow countries and their development partners to more accurately gauge the nature

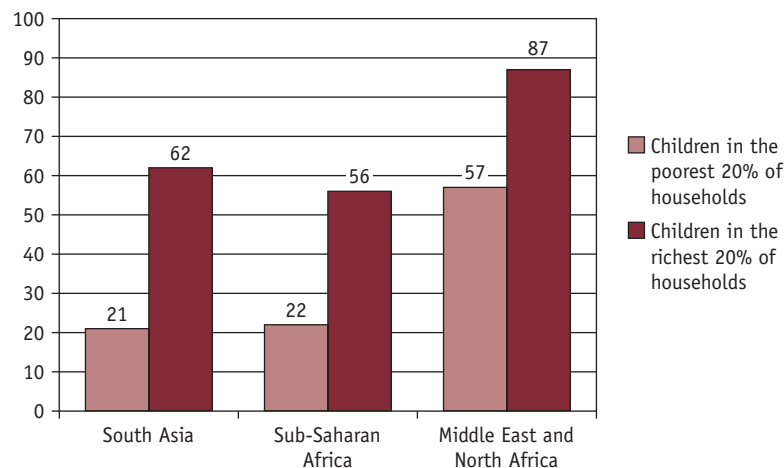
of key demographic and health issues and the progress made toward resolving them. Moving in this direction will require assessments of vital registration systems. It will also require programs to improve the organization and functioning of vital registration departments. This will have to include, among other things, strengthening their methods to improve the quality of vital statistics, including for the causes of death, and enhancing their approach to publishing data.²⁵

MEASURING THE BURDEN OF DISEASE

We have already seen in Chapter 1 that the definition of health is “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.” Those who work on global health have attempted for a number of years to construct a single indicator that could be used to compare how far different countries are from the state of good health, as defined previously. Ideally, such an index would take account of morbidity, mortality, and disability; allow one to calculate the index by age, by gender, and by region; and allow one to make comparisons of health status across regions within a country and across countries.²⁴ This kind of index would measure what is generally referred to as “the burden of disease.”

One such indicator is *health-adjusted life expectancy*, or HALE. It is a “health expectancy measure.” The HALE “summarizes the expected number of years to be lived in what

FIGURE 2-7 Percentage of Children 0–5 Whose Births Have Been Registered, by Income Quintile



Source: Data from UNICEF. Progress for Children: Achieving the MDGs with Equity. Available at: http://www.unicef.org/media/files/Progress_for_Children-No.9_EN_081710.pdf. Accessed September 17, 2010.

might be termed the equivalent of good health.”²⁵ This can also be seen as “the equivalent number of years in full health that a newborn can expect to live, based on current rates of ill health and mortality.”²⁶ To calculate the HALE, “the years of ill health are weighted according to severity and subtracted from the overall life expectancy.”²⁷

WHO has calculated HALEs for most countries, using a standard methodology. Table 2-2 shows life expectancy at birth in 2004 for a number of low-, middle-, and high-income countries and how it compares with HALEs for those countries in the same year. As you can see from Table 2-2, the greater the number of years that people in any population are likely to spend in ill health or with disability, the greater the

difference will be between life expectancy at birth and health-adjusted life expectancy.

The composite indicator of health status that is most commonly used in global health work is called the *disability-adjusted life year*, or DALY. This indicator was first used in conjunction with the 1993 World Development Report of the World Bank, and is a “health gap measure.” It is now used in burden of disease studies. In the simplest terms, a DALY is:

. . . a unit for measuring the amount of health lost because of a particular disease or injury. It is calculated as the present value of future years

TABLE 2-2 Life Expectancy at Birth and Health Adjusted Life Expectancy, Selected Countries, 2004

Country	Life Expectancy/Health-Adjusted Life Expectancy	
	Males	Females
Afghanistan	42/35.3	42/35.8
Bangladesh	62/55.3	63/53.3
Bolivia	63/53.6	66/55.2
Brazil	67/57.2	74/62.4
Cambodia	51/45.6	58/49.5
Cameroon	50/41.1	51/41.8
China	70/63.1	74/65.2
Costa Rica	75/65.2	80/69.3
Cuba	75/67.1	80/69.5
Denmark	75/68.6	80/71.1
Ethiopia	49/40.7	51/41.7
Ghana	56/49.2	58/50.3
India	61/53.3	63/53.6
Indonesia	65/57.4	68/58.9
Jordan	69/59.7	73/62.3
Malaysia	69/61.6	74/64.8
Nepal	61/52.5	61/51.1
Niger	42/35.8	41/35.2
Nigeria	45/41.3	46/41.8
Peru	69/59.6	73/62.4
Philippines	65/57.1	72/61.5
Sri Lanka	68/59.2	75/64.0
Turkey	69/61.2	73/62.8
United States of America	75/67.2	80/71.3
Vietnam	69/59.8	74/62.9

Source: Data from WHO. Core Health Indicators. Available at: http://www3.who.int/whosis/core/core_select_process.cfm. Accessed September 24, 2006.

of disability free life that are lost as the result of the premature deaths or causes of disability occurring in a particular year.²⁷

The DALY is a measure of losses due to illnesses, disabilities, and premature death in a population. A DALY measures how many healthy years of life are lost between the population being measured and the “healthiest” possible population, which is used as a standard. It does this by adding together the losses of healthy years of life that occur from illness, disability, and death. The value of disability is based on values that have been established for the severity of different disabling conditions. The calculation of a DALY “discounts” losses so that losses from ill health, disability, and death in the future are worth less than losses that occur today, just as a dollar you get in the future will be worth less than one you would get today.^{11, 25–30} This is why the DALY is referred to as a “present value.”

For calculating DALYs, health conditions are generally broken down into three categories:³²

Group 1—communicable, maternal, and perinatal conditions (meaning in the first week after birth), and nutritional disorders

Group 2—noncommunicable diseases

Group 3—injuries, including, among other things, road traffic accidents, falls, self-inflicted injuries, and violence

To get a better sense of the meaning of DALYs, it will be valuable to construct a few simple examples of what goes into their calculation and how they would be used. Consider, for example, that a male can expect under the standard used to live to be 80 years old. Now let us suppose that this person dies of a heart attack at 40 years of age. That person would have lost 40 years of life. The value of this loss, discounted to the present, would be part of the calculation of DALYs.

Let us also imagine that a woman, who is 40 years of age, has diabetes that has disabled her in a number of ways. In principle, she should live to the standard used of 82.5 years of age. In practice, however, the person’s disability is so severe that her quality of life is equal to only about half of what it would be if she were in a “disease free” state. Even if she were to live to be 80 years of age, therefore, she would have lost about half of the quality of her last 42.5 years due to disability. The value of this loss, discounted to the present, would also be part of the calculation of DALYs.

The DALYs for the society in which the two people are living would be a composite of the data calculated from the losses due to the premature death of the first person and the disability of the second.

In reality, of course, many health conditions produce both disability and premature death. Let us suppose that a man gets TB at 45 years of age. In the absence of treatment, let us say that he dies at 47 years of age. He suffered two years of disability and lost 33 years of life due to his illness, compared to the standard used for longevity. A person who suffers a severe road traffic injury at age 50 may live, let us say, 10 years with severe disability due to his injuries and then at age 60 die due to those injuries. He would have lost quality of life years during the period of his disability and 20 years of life from premature death, compared to the standard against which DALYs are calculated.

A society that has more premature death, illness, and disability has more DALYs than a society that is healthier and has less illness, disability, and premature death. One of the goals of health policy is to avert these DALYs in the most cost-efficient manner possible. If, for example, a society is losing many hundreds of thousands of DALYs due to malaria that is not diagnosed and treated in a timely and proper manner, what steps can be taken to avert those DALYs at the lowest cost?

An important point to remember when considering DALYs, compared to measuring deaths, is that DALYs take account of periods in which people are living in ill health or with disability. By doing this, DALYs and other composite indicators try to give a better estimate than measuring deaths alone of the true “health” of a population. This is easy to understand. Most mental health problems, for example, are not associated with deaths. However, they cause an enormous amount of disability. Several parasitic infections, such as schistosomiasis (which is discussed in Chapter 11), also cause very few deaths, but enormous amounts of illness and disability. If we measured the health of a population with an important burden of schistosomiasis and mental illness only by measuring deaths, we would miss a major component of morbidity and disability and would seriously overestimate the health of that population. The next section on the global burden of disease will make the concept of DALYs clearer to you, especially as you see how DALYs compare to deaths for a number of health conditions. Other sections of the book will also make extensive use of the concept of DALYs.

Indeed, calculating DALYs requires information on disease prevalence and incidence that is not always available. In addition, the health expectancy measures are more widely used in developed countries, given the health information available to them. A number of critiques of DALYs have been written.²⁹ Nonetheless, this book will repeatedly refer to DALYs because this measure is so extensively used in global health work. In addition, a considerable amount of important analysis has been carried out that is based on the use

of DALYs for measuring overall health status and assessing the most cost-effective approaches to dealing with various health problems. These uses of the DALY will be discussed in Chapter 3.

THE GLOBAL BURDEN OF DISEASE

As you start a review of global health, it is important to get a clear picture of the leading causes of illness, disability, and death in the world. As noted earlier, it is also very important to understand how they vary by age, sex, ethnicity, and socioeconomic status, both within and across countries. It is also essential to understand how these causes have varied over time and how they might change in the future. These topics are examined briefly below and in much greater detail throughout the book.

As discussed earlier, it is important to note that the tables that follow on the burden of disease are based on a consistent set of 2001 data that was part of a study on the global burden of disease. The most up-to-date data on specific diseases is generally given in the chapters that review those diseases.

Table 2-3 shows the 10 leading causes of death and the 10 leading causes of DALYs lost for low- and middle-income countries and for high-income countries. Both deaths and DALYs are ranked in order of importance.

The table indicates that the leading causes of death in low- and middle-income countries are noncommunicable diseases, which account for about 54% of all deaths. This is followed by communicable diseases at about 36% of all deaths and then injuries at about 10% of all deaths.³⁰

TABLE 2-3 The 10 Leading Causes of Death and DALYs, 2001

Low- and Middle-Income Countries		High-Income Countries	
Cause	Percentage of Total Deaths	Cause	Percentage of Total Deaths
1. Ischemic heart disease	11.8	1. Ischemic heart disease	17.3
2. Cerebrovascular disease	9.5	2. Cerebrovascular disease	9.9
3. Lower respiratory infections	7.0	3. Trachea, bronchus, and lung cancers	5.8
4. HIV/AIDS	5.3	4. Lower respiratory infections	4.4
5. Perinatal conditions	5.1	5. Chronic obstructive pulmonary disease	3.8
6. Chronic obstructive pulmonary disease	4.9	6. Colon and rectal cancers	3.3
7. Diarrheal diseases	3.7	7. Alzheimer's and other dementias	2.6
8. Tuberculosis	3.3	8. Diabetes mellitus	2.6
9. Malaria	2.5	9. Breast cancer	2.0
10. Road traffic accidents	2.2	10. Stomach cancer	1.9
Cause	Percentage of Total DALYs	Cause	Percentage of Total DALYs
1. Perinatal conditions	6.4	1. Ischemic heart disease	8.3
2. Lower respiratory infections	6.0	2. Cerebrovascular disease	6.3
3. Ischemic heart disease	5.2	3. Unipolar depressive disorders	5.6
4. HIV/AIDS	5.1	4. Alzheimer's and other dementias	5.0
5. Cerebrovascular disease	4.5	5. Trachea, bronchus, and lung cancers	3.6
6. Diarrheal diseases	4.2	6. Hearing loss, adult onset	3.6
7. Unipolar depressive disorders	3.1	7. Chronic obstructive pulmonary disease	3.5
8. Malaria	2.9	8. Diabetes mellitus	2.8
9. Tuberculosis	2.6	9. Alcohol use disorders	2.8
10. Chronic obstructive pulmonary disease	2.4	10. Osteoarthritis	2.5

Source: Adapted with permission from Lopez AD, Mathers CD, Murray CJL. The burden of disease and mortality by condition: data, methods, and results for 2001. In: Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, eds. *Global Burden of Disease and Risk Factors*. Washington, DC and New York: The World Bank and Oxford University Press; 2006.

In order of rank, ischemic heart disease and cerebrovascular disease are the two leading causes of death in low- and middle-income countries. However, all but one of the next leading causes of death in these countries is communicable. The third leading cause of death is lower respiratory conditions, related to pneumonia, often in children. The fourth leading cause is HIV/AIDS. The next are perinatal conditions, linked with the death of newborns. TB, diarrheal disease, and malaria are also major killers. Road traffic accidents are the 10th leading cause of death in low- and middle-income countries.³¹

Noncommunicable diseases are also the leading causes of deaths in high-income countries. However, in other respects, the picture of deaths that emerges in high-income countries is quite different from that in low- and middle-income countries. In high-income countries almost 87% of the deaths are from noncommunicable causes, 7.5% are from injuries, and only 5.7% are from communicable causes. In high-income countries, the first three leading causes of death are heart disease, stroke, and lung and related cancers. The fourth, and the only communicable cause among the leading causes of death, is lower respiratory infections, which is associated in high-income countries mostly with death from pneumonia of older people. Chronic obstructive pulmonary disease is the fifth leading cause of death and colon and rectal cancers are the sixth.³¹

If we look at DALYs, rather than deaths, for low- and middle-income countries, communicable diseases and injuries become slightly more important and noncommunicable diseases somewhat less important in percentage terms than they were for deaths. In terms of individual conditions, diarrheal disease, malaria, and perinatal conditions become more important percentages than they were for deaths. However, the most significant difference is for unipolar depressive disorders (depression), which were not in the 10 leading causes of death, but which are in the 10 leading causes of DALYs. This stems from the fact that this mental illness, which is discussed more in Chapter 12, is not associated with many deaths but is associated with an exceptional amount of disability in almost all countries. In fact, when we look at DALYs compared to deaths for high-income countries, the relative shares of DALYs by cause group is generally not very different than it is for deaths. However, for high-income countries, as well as low- and middle-income countries, unipolar depressive disorders become very important, as do Alzheimer's disease and other dementias. As noted earlier and in the chapter on communicable diseases (Chapter 11), DALYs are also an important measure for understanding the impact of the neglected tropical diseases.

Causes of Death by Region

As you would expect, the burden of disease varies by region, as shown in Table 2-4. In general, the higher the level of income within the region, the more likely it is that the leading causes of the burden of disease will be noncommunicable. The lower the level of income, the more likely it is that the leading causes of the burden of disease will be communicable. What is most important to note is the remarkable extent to which the burden of disease in the Africa region remains dominated by communicable diseases. The relative importance of communicable diseases in the South Asia region also sets that region apart. Throughout the book, in fact, the relatively high burden of communicable diseases in South Asia and sub-Saharan Africa will be highlighted.³⁴

Causes of Death by Age

Tables 2-5 and 2-6 show the leading causes of death by age group for both low- and middle-income countries and high-income countries.

It is clear from Table 2-5 that children in low- and middle-income countries often die of communicable diseases that are no longer problems in the more developed countries. You can also see that HIV/AIDS and TB are among the leading causes of death in low- and middle-income countries among adults, whereas no communicable disease is among the 10 leading causes of death in the high-income countries.

Causes of Death by Gender

It is also important to examine deaths by gender. Table 2-7 shows deaths by gender for low- and middle-income countries.

For this group of countries, the causes of death among men and women are largely alike. However, it is important to note that, even in these countries, heart disease and stroke are the leading causes of death among both genders, that men die much more than women of road traffic accidents, and that diabetes has become the 10th leading cause of death among women.

The Burden of Deaths and Disease Within Countries

As you consider causes of death and the burden of disease globally and by region, age, and sex, it is also important to consider how deaths and DALYs would vary within countries, by gender, ethnicity, and socioeconomic status. In most low- and middle-income countries, the answer to this is relatively simple:

- Rural people will be less healthy than urban people.
- Disadvantaged ethnic minorities will be less healthy than majority populations.

- Women will suffer a number of conditions that relate to their relatively weak social positions.
- Poor people will be less healthy than better-off people.
- Uneducated people will be less healthy than better educated people.

In addition, people of lower socioeconomic status will have higher rates of communicable diseases, illness, and death related to maternal causes and malnutrition than will people of higher status. Lower socioeconomic status people will also suffer from a larger burden of disease related to

TABLE 2-4 The 10 Leading Causes of the Burden of Disease in Low- and Middle-Income Countries by Region, 2001

East Asia and Pacific	Percentage of Total DALYs	Europe and Central Asia	Percentage of Total DALYs
1. Cerebrovascular disease	7.5	1. Ischemic heart disease	15.9
2. Perinatal conditions	5.4	2. Cerebrovascular disease	10.8
3. Chronic obstructive pulmonary disease	5.0	3. Unipolar depressive disorders	3.7
4. Ischemic heart disease	4.1	4. Self-inflicted injuries	2.3
5. Unipolar depressive disorders	4.1	5. Hearing loss, adult onset	2.2
6. Tuberculosis	3.1	6. Chronic obstructive pulmonary disease	2.0
7. Lower respiratory infections	3.1	7. Trachea, bronchus, and lung cancers	2.0
8. Road traffic accidents	3.0	8. Osteoarthritis	2.0
9. Cataracts	2.8	9. Road traffic accidents	1.9
10. Diarrheal diseases	2.5	10. Poisonings	1.9
Latin America and the Caribbean	Percentage of Total DALYs	Middle East and North Africa	Percentage of Total DALYs
1. Perinatal conditions	6.0	1. Ischemic heart disease	6.6
2. Unipolar depressive disorders	5.0	2. Perinatal conditions	6.3
3. Violence	4.9	3. Road traffic accidents	4.6
4. Ischemic heart disease	4.2	4. Lower respiratory infections	4.5
5. Cerebrovascular disease	3.8	5. Diarrheal diseases	3.9
6. Endocrine disorders	3.0	6. Unipolar depressive disorders	3.1
7. Lower respiratory infections	2.9	7. Congenital anomalies	3.1
8. Alcohol use disorders	2.8	8. Cerebrovascular disease	3.0
9. Diabetes mellitus	2.7	9. Vision disorders, age-related	2.7
10. Road traffic accidents	2.6	10. Cataracts	2.3
South Asia	Percentage of Total DALYs	Sub-Saharan Africa	Percentage of Total DALYs
1. Perinatal conditions	9.2	1. HIV/AIDS	16.5
2. Lower respiratory infections	8.4	2. Malaria	10.3
3. Ischemic heart disease	6.3	3. Lower respiratory infections	8.8
4. Diarrheal diseases	5.4	4. Diarrheal diseases	6.4
5. Unipolar depressive disorders	3.6	5. Perinatal conditions	5.8
6. Tuberculosis	3.4	6. Measles	3.9
7. Cerebrovascular disease	3.2	7. Tuberculosis	2.3
8. Cataracts	2.3	8. Road traffic accidents	1.8
9. Chronic obstructive pulmonary disease	2.3	9. Pertussis	1.8
10. Hearing loss, adult onset	2.0	10. Protein-energy malnutrition	1.5

Source: Reprinted with permission from Lopez AD, Mathers CD, Murray CJL. The burden of disease and mortality by condition: data, methods, and results for 2001. In: Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, eds. *Global Burden of Disease and Risk Factors*. Washington, DC and New York: The World Bank and Oxford University Press; 2006:91.

TABLE 2-5 The 10 Leading Causes of Death in Children Ages 0–14, by Broad Income Group, 2001

Low- and Middle-Income Countries		High-Income Countries	
Cause	Percentage of Total Deaths	Cause	Percentage of Total Deaths
Perinatal conditions	20.7	Perinatal conditions	33.9
Lower respiratory infections	17.0	Congenital anomalies	20.0
Diarrheal diseases	13.4	Road traffic accidents	5.9
Malaria	9.2	Lower respiratory infections	2.5
Measles	6.2	Endocrine disorders	2.4
HIV/AIDS	3.7	Drownings	2.4
Congenital anomalies	3.7	Leukemia	1.9
Whooping cough	2.5	Violence	1.8
Tetanus	1.9	Fires	1.2
Road traffic accidents	1.5	Meningitis	1.2

Source: Adapted with permission from Lopez A, Begg S, Bos E. Demographic and epidemiological characteristics of major regions, 1990–2001. In: Lopez A, Mathers C, Ezzati M, Jamison D, Murray C, eds. *Global Burden of Disease and Risk Factors*. Washington, DC and New York: The World Bank and Oxford University Press; 2006:70.

TABLE 2-6 The 10 Leading Causes of Death in Adults 15–59, by Broad Income Group, 2001

Low- and Middle-Income Countries		High-Income Countries	
Cause	Percentage of Total Deaths	Cause	Percentage of Total Deaths
HIV/AIDS	14.1	Ischemic heart disease	10.8
Ischemic heart disease	8.1	Self-inflicted injuries	7.2
Tuberculosis	7.1	Road traffic accidents	6.9
Road traffic accidents	5.0	Trachea, bronchus, and lung cancers	6.8
Cerebrovascular disease	4.9	Cerebrovascular disease	4.4
Self-inflicted injuries	4.0	Cirrhosis of the liver	4.4
Violence	3.1	Breast cancer	4.0
Lower respiratory infections	2.3	Colon and rectal cancers	3.1
Cirrhosis of the liver	2.2	Diabetes mellitus	2.1
Chronic obstructive pulmonary disease	2.2	Stomach cancer	2.0

Source: Adapted with permission from Lopez A, Begg S, Bos E. Demographic and epidemiological characteristics of major regions, 1990–2001. In: Lopez A, Mathers C, Ezzati M, Jamison D, Murray C, eds. *Global Burden of Disease and Risk Factors*. Washington, DC and New York: The World Bank and Oxford University Press; 2006:70.

smoking, alcohol, and diet than would be the case for better-off people. These points are fundamental to understanding global health and will also be highlighted throughout the book.

RISK FACTORS

As we discuss the determinants of health and how health status is measured, there will be many references to *risk factors* for various health conditions. A risk factor is “an aspect or

TABLE 2-7 The 10 Leading Causes of Death Ordered by Sex, in Low- and Middle-Income Countries, 2001

Males		Females	
Cause	Percentage of Total Deaths	Cause	Percentage of Total Deaths
Ischemic heart disease	11.8	Ischemic heart disease	10.8
Cerebrovascular disease	8.5	Cerebrovascular disease	7.2
Lower respiratory infections	6.7	Lower respiratory infections	6.9
Perinatal conditions	5.4	HIV/AIDS	6.8
HIV/AIDS	5.4	Chronic obstructive pulmonary disease	4.4
Chronic obstructive pulmonary disease	4.7	Perinatal conditions	4.4
Tuberculosis	4.1	Diarrheal diseases	4.0
Diarrheal diseases	3.6	Malaria	3.1
Road traffic accidents	3.1	Tuberculosis	2.1
Malaria	2.3	Diabetes mellitus	2.0

Source: Data from Lopez A, Begg S, Bos E. Demographic and epidemiological characteristics of major regions, 1990–2001. In: Lopez A, Mathers C, Ezzati M, Jamison D, Murray C, eds. *Global Burden of Disease and Risk Factors*. Washington, DC and New York: The World Bank and Oxford University Press; 2006:70.

personal behavior or life-style, an environmental exposure, or an inborn or inherited characteristic, that, on the basis of epidemiologic evidence, is known to be associated with health-related condition(s) considered important to prevent.³⁵ Risks that relate to health can also be thought of as “a probability of an adverse outcome, or a factor that raises this probability.”³⁶ We are all familiar with the notion of risk factors from our own lives and from encounters with health services. When we answer questions about our health history, for example, we are essentially helping to identify the most important risk factors that we face ourselves. Do our parents suffer from any health conditions that might affect our own health? Are we eating in a way that is conducive to good health? Do we get enough exercise and enough sleep? Do we smoke or drink alcohol excessively? Are there any special stresses in our life? Do we wear seat belts when we drive?

If we extend the idea of risk factors to poor people in low- and middle-income countries, then we might add some other questions that relate more to the ways that they live. Does the family have safe water to drink? Do their house and community have appropriate sanitation? Does the family cook indoors in a way that makes the house smoky? Do the father and mother work in places that are safe environmentally? We might also have to ask if there is war or conflict in the country, because they are also important risk factors for illness, death, and disability.

If we are to understand how the health status of people can be enhanced, particularly poor people in low- and middle-income countries, then it is very important that we understand the risk factors to which their health problems relate. Table 2-8 shows the relative importance of different risk factors to deaths and DALYs in low- and middle-income countries, compared to high-income countries. These are shown in the table in order of their importance by category of risk.

When we consider low- and middle-income countries, the most striking factor is the extent to which malnutrition is a risk factor. Another important point is the extent to which other nutrition-related risk factors are important for deaths and DALYs, such as high blood pressure and high cholesterol. Deaths and DALYs attributable to the risks of smoking and unsafe sex make up the other most significant risk factors in low- and middle-income countries.³⁷

In high-income countries, there is little undernutrition but a considerable amount of overweight and obesity. It is not surprising, therefore, that three of the most important risk factors for both deaths and DALYs in high-income countries are high blood pressure, high cholesterol, and overweight and obesity. Nor is it surprising that, despite important progress in reducing the prevalence of smoking in some countries, tobacco remains the leading risk factor for both deaths and DALYs in high-income countries.³⁷

TABLE 2-8 The Leading Risk Factors for the Burden of Disease, 2001, Low- and Middle-Income and High-Income Countries, Ranked in Order of Percent of Total DALY

Low- and Middle-Income Countries		High-Income Countries	
Deaths	DALYs	Deaths	DALYs
High blood pressure (12.9)	Childhood underweight (8.7)	Smoking (12.7)	Smoking (12.7)
Childhood underweight (7.5)	Unsafe sex (5.8)	High blood pressure (17.6)	High blood pressure (9.3)
Smoking (6.9)	High blood pressure (5.6)	High cholesterol (10.7)	Overweight and obesity (7.2)
High cholesterol (6.3)	Smoking (3.9)	Overweight and obesity (7.8)	High cholesterol (6.3)
Unsafe sex (5.8)	Unsafe water, sanitation, and hygiene (3.7)	Physical inactivity (4.8)	Alcohol use (4.4)
Low fruit and vegetable intake (4.8)	Alcohol use (3.6)	Low fruit and vegetable intake (4.2)	Physical inactivity (3.2)
Alcohol use (3.9)	High cholesterol (3.1)	Urban air pollution (1.0)	Low fruit and vegetable intake (2.7)
Indoor smoke from household use of solid fuels (3.7)	Indoor smoke from household use of solid fuels (3.0)	Illicit drug use (0.5)	Unsafe sex (0.6)
Overweight and obesity (3.6)	Low fruit and vegetable intake (2.4)	Unsafe sex (0.4)	Iron-deficiency anemia (0.5)
Unsafe water, sanitation, and hygiene (3.2)	Overweight and obesity (2.3)	Alcohol use (0.3)	Child sexual abuse (0.5)

Source: Data used with permission from Lopez A, et al. *Global Burden of Disease and Risk Factors*. Washington, DC and New York: The World Bank and Oxford University Press; 2006:10.

DEMOGRAPHY AND HEALTH

There are a number of trends related to population that are extremely important to people's health. Among the most important of these are:

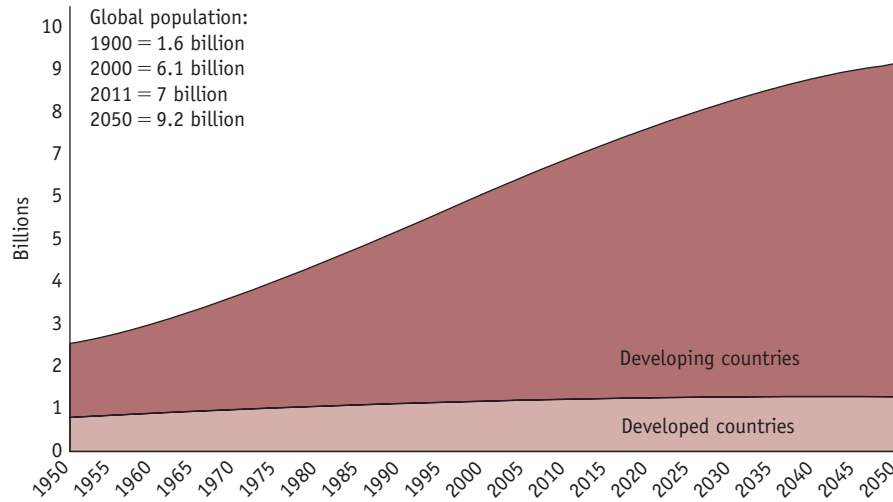
- Population growth
- Population aging
- Urbanization
- The “demographic divide”
- The demographic transition

These are briefly discussed below, along with their implications for health. Other important matters related to population, such as the relationship between fertility and the health of women and children, are discussed in other chapters.

Population Growth

The population of the world is about 6.9 million³⁸ and is still growing. As shown in Figure 2-8, it is estimated that by 2050

the population of the world will be about 9.2 million. As also shown in the figure, the overwhelming majority of population growth in the future will occur in low- and middle-income countries. This reflects the facts that fertility is falling only slowly in many countries that have had high fertility rates historically, while many of the high-income countries have very low fertility. At a minimum, we should expect that increasing population growth in low-income countries will put substantial pressure on the environment, with its attendant risks for health. It will also mean that infrastructure, such as water supply and sanitation, will have to be provided to an increasing number of people—in the countries that have the largest service gaps, can least afford to expand such services, and will face substantial impacts on health as a result. Increasing population will also make it more difficult for low-income countries to provide education and health services, with additional consequences for the health of their people in the future.

FIGURE 2-8 World Population—1950 to 2050

Source: Adapted from Haub, Carl and PRB. Data from United Nations Population Division. World Population Prospects, The 2008 Revision. Available at: <http://esa.un.org/UNPP>. Accessed December 4, 2010. The figure is based on the medium UN variant, with an average world fertility rate of 2.0 in 2050.

Population Aging

As shown in Table 2-9, the population of the world is aging. This is especially true in high-income countries that have low fertility, but this is occurring in other countries, as well. One impact of population aging is that it changes the ratio between the share of the population that is working and the share of the population that is 65 years of age or more. This is called the *elderly support ratio*. Whereas this ratio is 19 in

Niger, for example, it is already approaching 1 in Japan.⁴⁰ Population aging and the shift in the elderly support ratio have profound implications for the burden of disease and for health expenditures and how they will be financed. In the simplest terms, people will live longer and spend more years with morbidities and disabilities related to noncommunicable diseases. This will raise the costs of health care. In addition, the large numbers of older adults for every working person will make it difficult for countries to finance that health care.

Urbanization

In the last decade, the majority of the world's population has lived in urban areas for the first time in world history. People are continuing to move from rural to urban areas, especially in low- and middle-income countries, in which important shares of the population have continued to live in rural areas until recently. Continuing urbanization will also put enormous pressure on urban infrastructure, such as water and sanitation, schools, and health services, which are already in short supply in many countries. Gaps in such infrastructure, as well as the development of crowded and low-standard housing, for example, could have substantial negative consequences for health.

TABLE 2-9 Percentage of the Population Projected to Be Over 65 Years of Age

	2010	2050
Developed countries	15.9	26.2
Developing countries	5.8	14.6

Source: Adapted from Haub, Carl and PRB. Data from United Nations Population Division. World Population Prospects, The 2008 Revision. Available at: <http://esa.un.org/UNPP>. Accessed December 4, 2010. Data is shown only for the medium population variant of the UN.

The Demographic Divide

There is an exceptional difference in the demographic indicators and future demographic paths of the best-off and the least-well-off countries, as suggested in the two sections above. The highest income countries generally have very low fertility, declining populations, and aging populations. By contrast, fertility in the lowest income countries is generally still high, although it is declining slowly. In addition, the population is still growing in these countries and will continue to grow for some time. As will be discussed throughout the book, and related to the demographic divide, there is also an enormous difference in the health circumstances of the high- and low-income countries. Table 2-10 portrays the demographic divide.

The Demographic Transition³⁹

One important demographic trend of importance is called the *demographic transition*. This is the shift from a pattern of high fertility and high mortality to low fertility and low mortality, with population growth occurring in between.

When we look back historically at the countries that are now high-income, we can see that they had long periods historically when fertility was high, mortality was high, and population growth was, therefore, relatively slow, or which might even have declined in the face of epidemics. Beginning around the turn of the nineteenth century, however, mortality in those countries began to decline as hygiene and nutrition improved and the burden of infectious diseases became less. In most cases, this decline in mortality went before

much decline in fertility. As mortality declined, the population increased and the share of the population that was of younger ages also increased. Later, fertility began to decline and, as births and deaths became more equal, population growth slowed. As births and deaths stayed more equal, the share of the population that was of older ages increased.

The demographic transition is shown graphically in Figure 2-9.

The first population pyramid reflects a country with high fertility and high mortality. The second population pyramid is indicative of a country in which mortality has begun to decline but fertility remains high. This would be similar to the demographics one would find, for example, in a number of countries in sub-Saharan Africa that are undergoing demographic transition. The third pyramid looks more like a cylinder than a pyramid. This reflects a population in which fertility has been reduced and in which there is a larger share of older people in the population than in the first and second pyramids. This would be similar to the demographics that one would find in a number of low-fertility, aging populations in Western Europe.

The Epidemiologic Transition⁴⁰

The epidemiologic transition is closely related to the demographic transition, as suggested throughout the previous discussion. Historically there has been a shift in the patterns of disease that follows the trends noted below:

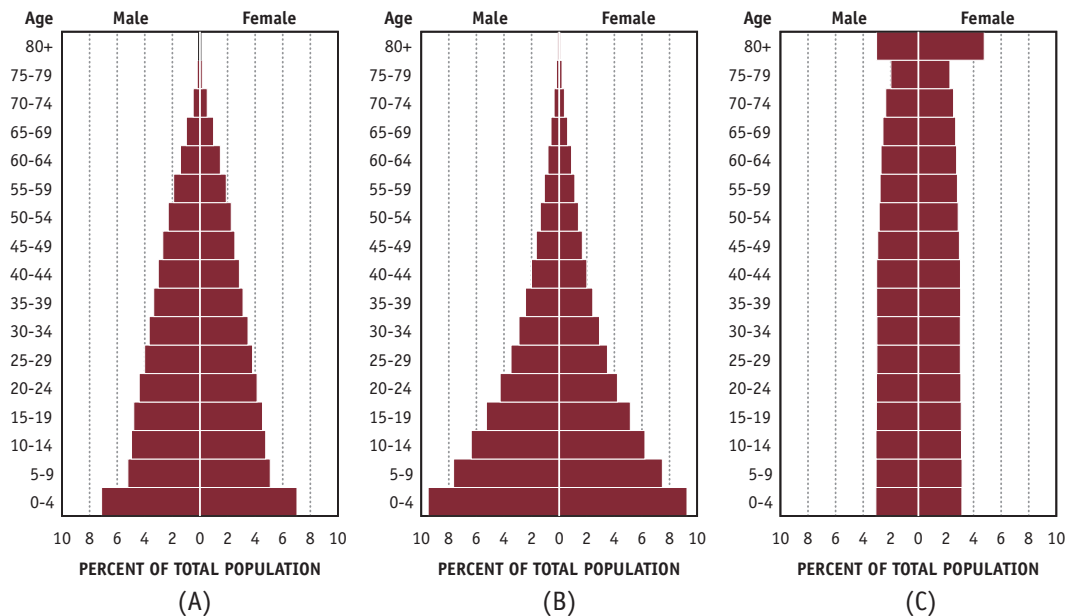
- First, high and fluctuating mortality, related to very poor health conditions, epidemics, and famine

TABLE 2-10 The “Demographic Divide”: The Example of Nigeria and Japan

	Nigeria	Japan
Population 2009 (millions)	153	128
Population 2050 (millions)	285	95
Lifetime births per woman	5.7	1.4
Annual number of births	6.2 million	1.1 million
Percentage of population below age 15	45	13
Percentage of population age 65+	3	23
Life expectancy at birth	47	83
Infant deaths per 1000 births	75	2.6
Annual number of infant deaths	465,000	2900
Percentage of adults with HIV/AIDS	3.1	—

Source: Data from Population Reference Bureau. 2009 World Population Data Sheet. Available at: <http://www.prb.org/Publications/Datasheets/2009/2009wpds.aspx>. Accessed November 24, 2010.

FIGURE 2-9 The Demographic Transition: (A) High Fertility/High Mortality; (B) Declining Mortality/High Fertility; (C) Reduced Fertility/Reduced Mortality



Source: Reprinted from U.S. Census Bureau. International population reports WP/02. *Global Population Profile: 2002*. Washington, DC: U.S. Government Printing Office; 2004:35.

- Then, progressive declines in mortality, as epidemics become less frequent
- Finally, further declines in mortality, increases in life expectancy, and the predominance of noncommunicable diseases

Figure 2-10 shows examples of two sets of countries. The first has a burden of disease profile that is pretransition. The second is of a developed country that has completed its epidemiological transition.

You can see in Figure 2-10 how the pattern of disease differs between the two types of countries. You can also see the changes that will occur over time, as the low-income country develops and the burden of disease moves from one that is dominated by communicable diseases to one that is dominated by noncommunicable diseases.

The pace of the epidemiologic transition in different societies depends on a number of factors related to the determinants of health that were discussed earlier. In its early stages, the transition appears to depend primarily on improvements in hygiene, nutrition, education, and socioeconomic status. Some improvements also stem from advances in public health

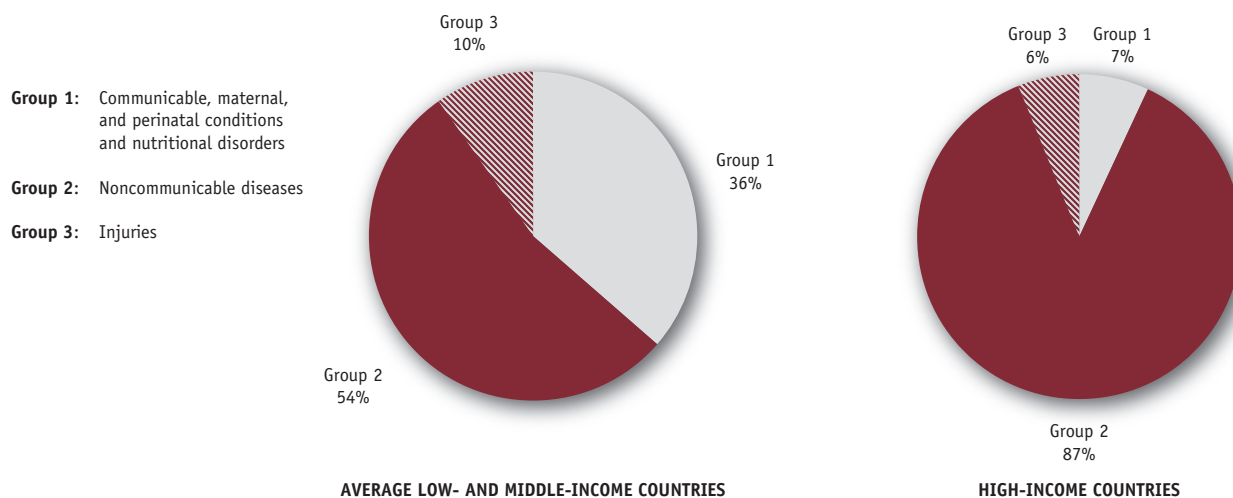
and in medicine, such as the development of new vaccines and antibiotics.⁴¹

Most of the countries that are now high-income went through epidemiologic transitions that were relatively slow, with the exception of Japan. Most developing countries have already begun their transition; however, it is still far from complete in most of them.

In fact, most low-income countries are in an ongoing epidemiologic transition and many of them, therefore, face significant burdens of communicable and non-communicable diseases, and injuries at the same time. This strains the capacity of the health system of many of these countries. It is also expensive for countries that are resource poor to address a substantial burden of all three of these types of diseases simultaneously.

PROGRESS IN HEALTH STATUS

As noted in the introductory chapter, there has been substantial progress in improving health and raising life expectancy in many parts of the world. However, as also noted, those gains have not been uniform across regions. Rather, life

FIGURE 2-10 The Burden of Disease by Group of Cause, Percent of Deaths, 2001

Source: Data used with permission from Lopez AD, et al. *Global Burden of Disease and Risk Factors*. Washington, DC and New York: The World Bank and Oxford University Press; 2006:8.

expectancy in sub-Saharan Africa and South Asia continue to substantially lag that in other regions. In addition, for countries that had a life expectancy in 1960 of less than 50 years, the pace of improvements in life expectancy in sub-Saharan Africa has been much slower than in any other region.

Table 2-11 shows life expectancy in 1960, 1990, and 2008 by World Bank region, including for high-income countries. The table also shows the percentage gain in life expectancy over three different periods, 1960 to 2008, 1960 to 1990, and 1990 to 2008.

TABLE 2-11 Life Expectancy and Percentage Gain in Life Expectancy, 1960–2008, by World Bank Region

World Bank Region	Life Expectancy (Years)			Percentage Gain (1960–2008)	Percentage Gain (1960–1990)	Percentage Gain (1990–2008)
	1960	1990	2008			
East Asia and the Pacific	46	67	72	57%	46%	7%
Europe and Central Asia	—	69	70	—	—	1%
Latin America and the Caribbean	56	68	73	30%	21%	7%
Middle East and North Africa	47	64	71	51%	36%	11%
South Asia	43	58	64	49%	35%	10%
Sub-Saharan Africa	41	50	52	27%	22%	4%
High-income OECD	69	76	80	16%	10%	5%

Source: Data from the World Bank. World Development Indicators, Data Query. Available at: <http://databank.worldbank.org>. Accessed July 6, 2010.

No data for Europe and Central Asia for 1960.

Life expectancy grew over each successive period in each region; however, the increases in Europe and Central Asia were very small in the period 1990–2008, largely reflecting the social and economic consequences of the break-up of the former Soviet Union and the impact of changes on the health system, as well. The slow progress in improving life expectancy in sub-Saharan Africa between 1990 and 2008 mostly reflects the negative impact on life expectancy of the HIV/AIDS epidemic, as well as slow economic progress in some countries and political conflict. By contrast, the dramatic increases in life expectancy from 1960 to 2008 in the East Asia and the Pacific region suggest the rapid pace of economic development in that region, usually accompanied by substantial investments in improving nutrition, education, and health. The region was also relatively free of conflict.

The factors that lead to improvements in health are complex, as suggested by the determinants of health that you reviewed earlier in this chapter. Additional comments are made at the end of this chapter and in Chapter 3 about these factors, including the role, for example, of nutrition, education, political stability, and scientific improvements. Many other chapters also include comments on the progress in improving the health of women and children and in addressing particular causes of illness, disability, and death.

THE BURDEN OF DISEASE: LOOKING FORWARD

The burden of disease in the future will be influenced by a number of factors that will continue to change. Some of these will relate to the determinants of health discussed earlier in the chapter. Some will relate to the demographic forces just discussed, including population growth, population aging, and migration. The burden of disease in the future will also be driven, among other things, by:

- Economic development
- Scientific and technological change
- Climate change
- Political stability
- Emerging and re-emerging infectious disease

These are discussed very briefly in the following sections. Chapter 12 offers additional comments on emerging and re-emerging infectious diseases.

Economic Development

The economies of low-income countries will need to grow if those countries are to generate the income they need to invest in improving people's health. The impact of economic development on health will depend partly on the extent

to which economic growth is equitable across population groups. It will also depend on the extent to which countries are able—or choose—to use their increased income to invest in other areas that improve health, such as water, sanitation, hygiene, and education. The extent and appropriateness of their investments in health, such as in low-cost, high-yielding efforts in health, will also be critical.

Scientific and Technological Change

As you will read about further throughout the book and in Chapter 16, scientific and technological change have had an enormous impact on health and will continue to do so in the future. This is easy to understand, as one considers the development of vaccines or new drugs, such as antibiotics or antiretroviral therapy. The development of new diagnostics for TB, for example, would make an enormous difference to the health of the world, as would the development of a vaccine against HIV or malaria. As also discussed in Chapter 16, the impact of scientific and technological change on the low-income countries of today will depend to a large extent on the pace at which they are able to effectively adopt any improvements when they are developed.

Climate Change

The impact of climate change on health is not clear; however, it is anticipated that climate change and its attendant impact on weather and rising sea levels could directly and indirectly have an important impact on health. On the indirect side, climate change could alter the nature of the food crops that can be grown in different places and lead to migration from some places to others that are deemed more habitable. On the more direct side, climate change could lead to weather changes and adverse weather that harms people's health. It could also lead to the disappearance of disease vectors in some places as the weather is no longer hospitable to them, while allowing the emergence or re-emergence of disease vectors in other places.

Political Stability

In low-income countries, political stability appears to be necessary to achieving long-term gains in health. There is substantial evidence, for example, that the lack of political stability has been a major impediment to progress in achieving the MDGs in a number of countries. It is not hard to imagine, for example, how conflicts in Liberia, Sierra Leone, and the Democratic Republic of the Congo could set back health status for many years. These conflicts led directly to substantial illness, disability, and death. In addition, by causing a breakdown in infrastructure, such as water, sanitation,

and electricity, as well as the erosion of health services, they also had enormous indirect impacts on health.

Emerging and Re-emerging Infectious Diseases

It is not possible to predict if and when new diseases will emerge or diseases already known will re-emerge. It is also not possible to know how well individual countries and the world will do in recognizing any such problems and addressing them quickly and effectively. What is clear is that pandemic flu, for example, could have a major impact on future disease patterns. It is also clear, for example, that if the growth of drug-resistance for, say, malaria, outpaced our ability to produce safe and effective drugs to fight malaria, this, too, could have a substantial impact on the burden of disease.

Projecting the Burden of Disease

Given the complex array of factors that influence health status and will drive future changes in the burden of disease, it is difficult to predict with any certainty how the burden of disease will evolve in different countries in the next two decades. Nonetheless, it is possible, using models, to project the future burden of disease, given assumptions about key health determinants and how they will evolve in different parts of the world. WHO has projected the burden of disease in 2030 by country income group.

Table 2-12 examines trends in the 10 leading causes of the burden of disease between 2004 and 2030, by country income group (low, lower-middle, upper-middle, and

upper). In cases where there is very little difference between the tenth and eleventh leading cause of DALYs lost, the table also shows, in parentheses and without enumeration, an eleventh cause of disease.

The main message of the table is clear: over the period 2004 to 2030, it is projected that there will be substantial changes in the burden of disease in all country income groups. In the simplest of terms, we can see for low- and lower-middle-income countries there will be a substantial shift away from communicable diseases and towards non-communicable diseases and accidents and injuries. HIV/AIDS is projected to be the only communicable disease in the top 10 causes of DALYs lost in low-income countries, and no communicable diseases are predicted to be in the top 10 for lower-middle-income countries. Unipolar depressive disorders, ischemic heart disease, and cerebrovascular disease become more important causes of DALYs lost for both income groups. Some causes we associate with aging populations, such as hearing loss and refractive errors, also become more prominent, even in low-income countries. The projected growth of diabetes in all income groups is also evident in the table.

For the upper-middle-income countries, the burden would continue to shift in similar ways, as noted above. TB, which was the eleventh leading cause of DALYs lost, would decline in relative importance, and no communicable disease would be in the top 10. Adult-onset hearing loss and arthritis, however, would join the top 10 leading causes of DALYs lost, clearly reflecting the aging populations in these countries.

TABLE 2-12 Trends in the 10 Leading Causes of the Burden of Disease, by Income Group, 2004–2030

2004	Percentage of Total DALYs	Projected in 2030	Percentage of Total DALYs
Low-income countries	827,669		718,076
1. Perinatal conditions	11.28%	Perinatal conditions	8.56%
2. Lower respiratory infections	9.30%	Unipolar depressive disorders	5.75%
3. Diarrheal disease	7.15%	Road traffic accidents	5.53%
4. HIV/AIDS	5.18%	Ischemic heart disease	5.23%
5. Malaria	3.96%	Lower respiratory infections	4.95%
6. Unipolar depressive disorders	3.20%	Cerebrovascular disease	3.14%
7. Ischemic heart disease	3.14%	HIV/AIDS	3.13%
8. Other unintentional injuries	2.94%	Other unintentional injuries	3.09%
9. Tuberculosis	2.70%	Chronic obstructive pulmonary disease	3.08%
10. Road traffic accidents	2.02%	Hearing loss, adult onset	2.59%
Cerebrovascular disease	1.73%	Refractive disorders	2.56%

(continues)

TABLE 2-12 (Continued)

2004	Percentage of Total DALYs	Projected in 2030	Percentage of Total DALYs
Lower-middle-income countries	451,827		424,681
1. Perinatal conditions	6.06%	Unipolar depressive disorders	6.43%
2. Unipolar depressive disorders	5.22%	Cerebrovascular disease	6.03%
3. Cerebrovascular disease	4.72%	Chronic obstructive pulmonary disease	5.90%
4. Other unintentional injuries	4.37%	Ischemic heart disease	5.16%
5. Ischemic heart disease	4.18%	Road traffic accidents	5.04%
6. Road traffic accidents	3.89%	Refractive errors	3.29%
7. Chronic obstructive pulmonary disease	3.25%	Hearing loss, adult onset	3.14%
8. Lower respiratory infections	3.13%	Perinatal conditions	2.93%
9. Refractive errors	2.72%	Diabetes mellitus	2.74%
10. Diarrheal disease	2.61%	Alcohol use disorders	2.72%
Alcohol use disorders	2.51%	Other unintentional injuries	2.66%
Upper-middle-income countries	121,032		97,332
1. HIV/AIDS	8.32%	Ischemic heart disease	8.16%
2. Ischemic heart disease	8.23%	HIV/AIDS	6.20%
3. Cerebrovascular disease	5.13%	Unipolar depressive disorders	6.02%
4. Unipolar depressive disorders	4.46%	Cerebrovascular disease	5.57%
5. Other unintentional injuries	3.86%	Diabetes mellitus	4.20%
6. Perinatal conditions	3.21%	Violence	3.89%
7. Road traffic accidents	3.15%	Alcohol use disorders	3.08%
8. Violence	3.03%	Road traffic accidents	2.97%
9. Alcohol use disorders	2.91%	Hearing loss, adult onset	2.78%
10. Diabetes mellitus	2.08%	Osteoarthritis	2.32%
Tuberculosis	2.01%		
High-income countries	122,092		122,207
1. Unipolar depressive disorders	8.19%	Unipolar depressive disorders	8.46%
2. Ischemic heart disease	6.34%	Ischemic heart disease	6.54%
3. Cerebrovascular disease	3.90%	Alzheimer's and other dementias	5.53%
4. Alzheimer's and other dementias	3.59%	Hearing loss, adult onset	4.07%
5. Alcohol use disorders	3.45%	Cerebrovascular disease	3.76%
6. Hearing loss, adult onset	3.44%	Alcohol use disorders	3.32%
7. Chronic obstructive pulmonary disease	3.00%	Osteoarthritis	2.75%
8. Diabetes mellitus	2.97%	Trachea/bronchus/lung cancers	2.74%
9. Trachea/bronchus/lung cancers	2.96%	Refractive errors	2.40%
10. Road traffic accidents	2.56%	Self-inflicted intentional injuries	2.39%

Source: Data from World Health Organization. Global Burden of Disease (GBD). Available at: http://www.who.int/healthinfo/global_burden_disease/en. Accessed September 14, 2010.

The projected burden of disease in high-income countries also suggests an increase in burdens associated with aging, such as dementias, hearing loss, and refractive disorders.

Mental health issues are projected to increase in importance in all income groups over the period 2004 to 2030. The largest percentage increases will occur in low-income countries, probably reflecting the extent to which these issues

arise as people lose connections with their families and their culture group, as often occurs in modernizing and globalizing economies in which people leave their native places to migrate to cities in search of employment. As noted earlier, the neglected tropical diseases are not treated as a group in the burden of disease data, like those shown in Tables 2-3 to 2-8. We should anticipate that the burden of these diseases

will remain substantial for many years to come, but that their burden will decline consistently between 2004 and 2030.

THE DEVELOPMENT CHALLENGE OF IMPROVING HEALTH

One of the key development challenges facing policy makers in low-income countries is how they can speed the demographic and epidemiologic transitions at the lowest possible cost. How can Niger, for example, improve its health status as rapidly as possible and at the least possible cost? Will it be possible for the people of Niger to enjoy the health status of a middle-income country, even if Niger remains a low-income country?

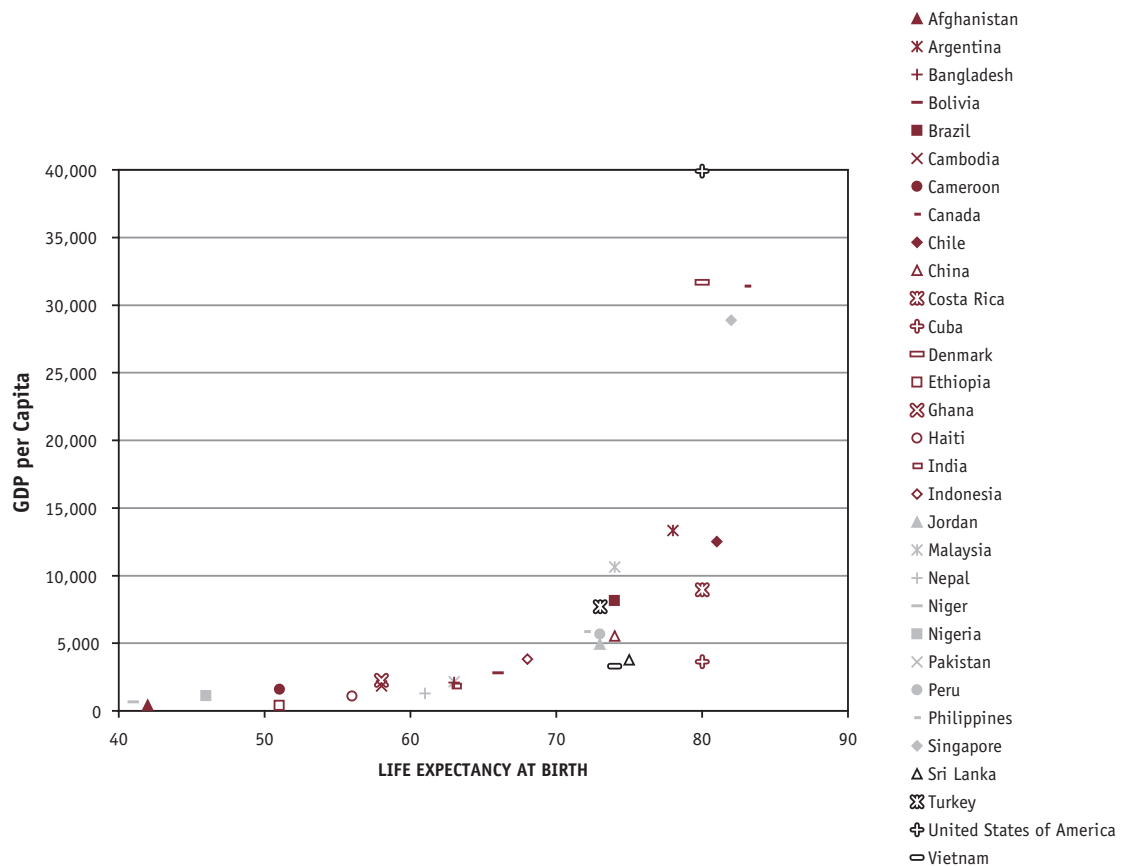
Figure 2-11 shows national income of a sample of countries, plotted against life expectancy at birth for females in those countries.

From this figure, one can see that, generally, the health of a country does increase as national income rises. However, one can also see that there are some countries, such as China, Costa Rica, Cuba, and Sri Lanka, that have achieved higher average life expectancies at birth than one would have predicted for countries at their level of income.

To a large extent, countries like those above achieved these important health gains as a result of:

- Focusing on investing in nutrition, health, and education, particularly of their poor people
- Improving people's knowledge of good hygiene
- Making selected investments in health services that at low cost could have a high impact on health status, such as vaccination programs for children and TB control

FIGURE 2-11 Gross Domestic Product per Capita and Female Life Expectancy at Birth, Selected Countries, 2004



Source: Data from WHO. Core Health Indicators. Available at: http://www3.who.int/whosis/core/core_select_process.cfm. Accessed September 24, 2006.

These themes will also be discussed throughout this book.

Indeed, in the long run, economic progress *will* help to bring down fertility, reduce mortality from communicable diseases, and help to produce a healthier population. However, at the present rates of progress in improving health in most low-income countries, these changes will take a very long time to occur. One great public policy challenge for these countries and their governments, therefore, is how they can “short-circuit” this process and reach reduced levels of fertility, lower mortality, and better health for their people, even as they remain relatively poor.

CASE STUDY

The State of Kerala

Having begun to review health status and how countries can speed improvements in health, it will be valuable to end this chapter by examining a well-known case of a place that improved health status considerably, even at relatively low levels of income. One of the best known of such success stories concerns Kerala State in India.

Introduction

Kerala is a coastal state in Southwestern India with a population of more than 31 million people.⁴² Despite having only slow rates of economic growth and a state per capita income lower than that of many other states in India, the health indicators for Kerala are the best in India and rival those in developed countries. What approach did Kerala take historically to produce such high levels of health, even in the face of relatively low income? What factors contributed to improvements in health status? What lessons does the Kerala experience suggest for other countries and for other states within India?

The Kerala Approach

One of the primary reasons why people in Kerala have such high levels of health has been the emphasis that the state put on education and the exceptionally widespread access to education in Kerala. The state introduced free primary and secondary education in the early part of 20th century.⁴³ In addition, Kerala has always put important emphasis on the education of females.

Kerala also made an early commitment to widespread health services for its people. The state created, for example, an extensive network of primary healthcare centers. This provided its citizens, throughout the state, with access to free basic health care and free family planning services. This was coupled with programs to promote exclusive breastfeeding

and the improved nutrition of infants, children, and pregnant women. The central government supported the family planning program, the maternal and child health program, and the universal immunization program in all of India, but they were implemented far more effectively and efficiently in Kerala than in other states of India.⁴⁴

The place of women in Kerala society also contributed to the uptake of education by females and improvements throughout Kerala in nutrition and health status. The role of women in many communities in Kerala differs from the roles ascribed to women in many other parts of India. In much of the rest of India, especially in parts of North India, women are regarded by families as liabilities rather than as assets. In most of India, this is partly represented in cultural terms by the fact that the family of a bride must pay a dowry to the family of the groom. In Kerala, however, women have been treated differently for over a century. They have been seen culturally much more as assets to families and they could inherit and own land, giving them a financial independence and power which was unrivalled among women elsewhere in India.⁴⁵

It is also important to note that Kerala has historically been run by a government that has traditionally placed a premium on community mobilization on important social issues, such as education, greater empowerment of women, health, nutrition, and land reform. Many of these efforts were carried out in ways that raised social awareness about health and nutrition. In 1989, Kerala launched a total literacy campaign, for example, and by the start of the World Literacy Year in 1990, Ernakulam district in Kerala was declared India’s first totally literate district.⁴⁶

Given widespread education in Kerala and the place of women in society, it is not surprising that Kerala went through the demographic transition quite early and well before other places in India. Women with more education are more likely to work and marry later and thus have wider choice in economic and social pursuits. They also have a better knowledge of and easier access to family planning methods and lower fertility than do women with less education.⁴⁷

The Impact

What were the impacts on health status of the emphasis that Kerala placed on education, health, nutrition, and the empowerment of women? Although it is not possible to scientifically indicate which policy contributed what share of better health, we can say that for many years the people of Kerala have enjoyed the best educational attainment of any group within India. In the 2001 census, the literacy rates of people aged 7 years and above for India were about 65% on average, with about 76% for males and 54% for females.

Kerala, however, had the highest literacy rate in the country, with about 91% overall and about 94% for males and 88% for females.⁴⁹ Kerala also boasts one of the highest newspaper readerships in the world, another feature that promotes the value of women, education, nutrition, and health. It also helps to raise political awareness and the demands of people for participation in and solutions to their concerns, such as education, health, and water.

Linked with this high level of education, especially of women, and the promotion of nutrition and health, infant mortality in Kerala in 2001 was 14 per 1000, compared with 91 per 1000 for low-income countries generally and 68 per 1000 on average for India.⁴⁸ The national under-5 mortality rate for 1998–1999 was around 87 per 1000 live births with a wide variation between states. In Kerala, however, the mortality of children under 5 years was the best in India with an impressive rate of only 19 such deaths per 1000 births in 1998–1999.⁴⁹ In addition, maternal deaths in Kerala were much less common, at 87 per 100,000, than the Indian average of 407 per 100,000.⁵⁰ This partly reflects the extent to which deliveries take place in hospitals in Kerala. Indeed, Kerala's healthcare system garnered international acclaim when UNICEF and WHO designated it as the world's first "baby-friendly state." This was in recognition of the fact that more than 95% of Keralite births are hospital-delivered.⁵¹

Finally, one should note that life expectancy for men and women in Kerala at the time of the 2001 census was 73 years. This was close to life expectancy in many developed countries.⁵²

Lessons Learned

Kerala has long been cited, along with China, Costa Rica, Cuba, and Sri Lanka, as a model of a country or state within a country that has achieved high levels of education and health for its people, before achieving high levels of income. It appears that Kerala has achieved these impacts by politically supporting widespread access to education, nutrition, and health; mobilizing communities around the importance of these areas and of women's empowerment; and investing in low-cost but high-yielding areas of education, nutrition, and health. In a manner much like Sri Lanka, Kerala has also managed to achieve high levels of health status at relatively low cost.

Have the high levels of health and education in Kerala, however, been associated with high levels of growth of income in the state? The answer to that question is no. The annual per capita Gross Domestic Product (GDP) for the state in year 2001 was \$469. This was close to the Indian average of \$460.⁵³ It appears that the economic policies held

by the state government over time in Kerala have not yielded high rates of economic growth or produced an environment in which domestic and foreign investors were prepared to work. Rather, the overall income of the state remains quite dependent on the money that workers from Kerala living abroad, especially in the Middle East, send back to their families in Kerala.⁵⁴

What, then, are the messages to take away from Kerala in terms of the link between health and development? First, it is possible, even in the absence of high levels of income, to achieve high levels of health through political commitment, sound investments, and social mobilization. Second, however, in the absence of sound economic policies, the presence of a literate and healthy population alone will not be sufficient to promote rapid economic growth.

MAIN MESSAGES

To understand the most important global health issues, we must be able to understand the determinants of health, how health status is measured, and the meaning of the demographic and epidemiologic transitions. There are a number of factors that influence health status, including genetic makeup, sex, and age. Social and cultural issues and health behaviors are also closely linked to health status. The determinants of health also include education, nutritional status, and socioeconomic status. The environment is also a powerful determinant of health, as is access to health services, and the policy approaches that countries take to their health sectors and to investments that could influence the health of their people. Increasing attention is being paid to the social determinants of health.

It is also important to understand the most important risk factors that lead to ill health. In the low-income countries on which this book focuses considerable attention, some of the most important risk factors include nutritional status, the lack of safe water or appropriate sanitation, and tobacco smoking. Poor diets that relate to obesity, high blood pressure, high cholesterol, and cardiovascular disease are becoming increasingly important problems as well, even in low-income countries.

There are a number of uses of health data including measuring health status, carrying out disease surveillance, making decisions about investments in health, and assessing the performance of health programs. Those working in health use a common set of indicators to measure health status, including life expectancy, infant and neonatal mortality, under-5 child mortality, and the maternal mortality ratio. They also use composite indices, such as DALYs, to measure the burden of disease. Vital registration systems are

weak in low-income countries and need to be strengthened to improve the quality of health data.

Poorer countries have a relatively larger burden of disease from communicable diseases than from noncommunicable diseases, compared to richer countries. As these poorer countries develop, fertility and mortality will decline, the population will age, and the burden of disease will shift toward the noncommunicable diseases. These phenomena occur as countries go through what are referred to as the demographic transition and the epidemiologic transition.

Life expectancy has improved in all regions of the world since 1990, but at a slower pace in sub-Saharan Africa than

elsewhere. The leading cause of death worldwide has now become cardiovascular disease. However, communicable diseases remain relatively much more important in South Asia and Sub-Saharan Africa than in the rest of the world. Projections of the burden of disease to 2030 suggest a continuing trend toward noncommunicable diseases. By 2030, the preponderance of disease, even in low- and lower-middle-income countries, will be noncommunicable. There will also be substantial increases in the share of total DALYs lost to depression and cardiovascular disease.



Study Questions

1. What are the main factors that determine your health?
2. What are the main factors that would determine the health of a poor person in a poor country?
3. If you could only pick one indicator to describe the health status of a poor country, which indicator would you use and why?
4. Why is it valuable to have composite indicators like DALYs to measure the burden of disease?
5. What is a HALE and how does it differ from just measuring life expectancy at birth?
6. As countries develop economically, what are the most important changes that occur in their burden of disease?
7. Why do these changes occur?
8. In your own country, what population groups have the best health indicators and why?
9. In your country, what population groups have the worst health status and why?
10. How would the population pyramid of Italy differ from that of Nigeria and why?
11. How does the burden of disease differ from one region to another?
12. How will the burden of disease evolve in different regions over the next 20 years?

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