

THE STATE OF GLOBAL HEALTH

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The state of global health has changed dramatically over the past two decades. Life expectancy has increased globally and in all regions (World Bank, 2015a). The number of under-five children dying every year has fallen from about 11.6 million in 1990 to about 6.3 million in 2013 (UNICEF, 2014, p. 4). The number of women dying maternal deaths decreased from 1990 to 2010 from about 359,000 to 255,000 (Lozano et al., 2012, p. 2122). Even in the face of HIV, the share of total deaths due to **communicable diseases** has fallen from 1990 to 2010, and the share from **noncommunicable diseases** has risen. Today, communicable diseases are the predominant cause of death only in sub-Saharan Africa (IHME, 2015).

The most important **risk factors** for death and disability have also shifted. Twenty years ago, childhood underweight, indoor air pollution from cooking in unventilated spaces with biofuels, and the lack of access to safe drinking water or sanitation were the leading risk factors globally for death and disability. These risk factors remain significant to the lives of poor people in low- and middle-income countries. Today, however, the most important risk factors globally relate to “behavioral risks.” These include a diet abundant in salt and saturated fats but lacking in fresh fruits and vegetables; sedentary lifestyle; hypertension; diabetes; and tobacco and alcohol use. There are now more people in the world who are obese than who are undernourished (Lim et al., 2012, p. 2246).

There has also been a change in the composition of healthy life years lost. Twenty years ago, the majority of healthy life years lost was due to premature death. In the face of lower child death rates, lower death rates for some diseases, and greater longevity, however, the predominant cause of healthy life years lost has shifted from death to disability. People are living longer. However, they are also spending more years living with disability (Institute for Health Metrics and Evaluation [IHME], 2013, pp. 24–30).

LEARNING OBJECTIVES

By the end of this chapter, the reader should be able to:

- Explain the concepts of “DALYs” and “burden of disease”
- Outline the leading causes of morbidity and mortality globally
- Discuss the main risk factors for the leading causes of morbidity and mortality
- Explain how the leading causes of morbidity and mortality and their risk factors vary by country income group, age, and sex
- Review broadly how health communication relates to the burden of disease and its risk factors

The promotion of better health requires that we understand *what* people get sick and die from and *why* they get sick and die from these causes. It is also essential that we understand *how* these burdens have changed in the past and how they are likely to change in the future. In addition, **morbidity** and **mortality** vary by age, gender, location, income group, and country income level. Efforts to promote better health must take account of these differences.

The objective of this chapter is help the reader understand the most important causes of morbidity and mortality both globally and as they vary across regions, countries, and groups. It also aims to assist readers in understanding the underlying risk factors and determinants of these causes. The chapter seeks to answer the following questions:

- How long do people live and how many of those years are lived in good health?
- What are the most important causes of morbidity?
- What are the most important causes of mortality?
- What are the most important risk factors associated with these leading causes of morbidity and mortality?
- How do morbidity and mortality and their associated risk factors vary across regions, countries, and groups?
- How have the leading causes of morbidity and mortality changed over time?
- How do we project that the leading causes of morbidity and mortality will change in the future?

A Note on Data Sources and Definitions

Before one begins to examine these questions, it is important to understand the sources of the data for this chapter.

Since the early 1990s, an important foundation for work on global health has been studies of the burden of disease. One of the most recent and important such studies was published in 2012: *Global Burden of Disease: Generating Evidence, Guiding Policy* (Institute for Health Metrics and Evaluation [IHME], 2013). A series of related articles was also published in 2012 in the *Lancet*. The Institute of Health Metrics and Evaluation, the lead author of these studies, also has an extensive interactive website on the burden of disease. This chapter will refer to the main IHME *Global Burden of Disease* report, the *Lancet* series, and the interactive website as the “Global Burden of Disease Study, 2010” or “GBD.”

The GBD has coherent and consistent information on the global burden of disease, and it is used extensively in this chapter. Additional data, primarily from the World Health Organization (WHO), UNAIDS, UNICEF, and the World Bank, are presented when needed to complement GBD data.

The GBD 2010 study examined 133 causes of death for 187 countries. These are referred to as “causes” and include conditions such as lower respiratory infections, diarrhea, and HIV/AIDS. The study also assessed the extent to which these causes were attributable to 67 risk factors and clusters of risk factors that they also examined. These are referred to here as “risk factors.”

They include factors such as unimproved water and sanitation, indoor and outdoor air pollution, and tobacco smoking.

Earlier studies of the burden of disease grouped disease conditions into three categories: “Group 1”: communicable, maternal, nutritional, and perinatal causes; “Group 2”: noncommunicable causes; and “Group 3”: injuries. This chapter does not explicitly use these groupings, but they are occasionally mentioned here.

The chapter generally uses GBD terms exactly as they are laid out in the GBD. However, a few terms are simplified in this chapter. This chapter, for example, will refer to “cerebrovascular disease” as “stroke.” It will refer to “neonatal preterm birth” as “preterm birth.”

Much of the data used in work on development and global health are organized by World Bank region, and this chapter follows that convention. However, some data that are not readily available by World Bank region are organized by the regions of the World Health Organization.

Life Expectancy

We can start to explore the health status of different populations by examining life expectancy. Life expectancy at birth in 2013 ranged from 58 years in the sub-Saharan Africa region of the World Bank to 79 years in the high-income countries, as shown in Figure 1.1. This figure indicates that life expectancy

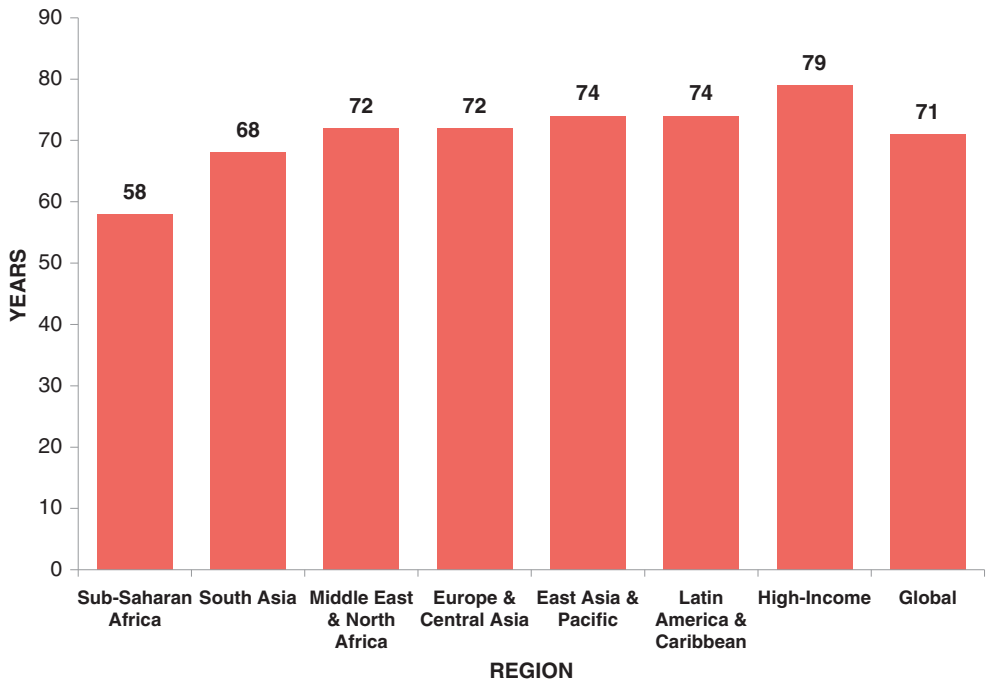


Figure 1.1 Life Expectancy at Birth for World Bank Regions, High-Income Countries, and Globally, 2013

Source: World Bank. World Development Indicators. <http://wdi.worldbank.org/table/2.2>

at birth in most regions is within 10% of that of the high-income countries, except for South Asia and sub-Saharan Africa. The figure also shows that life expectancy in sub-Saharan Africa substantially lags beyond other regions (World Bank, 2015a).

Figure 1.2 shows the trends in life expectancy by World Bank region from 1960 to 2013.

Figure 1.2 indicates that from 1960 to 2013, life expectancy increased in all World Bank regions. The fastest increase occurred in the East Asia and the Pacific region. However, there were also substantial increases in other low- and middle-income regions, including the Middle East and North Africa, sub-Saharan Africa, and South Asia. Of course, the relatively smaller increases in the high-income countries and in Latin America and the Caribbean largely reflect their already high life expectancies. The relatively small increase in Europe and Central Asia reflects both the high level of life expectancy before the breakup of the former Soviet Union and the social and economic dislocations that occurred after that breakup.

Another valuable data point to use in assessing health status is the share of total deaths in a population that is made up of children under five years of

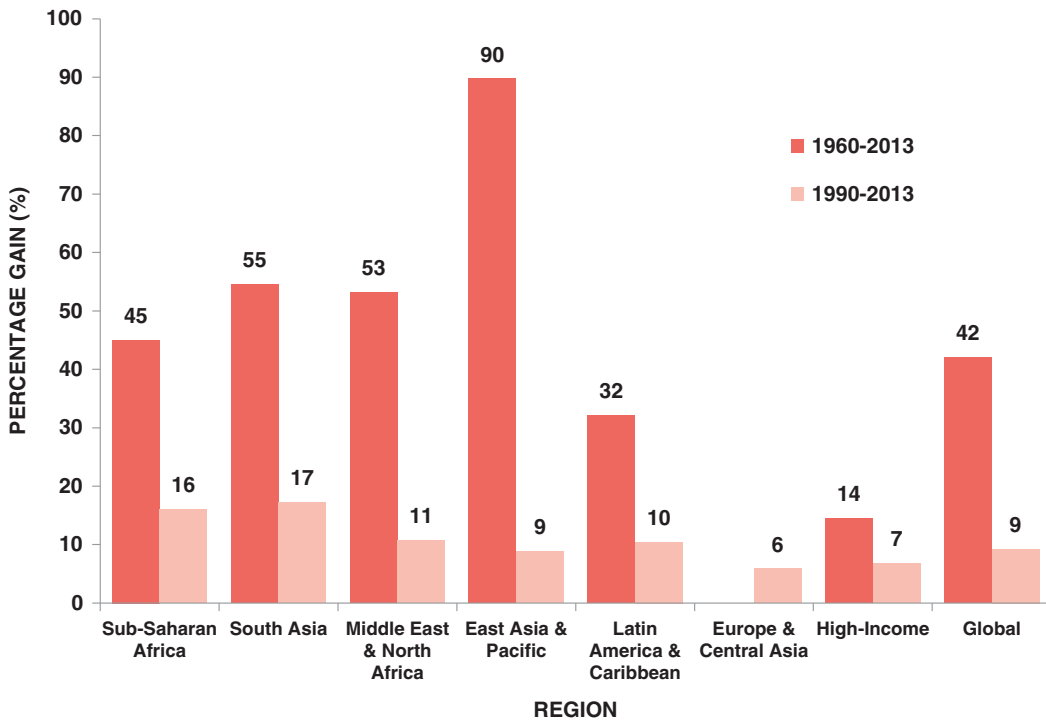


Figure 1.2 Percentage Gain in Life Expectancy for World Bank Regions, High-Income Countries, and Globally, 1960–2013

Note: Data not available for Europe and Central Asia region in 1960.

Source: World Bank. World Development Indicators. <http://wdi.worldbank.org/table/2.21>; data for 1960 from: Jamison, D. T. (2006). Investing in health. In D. T. Jamison, J. G. Breman, A. R. Measham, et al. (Eds.), *Disease control priorities in developing countries* (2nd ed., p. 6). Washington, DC, and New York, NY: World Bank and Oxford University Press.

age. The world has made important progress in reducing the deaths of children under five as a share of total deaths. Globally, such deaths fell from about 25% of total deaths in 1990 to about 13% in 2010. Nonetheless, under-five child deaths continue to be major shares of total deaths in many low-income countries, as is discussed further in the next section (Wang et al., 2012, pp. 2071, 2075).

Maternal, Neonatal, Infant, and Child Mortality

To understand the “state of global health”, we must also understand the maternal mortality ratio and the rates of neonatal, infant, and child mortality and how they vary across country income and other groups.

The maternal mortality ratio is the number of women who die of pregnancy related causes over a given time period, per 100,000 live births over that same period (United Nations Statistical Division, 2015). Figure 1.3 depicts the maternal mortality ratio by World Bank region, for the high-income countries, and globally.

Two main points stand out from this figure. First, two regions, sub-Saharan Africa and South Asia, have substantially higher maternal mortality ratios than any other regions. Second, there is an exceptional variance in maternal mortality ratios by region, with the ratio for sub-Saharan Africa more than 30 times the

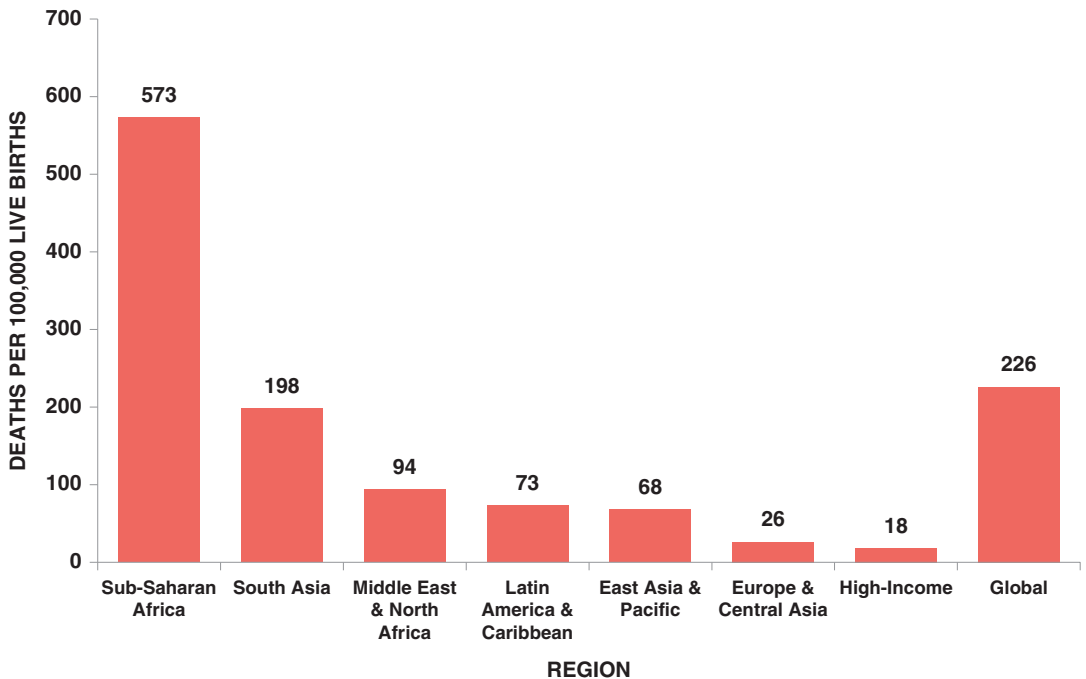


Figure 1.3 Maternal Mortality Ratios for World Bank Regions, High-Income Countries, and Globally 2013

Source: World Bank. World Development Indicators. <http://wdi.worldbank.org/table/2.21>

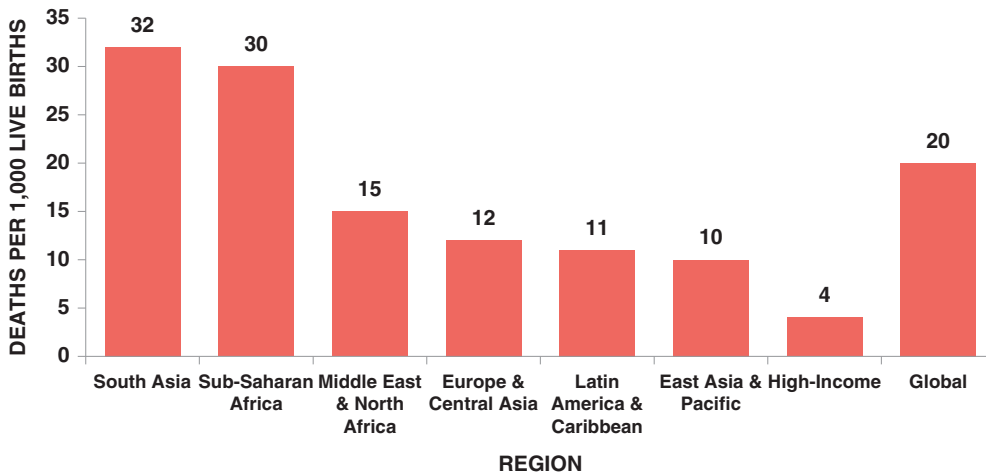


Figure 1.4 Neonatal Mortality Rates for World Bank Regions, High-Income Countries, and Globally, 2013

Source: World Bank. World Development Indicators. <http://data.worldbank.org/indicator/SH.DYN.NMRT/countries/1W-8S-ZF-4E-XQ-XJ-XD?display=graph>

ratio for the high-income countries, and the ratio in South Asia is 11 times the ratio for high-income countries.

It is essential to assess the age at which children die if one is to develop policies and programs to reduce child death. Figure 1.4 shows the rates of neonatal mortality by World Bank region and for the high-income countries. The neonatal mortality rate refers to the number of children under 28 days old who die for every 1,000 live births in a given year (World Bank, 2015c).

Once again we see that the rates of neonatal mortality are highest in sub-Saharan Africa and South Asia and that there is substantial variance across regions and country income groups. Children in sub-Saharan Africa and South Asia are about 8 times more likely to die during their first 28 days of life than are children in the high-income countries.

The infant mortality rate refers to children who die below one year of age, for every 1,000 live births in a given year (World Bank, 2015d). As expected, the rates of infant mortality follow a similar pattern to neonatal mortality rates, as shown in Figure 1.5.

Figure 1.5 clearly indicates that sub-Saharan Africa has a rate of infant mortality that is about three times, and South Asia about twice the rate of the next worst-off region, the Middle East and North Africa.

The under-five mortality rate is “the probability per 1,000 that a newborn baby will die before reaching age five, if subject to age-specific mortality rates of the specified year” (World Bank, 2015d). Figure 1.6 depicts under-five-child mortality by World Bank region.

Considered together, figures 1.4, 1.5, and 1.6 highlight the importance of neonatal deaths to all under-five child deaths. In the poorest regions of the world, children face almost equal risks of dying as neonates, between their first month and their first year, and between their first and fifth years of life. By contrast, in the middle- and higher-income countries, the risks of under-five

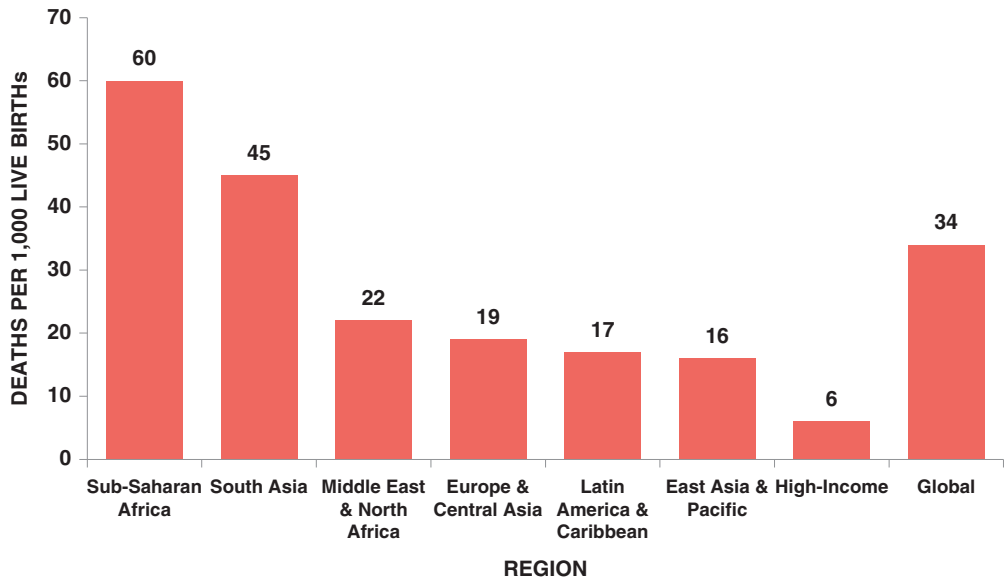


Figure 1.5 Infant Mortality Rates for World Bank Regions, High-Income Countries, and Globally, 2013

Source: World Bank. World Development Indicators. <http://data.worldbank.org/indicator/SP.DYN.IMRT.IN/countries/1W-ZF-8S-4E-XJ-7E-XD?display=graph>

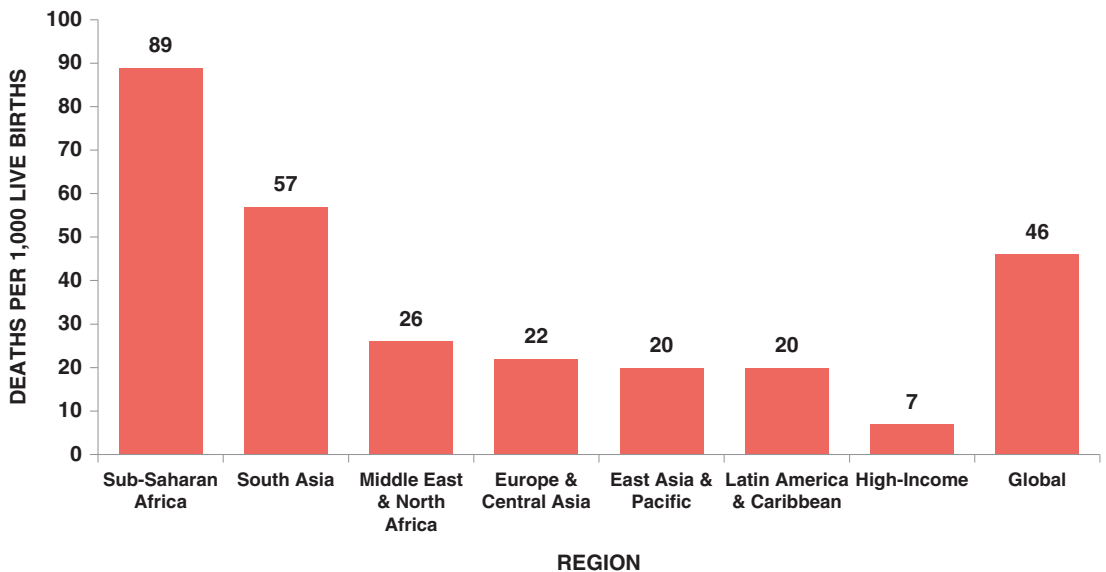


Figure 1.6 Under-Five Child Mortality Rates for World Bank Regions, High-Income Countries, and Globally, 2013

Source: World Bank. World Development Indicators. <http://data.worldbank.org/indicator/SH.DYN.MORT/countries/1W-ZF-8S-XQ-XD-4E-XJ?display=graph>

child death are greatest for neonates, and the rates of death of infants and children between the first and fifth years are very low.

When considering these data and the data on deaths and DALYs discussed in the next section, one must take into account not only the differences *between* countries, but also the differences in health status among different groups *within* countries. We should increasingly expect the health status of higher-income and better-educated people in low- and middle-income countries to be similar to that of high-income and well-educated people in high-income countries. By contrast, low-income and poorly educated people in low- and middle-income countries will generally have much worse health indicators than the better-off people in their own countries. We should also expect health status to vary not only by income and education status. In addition, it will vary with sex, ethnicity, location, and the extent to which people belong to marginalized groups, such as sexual minorities and prisoners. One of the main goals of health policy, of course, is to reduce these disparities.

Measuring Health Status

Life expectancy, and indicators of maternal, neonatal, infant, and child mortality are useful indicators of the health of a population. However, they fail to capture how healthy or unhealthy children and adults were when they lived. Say, for example, that there are two communities with 100 people each. In both communities, life expectancy at birth is 80 years. In one of the communities, the people stay completely healthy until they die. In the other, however, one-third of the adults get diabetes when they are 60. Nonetheless they still live 20 additional years—they just do so with a variety of complications of diabetes, including vision and wound problems and amputations of limbs. In this case, one society is clearly much “healthier” than the other, but the life expectancy indicator does not capture this difference.

Over the past several decades, therefore, those working in global health have primarily measured the health status of countries and regions in **disability-adjusted life years**, referred to as “DALYs.” The DALY is a composite indicator that sums the years of healthy life lost to disability from illness or injury or the after effects of illness or injury (called years lived with disability or YLD) and the years of life lost due to premature death (YLL) (IHME, 2013, pp. 6–14).

The years of life lost to death are calculated by assessing the gap between the age at which people die and their projected life expectancy at that age. Ideally, of course, all people everywhere would live just as long as any other group. Thus, the gap between the age at death and how long people “should have lived at that age” is calculated against a standard that is based on the group with the highest life expectancy in 2010 (IHME, 2013, pp. 10–14).

As a simplified example of how one calculates years of life lost to premature death, let’s suppose a woman dies at 50 years of age. In principle, if she lived as long as the standard suggests she could have lived at age 50, then the woman should have lived until she was 83. Thus, the years of life lost to premature death would equal 33.

The years of life lived with disability (YLD) are calculated by multiplying the number of years that a person lives with a disability by a disability weight.

These weights have generally been derived from panels assembled by the World Health Organization, and they are periodically updated. GBD based them on 14,000 household surveys in a number of countries and 16,000 internet surveys. (Salomon, 2012).

As an example, let's suppose that someone aged 53 loses a leg to amputation because of complications of diabetes and then dies at 83 years of age. Let's further suppose that those who determine disability weights have assigned a disability weight of .5 to this disability. The person lived 30 years with disability. This would be equal to 15 DALYs, which is the number of years lived with disability, multiplied by the weight of that disability.

As noted previously, the DALY combines into a single metric the years of life lost to premature death and the years of healthy life lost due to disability. If everyone in a country lived until the normative standard life expectancy for the age at which they died and did so without any disability, the country would have no DALYs. By contrast, a low-income country like Liberia sees considerable premature death and a substantial number of disabilities from communicable and noncommunicable diseases and injuries. This would produce a substantial number of DALYs per person, indicating significant deviance from a population that "lives a healthy life until its time" and then dies.

The text that follows discusses both deaths and DALYs. This allows the reader to get a fuller appreciation for the state of the world's health than would be possible if only deaths were examined. In general, when the text refers to "burden of disease," it is speaking of DALY measures, as opposed to speaking only of deaths.

The IHME website on the burden of disease allows one to interactively manipulate the data by country, subregion, or a variety of different regions, such as those used by the World Bank and the World Health Organization. To simplify the presentation of burden of disease data below, most of the data has been organized into "representative" subregions from GBD, one for low-income, one for middle-income, and one for high-income countries. The text will also sometimes speak of these country income groups, rather than name the subregions that represent them. Those interested in more detail on burden of disease data should consult the IHME website (IHME, 2015).

Global Deaths and the Global Burden of Disease

The Leading Causes of Death Globally and Their Risk Factors

Causes of Death

The leading causes of death globally for all age groups and both sexes in 2010 were ischemic heart disease, stroke, chronic obstructive pulmonary disease (COPD), lower respiratory infections, and tracheal, bronchus, and lung cancers, as shown in Table 1.1. These were followed in the top 10 by HIV/AIDS, Alzheimer's disease and other dementias, road injuries, diarrheal disease, and tuberculosis (TB) (IHME, 2015).

Table 1.1 Ten Leading Causes of Death in Examples Low-Income, Middle-Income, and High-Income Sub-Regions and Globally, 2010

Disease	Western Sub-Saharan Africa (Low-Income)		Southern Latin America (Middle-Income)		Western Europe (High-Income)		Global	
	% of Total Deaths	Disease	% of Total Deaths	Disease	% of Total Deaths	Disease	% of Total Deaths	Disease
1 Malaria	16.9	Ischemic heart disease	13.5	Ischemic heart disease	17.8	Ischemic heart disease	14.4	Ischemic heart disease
2 Lower respiratory infections	9.9	Stroke	9.4	Stroke	9.8	Stroke	11.5	Stroke
3 HIV/AIDS	9.3	COPD	7.3	Alzheimer's disease and other dementias	8.4	COPD	5.2	COPD
4 Diarrheal diseases	5.9	Lower respiratory infections	7.0	Tracheal, bronchial, and lung cancers	5.8	Lower respiratory infections	4.9	Lower respiratory infections
5 Road injuries	4.0	Alzheimer's disease and other dementias	5.8	COPD	4.7	Tracheal, bronchial, and lung cancers	2.9	Tracheal, bronchial, and lung cancers
6 Stroke	3.9	Tracheal, bronchus, and lung cancers	3.3	Lower respiratory infections	3.9	HIV/AIDS	2.8	HIV/AIDS
7 Preterm birth complications	3.5	Diabetes	2.8	Colon and rectum cancers	3.7	Alzheimer's disease and other dementias	2.8	Alzheimer's disease and other dementias
8 Hemoglobinopathies and hemolytic anemias	3.4	Chronic kidney disease	2.7	Other cardio and circulatory diseases	2.3	Road injuries	2.6	Road injuries
9 Neonatal encephalopathy	3.2	Colon and rectum cancer	2.7	Diabetes	2.3	Diarrheal diseases	2.5	Diarrheal diseases
10 Protein energy malnutrition	3.1	Hypertensive heart disease	2.2	Breast cancer	2.1	Tuberculosis	2.4	Tuberculosis

Source: IHME. Global Burden of Disease Heatmap. Accessed December 18, 2015. Available at: <http://vizhub.healthdata.org/gbd-compare/>

As also shown in Table 1.1, and as discussed previously, the leading causes of death vary substantially by country income group and by the regions into which GBD data is organized. As generally expected, the higher the income per capita of the country or the region, the larger the share of deaths that is due to noncommunicable causes.

Risk Factors for Deaths

As part of GBD, calculations were also made of attributable risk factors for the causes of death and DALYs. As seen in Table 1.2, the five leading risk factors in 2010 for deaths globally were high blood pressure, smoking, high body-mass index, high fasting plasma glucose, and a diet high in sodium. These were followed by a diet low in fruit, household air pollution, ambient particulate matter pollution, alcohol use, and high total cholesterol (IHME, 2015).

As expected, the leading risk factors also vary by region and country income group. Generally, the lower the income of the country group, the more the leading risk factors will include risks related to undernutrition, such as childhood underweight and suboptimal breastfeeding. However, even in these low-income countries, some of the leading risk factors include those related to noncommunicable diseases such as high blood pressure, high body-mass index, and alcohol use (IHME, 2015).

DALYs and Their Attributable Risk Factors

Table 1.3 shows the top ten causes of the burden of disease in DALYs globally and in representative GBD subregions.

Table 1.2 Leading Risk Factors for Death in Low-Income, Middle-Income, and High-Income Sub-Regions and Globally, 2010

	Western Sub-Saharan Africa (Low-Income)	Southern Latin America (Middle-Income)	Western Europe (High-Income)	Global
1	Childhood undernutrition	High blood pressure	High blood pressure	High blood pressure
2	Unsafe sex	Smoking	Smoking	Smoking
3	High blood pressure	High body-mass index	High body-mass index	High body-mass index
4	Unsafe water source	High fasting plasma glucose	High total cholesterol	High fasting plasma glucose
5	Household air pollution	Alcohol use	Low physical activity	Diet high in sodium
6	Unsafe sanitation	Low glomerular filtration	Low glomerular filtration	Diet low in fruit
7	Suboptimal breastfeeding	High total cholesterol	Alcohol use	Household air pollution
8	Alcohol use	Diet low in fruits	Diet high in sodium	Ambient particulate matter pollution
9	High body-mass index	Diet low in vegetables	Ambient particulate matter pollution	Alcohol use
10	Ambient particulate matter pollution	Low physical activity	Low fruit in diet	High total cholesterol

Source: IHME. Global Burden of Disease Heatmap. Accessed December 18, 2015. Available at: <http://vizhub.healthdata.org/gbd-compare/>

Table 1.3 Ten Leading Causes of Burden of Disease in Low-Income, Middle-Income, and High-Income Sub-Regions and Globally, 2010

Disease	Western Sub-Saharan Africa (Low-Income)		Southern Latin America (Middle-Income)		Western Europe (High-Income)		Global	
	% of Total DALYs	Disease	% of Total DALYs	Disease	% of Total DALYs	Disease	% of Total DALYs	Disease
1	19.3	Ischemic heart disease	6.3	Low back and neck pain	9.5	Ischemic heart disease	5.9	Ischemic heart disease
2	9.2	Low back and neck pain	5.0	Ischemic heart disease	7.8	Lower respiratory infections	4.9	Lower respiratory infections
3	7.0	COPD	4.8	Stroke	4.1	Stroke	4.5	Stroke
4	6.0	Stroke	4.3	Tracheal, bronchus, and lung cancers	3.8	Low back and neck pain	4.1	Low back and neck pain
5	4.2	Depressive disorders	3.2	Sense organ diseases	3.5	Diarrheal diseases	3.2	Diarrheal diseases
6	3.9	Lower respiratory infections and hemolytic anemia	3.2	Alzheimer's disease and other dementias	3.5	HIV/AIDS	3.2	HIV/AIDS
7	3.8	Congenital anomalies	2.9	Falls	3.2	Malaria	3.2	Malaria
8	3.4	Road injuries	2.9	Depressive disorders	3.2	Preterm birth complications	3.1	Preterm birth complications
9	3.4	Skin diseases	2.5	COPD	3.0	Road injuries	3.0	Road injuries
10	2.9	Diabetes	2.4	Diabetes	2.9	COPD	2.8	COPD

Source: IHME. Global Burden of Disease Heatmap. Accessed December 18, 2015. Available at: <http://vizhub.healthdata.org/gbd-compare/>

Table 1.4 Leading Risk Factors for DALYs in Low-Income, Middle-Income, and High-Income Sub-Regions and Globally, 2010

	Western Sub-Saharan Africa (Low-Income)	Southern Latin America (Middle-Income)	Western Europe (High-Income)	Global
1	Childhood undernutrition	Smoking	Smoking	High blood pressure
2	Unsafe sex	High body-mass index	High blood pressure	Smoking
3	Unsafe water	High blood pressure	High body-mass index	Childhood undernutrition
4	Unsafe sanitation	Alcohol use	High fasting plasma glucose	High body-mass index
5	Suboptimal breastfeeding	High fasting plasma glucose	Alcohol use	High fasting plasma glucose
6	Household air pollution	Low glomerular filtration	High total cholesterol	Alcohol use
7	No handwashing with soap	High total cholesterol	Low glomerular filtration	Household air pollution
8	Alcohol use	Diet low in fruits	Low physical activity	Unsafe water
9	High blood pressure	Drug use	Diet high in sodium	Unsafe sex
10	Iron deficiency	Diet low in vegetables	Diet low in fruits	Diet low in fruits

Source: IHME. Global Burden of Disease Heatmap. Accessed December 18, 2015. Available at: <http://vizhub.healthdata.org/gbd-compare/>

Table 1.4 shows the top ten risk factors associated with those DALYs.

As seen in Tables 1.1 and 1.3, the main differences among the leading causes of deaths and DALYs globally in 2010 were the greater importance for DALYs than deaths of low back and neck pain, malaria, and preterm birth complications. At the same time, COPD, tracheal, bronchus and lung cancers, Alzheimer's and other dementias, and tuberculosis were more important for deaths than for DALYs (IHME, 2015).

Moreover, just as we would anticipate, major depressive disorders were ranked number 12 in DALYs globally, but were not in the top 25 causes of death globally. This reflects the fact that major depressive disorders create an enormous amount of ill health and disability but are not directly associated with much death. The neglected tropical diseases (NTD), discussed later, also rank higher in DALYs than deaths. They are not associated with much mortality, but in the poorest countries they are an important cause of disability, which is often severe and long lasting (IHME, 2015).

The most important risk factors for DALYs globally in 2010 were similar to those for death and included high blood pressure, smoking, high body-mass index, and high fasting plasma glucose. However, they also included childhood undernutrition, which is associated with a very large burden of excess morbidity and mortality (IHME, 2015).

Trends in Deaths, in the Burden of Disease, and in Risk Factors

As noted earlier in the chapter, there has been a substantial shift over the past two decades in the leading causes of death and in the leading causes of the burden of disease, measured in DALYs.

Table 1.5 Leading Causes of Deaths Globally, 1990 and 2010

1990		2010	
Rank	Disease	Rank	Disease
1	Ischemic heart disease	1	Ischemic heart disease
2	Stroke	2	Stroke
3	Lower respiratory infections	3	COPD
4	Diarrheal diseases	4	Lower respiratory infections
5	COPD	5	Tracheal, bronchial, and lung cancers
6	Tuberculosis	6	HIV/AIDS
7	Preterm birth complications	7	Alzheimer's disease and other dementias
8	Road injuries	8	Road injuries
9	Tracheal, bronchial, and lung cancers	9	Diarrheal diseases
10	Malaria	10	Tuberculosis

Source: IHME. Global Burden of Disease Heatmap. Accessed December 18, 2015. Available at: <http://vizhub.healthdata.org/gbd-compare/>

Table 1.5 shows the leading causes of deaths in 1990 and 2010, calculated as part of the 2010 GBD, using a consistent methodology.

Ischemic heart disease and stroke were the leading causes of death globally in 1990, and they remained so in 2010. However, beyond that, there were substantial changes in the leading causes of death, because almost all communicable causes and causes linked to the conditions of poverty fell and noncommunicable causes rose. The only exception to this was HIV/AIDS, a relatively “new” disease in 1990, which became, of course, a global pandemic (IHME, 2015).

Table 1.6 shows the leading causes of DALYS in 1990 and 2010.

Table 1.6 Leading Causes of DALYs Globally, 1990-2010

1990		2010	
Rank	Disease	Rank	Disease
1	Lower respiratory infections	1	Ischemic heart disease
2	Diarrheal diseases	2	Lower respiratory infections
3	Preterm birth complications	3	Stroke
4	Ischemic heart disease	4	Low back and neck pain
5	Stroke	5	Diarrheal diseases
6	Neonatal encephalopathy	6	HIV/AIDS
7	Tuberculosis	7	Malaria
8	Low back and neck pain	8	Preterm birth complications
9	Malaria	9	Road injuries
10	Congenital anomalies	10	COPD

Source: IHME. Global Burden of Disease Heatmap. Accessed December 18, 2015. Available at: <http://vizhub.healthdata.org/gbd-compare/>

The trends in DALYs over this period mirror those in deaths. The communicable causes of death and perinatal conditions, except for HIV/AIDS, became less important as causes of DALYs. Noncommunicable causes became more important, and those associated with substantial disability also became higher in the rankings. One of the most substantial changes over the two decades concerns measles. The progress in immunizing against measles moved measles from 15 to 62 in the leading causes of DALYs between 1990 and 2010 (IHME, 2015).

The composition of DALYs changed substantially between 1990 and 2010. Over this period the share of DALYs made up of years of life lost due to premature death declined and the share due to years lived with disability increased. These shifts reflect the facts that health status improved over this period, child death rates declined, and people lived longer than before. However, as people lived longer, they also suffered increasing amounts of disability (IHME, 2013a, pp. 25–30).

The Health of Women and Children

The health of women and children is a particular concern in the study of global health, especially those women and children in lower-income settings. The section that follows examines the most important causes of death and DALYs and their related risk factors for women and for children under five years of age.

The Health of Women

The five leading causes of death for women ages 15 to 49 globally in 2010 were HIV/AIDS, tuberculosis, ischemic heart disease, self-harm, and stroke. The sixth and seventh leading causes of death were road injuries and breast cancer (IHME, 2015).

Causes of death vary substantially by country income group and region. In the low-income countries of Western sub-Saharan Africa, for example, the five leading causes of death for women aged 15–49 in 2010 were HIV/AIDS, road injuries, tuberculosis, malaria, and “other maternal disorders.” (This refers to causes other than hemorrhage, sepsis, hypertensive disorders, obstructed labor, and abortion; World Health Organization, n.d.). By contrast, in Western Europe, the five leading causes of death of women 15 to 49 were breast cancer, self-harm, lung cancer, road injuries, and ischemic heart disease (IHME, 2015).

The leading causes of DALYs in 2010 for this age group differed substantially from the leading causes of death, a difference that is critical for developing policies and programs. The five leading causes of DALYs globally for women ages 15–49 in 2010 were low back and neck pain, HIV/AIDS, depressive disorders, migraine, and skin diseases. The five leading causes of DALYs in Western Europe were low back and neck pain, depressive disorders, migraine, anxiety disorders, and skin diseases. In Western sub-Saharan Africa, the five leading causes of DALYs among women 15–49 globally in 2010 were HIV/AIDS, depressive disorders, road injuries, malaria, and low back and neck pain (IHME, 2015).

The most significant risk factors for deaths among women ages 15 to 49 globally in 2010 were unsafe sex, high blood pressure, high body-mass index, intimate partner violence, and alcohol use. However, the risk factors also vary, as we would expect, by country and regional income group and epidemiological status. In Western Europe, the five leading risk factors were alcohol use, smoking, high body-mass index, high blood pressure, and unsafe sex. In Western sub-Saharan Africa, the five most important risk factors for death were unsafe sex, intimate partner violence, alcohol use, unsafe water, and high blood pressure (IHME, 2015).

The most significant risk factors for DALYs globally among women in this age group do not differ substantially from the most significant risk factors for death, and include unsafe sex, high body-mass index, high blood pressure, intimate partner violence, and high fasting plasma glucose. As we move up the country income scale, such as in Western Europe, however, the five leading risk factors for DALYs change toward high body-mass index, alcohol use, smoking, high fasting plasma glucose, and low glomerular filtration. “In a low-income region such as Western sub-Saharan Africa, the five leading risk factors for DALYs for women in this age group were unsafe sex, iron deficiency, intimate partner violence, alcohol use, and unsafe water (IHME, 2015).

The pattern of deaths among women between 50 and 69 years of age is different from that for women 15 to 49. For women 50 to 69, the five leading causes of death globally in 2010 were ischemic heart disease, stroke, COPD, diabetes, and breast cancer. In Western Europe, the five leading causes were breast cancer, lung cancer, ischemic heart disease, colorectal cancer, and stroke. For Western sub-Saharan Africa, the five leading causes of death of women in the 50 to 69 year old age group were stroke, HIV/AIDS, ischemic heart disease, lower respiratory infections, and tuberculosis (IHME, 2015).

For women 50 to 69 years of age, the five leading causes of DALYs were ischemic heart disease, stroke, low back and neck pain, diabetes, and COPD. In Western Europe, the five leading causes of DALYs among females in this age group were low back and neck pain, breast cancer, other musculoskeletal disorders, ischemic heart disease, tracheal, bronchial, and lung cancer. This pattern shifts dramatically, however, for low-income regions, such as Western sub-Saharan Africa. Here, the five leading causes of DALYs were HIV/AIDS, stroke, low back and neck pain, ischemic heart disease, and lower respiratory infections (IMHE, 2015).

The leading risk factors for death among women 50 to 69 years of age globally in 2010 all related to noncommunicable diseases: high blood pressure, high body-mass index, high fasting plasma glucose, a diet low in fruit and a diet high in sodium. In Western Europe, the leading risks were similar but smoking was the leading risk, followed by high body-mass index, high blood pressure, alcohol use, and high total cholesterol. For Western sub-Saharan Africa, the five leading risk factors for death were high blood pressure, unsafe sex, high body-mass index, household air pollution, and high fasting plasma glucose. These differences partly reflect the place of HIV/AIDS in parts of West Africa and the extent to which people cook there with biomass fuels on unventilated stoves (IMHE, 2015).

Implications for Health Promotion

A large share of the disability and premature deaths of women globally could be avoided by addressing the underlying risk factors and determinants of health. In the poorest countries of the world, women continue to die prematurely from communicable diseases such as HIV, TB, and malaria and from maternal disorders. The overwhelming majority of these deaths are preventable and treatable. Throughout the world, women are also increasingly dying prematurely of the most significant noncommunicable diseases, such as ischemic heart disease, stroke, COPD, and diabetes. By reducing tobacco smoking, alcohol use, and dietary risks, and increasing physical activity, women should be able to live longer with less disability while they are alive. Reducing exposure to indoor air pollution could also substantially reduce preventable female deaths in low-income settings. In each of these areas, there is an important role for health promotion and behavior change.

We also need to be attuned to the large number of DALYs among women that are attributable in most countries to musculoskeletal problems and to mental health conditions. To a large extent, these are not reflected in premature death, but they do cause very large amounts of disability and lost productivity. Given increasing life expectancy and the aging of populations, we need to promote measures to both prevent and treat these problems. If not, we will have more older women living longer, but doing so with disabilities that impose a substantial burden on them, their families, and society.

The Health of Children Ages 0 to 5

We saw earlier the rates at which neonates, infants, and under-five children die by region. However, improving the health of young children requires that we also understand what they get sick and die from, at what ages, and what are the key risk factors and determinants of those deaths. The section that follows examines children under five years of age. For young children, the DALY is a less useful concept than deaths, and this section looks only at child deaths and their related risk factors.

UNICEF estimated that about 6.3 million children under five years of age died in 2013. Given the dramatic differences in under-five child mortality between low- and high-income countries, it is clear that most of these deaths are preventable (UNICEF, 2014, p. 5).

UNICEF has also estimated that about 1 million, or about 16% of the under-five children who die each year, will die in their first day of life. UNICEF further estimates that about 2 million, or about 32% of the under-five children who die each year, will die in their first week of life and 2.8 million, or 44% of the annual under-five child deaths, occur in the first month of life (UNICEF, 2014, p. 6). Efforts to reduce young child deaths will clearly have to pay particular attention to neonatal deaths.

The GBD study estimates that the leading causes of under-five death globally are lower respiratory infections, preterm birth, neonatal encephalopathy, malaria, and diarrheal diseases. In Western sub-Saharan Africa, the five leading causes of under-five death are malaria, lower respiratory infections, diarrheal

diseases, preterm birth, and neonatal encephalopathy. In Western Europe, four of the five leading causes of death of children this age mostly relate to neonatal conditions: congenital anomalies, preterm birth, neonatal encephalopathy, other neonatal conditions and sudden infant death syndrome (SIDS). Clearly, the global estimates are dominated by the fact that almost all of the young children who die are in low- and middle-income countries. We also see that as countries progress economically, child deaths from communicable causes and causes related to poverty decline and the causes related to neonatal conditions make up a larger share of total under-five child deaths (IMHE, 2015).

Given the importance of neonatal deaths to under-five child deaths, it is also valuable to note the leading causes of their death. The World Health Organization estimated in 2013 that the leading causes of neonatal mortality were preterm birth complications, birth asphyxia and birth trauma, and sepsis and other infections (World Health Organization, 2015a). As noted below, there are low-cost highly effective interventions that can be promoted and taken at the community level to address several of these issues, especially birth asphyxia and some infections.

Globally, the most important risk factors for young child death are dominated by deaths in low-income countries. Thus, they relate largely to the household environment, the nutritional status of the mother and the child, and the circumstances under which the birth occurs, such as whether or not it was assisted by a skilled attendant. In this light, the leading risk factors for young child death globally include childhood underweight, suboptimal breastfeeding, unsafe water, unsafe sanitation, and household air pollution. In high-income countries some of the most important risk factors for young child death may relate to tobacco, alcohol, and drug use among mothers, as well as poor maternal health and nutrition (IMHE, 2015).

Implications for Health Promotion

What share of the more than 6 million under-five child deaths each year are preventable? There will always be some children who die at young ages. However, the lowest rates of under-five child death occur in Iceland, which has an under-five child death rate of 2 for every 1,000 live births (World Bank, 2015b). This can be thought of as a lower boundary for child death rates. This compares with the worst under-five child death rate in the world—147 per 1,000 live births, in Chad (World Bank, 2015b). An important study done several years ago suggested that about two-thirds of the deaths of children under five globally could be prevented by scaling up a package of known and evidence-based interventions at a high level in low-income countries. Such interventions would include, for example, vaccines such as measles and *Haemophilus influenzae* type B (Hib), long-lasting insecticide-treated bednets, micronutrients, oral rehydration therapy, and breastfeeding (Jones et al., 2003, pp. 66–70). Another important study showed that 15% of the under-five child deaths globally could be averted through a package of 10 evidence-based nutrition interventions implemented at 90% (Bhutta et al., 2013). It is clear that fundamental to reducing child death rates is the need to promote a better

understanding, especially in low-income and poorly educated communities, about the causes of child death, their risk factors, and how those risks can be prevented or mitigated. In principle, every country ought to aspire to bring its under-five child death rate down to the levels of today's highest-income countries, although it may take considerable time to achieve this.

Communicable Diseases

Although the share of the total burden of disease that is communicable is declining, communicable diseases remain an important part of the “unfinished agenda” among the poor everywhere, but especially in low- and middle-income countries. The section that follows offers some brief comments about the burden of HIV, TB, malaria, and the neglected tropical diseases. Because there are agencies responsible for addressing particular diseases, this section generally uses data from WHO or UNAIDS. However, it will complement that data with GBD data.

HIV

Incidence, Prevalence, and Deaths

About 35 million people in the world were living with HIV/AIDS in 2013. Of those who were infected with HIV, about 41% were men, 50% were women, and 9% were children under 15 years of age (UNAIDS, 2014, p. 1).

UNAIDS estimates that there were about 2.1 million people newly infected with HIV in 2013. About 1.86 million of these were adults, and the remaining 240,000 were children under 15. The number of new infections is a substantial decline from the 3.4 million new infections that were estimated to have occurred in 2001 (UNAIDS, 2014, p. 1).

In fact, the number of people newly infected globally with HIV each year has fallen, and following UNAIDS estimates, is now 38% lower than in 2001. Many countries in sub-Saharan Africa and the Caribbean have seen sharp declines in the number of new cases of HIV/AIDS between 2001 and 2013. However, the number of new infections continues to rise in some regions, particularly the Middle East and North Africa, Central Asia, and Eastern Europe (UNAIDS, 2014, p. 1).

The number of children newly infected with HIV has also fallen, with progress in the prevention of maternal to child transmission. Some highly affected countries, like Botswana, have made dramatic progress in stemming maternal to child transmission, even as some other countries have made only a start in reducing maternal to child transmission (UNAIDS, 2013, p. 30).

The overwhelming majority of new infections with HIV stem from sexual transmission, mostly heterosexual. In a number of places, however, the main route for the transmission of new infections is men who have sex with men or practice injecting drug use. Despite progress, maternal to child transmission remains an important share of the total number of new cases annually in a number of settings, overwhelmingly in sub-Saharan Africa (UNAIDS, 2013, pp. 38–45).

Over the past decade, the HIV/AIDS epidemic has also become “feminized,” with an increasing share of the total cases among adults being among women. In sub-Saharan Africa, for example, almost 60% of the HIV-positive people are women (UNAIDS, 2014, p. 2).

UNAIDS estimates that about 1.5 million people died from HIV/AIDS in 2013 (UNAIDS, 2014, p. 1). There have been substantial declines in HIV-related deaths in sub-Saharan Africa, the Caribbean, and Oceania. However, the number of deaths annually from HIV has increased in Central Asia, Eastern Europe, and in the Middle East and North Africa (UNAIDS, 2014, pp. 2–4). As noted earlier, HIV remains among the top five causes of deaths for all ages combined in sub-Saharan Africa (IHME, 2015).

The prevalence of HIV/AIDS varies by region, by country, and by location within countries. Sub-Saharan Africa has the highest rate of adult prevalence, close to 5%. The Caribbean, Central Asia, and Eastern Europe have the next highest rates, at about 1%. However, there are a number of countries with very high rates of adult prevalence, including Botswana at 23%, South Africa at 18%, and Swaziland at 21% (UNAIDS, 2013, pp. A7, A8).

There has been dramatic progress in getting people on antiretroviral therapy, and the number of such people has increased to about 12.9 million in 2013. This is 37% of the people eligible under the WHO 2013 guidelines (UNAIDS, 2014, p. 10).

Implications for Health Promotion

Although there has been substantial discussion of “treatment as prevention” (Granich, Williams, & Montaner, 2013), in the short to medium term, behavior change is the key to reducing incidence and prevalence. This is made even more important by the fact that there is no HIV vaccine and little promise that a safe and effective HIV vaccine will be available in the near future. Some of the key interventions include promoting later sexual debut, fewer sexual partners, correct and consistent condom usage, the uptake of medical male circumcision, and being placed on and adhering to antiretroviral therapy. It will also be important to continue to address the stigma of HIV/AIDS. There is clearly a large role for health promotion in work on HIV/AIDS.

Tuberculosis

Prevalence and Deaths

There has been important progress in addressing the burden of TB. The rate of new infections has been falling for a decade. In addition, mortality from tuberculosis has been reduced by 47% since 1990 (WHO, 2015b). Nonetheless, TB remains a disease of exceptional significance, especially in low-income countries and countries with a high burden of HIV/AIDS. Indeed, as noted earlier, TB was the 10th leading cause of death globally in 2010, and in the GBD subregions of South Asia, Eastern sub-Saharan Africa and Southern sub-Saharan Africa, TB is among the top five causes of death (IHME, 2015, p. 6).

WHO has estimated that there were about 9.6 million people infected with active TB disease in 2014 and that about 1.5 million people died from TB that year (WHO, 2015b). Although men are more likely to get TB than women, about one-third of the annual TB deaths are among women and TB remains a major killer of women of reproductive age (IMHE, 2015). It is difficult to diagnose TB in children, but WHO estimated that about 1 million children became ill with TB in 2014 and 140,000 children died that year of TB (IMHE, 2015).

TB is an opportunistic infection of HIV and TB/HIV co-infection is an important issue. It is estimated that about 13% of people with active TB disease in 2014 were co-infected with HIV, and about one-third of all deaths among people who are HIV-positive are from TB. About 75% of those who are co-infected are in Africa (WHO, 2015b).

Drug-resistant TB is a major issue in efforts to address TB. It is thought that about 480,000 of the 9.6 million cases of active TB disease were drug resistant 2014, but only about 20% of them have been identified and are being treated. The largest numbers of drug-resistant cases are in China, India, and Russia (WHO, 2015b).

Implications for Health Promotion

TB is treatable and curable, and proper treatment reduces the spread of TB and the development of drug-resistant TB. In principle, no one, certainly no one who is not immune compromised, should die of drug-susceptible TB. However, to avoid TB deaths, it is important to identify all people with TB and to seek to cure all of them. This is made more complicated by stigma against people with TB, the six-month course of therapy for drug-susceptible TB, and the even longer course of therapy for drug-resistant TB. Thus, progress against TB will require health promotion efforts aimed at helping people recognize the symptoms of TB, encouraging them to seek appropriate care as early as possible and to adhere faithfully to their drug regimen. In addition, it will be important to test all HIV positive people for TB and all people with TB for HIV.

Malaria

Incidence and Deaths

In 2010, malaria was the 12th leading cause of death globally. However, it was the first cause in the GBD subregions of Central and Western sub-Saharan Africa, the fourth cause in Eastern sub-Saharan Africa, and the ninth cause in Oceania (IMHE, 2015). WHO estimates that there were more than 200 million cases of malaria in 2012. The highest rates of malaria are found in Africa and six African countries: Nigeria, the Democratic Republic of the Congo (DRC), Tanzania, Uganda, Mozambique, and Cote d'Ivoire, which account for nearly half of the malaria cases worldwide. Nigeria and the DRC alone account for about 40% of all malaria deaths (Roll Back Malaria, 2013).

WHO estimates that 627,000 people died of malaria in 2012 (Roll Back Malaria, 2013, p. 21). The overwhelming majority of the deaths, 77%, were in children under five years of age (Roll Back Malaria, 2013). However, malaria

causes substantial risks for pregnant women in low-income countries and a significant share of the remaining deaths were among pregnant women (Roll Back Malaria, 2013). Adult male forest workers in some places in Southeast Asia and South Asia are also at risk for malaria.

Implications for Health Promotion

Many cases of malaria could be prevented through measures such as: the use of insecticide-treated bednets; indoor residual spraying; intermittent treatment of pregnant women; selected seasonal chemoprevention in young children; and, in some settings, larval and other environmental controls. Malaria can also be treated, which reduces transmission, provided that people recognize malaria symptoms, seek and receive appropriate care expeditiously, based on a confirmed diagnosis, and receive the correct drug. There are substantial gaps in each of these areas now and an important role for health promotion to help close them.

Neglected Tropical Diseases

The NTD Burden

The neglected tropical diseases (NTD) are a group of 17 diseases, some of which are highly prevalent but which did not garner much attention until the past decade. They include, for example, soil-transmitted helminths (worms), leprosy, schistosomiasis, lymphatic filariasis, onchocerciasis, and trachoma. They affect more than 1 billion people worldwide, about 90% in Africa, and many people suffer from more than one NTD at the same time (WHO, 2012, p. vii).

The NTDs are not associated with much mortality. However, many of the NTDs, such as lymphatic filariasis, can produce substantial morbidity, often for long periods of time or permanently. Estimates by those working on NTDs suggest that the burden of disease from the NTDs in DALYs may be greater than the burden from malaria and TB (Hotez, 2011, p. 104), although GBD suggests that NTDs cause about 30% of the burden of malaria and half the burden of TB (IMHE, 2015).

The largest number of NTD infections comes from soil-transmitted helminths. *Ascaris* (roundworm), for example, is estimated to infect about 1.2 billion people, *trichuris* (whipworm) about 800 million people, and hookworm about 740 million people. In addition, it is estimated that there are about 200 million cases of schistosomiasis, about 37 million cases of onchocerciasis, and about 84 million people actively infected with trachoma (Imperial College London—Schistosomiasis Control Initiative, 2015).

Implications for Health Promotion

Seven of the NTDs are now the focus of global attention: three soil-transmitted helminths, onchocerciasis, schistosomiasis, lymphatic filariasis, and trachoma. To combat these afflictions, a “Rapid Impact Package” of drug therapy is being promoted through mass drug administration at the community level.

This costs about US50 cents per person per year. This drug therapy can prevent the onset of these diseases in some cases and cure certain stages of the disease, as well. In addition, if mass drug administration is carried out effectively over an extended period, it should be possible to reduce transmission of some of these diseases in the affected locale. Reduction in transmission could also be aided if the people in endemic areas had greater knowledge of the diseases, their risk factors, and how to prevent those risk factors. This requires an effort to reduce the exceptional stigma attached to some of these diseases. There is a major role for health promotion in mobilizing communities around knowledge of the diseases and their risk factors, the need for participating in mass drug administration, and the need for early diagnosis and treatment if affected.

Noncommunicable Diseases

Two-thirds of the deaths that occurred in 2010 were due to noncommunicable causes. Ischemic heart disease and stroke caused almost 14 million deaths, or about 25% of total deaths. About 8 million people died from cancer and about 1.2 million from diabetes. Trachea, bronchus, and lung cancer accounted for about 1.5 million of those cancer deaths; however, if the deaths from all forms of cancer were combined, then cancer would have been the leading cause of death in 2010 (IHME 2015).

These figures represent a substantial change in the causes of death between 1990 and 2010, as noted earlier. In 1990, for example, the Group I diseases—communicable, maternal, neonatal, and nutritional causes—accounted for about 34% of all deaths. In 2010, however, they only accounted for 25% of all deaths. Today, these Group I causes are the predominant cause of death only in sub-Saharan Africa, in which they constitute about 75% of premature mortality (Lozano et al., 2012, p. 2096).

The total DALYs from all causes in 2010 is estimated to be about the same as in 1990. However, the composition of DALYs has changed significantly. First, the burden of disease has continued to shift from communicable to noncommunicable diseases. In 1990, communicable diseases were predominant, and noncommunicable diseases made up 43% of the total burden of disease. In 2010, however, noncommunicable diseases made up 54% of the burden of disease. Injuries as a share of the total burden of disease stayed about the same over the two periods, at around 11% (IHME, 2015).

The most important risk factors for deaths from noncommunicable diseases globally in 2010, for all age groups, are well known. These included high blood pressure, smoking, high body-mass index, high fasting plasma glucose, a diet high in sodium and low in fruit, household air pollution, ambient particulate matter, alcohol use, and high total cholesterol (IHME, 2015).

Implications for Health Promotion

The links between behavior and noncommunicable diseases are clear, and there is an enormous role for health promotion in trying to reduce the burden of noncommunicable diseases. It may be most effective and efficient to tie health promotion efforts to the implementation of policies that also aim to encourage

behavior change. This might include, for example, promoting healthier diets alongside better food labeling and taxes on unhealthy ingredients in processed foods. It could also include promoting a reduction in tobacco smoking, while raising tobacco taxes, or taking similar measures to reduce excessive alcohol use. Promoting better land use planning that encourages walking could also go hand in hand, for example, with efforts to promote more physical activity. In low- and middle-income settings, at least, it may also be necessary to mobilize communities to reduce the stigma of mental health and neuropsychiatric disorders and to engage them to provide psychosocial support to affected people.

Injuries

As noted earlier, about 9% of total deaths worldwide were associated with injuries in 2010. This was similar to the share of total deaths attributable to injuries in 1990. The share total DALYs attributable to injuries in 2010 was about 11%, also about the same as in 1990 (IHME, 2015).

The most important injuries in terms of their contributions to deaths and DALYs are road injuries, as also cited earlier, and almost 3% of all deaths in 2010 were related to such injuries. Road injuries that year were associated with about 50% more deaths than the next most important injury-related cause of death, which was self-harm, and about three times more deaths than the next largest injury-related cause of death, which was falls. Some of the other important causes of injury related deaths and DALYs are drowning, fire, and poisoning (IHME, 2015).

As expected, there is variance in injuries by location, age, and sex, among other factors. The rates of road traffic injuries vary considerably across regions, as is the likelihood that one will survive such an injury. Falls are of special importance for older people, drownings for younger people, and fires for women, especially in the South Asia region (IHME, 2015).

Implications for Health Promotion

Health promotion has an important role to play in efforts to reduce deaths and disability from injuries. At the simplest level, health promotion, often coupled with regulation, has played a very important role in reducing road injuries and deaths through encouragement of seat belt use and the use of motorcycle and bicycle helmets. Health promotion can also play a key role at the community level in promoting greater awareness of the risks of falls for older people and drowning for younger people and measures that can be taken to address them. This is also true of approaches to accidental poisoning, which is often the subject of health promotion efforts in high-income countries. Many countries face major gaps in their approach to mental health issues, including self-harm. Nonetheless, health promotion could also play an important role in reducing self-harm by helping to reduce the stigma of mental disorders and making individuals and communities more aware of such disorders and how they can get help for them.

Looking Forward

There are many factors that will influence the burden of disease in the future, in different communities, countries, and globally. Among the most important will be the pace of:

- their **epidemiological transition**
- their nutrition transition
- their **demographic transition**
- economic development
- urbanization
- increases in educational attainment, especially for girls
- technological change, especially in the health sector
- climate change

The possible outbreak of emerging and reemerging infectious diseases, of course, could also dramatically alter the future burden of disease, as epidemics have done historically and as HIV/AIDS has done more recently.

It is anticipated that most countries during the next few decades will continue to grow economically, become more urban, and that their children will achieve increasingly higher levels of educational attainment. It is also anticipated that fertility, even in today's high-fertility countries, will continue to fall, that people will live longer throughout the world, and that an increasing number of countries will have to deal with an aging population. Despite the stresses of urbanization, living in cities should increase longevity for most people. It can also be assumed that technological change in the health sector could lead to people living longer, as we are able to make use of better diagnostics, drugs, and vaccines. Increasing amounts are being written about the impact of climate change on health. Some of this change may hurt human health in some places, such as by enabling the spread of insect vectors that had been absent. However, it is certainly possible that in some places climate change might lead to a reduction in health risks.

In the absence of any major outbreak of infectious diseases, these factors are likely to lead, on balance, to continued reduction in fertility, the aging of populations, and an increase in the share of the population that is over 65 years of age. These changes *could* lead to healthier populations who live longer with less disability. However, this will also depend on the extent to which countries can avoid an increasing share of the globe becoming more exposed to "behavioral" risk factors, such as tobacco and obesity.

Projections of the future burden of disease have not yet been made in conjunction with the GBD. However, the World Health Organization in 2008 developed projections of the burden of disease to 2030. These projections suggest that there will be a continuing increase in the average age of death. In addition, the projections indicate that the burden of disease will continue to shift toward noncommunicable diseases. These projections further suggest

that the three leading burdens of disease in 2030 would be unipolar depression, ischemic heart disease, and road traffic accidents. As expected, the projections also suggest that the burdens of disease we associate with poverty and underdevelopment will decrease, while those we associate with high-income settings and increasing age, such as vision and hearing loss, will increase. Of course, the pace of these changes will depend largely on the points noted earlier (WHO, 2008, p. 26).

Summary

The promotion of better health requires that we understand what people get sick, disabled, and die from. It is also important to understand how morbidity, disability, and mortality vary across groups, such as by sex, age, ethnicity, location, and socioeconomic status. In addition, we need to understand the risk factors and the social determinants that are associated with people falling ill from these causes.

There *has been* important progress in human health. People are living longer than ever before. The number of maternal deaths has decreased. The number of new TB and HIV infections have also decreased, and fewer people are dying of HIV/AIDS and TB than before. Many fewer young children are dying of diarrhea, pneumonia, malaria, or measles than ever before.

Despite this progress, there remains a substantial “unfinished agenda” of deaths from overwhelmingly preventable communicable, maternal, nutritional, and perinatal causes. These occur mostly in a range of low- and middle-income countries and especially among the poor. Moreover, they occur at highest rates in South Asia and sub-Saharan Africa, whose health indicators substantially lag those of the rest of the world.

At the same time, there is a growing burden of morbidity and mortality from noncommunicable causes. Today, the overwhelming majority of deaths and of the burden of disease measured in DALYs is linked with noncommunicable diseases. In fact, noncommunicable diseases are the predominant cause of both deaths and DALYs in all regions except sub-Saharan Africa. Moreover, over the past 20 years or so, DALYs related to noncommunicable causes as a share of total DALYs have increased from about 42% to 58%. The patterns of these noncommunicable causes vary among countries. However, as country incomes rise and lifestyles change, ischemic heart disease and stroke increasingly become the two leading causes of adult death. A large share of the deaths and DALYs associated with noncommunicable diseases are also preventable.

Injuries are also an important contributor to death and DALYs, and in 2010, about 9% of total deaths and 11% of total DALYs worldwide were attributed to injuries. These figures are about the same as they were in 1990. The importance of injuries to deaths and DALYs varies by location, sex, and age, among other things. It also varies with the ability in different places to both prevent and treat such injuries. Road injuries are the most important injury-related contributor to deaths and DALYs. However, self-harm, falls, drowning, fires, and poisoning are also important contributors to death and DALYs.

As populations have aged and people have lived longer, there has also been an increase in many settings in the number of years people are living with

disability. In some settings, disability is also an increasing share of total healthy life years lost. The share of noncommunicable diseases in the overall burden of disease is expected to continue rising. Part of this rise is expected to follow substantial projected increases in the burden of ill health from conditions such as dementia, diabetes, and mental health disorders. These shifts will contribute to growing amounts of disability.

There is increasingly good evidence on the social determinants of and the risk factors for the unfinished agenda of communicable diseases, for noncommunicable diseases, and for injuries. To reduce child deaths, for example, there will have to be improvements in nutrition, access to safe water, improved sanitation, and handwashing with soap. In addition, child deaths could be reduced relatively rapidly if the affected countries could implement at scale a cost-effective package of evidence-based interventions, such as promotion of better birthing practices, improved caring behaviors for neonates, exclusive breastfeeding, and immunization.

Addressing the growing burden of noncommunicable diseases will require reductions in the use of tobacco and alcohol, dietary improvements, and more physical activity, among other things. These would also contribute to reductions in some of the conditions that are themselves risk factors for heart disease and stroke, such as diabetes and high blood pressure. Reducing deaths and DALYs from injuries will require efforts to reduce road injuries. These could include, for example, better enforcement of traffic, drunk driving, and seat belt and helmet laws. These could also include efforts to calm traffic, such as traffic circles and speed bumps.

There is a substantial role for health promotion in dealing with the agendas of all three “cause groups”: communicable, maternal, perinatal, and nutritional (Group 1); noncommunicable (Group 2); and injuries (Group 3). On the Group 1 side, there is a need, among many other things, to mobilize families and communities to engage in a range of better health behaviors, such as more optimal breastfeeding, the feeding of a more diverse diet, safer use of water, the elimination of open defecation, and handwashing with soap. Families also need to be more knowledgeable, for example, about how to reduce exposure to malaria and diagnose and treat it effectively; how to recognize TB and seek appropriate care for it; and how to reduce exposure to HIV and to seek out testing for it. Promoting the immunization agenda will also continue to be important.

On the noncommunicable side (Group 2), many of the causes of morbidity and mortality are associated with behavioral factors. Among other things, it will be important to promote reduction in the use of tobacco and alcohol. It will also be important to encourage people to eat healthier and exercise more. People will also need to be encouraged to recognize early the risk factors for the most important noncommunicable diseases and to address them at an early stage.

We have known for many years that health promotion can play an extremely important role in preventing injuries.

For Group 3, in fact some of the most important measures will be to promote the use of seat belts in automobiles and helmets for motorcycles and bicycles. Health promotion at the community level, for example, can also be instrumental to reducing falls, drowning, and accidental poisonings. There

is also a large and often forgotten agenda for health promotion to reduce self-harm and help to make people more aware of, more accepting of, and more willing to seek care for mental health disorders.

KEY TERMS

1. **Communicable diseases:** Illnesses that are caused by a particular infectious agent and that spread directly or indirectly from people to people, from animals to animals, from animals to people, or from people to animals
2. **Demographic transition:** The shift from high fertility and high mortality to low fertility and low mortality
3. **Disability-adjusted life years (DALYs):** A composite measure of premature deaths and losses due to illnesses and disabilities in a population
4. **Epidemiologic transition:** A shift in the pattern of disease from largely communicable diseases to noncommunicable diseases
5. **Morbidity:** Illness
6. **Mortality:** Death
7. **Noncommunicable diseases:** Illnesses that are not spread by any infectious agent
8. **Risk factor:** An aspect or personal behavior or lifestyle, an environmental exposure, or an inborn or inherited characteristic that, on the basis of epidemiologic evidence, is known to be associated with health-related conditions

REVIEW QUESTIONS

1. What is a DALY?
2. What is meant by the concept “the burden of disease”?
3. What are the three leading causes of death globally for all age groups and both sexes?
4. How would these causes vary by country income group?
5. How would the leading causes of death for women globally vary from that for men?
6. What are the three leading causes of death globally for under-five children?

7. How would the leading causes of death for under-five children vary across country income groups?
8. What types of health conditions might cause substantial numbers of years lived with disability but not be associated with many deaths?
9. What share of the burden of disease in a poor sub-Saharan African country today will be communicable diseases and how would you expect that to change during the next twenty years?

References

- Bhutta, Z. A., Das, J. K., Rizvi, A., et al. for the Lancet Nutrition Interventions Review Group and the Maternal and Child Study Group. (2013). Evidence-based interventions for improvement of maternal and child nutrition: What can be done and at what cost? *Lancet*, 382(9890), 452–477.
- Granich, R., Williams, B., & Montaner, J. (2013). Fifteen million people on antiretroviral treatment by 2015: Treatment as prevention. *Current Opinion in HIV and AIDS*, 8(1), 41–49.
- Hotez, P. (2011). Enlarging the “audacious goal”: Elimination of the world’s high prevalence neglected tropical diseases. *Vaccine*, 29 (Suppl. 4), 104–110.
- Imperial College London-Schistosomiasis Control Initiative. (2015). *What are neglected tropical diseases*. Retrieved from <http://www3.imperial.ac.uk/schisto/whatwedo/7ntds>
- Institute for Health Metrics and Evaluation. (2013). *The global burden of disease: Generating evidence, guiding policy*. Seattle, WA: Author.
- Institute of Health Metrics and Evaluation. (2015). *GBD Compare|Viz Hub*. Retrieved from <http://vizhub.healthdata.org/gbd-compare/>
- Jones, G., Steketee, R. W., Black, R. E., Bhutta, Z. A., Morris, S. S., and the Bellagio Child Survival Study Group. (2003). How many child deaths can we prevent this year? *Lancet*, 362(9377), 65–71.
- Lim, S. S., Vos, T., Flaxman, A. D., et al. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 380(9859), 2224–2260.
- Lozano, R., Nagavi, M., Foreman, K., et al. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 380(9859), 2095–2128.
- Roll Back Malaria. (2013). *Key malaria facts*. Retrieved from <http://www.rollbackmalaria.org/keyfacts.html>

- Salomon, J. A., Vos, T., Hogan, D. R., et al. (2012). Common values in assessing health outcomes from disease and injury: Disability weights measurement study for the Global Burden of Disease Study 2010. *Lancet*, 380(9859), 2129–2143.
- UNAIDS. (2013). *Global report: UNAIDS report on the global AIDS epidemic 2013*. Geneva: Author.
- UNAIDS. (2014). *2014 Fact Sheet*. Global Statistics. Geneva: Author.
- UNICEF. (2014). *Committing to child survival: A promise renewed*. New York, NY: Author.
- United Nations Statistics Division. (2015). *Millennium Development Goals Indicators*. Retrieved from <http://mdgs.un.org/unsd/mdg/Metadata.aspx?IndicatorId=0&SeriesId=553>
- Wang, H., Dwyer-Lindgren, L., Lofgren, K. T., et al. (2012). Age-specific and sex-specific mortality in 187 countries, 1970–2010: A systematic study for the Global Burden of Disease Study 2010. *Lancet*, 380(9859), 2071–2094.
- World Bank. (2015a). *Data; Life expectancy at birth, total (years)*. Retrieved from <http://data.worldbank.org/indicator/SP.DYN.LE00.IN>
- World Bank. (2015b). *Data; Mortality rate, infant (per 1,000 live births)*. Retrieved from <http://data.worldbank.org/indicator/SP.DYN.IMRT.IN> <http://data.worldbank.org/indicator/SP.DYN.IMRT.IN>
- World Bank. (2015c). *Data; Mortality rate, neonatal (per 1,000 live births)*. Retrieved from <http://data.worldbank.org/indicator/SH.DYN.NMRT>
- World Bank. (2015d). *Data; Mortality rate, under five (per 1,000 live births)*. Retrieved from <http://data.worldbank.org/indicator/SH.DYN.MORT>
- World Health Organization. (n.d.). *The Global Burden of Disease Study (2000–2002): Definition of cause categories in terms of international classification of disease (ICD) codes*. Retrieved from <http://www.who.int/healthinfo/statistics/gbdestimatescauselist.pdf>
- World Health Organization. (2008). *The global burden of disease: 2004 update*. Geneva: Author.
- World Health Organization. (2012). *Accelerating work to overcome the global impact of neglected tropical diseases*. Geneva: Author.
- World Health Organization. (2013). *Global tuberculosis report 2013*. Geneva: Author.
- World Health Organization. (2015a). *Global health observatory data repository*. Retrieved from <http://apps.who.int/gho/data/view.main.CM300WORLD-CH17?lang=en>.
- World Health Organization. (2015b). *Tuberculosis. Fact sheet No. 104*. Updated October 2015. <http://www.who.int/mediacentre/factsheets/fs104/en/>

Ms. Lindsey Hiebert provided substantial assistance in the preparation of this chapter, including preparation of tables and figures and assistance in editing.