

# Health from an Ecological Perspective

### OBJECTIVES

After completing Chapter 2, learners will be proficient in applying measures of population health and illness, including risk factors, in community health improvement activities and initiatives. Key aspects of this competency expectation include the following:

- Articulating several different definitions of health
- Identifying four or more categories of factors that influence health
- For each of these categories, specifying three or more factors that influence health
- Identifying several categories of commonly used measures of health status
- For each of these categories, identifying three or more commonly used measures
- Describing major trends in health status for the United States over the past 100 years
- Accessing and using comprehensive and current national data on health status and factors influencing health in the United States
- Using information on factors that influence health and measures of health to develop community health priorities and effective interventions for improving community health status

The 21st century began much as its predecessor did, with immense opportunities to advance the public's health through actions to ensure conditions favorable for health and quality of life. All systems direct their efforts toward certain outcomes; they track progress by ensuring that these outcomes are clearly defined and measurable. In public health, this calls for clear definitions and measures of health and quality of life in populations. That task is the focus of this chapter. Key questions to be addressed are as follows:

- What is health?
- What factors influence health and illness?

- How can health status and quality of life be measured?
- What do current measures tell us about the health status and quality of life of Americans in the early decades of the 21st century?
- How can this information be used to develop effective public health interventions and public policy?

The relevance of these questions resides in their focus on factors that cause or influence particular health outcomes. Efforts to identify and measure key aspects of health and factors influencing health have relied on traditional approaches over the past century, although there are signs that this pattern may be changing. The key questions listed above are addressed slightly out of order, for reasons that should become apparent as we proceed.

## HEALTH IN THE UNITED STATES

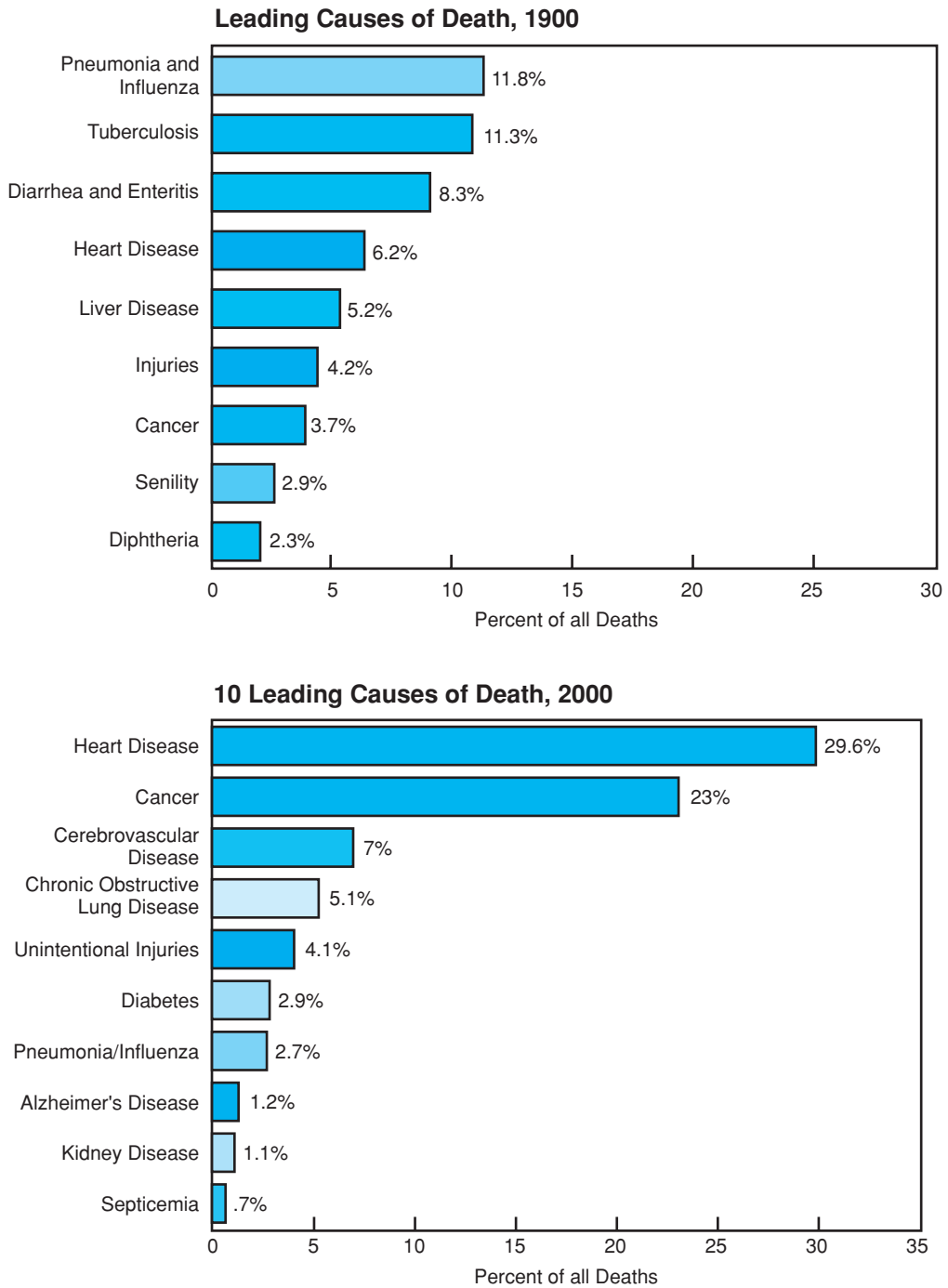
Many important indicators of health status in the United States have improved considerably over the past century, although there is evidence that health status could be even better than it is. At the turn of the 20th century, nearly 2% of the U.S. population died each year. The crude mortality rate in 1900 was about 1,700 deaths per 100,000 population. Life expectancy at birth was 47 years. Additional life expectancy at the age of 65 years was another 12 years. Medicine and health care were largely proprietary in 1900 and of questionable benefit to health. More extensive information on the health status of the population at that time would be useful, but very little exists.

Indicators of health status improved in the United States throughout the 20th century.<sup>1</sup> Between 1900 and 2000, the crude mortality rate was cut nearly in half to 854 per 100,000. By the year 2000, life expectancy at birth was nearly 77 years, and life expectancy at 65 years old was another 18 years.

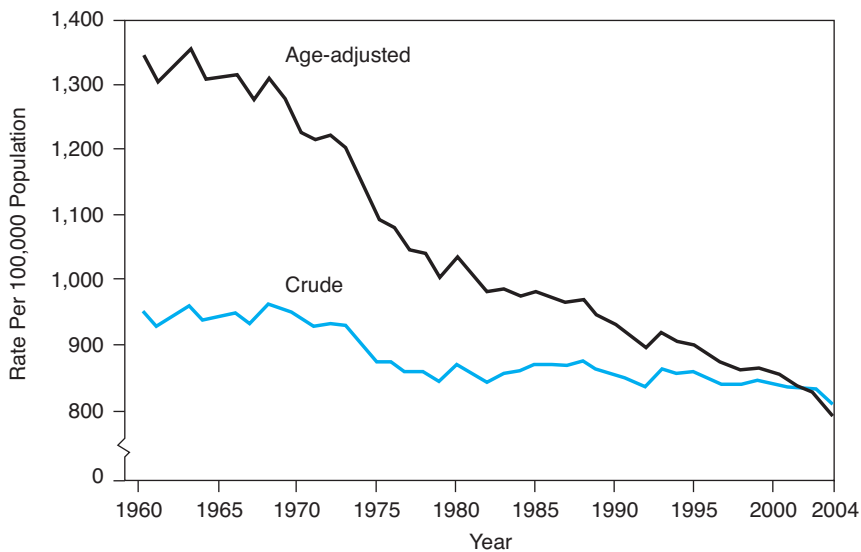
The leading causes of death also changed dramatically over the 20th century, as demonstrated in Figure 2-1. In 1900, the leading causes of death were influenza and pneumonia, tuberculosis, diarrhea and related diseases, heart disease, liver disease, stroke, chronic nephritis, accidents, cancer, perinatal conditions, and diphtheria. By the year 2000, tuberculosis, gastroenteritis, and diphtheria dropped off the list of the top 10 killers, and deaths from influenza and pneumonia fell from first to seventh position on the list. Diseases of aging and other chronic conditions superseded these infectious disease processes, as changes in the age structure of the population, especially the increase in persons over age 65 years, resulted in higher overall crude rates for heart disease and cancer and the appearance of diabetes, Alzheimer's disease, chronic kidney conditions, and septicemia on the modern list of the top 10 killers.

Changes in crude death rates, however, only partly explain the gains in life expectancy realized for all age groups over the 20th century. On an age-adjusted basis, improvements were even more impressive. Age-adjusted mortality rates fell about 75% between 1900 and 2000. Over the course of the entire 20th century, infant and child mortality rates fell 95%. Adolescent and young adult mortality rates dropped 80%. Rates for adults aged 25 to 64 years fell 60%, and rates for older adults (older than 65 years) declined 35%.

During the second half of the 20th century, overall age-adjusted mortality rates fell about 50% (see Figure 2-2), whereas infant mortality rates declined



**Figure 2-1** The 10 leading causes of death as a percentage of all deaths in the United States, 1900 and 2000. *Sources:* From U.S. Dept. of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010: Understanding and Improving Health*. Rockville, MD: ODPHP; 2000 and Centers for Disease Control and Prevention, National Center for Health Statistics. *Health, United States, 2002*. Hyattsville, MD: NCHS; 2002.



**Figure 2-2** Crude and age-adjusted mortality rates, United States, 1960–2004. *Source:* From Centers for Disease Control and Prevention, National Center for Health Statistics, *Health, United States, 2006*. Hyattsville MD: NCHS; 2006.

more than 75%. During that period, mortality rates among children and young adults (ages 1 to 24 years) and adults 45 to 64 years were reduced by more than one half. Mortality rates among adults 25 to 44 years fell more than 40%, and rates for older persons (65 years old and older) fell about one third.

Gains for adult age groups in recent decades have outstripped those for younger age groups, a trend that began about 1960 as progress accelerated toward reduction of mortality from injuries and certain major chronic diseases that largely affected adults (earlier reductions for children also left little room for further improvements). Table 2-1 demonstrates changes in the age-adjusted frequency of selected major causes of death over the second half of the 20th century. Dramatic reductions in the death rates for heart disease, stroke, unintentional injuries, influenza and pneumonia, and infant mortality have been joined by more recent reductions in rates for human immunodeficiency virus (HIV) infections, liver diseases, and suicide. Age-adjusted death rates have increased for diabetes, Alzheimer's disease, and chronic lung and kidney conditions, signaling the new morbidities associated with longer life spans. Homicide rates have improved somewhat over the past decade, but they reflect a substantial increase since 1950.

Table 2-1 also demonstrates the considerable disparities that exist for many of the major causes of death. Differences among races are notable, but there are also significant differences by gender for the various causes of death. These differences are often dramatic and run from top to bottom through the chain of causation. Disparities are found not only in indicators of poor health outcomes, such as mortality, but also in the levels of risk factors in the population groups most severely affected. A poignant example of these disparities

**Table 2-1** Year 2000 Age-Adjusted Death Rates (Per 100,000 Population) for Selected Leading Causes of Death, Percentage of All 2000 Deaths, Percentage Rate Change from 1950 to 2000, and 2000 Ratio by Gender and Race, United States

<i>Cause of Death</i>	<i>Percentage of 2000 Deaths</i>	<i>Year 2000 Rate*</i>	<i>Percentage Change in Rates* 1950 to 2000</i>	<i>Male to Female 2000 Rate* Ratio</i>	<i>Black to White 2000 Rate* Ratio</i>
Diseases of the heart	29.6	257.9	-56.0	1.5	1.3
Malignant neoplasms	23.0	201.0	-3.7	1.5	1.3
Cerebrovascular disease	7.0	60.8	-66.4	1.0	1.4
Chronic lung disease	5.1	44.3	x	1.4	0.7
Accidents and adverse effects	4.1	35.5	-54.5	2.3	1.1
Diabetes	2.9	25.2	-9.1	1.2	2.2
Influenza and pneumonia	2.7	23.7	-50.7	1.3	1.1
Suicide	1.2	10.6	-19.7	4.5	0.5
Chronic liver disease and cirrhosis	1.1	9.6	-15.0	2.2	1.0
Homicide	0.7	6.1	-19.6	3.3	5.7

\*Rates age-adjusted to the 2000 U.S. population.  
 x = 1950 comparison rate not available, although believed to be much lower than 2000 rate.  
 Source: From National Center for Health Statistics. *Health, United States, 2002*. Hyattsville, MD: NCHS; 2002.

is reflected in the 12-year difference in life expectancy between white females and African American males.

There is also evidence that health is improving and that disability levels are declining in the population over time. Disability levels among individuals aged 55 to 70 years who were offspring of the famous Framingham Heart Study cohort were substantially lower in comparison with their parents' experience at the same age.<sup>2</sup> In addition, fewer offspring had chronic diseases or perceived their health as fair or poor. Self-reported health status and activity limitations caused by chronic conditions changed little during the 1990s, and injuries with lost workdays steadily declined during the 1990s.

In summary, U.S. health indicators tell two very different tales. By many measures, the American population has never been healthier. By others, much more needs to be done for specific racial, ethnic, and gender groups. The gains in health status over the past century have not been shared equally by all subgroups of the population. In fact, relative differences have been increasing. This widening gap in health status creates both a challenge and a dilemma for future health improvement efforts. The greatest gains can be made through closing these gaps and equalizing health status within the population. Nevertheless, the burden of greater risk and poorer health status resides in a relatively small part of the total population, calling for efforts that target those minorities with increased resources. An alternative approach is to continue

current strategies and resource deployment levels. Although this may continue the steady overall improvement among all groups in the population, it is likely to continue or worsen existing gaps. In the early years of the new century, the major health challenge facing the United States appears to be less related to the need to improve population-wide health outcomes than the need to eliminate or reduce disparities. This challenges the nation's commitment to its principles of equality and social justice; however, addressing inequalities in measures of health and quality of life requires a greater understanding of health and the measures used to describe it than afforded by death rates and life expectancies.

## HEALTH, ILLNESS, AND DISEASE

The relationship between health outcomes and the factors that influence them is complex, often confounded by different understandings of the concepts in question and how they are measured. Health is difficult to define and more difficult yet to measure. For much of history, the notion of health has been negative. This was due in part to the continuous onslaught of epidemic diseases. With disease a frequent visitor, health became the disease-free state. One was healthy by exclusion.

As knowledge of disease increased and methods of prevention and control improved, however, health was more commonly considered from a positive perspective. The World Health Organization (WHO) seized this opportunity in its 1946 constitution, defining health as not merely the absence of disease but a state of complete physical, mental, and social well-being.<sup>3</sup> This definition of health emphasizes that there are different, complexly related forms of wellness and illness, and suggests that a wide range of factors can influence the health of individuals and groups. It also suggests that health is not an absolute.

Although health and well-being may be synonyms, health and disease are not necessarily opposites. Most people view health and illness as existing along a continuum and as opposite and mutually exclusive states; however, this simplistic, one-dimensional model of health and illness does not comport very well with the real world. A person can have a disease or injury and still be healthy or at least feel well. There are many examples, but certainly Olympic wheelchair racers would fit into this category. It is also possible for someone without a specific disease or injury to feel ill or not well. If health and illness are not mutually exclusive, then they exist in separate dimensions, with wellness and illness in one dimension and the presence or absence of disease or injury in another.

These distinctions are important because disease is a relatively objective, pathologic phenomenon, whereas wellness and illness represent subjective experiences. This allows for several different states to exist: wellness without disease or injury, wellness with disease or injury, illness with disease or injury, and illness without physical disease or injury. This multidimensional view of health states is consistent with the WHO delineation of physical, mental, and social dimensions of health or well-being. Health or wellness is more than the absence of disease alone. Furthermore, one can be physically but not mentally and socially well.

With health measurable in several different dimensions, the question arises as to whether there is some maximum or optimal end point of health or well-being, or perhaps health is a state that can always be improved through changes in its physical, mental, and social facets. Should the goal of health policies be a minimal acceptable level of health, rather than a state of complete and absolute health? In part because of these considerations, WHO revised its definition in 1978, calling for a level of health that permits people to lead socially and economically productive lives.<sup>4</sup> This shifts the focus of health from an end in itself to a resource for everyday life, linking physical to personal and social capacities. It also suggests that it will be easier to identify measures of illness than of health.

Disease and injury are often viewed as phenomena that may lead to significant loss or disability in social functioning, making one unable to carry out one's main personal or social functions in life, such as parenting, schooling, or employment. In this perspective, health is equivalent to the absence of disability; individuals able to carry out their basic functions in life are healthy. This characterization of health as the absence of significant functional disabilities is perhaps the most common one for this highly sought state. Still, this definition is negative in that it defines health as the absence of some undesirable state.

In attempting to measure health, both quantity and quality become important considerations. It is not always easy to answer the questions, however: How much? Compared with what? For example, physical health for a 10-year-old child carries a much different expectation than physical health for an 80-year-old. It is reasonable to conclude that the natural processes of aging lead to gradual diminution of functional reserve capacity and that this is normal and not easily prevented. Thus, our perceptions of normal functioning are influenced by social and cultural factors.

The concept of well-being advanced in the WHO definition goes beyond the physical aspects of health that are the usual focus of measurements and comparisons. Including the mental and social aspects of well-being or health legitimizes the examination of factors that affect mental and social health. Together, these themes suggest that we need to consider carefully what we are measuring in order to understand what these measures are telling us about health, illness, and disease states in a population and the factors that influence these outcomes.

## MEASURING HEALTH

The availability of information on health outcomes suggests that measuring the health status of populations is a simple task; however, although often interesting and sometimes even dramatic, the commonly used measures of health status fail to paint a complete picture of health. Many of the reasons are obvious. The commonly used measures actually reflect disease and mortality, rather than health itself. The long-standing misperception that health is the absence of disease is reinforced by the relative ease of measuring disease states, in comparison with states of health. Actually, the most commonly used indicators focus on a state that is neither health nor disease—namely, death.



Despite the many problems with using mortality as a proxy for health, mortality data are generally available and widely used to describe the health status of populations. This is ironic because such data only indirectly describe the health status of living populations. Unfortunately, data on morbidity (illnesses, injuries, and functional limitations of the population) are neither as available nor as readily understood as are mortality data. This situation is improving, however, as new forms and sources of information on health conditions become more readily available. Sources for information on morbidities and disabilities now include medical records from hospitals, managed care organizations, and other providers, as well as information derived from surveys, businesses, schools, and other sources. Assessments of the health status of populations are increasingly using measures from these sources. Chapter 6 identifies a variety of useful data and information sources for public health practice. An excellent compilation of data and information on both health status and health services, *Health, United States*,<sup>1</sup> is published annually by the Centers for Disease Control and Prevention (CDC), National Center for Health Statistics. Many of the data used in this chapter are derived from this source.

### Mortality-Based Measures

Although mortality-based indicators of health status are both widely used and useful, there are some important differences in their use and interpretation. The most commonly used are crude mortality, age-specific and age-adjusted mortality, life expectancy, and years of potential life lost (YPLL). Although all are based on the same events, each provides somewhat different insights as to the health status of a population.

Crude mortality rates count deaths within the entire population and are not sensitive to differences in the age distribution of different populations. The mortality comparisons presented in Figure 2-2 illustrate the limitations of using crude death rates to compare the mortality experience of the U.S. population late in the 20th century with that of the year 1950. On the basis of these data, we might conclude that mortality rates in the United States had declined about 20% since 1950; however, because there was a greater proportion of the late 20th century population in the higher age categories, these are not truly comparable populations. The 20% reduction actually understates the differences in mortality experience over the 20th century. Because differences in the age characteristics of the two populations are a primary concern, we look for methods to correct or adjust for the age factor. Age-specific and age-adjusted rates do just that.

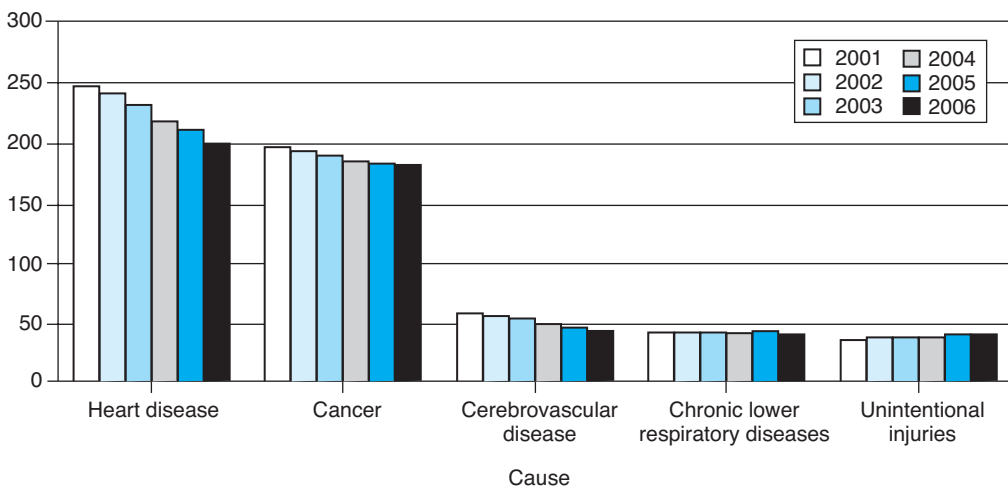
Age-specific mortality rates relate the number of deaths to the number of persons in a specific age group. The infant mortality rate is probably the best known example, describing the number of deaths of live-born infants occurring in the first year of life per 1,000 live births. Public health studies often use age-adjusted mortality rates to compensate for different mixes of age groups within a population (e.g., a high proportion of children or older persons). Age-adjusted rates are calculated by applying age-specific rates to a standard population (we now use the 2000 U.S. population). This adjustment permits more meaningful comparisons of mortality experience between populations with different age



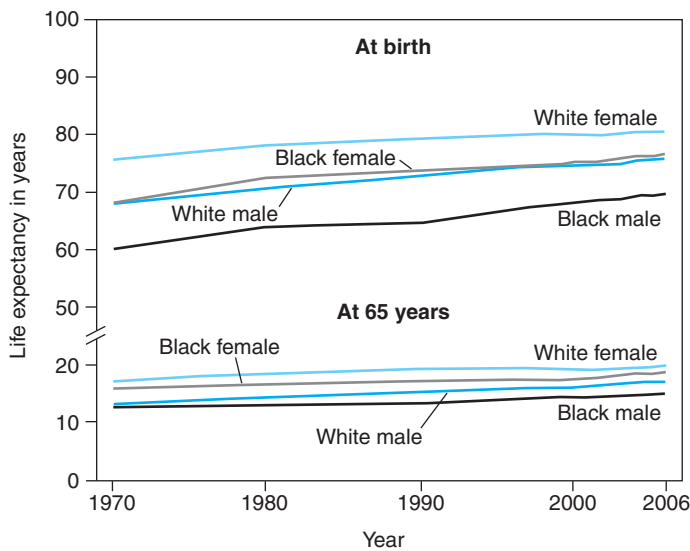
distribution patterns. Differences between crude and age-adjusted mortality rates can be substantial, such as those in Figure 2-2. The explanation is simply that the population at the end of the 20th century had a greater proportion of persons in older age groups than the 1900 or 1950 populations. Using crude rates, the improvement between 1950 and 2000 was about 20%; age-adjusted rates showed a 40% improvement. This 50-year period witnessed decreases of 50% or more for age-adjusted mortality rates for stroke, heart disease, infant deaths, tuberculosis, influenza and pneumonia, syphilis, unintentional injuries, HIV infections, gastric cancer, and uterine and cervical cancer. Figure 2-3 demonstrates that improvements in age-adjusted mortality rates for five leading causes of death are continuing in the early years of the new century.

Life expectancy, also based on the mortality experience of a population, is a computation of the number of years between any given age (e.g., birth or age of 65 years) and the average age of death for that population. Figure 2-4 provides recent data on life expectancy at birth and age 65 in the United States. Together with infant mortality rates, life expectancies are commonly used in comparisons of health status among nations. These two mortality-based indicators are often perceived as general indicators of the overall health status of a population. Infant mortality and life expectancy measures for the United States are mediocre in comparison with those of other developed nations. Figure 2-5 presents international comparisons of life expectancy by gender for the United States and selected other countries for 2004.

YPLL is a mortality-based indicator that places greater weight on deaths that occur at younger ages. Years of life lost before some arbitrary age (often



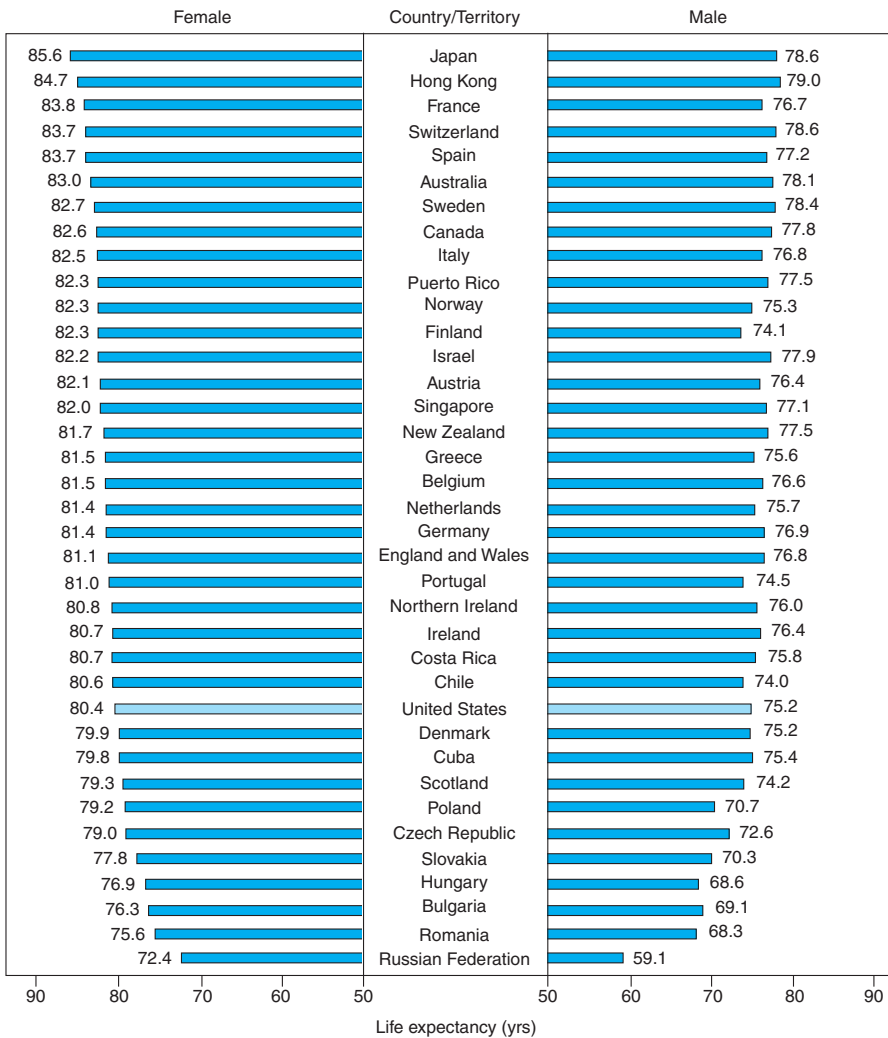
**Figure 2-3** Age-adjusted death rates (per 1,000,000 standard population) for the five leading causes of death, United States, 2001–2006. *Source:* From Centers for Disease Control and Prevention. Age-adjusted death rates for the five leading causes of death, United States, 2001–2006. *MMWR*. 2008;57(24):666. Data from Heron M, Hoyert DL, Xu J, Scott C, Tejada B. Deaths: preliminary data for 2006. *Natl Vital Stat Rep*. 2008;56(16). [http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56\\_16.pdf](http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_16.pdf)



**Figure 2-4** Life expectancy at birth and at age 65 years by race and gender, United States, 1970–2006. *Source:* From Centers for Disease Control and Prevention, National Center for Health Statistics. *Health, United States, 2009*, Figure 16. Hyattsville, MD: NCHS; 2009. Data from the National Vital Statistics System.

the age of 65 or 75 years) are computed and used to measure the relative impact on society of different causes of death. If 65 years old is used as the threshold for calculating YPLL, an infant death would contribute 65 YPLL, and a homicide at age 25 would contribute 40 YPLL. A death caused by stroke at age 70 would contribute no years of life lost before age 65 and so on. Until relatively recently, the age of 65 years was widely used as the threshold age. With life expectancies now exceeding 75 years at birth, YPLL calculations using age 75 as the threshold have become more common. Table 2-2 presents data on YPLL before age 75, illustrating the usefulness of this approach in providing a somewhat different perspective as to which problems are most important in terms of their magnitude and impact. The use of YPLL ranks cancer, HIV/acquired immune deficiency syndrome (AIDS), and various forms of injury-related deaths higher than does the use of crude numbers or rates. Conversely, the use of crude rates ranks heart disease, stroke, pneumonia, diabetes, and chronic lung and liver diseases higher than does the use of YPLL. Four of the top 10 causes of death, as determined by the number of deaths, do not appear in the list of the top 10 causes of YPLL.

Each of these different mortality indicators can be examined for various racial and ethnic subpopulations to identify disparities among these groups. For example, age-adjusted rates of YPLL before age 75 for 2000 ranged from 6,284 per 100,000 population for Hispanics to 7,029 for whites and 13,177 for African Americans. The rate for all groups was 7,694 per 100,000. The large disparity for African Americans is attributable primarily to differences in infant mortality, homicide, and HIV infection deaths.



**Figure 2-5** Life expectancy ranking at birth, by sex, selected countries and territories, 2004.

*Notes:*

- Rankings are from the highest to lowest female life expectancy at birth.
- Life expectancy at birth represents the average number of years that a group of infants would live if the infants were to experience throughout life the age-specific death rates present at birth.
- Countries and territories were selected based on quality of data, high life expectancy, and a population of at least 1 million population. Differences in life expectancy reflect differences in reporting methods, which can vary by country, and actual differences in mortality rates.
- 2004 data except for Ireland and Italy (2003 data).

*Source:* From Centers for Disease Control and Prevention. Life expectancy ranking at birth, by sex, selected countries and territories, 2004. *MMWR*. 2008; 57(13):346. Data from Organisation for Economic Co-operation and Development. *OECD health data 2007: statistics and indicators for 30 countries*. Paris, France: Organisation for Economic Co-operation and Development; 2008. <http://www.oecd.org/health/healthdata>. CDC. *Health, United States, 2007. With chartbook on trends in the health of Americans*. Hyattsville, MD: U.S. Department of Health and Human Services, CDC, National Center for Health Statistics; 2007. <http://www.cdc.gov/nchs/data/hus/hus07.pdf>. Accessed May 31, 2010.

**Table 2-2** Age-Adjusted YPLL Before Age 75 by Cause of Death and Ranks for YPLL and Number of Deaths, United States, 2000

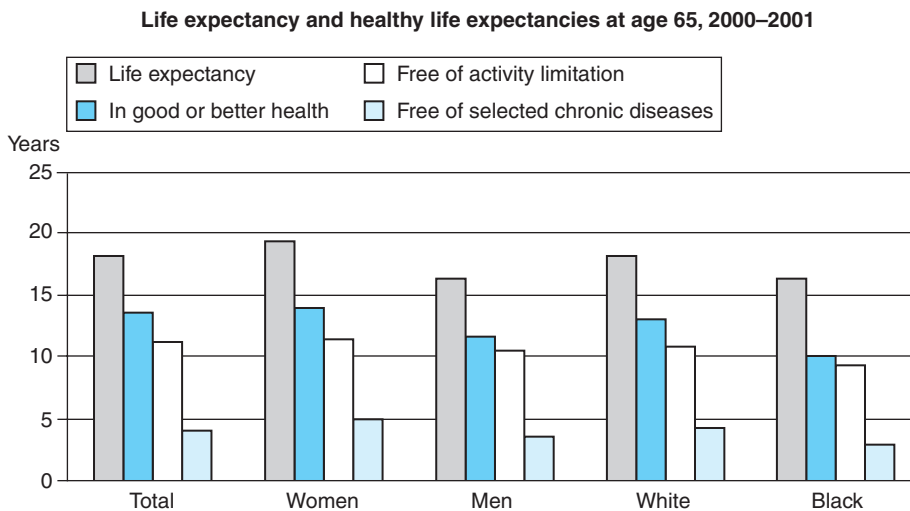
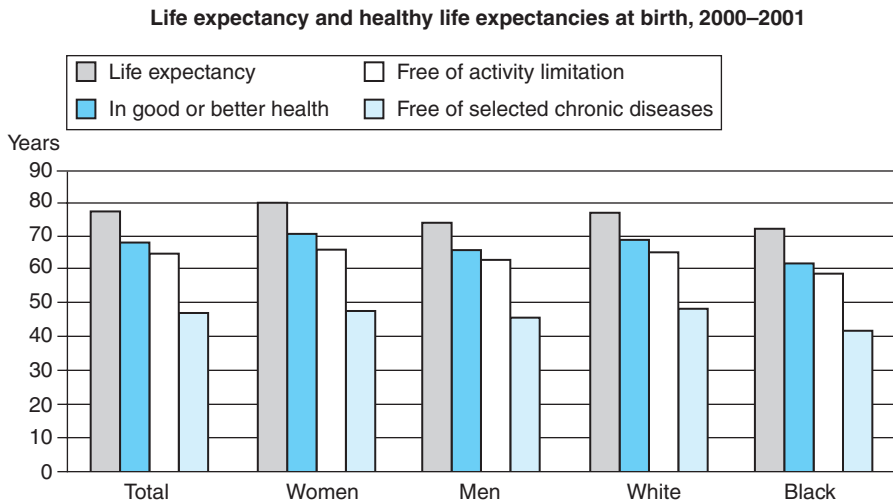
<i>Causes of Death</i>	<i>YPLL</i>	<i>Rank by YPLL</i>	<i>Rank by Number of Deaths</i>
Cancer	1,698,500	1	2
Heart disease	1,270,700	2	1
Unintentional injuries	1,052,500	3	5
Suicide	343,300	4	11
Homicide	274,200	5	14
Cerebrovascular diseases	226,500	6	3
Chronic obstructive lung disease	190,700	7	4
Diabetes mellitus	181,200	8	6
HIV infections	178,900	9	18
Chronic liver disease and cirrhosis	141,700	10	12

*Note:* Years lost before age 75 per 100,000 population younger than 75 years of age.

*Source:* Adapted from National Center for Health Statistics. *Health, United States, 2002*. Hyattsville, MD: NCHS; 2002.

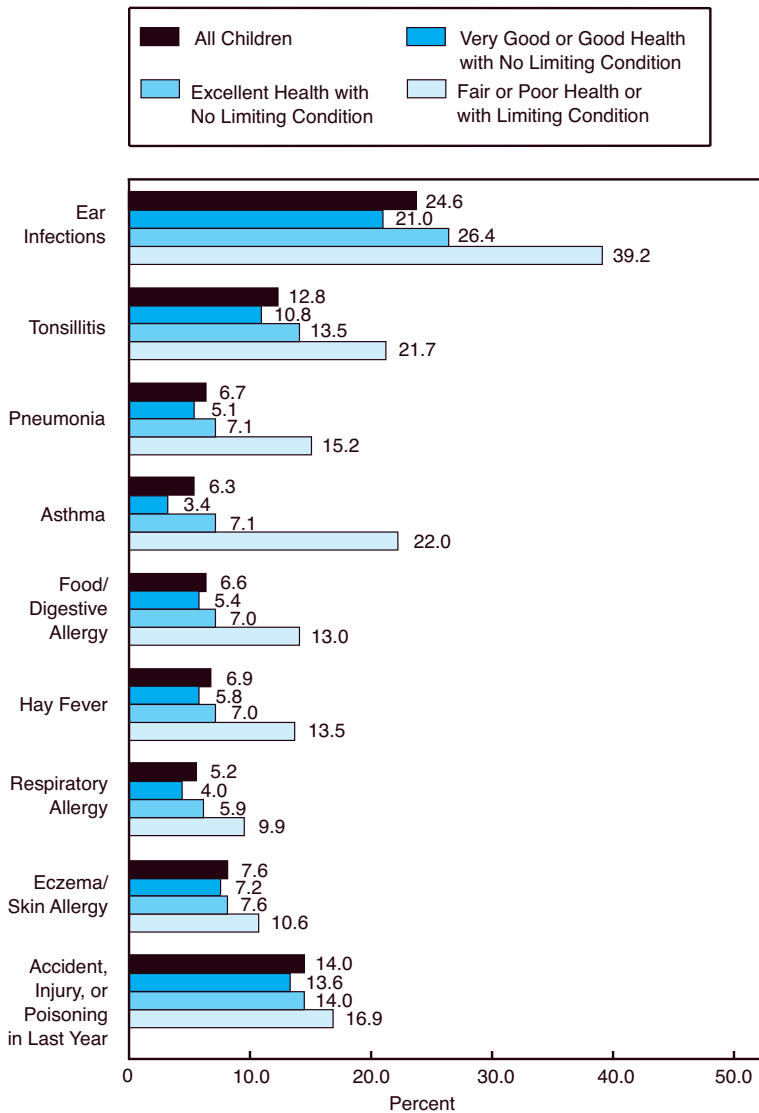
### Morbidity, Disability, and Quality Measures

Mortality indicators can also be combined with other health indicators that describe quality considerations to provide a measure of the span of healthy life. These indicators can be an especially meaningful measure of health status in a population because they also consider morbidity and disability from conditions that impact on functioning but do not cause death (e.g., cerebral palsy, schizophrenia, and arthritis). A commonly used measure of aggregate disease burden is the disability-adjusted life year. Other variants on this theme are span-of-healthy-life indicators (called years of healthy life) that combine mortality data with self-reported health status and activity limitation data acquired through the National Health Interview Survey. This concept is illustrated in the two components of Figure 2-6, which shows life expectancy at birth and at age 65 by race and gender as well as several views of the expectancy of healthy life within the overall life expectancy. Years associated with self-reported good or better health, years free of activity limitation, and years free of selected chronic diseases are also presented. Depending on the healthy life expectancy measure, Figure 2-6 demonstrates that Americans average about 10 years of poor health, 15 years of activity limitation, and 30 years of living with a chronic disease. Women have better health status than men, and whites do better than blacks on virtually all of these measures. For healthy life expectancies at age 65, a similar picture appears. The implication is that extending healthy life expectancy can be achieved through several pathways. One would be to extend life expectancy without increasing the measures of poor health, activity limitation, and chronic disease burden. Another would be to reduce the measures of poor health, activity limitation, and chronic disease burden within a constant life expectancy. The optimal approach would accomplish both by extending life expectancy and reducing the burden of poor health, activity limitation, and chronic disease.



**Figure 2-6** Life expectancy and healthy life expectancies at birth and at age 65, 2000–2001. *Source:* From National Health Interview Survey (NHIS), NCHS, CDC; National Vital Statistics System (NVSS), NCHS, CDC.

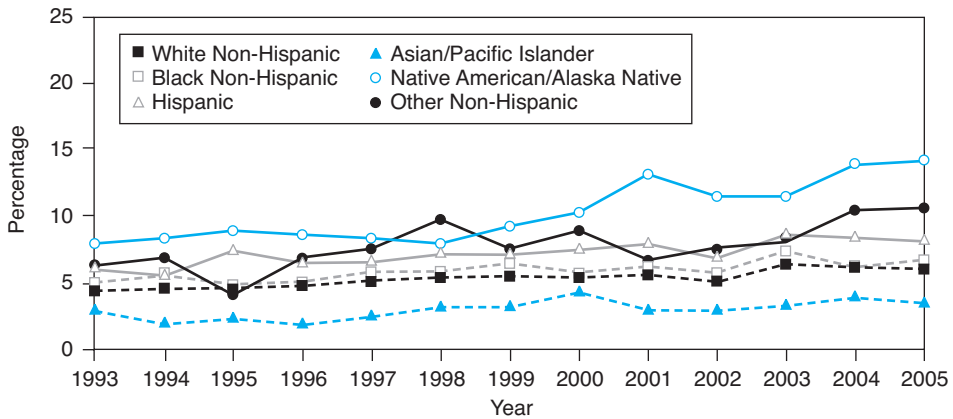
Although less frequently encountered, indicators of morbidity and disability are also quite useful in measuring health status. Figure 2-7 presents information on both morbidity and disability for children in terms of the prevalence of specific childhood diseases (here, the percentage of children 0 to 17 years old who have ever had these conditions) and the relationship between these conditions and self-reported health and activity status (a measure of disability). Similarly, few people appreciate that arthritis is now the leading cause of disability in the United States. Its burden is expected to grow as a result of the aging of the population and increases in obesity along with decreased physical activity.



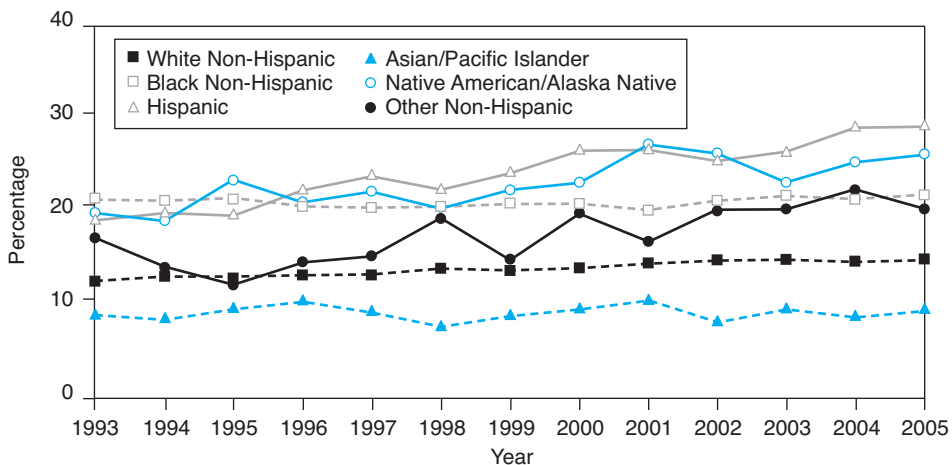
**Figure 2-7** Percentage of children 0 to 17 years old who have had selected childhood diseases by child's health and limitations status, United States, 1998. *Source:* From Coiro MJ, Zill N, and Bloom B, Health of our nation's children. *Vital Health Stat.* 1994;10(191):1-64.

Both the prevalence (the number or rate of cases at a specific point or period in time) and incidence (the number or rate of new cases occurring during a specific period) are widely used measures of morbidity. One of the earliest systems for reporting on diseases of public health significance is the national notifiable disease-reporting system for specific diseases. This system operates through the collaboration of local, state, and federal health agencies. Although initially developed to track the incidence of communicable diseases, this system has steadily moved toward collecting information on noninfectious conditions, as well as important risk factors.

Increasingly, information on self-reported health status and on days lost from work or school caused by acute or chronic conditions is available through surveys of the general population. The National Center for Health Statistics also conducts ongoing surveys of health providers on complaints and conditions requiring medical care in outpatient settings. These surveys provide direct information on self-reported health status and illuminate some of the factors, such as race, ethnicity, and household income levels, depicted in Figures 2-8 through 2-10, that are associated with health status.

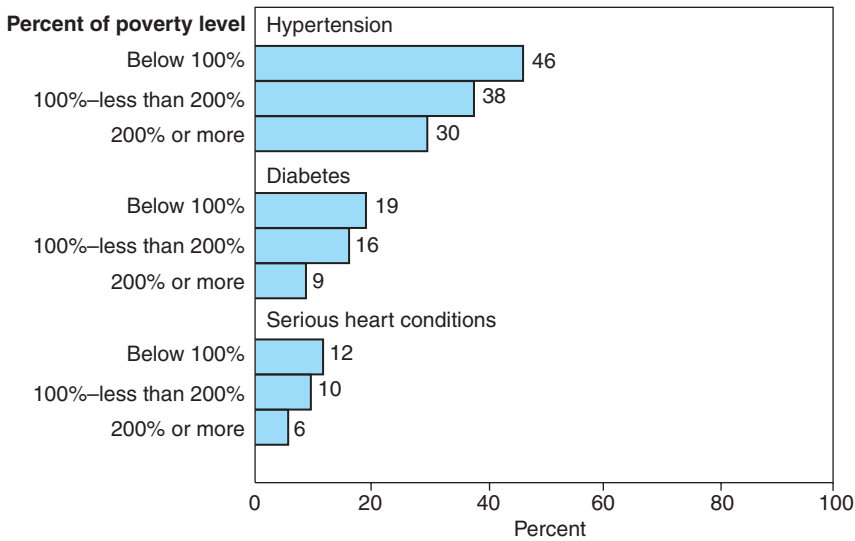


**Figure 2-8** Percentage of individuals with 14 or more activity limitation days by race and ethnicity, United States, 1993–2005. *Source:* From Centers for Disease Control and Prevention, National Center for Health Statistics, National Household Interview Survey Data.



**Figure 2-9** Percentage of individuals with fair or poor self-rated health by race and ethnicity, United States, 1993–2005. *Source:* From Centers for Disease Control and Prevention, National Center for Health Statistics, National Household Interview Survey Data.





**Figure 2-10** Respondent-reported conditions among adults age 45–64 by percent of poverty level, United States, 2007. *Source:* From Centers for Disease Control and Prevention, National Center for Health Statistics, *Health, United States 2009*, Figure 10. Hyattsville, MD: NCHS; 2009. Data from the National Health Interview Survey.

## INFLUENCES ON HEALTH

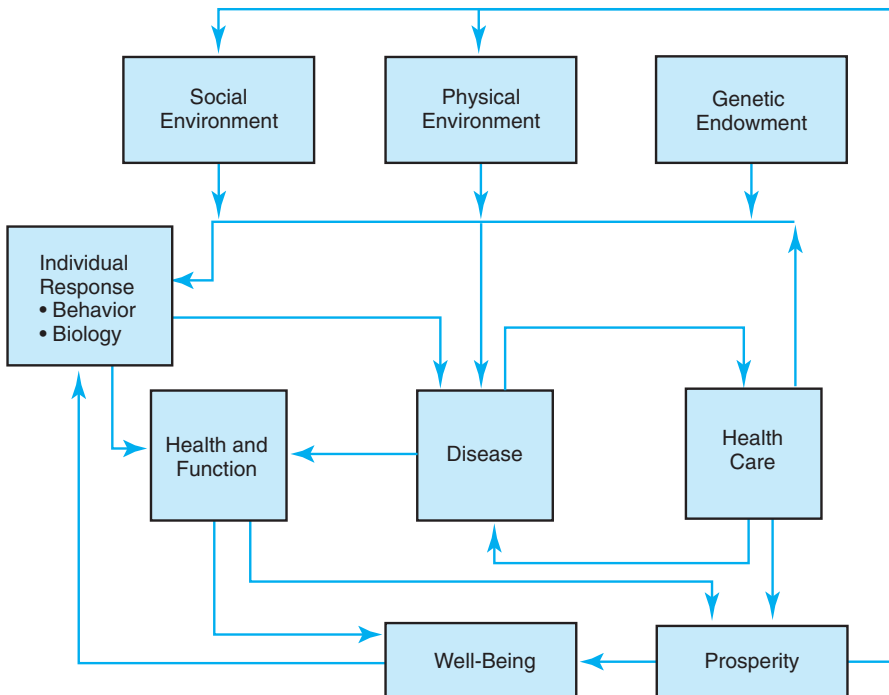
In 1996, public health surveillance in the United States took a historic step, reflecting changes in national morbidity and mortality patterns as well as in the ability to identify specific factors that result in disease and injury. At that time, the CDC added prevalence of cigarette smoking to the list of diseases and conditions to be reported by states to CDC.<sup>5</sup> This action marked the first time that a health behavior, rather than an illness or disease, was considered nationally reportable—a groundbreaking step for surveillance efforts. How the focus of public health efforts shifted from conventional disease outcomes to reporting on underlying causes amenable to public health intervention is an important story. That story is closely linked to one of the most important and most bitterly contested public health achievements of the 20th century, the recognition of tobacco use as a major health hazard. One of this chapter's Public Health Spotlights chronicles this story, providing important lessons for public health efforts in the 21st century seeking to improve measures of health status and quality of life.

### Risk Factors

The recognition of tobacco use as a major health hazard was no simple achievement, partly because many factors directly or indirectly influence the level of a health outcome in a given population. For example, greater per capita tobacco use in a population is associated with higher rates of heart disease and lung cancer, and lower rates of early prenatal care are associated with

higher infant mortality rates. Because these factors are part of the chain of causation for health outcomes, tracking their levels provides an early indication as to the direction in which the health outcome is likely to change. These factors increase the likelihood or risk of particular health outcomes occurring and can be characterized broadly as risk factors.

The types and number of risk factors are as varied as the influences themselves. Depending on how these factors are lumped or split, traditional categories include biologic factors (from genetic endowment to aging), environmental factors (from food, air, and water to communicable diseases), lifestyle factors (from diet to injury avoidance and sexual behaviors), psychosocial factors (from poverty to stress, personality, and cultural factors), and the use of and access to health-related services. Refinements of this framework differentiate several outcomes of interest, including disease, functional capacity, prosperity, and well-being, that can be influenced by various risk factors (Figure 2-11). These various components are often interrelated (e.g., stress, a social environmental factor, may stimulate individual responses, such as tobacco or illicit drug use, which, in turn, influences the likelihood of disease, functional capacity, and well-being). In addition, variations in one outcome, such as disease, may influence changes in others, such as well-being, depending on the mix of other factors present. This complex set of interactions, consistent with the ecological model introduced in Chapter 1, draws attention to general factors that



**Figure 2-11** Determinants of health. *Source:* From Evans RG, Stoddard GL. Producing health, consuming health care. *Soc Sci Med.* 1990;31:1359. Reprinted with permission, copyright 1990, from Elsevier Science.

can result in many diseases, rather than focusing on specific factors that contribute little to population-wide health outcomes.

Although many factors are causally related to health outcomes, some are more direct and proximal causes than others. Specific risk factors have been clearly linked to specific adverse health states through epidemiologic studies. For example, numerous studies have linked unintentional injuries with a variety of risk factors, including the accessibility to firearms and the use of alcohol, tobacco, and seat belts. Tobacco, hypertension, overnutrition, and diabetes are well-known risk factors for heart disease. Epidemiologic research and studies over the past 50 years have identified behavioral risk factors for many common diseases and conditions,<sup>6</sup> as shown in Table 2-3. In recent decades, for example, the prevalence of obesity has doubled in virtually all gender, age, racial, and ethnic groups. Ongoing behavioral risk factor surveys (often through telephone interviews) are conducted by governmental public health agencies to track trends in the prevalence of many important risk behaviors within the population. These surveys document that the health-related behaviors of tens of millions of Americans place them at risk for developing chronic disease and injuries.

Despite the recent emphasis on behavioral factors, risk factors in the physical environment remain important influences on health. Air pollution, for example, is directly related to a wide range of diseases, including lung cancer, pulmonary emphysema, chronic bronchitis, and bronchial asthma. National standards exist for many of the most important air pollutants and are tracked to determine the extent of these risks in the general population. The proportion of the U.S. population residing in counties that have exceeded national standards for these pollutants suggests that air pollution risks, like behavioral

**Table 2-3** Selected Behavioral Risk Factors Related to Leading Causes of Deaths in the United States, 2000

<i>Cause of Death and Percentage of All Deaths</i>	<i>Smoking</i>	<i>High Fat/Low Fiber</i>	<i>Sedentary Lifestyle</i>	<i>High Blood Pressure</i>	<i>Elevated Cholesterol</i>	<i>Obesity</i>	<i>Alcohol Use</i>
Heart disease (30%)	X	X	X	X	X	X	X
Cancer (23%)	X	X	X			X	X
Stroke (7%)	X	X		X	X	X	
Chronic lung disease (5%)	X						
Unintentional injuries (4%)	X						X
Pneumonia and influenza (3%)	X						
Diabetes (3%)		X	X			X	
HIV infection (1%)							
Suicide (1%)							X
Chronic liver disease (1%)							X
Atherosclerosis (1%)	X	X	X		X		

*Sources:* Data for causes and percent deaths from National Center for Health Statistics. *Health, United States 2002*. Hyattsville, MD: NCHS; 2002. Data for risk factors related to causes from Brownson RC, Remington PL, Davis JR, et al. *Chronic Disease Epidemiology and Control*. 2nd ed. Washington, DC: American Public Health Association; 1998; and U.S. Public Health Service. *The Surgeon General's Report on Nutrition and Health*. Washington, DC: Public Health Service; 1988.

risks, affect tens of millions of Americans.<sup>7</sup> Environmental risks are ubiquitous and growing in the United States. Estimates from the CDC are that 22 to 30 million people drink water from private wells; 40 to 45 million people are exposed to extreme heat; 150 million people are exposed to environmental tobacco smoke; and 65 million people reside in homes built before 1950, when lead paint was banned for residential use.

The physical environment influences health through several pathways, including facilitating risk-taking behaviors, influencing social relationships, and even exposing residents to visual cues that can arouse fear, anxiety, and depression. The “broken windows” theory suggests that a neighborhood in disrepair sends out messages that no one cares and that otherwise unacceptable behaviors will be tolerated in the area.<sup>7</sup>

Behavioral and environmental risk factors are clearly germane to public health interest and efforts. Focusing on these factors provides a different perspective of the enemies of personal and public health than that conveyed by disease-specific incidence or mortality data. Such a focus also promotes rational policy development and interventions. Unfortunately, determining which underlying factors are most important is more difficult than it appears because of differences in the outcomes under study and measures used. For example, a study using 1980 data found tobacco, hypertension, and overnutrition responsible for about three fourths of deaths before the age of 65 years and injury risks, alcohol, tobacco, and gaps in primary prevention accountable for about three fourths of all YPLL before the age of 65 years.<sup>8</sup> Further complicating these analyses is the finding that individual risk factors may result in several different health outcomes. For example, alcohol use is linked with motor vehicle injuries, other injuries, cancer, and cirrhosis; tobacco use can result in heart disease, stroke, ulcers, fire and burn injuries, and low birth weight, as well as cancer.<sup>6,8</sup>

Despite problems with their measurement, the identification of antecedent causes is important for public health policy and interventions. Table 2-4 provides a comparison of 2000 deaths by their listed causes of death and their actual causes (major risk factors).<sup>9</sup> The two lists provide contrasting views as to the major health problems and needs of the U.S. population. Although this debate has continued since the days of Chadwick and Farr (see Chapter 1), it is by no means settled.

Coroners and medical examiners view immediate and underlying causes of death somewhat differently from the perspective offered in Table 2-4. Death certificates have two parts, one for entering the immediate and underlying conditions that caused the death and a second for identifying conditions or injuries that contributed to that death. For example, a death attributed to cardiovascular disease might list cardiac tamponade as the immediate cause or as a consequence of a ruptured myocardial infarction, which itself was a consequence of coronary arteriosclerosis. For this death, hypertensive cardiovascular disease might be listed as a significant condition contributing to, but not causing, the immediate and underlying causes. Thus, where do smoking, obesity, diet, and physical inactivity get identified as the real causes of such deaths? Perhaps the Chadwick-Farr debate continues into the 21st century in terms of whether deaths in the year 2000 should be attributed to tobacco use and dietary excesses, just as many of those in England in 1839 should have been attributed to starvation.

**Table 2-4** Listed and Actual Causes of Death, United States, 2000

<i>10 Leading Causes of Death</i>	<i>Number</i>	<i>Actual Causes of Death</i>	<i>Number</i>
Heart disease	710,760	Tobacco	435,000
Malignant neoplasm	553,091	Poor diet and physical inactivity	400,000
Cerebrovascular disease	167,661	Alcohol consumption	85,000
Chronic lower respiratory tract diseases	122,009	Microbial agents	75,000
Unintentional injuries	97,900	Toxic agents	55,000
Diabetes mellitus	69,301	Motor vehicle	43,000
Influenza and pneumonia	65,313	Firearms	29,000
Alzheimer disease	49,558	Sexual behavior	20,000
Nephritis, nephrotic syndrome, and nephrosis	37,251	Illicit drug use	17,000
Septicemia	31,224		
Other	499,283		
Total	2,403,351	Total	1,159,000

*Source:* Data from Mokdad AH, Marks JS, Stroup DF, et al. Actual causes of death in the United States, 2000. *JAMA*. 2004;291:1238–1245.

## Social and Cultural Influences

Understanding the health effects of biologic, behavioral, and environmental risk factors is straightforward in comparison with understanding the effects of social, economic, and cultural factors on the health of populations. This is due in part to a lack of agreement as to what is being measured. Socioeconomic status and poverty are two factors that generally reflect position in society. There is considerable evidence that social position is an overarching determinant of health status, even though the indicators used to measure social standing are imprecise, at best.

Social class affects lifestyle, environment, and the use of services; it remains an important predictor of good and poor health in our society. Social class differences in mortality have long been recognized around the world. In 1842, Chadwick reported that the average ages at death for occupationally stratified groups in England were as follows: “gentlemen and persons engaged in the professions, 45 years; tradesmen and their families, 26 years; mechanics, servants and laborers, and their families, 16 years.”<sup>10</sup> Life expectancies and other health indicators have improved considerably in England and elsewhere since 1842, but differences in mortality rates among the various social classes persist to this day.

Some countries (such as Great Britain and the United States) have identifiable social strata that permit comparisons of health status by social class. Britain conducts ongoing analyses of socioeconomic differences according to official categorizations based on general social standing within the community. For the United States, educational status, race, and family income are often used as indirect or proxy measures of social class. Despite the differences in approaches and indicators, there is little evidence of any real difference between Britain and the United States in terms of what is being measured. In

both countries, explanations for the differences in mortality appear to relate primarily to inequalities in social position and material resources.<sup>11,12</sup> This effect operates all up and down the hierarchy of social standing; at each step, improvements in social status are linked with improvements in measures of health status. For example, a study based on 1971 British census follow-up data found that a relatively affluent, home-owning group with two cars had a lower mortality risk than did a similar relatively privileged group with only one car.<sup>11</sup>

In the United States, epidemiologists have studied socioeconomic differences in mortality risk since the early 1900s. Infant mortality has been the subject of many studies that have consistently documented the effects of poverty. Findings from the National Maternal and Infant Health Survey, for example, demonstrated that the effects of poverty were greater for infants born to mothers with no other risk factors than for infants born to high-risk mothers.<sup>13</sup> Poverty status was associated with a 60% higher rate of neonatal mortality and a 200% higher rate for postneonatal mortality than for those infants of higher-income mothers.

Poverty affects many health outcomes, as illustrated in Figure 2-10 and Table 2-5. Low-income families in the United States have an increased likelihood (or relative risk) of a variety of adverse health outcomes, often two to five times greater than that of higher income families. The percentage of persons reporting fair or poor health is about four times as high for persons living below the poverty level as for those with family income at least twice the poverty level.<sup>1</sup>

The implications of the consistent relationship between measures of social status and health outcomes suggest that studies need to consider how and how well social class is categorized and measured. Imprecise measures may understate the actual differences that are the result of socioeconomic position in society. Importantly, if racial or ethnic differences are simply the result of social class differences, factors that operate through race and ethnicity, such as racism or ethnism, will be overlooked. These additional factors also affect the difference

**Table 2-5** Selected Outcomes and Relative Risk for Low-Income Families, as Compared with High-Income Families

<i>Outcome</i>	<i>Relative Risk</i>
Child neglect	9
Child abuse	4.5
Iron-deficiency anemia	3 to 4
Childhood mortality	.3
Fair or poor health	3
Fatal injuries	2–3
Growth retardation	2.5
Severe asthma	2
Pneumonia	1.6
Infant mortality	1.3 to 1.5
Low birth weight	1.2 to 2.2
Extreme behavioral problems	1.3

*Source:* Data from Geltman PL, Meyers AF, Greenberg J, et al. Welfare reform and children's health. *Health Policy Child Health*. 1996;3:1–5.

between the social position one has and the position one would have attained, were it not for one's race or ethnicity. It is clear that race in the United States, independent of socioeconomic status, is linked to mortality, although these effects vary across age and disease categories.<sup>14</sup> Nevertheless, anthropologists concluded long ago that race is not an appropriate generic category for comparing health outcomes. Its usefulness does not derive from any biologic or genetic differences but rather from its social, cultural, political, and historical meanings.

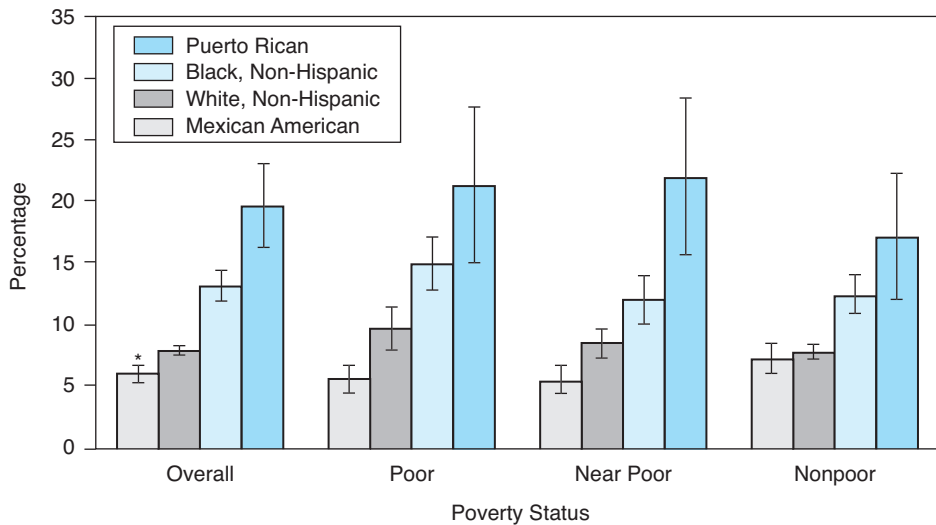
Studies of the effect of social factors on health status across nations add some interesting insights. In general, health appears to be closely associated with income differentials within countries, but there is only a weak link between national mortality rates and average income among the developed countries.<sup>15</sup> This pattern suggests that health is affected less by changes in absolute material standards across affluent populations than by relative income differences and the resulting disadvantage in each country. It is not the richest countries that have the greatest life expectancy. Rather, it is those developed nations with the narrowest income differentials between rich and poor, as suggested by Figure 2-5. This finding argues that health in the developed world is less a matter of a population's absolute material wealth than of how the population's circumstances compare with those of other members of their society. A similar perspective views income to be related to health through two pathways: a direct effect on the material conditions necessary for survival and an effect on social participation and the opportunity to control one's own life circumstances.<sup>16</sup> In settings or societies that provide little in the way of material conditions (e.g., clean water, sanitation services, ample food, and adequate housing), income is more important for health. Where material conditions are conducive to good health, income acts through social participation.

The effects of culture on health and illness are also becoming better understood. To medical anthropologists, diseases are not purely independent phenomena. Rather, they are to be viewed and understood in relation to ecology and culture. Certainly, the type and severity of disease vary by age, gender, social class, and ethnic group. For example, as documented in Figure 2-12, Puerto Rican children overall have a higher prevalence of asthma than Mexican American, non-Hispanic white, and African American children. Differences in poverty status do not explain the disparities for Puerto Rican and African American children, two populations that have higher asthma rates than non-Hispanic white and Mexican American children regardless of poverty status. The reason for the higher rate among Puerto Rican children overall is unknown, but the different distributions and social patterns suggest differences in culture-mediated behaviors.

Such insights are essential to developing successful prevention and control programs. Culture serves to shape health-related behaviors, as well as human responses to diseases, including changes in the environment, which in turn affect health. As a mechanism of adapting to the environment, culture has great potential for both positively and negatively affecting health.

There is evidence that different societies shape the ways in which diseases are experienced and that social patterns of disease persist, even after risk factors are identified and effective interventions become available.<sup>17-19</sup> For example, the link between poverty and various outcomes has been well established; nevertheless, even after advances in medicine and public health and significant





**Figure 2-12** Percentage of children younger than age 18 who currently have asthma, by race/ethnicity<sup>†</sup> and poverty status<sup>§</sup>, United States, 2003–2005.

Notes:

\* 95% confidence interval.

<sup>†</sup> Data are shown for two Hispanic subpopulations (Puerto Rican and Mexican American) because these groups have adequate sample sizes to provide stable estimates. Estimates for other Hispanic subpopulations are not reliable.

<sup>§</sup> Poor is defined as annual household income <100% of the poverty threshold, near poor as 100%–199%, and nonpoor as >200%, based on U.S. Bureau of the Census thresholds. For example, in 2004, for a family of four (two adults and two children aged <18 years), the poverty threshold was \$19,157, and poverty status levels were as follows: poor: <\$19,157; near poor: \$19,157–\$38,314; nonpoor: >\$38,315.

Source: From Centers for Disease Control and Prevention. Percentage of children aged <18 years who currently have asthma, by race/ethnicity and poverty status, United States, 2003–2005. *MMWR*. 2007;56(05):99.

improvement in general living and working conditions, the association persists. One explanation is that as some risks were addressed, others developed, such as health-related behaviors, including violent behavior and alcohol, tobacco, and drug use. In this way, societies create and shape the diseases that they experience. This makes sense, especially if we view the social context in which health and disease reside—the setting and social networks. For problems such as HIV/AIDS, sexually transmitted diseases, and illicit drug use, spread is heavily influenced by the links between those at risk.<sup>20</sup> This also helps to explain why people in disorganized social structures are more likely to report their own health as poor than are similar persons with more social capital.<sup>21,22</sup>

Societal responses to diseases are also socially constructed. Efforts to prevent the spread of typhoid fever by limiting the rights of carriers (such as Typhoid Mary) differed greatly from those to reduce transmission risks from diphtheria carriers. Because many otherwise normal citizens would have been subjected to extreme measures in order to avoid the risk of transmission, it was not socially acceptable to invoke similar measures for these similar risks.

If these themes of social and cultural influences are on target, they place the study of health disparities at the top of the public health agenda. They also argue that health should be viewed as a social phenomenon. Rather than attempting to identify each and every risk factor that contributes only marginally to disparate health outcomes of the lower social classes, a more effective approach would be to address directly the broader social policies (distribution of wealth, education, employment, and the like) that foster the social disparities that cause the observed differences in health outcomes.<sup>19</sup> This broad view of health and its determinants is critical to understanding and improving health status in the United States, as well as internationally.

### Global Health Influences

Considerable variation exists among the world's nations on virtually every measure of health and illness currently in use. The principal factors responsible for observed trends and obvious inequities across the globe fall into the general categories of the social and physical environment, personal behavior, and health services. Given the considerable variation in social, economic, and health status among the developed, developing, and underdeveloped nations, it is naive to make broad generalizations. Countries with favorable health status indicators, however, generally have a well-developed health infrastructure, ample opportunities for education and training, relatively high status for women, and economic development that counterbalances population growth. Nonetheless, countries at all levels of development share some problems, including the escalating costs involved in providing a broad range of health, social, and economic development services to disadvantaged subgroups within the population. Social and cultural upheaval associated with urbanization is another problem common to countries at all levels of development. Over the course of the 20th century, the proportion of the world's population living in urban areas tripled—to about 40%; that trend is expected to continue throughout the new century.

The principal environmental hazards in the world today appear to be those associated with poverty. This is true for developed as well as developing and underdeveloped countries. Some international epidemiologists predict that in the 21st century the effects of overpopulation and production of greenhouse gases will join poverty as major threats to global health. These factors represent human effects on the world's climate and resources and are easily remembered as the “3 Ps” of global health (pollution, population, and poverty):

- Pollution of the atmosphere by greenhouse gases, which will result in significant global warming, affecting both climate and the occurrence of disease
- Worldwide population growth, which will result in a population of 10 to 12 billion people within the next century
- Poverty, which is always associated with ill health and disease<sup>23,24</sup>

It surprises many Americans that population is a major global health concern. Birth rates vary inversely with the level of economic development and the status of women among the nations of the world. Continuing high birth rates and declining death rates will mean even more rapid growth in popula-

tion in developing countries. It has taken all of history to reach the world's current population level, but it will take less than half a century to double that. Many factors have influenced this growth, including public health, which has increased the chances of conception by improving the health status of adults, increasing infant and child survival, preventing premature deaths of adults in the most fertile age groups, and reducing the number of marriages dissolved by one partner's death.

Global warming represents yet another phenomenon with considerable potential for health effects. Climate change has direct temperature effects on humans and increases the likelihood of extreme weather events. A number of infectious diseases are also climate sensitive, some because of effects on mosquitoes, ticks, and other vectors in terms of their population size and density and changes in population movement, forest clearance and land use practices, surface water configurations, and human population density.<sup>25</sup> Global warming will also contribute to air quality-related health conditions and concerns.

In general, public health approaches to dealing with world health problems must overcome formidable obstacles, including the unequal and inefficient distribution of health services, a lack of appropriate technology, poor management, poverty, and inadequate or inappropriate government programs to finance needed services. Much of the preventable disease in the world is concentrated in the developing and underdeveloped countries, where the most profound differences exist in terms of social and economic influences. Table 2-6 provides estimates of the preventable toll caused by water-related diseases worldwide.

Although many of these factors appear to stem from low levels of national wealth, the link between national health status and national wealth is not firm, and comparisons across nations are seldom straightforward. Improved health status correlates more closely with changes in standards of living, advances in the politics of human relations, and a nation's literacy, education, and welfare policies than with specific preventive interventions. The complexities involved in identifying and understanding these forces and their interrelationships often confound comparisons of health status between the United States and other nations.

## **ANALYZING HEALTH PROBLEMS FOR CAUSATIVE FACTORS**

The ability to identify risk factors and pathways for causation is essential for rational public health decisions and actions to address important health problems in a population. First, however, it is necessary to define what is meant by health problem. Here, health problem means a condition of humans that can be represented in terms of measurable health status or quality-of-life indicators. In later chapters, additional dimensions will be added to this basic definition for the purposes of community problem solving and the development of interventions. This characterization of a health problem as something measured only in terms of outcomes is difficult for some to accept. They point to important factors, such as access to care or poverty itself, and feel that these should rightfully be considered as health problems. Important problems they may be, but if they are truly important in the causation of some unacceptable

**Table 2-6** WHO Estimates of Morbidity and Mortality of Water-Related Diseases, Worldwide, 1995

<i>Disease</i>	<i>Morbidity (Episodes Per Year)</i>	<i>Mortality (Deaths Per Year)</i>	<i>Relationship to Water Supply Sanitation</i>
Diarrhea (drinking)	1 billion	3.3 million	Unsanitary excreta disposal, poor personal and domestic hygiene, unsafe water
Infection with intestinal helminths	1.5 billion*	100,000	Unsanitary excreta disposal, poor personal, and domestic hygiene
Schistosomiasis	200 million*	200,000	Unsanitary excreta disposal and absence of nearby sources of safe water
Dracunculiasis	100,000*†	—	Unsafe drinking water
Trachoma	150 million‡	—	Lack of face washing, often because of absence of nearby sources of safe water
Malaria	400 million	1.5 million	Poor water management and storage, poor operation of water points and drainage
Dengue fever	1.75 million	20,000	Poor solid wastes management, water storage, and operation of water points and drainage
Poliomyelitis (drinking)	114,000	—	Unsanitary excreta disposal, poor personal and domestic hygiene, unsafe water
Trypanosomiasis	275,000	130,000	Absence of nearby sources of safe water
Bancroftian filariasis	72.8 million*	—	Poor water management and storage, poor operation of water points and drainage
Onchocerciasis	17.7 million*§	40,000	Poor water management and large-scale projects

\* People currently infected.  
† Excluding Sudan.  
‡ Case of active disease. Approximately 5.9 million cases of blindness or severe complications of trachoma occur annually.  
§ Includes an estimated 270,000 blind.

Source: From WHO Wams of Inadequate Communicable Disease Prevention, U.S. Public Health Service. *Prevent Health Rep.* 1996;111:296–297.

health outcome, they can be dealt with as related factors rather than health problems.

The factors linked with specific health problems are often generically termed risk factors and can exist at one of three levels. Those risk factors most closely associated with the health outcome in question are often termed determinants. Risk factors that play a role further back in the chain of causation are called direct and indirect contributing factors. Risk factors can be described at either an individual or a population level. For example, tobacco use for an individual increases the chances of developing heart disease or lung cancer, and an increased prevalence of tobacco use in a population increases that population's incidence of (and mortality rates from) these conditions.

Determinants are scientifically established factors that relate directly to the level of a health problem. As the level of the determinant changes, the level of the health outcome changes. Determinants are the most proximal risk factors through which other levels of risk factors act. The link between the determinant and the health outcome should be well established through scientific or epidemiologic studies. For example, for neonatal mortality rates, two well-established determinants are the low-birth-weight rate (the number of infants born weighing less than 2,500 g, or about 5.5 lb, per 100 live births) and weight-specific mortality rates. Improvement in the neonatal mortality rate cannot occur unless one of these determinants improves. Health outcomes can have one or many determinants.

Direct contributing factors are scientifically established factors that directly affect the level of a determinant. Again, there should be solid evidence that the level of the direct contributing factor affects the level of the determinant. For the neonatal mortality rate example, the prevalence of tobacco use among pregnant women has been associated with the risk of low birth weight. A determinant can have many direct contributing factors. For low birth weight, other direct contributing factors include low maternal weight gain and inadequate prenatal care.

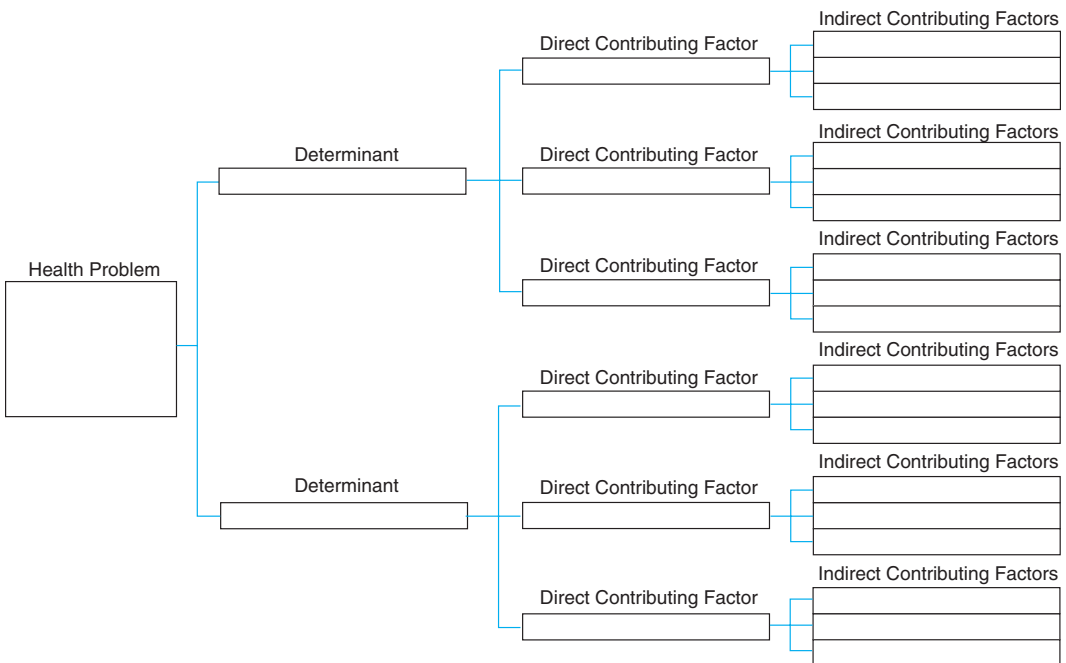
Indirect contributing factors affect the level of the direct contributing factors. Although several steps distant from the health outcome in question, these factors are often proximal enough to be modified. The indirect contributing factor affects the level of the direct contributing factor, which in turn affects the level of the determinant. The level of the determinant then affects the level of the health outcome. Many indirect contributing factors can exist for each direct contributing factor. For prevalence of tobacco use among pregnant women, indirect contributing factors might include easy access to tobacco products for young women, a lack of health education, and a lack of smoking cessation programs.

The health problem analysis framework begins with the identification of a health problem (defined in terms of health status indicators) and proceeds to establish one or more determinants; for each determinant, one or more direct contributing factors; and for each direct contributing factor, one or more indirect contributing factors. Intervention strategies at the community level generally involve addressing these indirect contributing factors. When completed, an analysis identifies as many of the causal pathways as possible to determine which contributing factors exist in the setting in which an intervention strategy is planned. The framework for this approach is presented in Table 2-7 and Figure 2-13. This framework forms the basis for developing

**Table 2-7** Risk Factors

Determinant	Scientifically established factor that relates directly to the level of the health problem. A health problem may have any number of determinants identified for it.	Example: Low birth weight is a prime determinant for the health problem of neonatal mortality.
Direct contributing factor	Scientifically established factor that directly affects the level of the determinant.	Example: Use of prenatal care is one factor that affects the low-birth-weight rate.
Indirect contributing factor	Community-specific factor that affects the level of a direct contributing factor. Such factors can vary considerably from one community to another.	Example: Availability of day care or transportation services within the community may affect the use of prenatal care services.

*Source:* Data from Centers for Disease Control and Prevention, Public Health Practice Program Office, 1991.



**Figure 2-13** Health problem analysis worksheet. *Source:* From Centers for Disease Control and Prevention, Public Health Practice Program Office, 1991.

meaningful interventions; it is used in several of the processes and instruments to assess community health needs that are currently in wide use at the local level. Community health improvement processes and tools comprise a major focus of Chapter 5.

Although this framework is useful, it does not fully account for the relationships among the various levels of risk factors. Some direct contributing factors may affect more than one determinant, and some indirect contributing factors may influence more than one direct contributing factor. For example, illicit drug use during pregnancy influences both the likelihood of low birth weight and birth weight-specific survival rates. To account fully for these interactions, some direct and indirect contributing factors may need to be included in several different locations on the worksheet. Despite the advancement of epidemiologic methods, many studies ignore the contributing factors that affect the level of these major risk factors, leading to simplistic formulations of multiple risk factors for health problems that exist at the community level.<sup>26</sup>

## ECONOMIC DIMENSIONS OF HEALTH OUTCOMES

The ability to measure and quantify outcomes and risks is essential for rational decisions and actions. Specific indicators, as well as methods of economic analysis, are available to provide both objective and subjective valuations. Several health indicators attempt to value differentially health status, outcomes, including age-adjusted rates, span of healthy life, and YPLL. For example, YPLL represents a method of weighting or valuing health outcomes by placing a higher value on deaths that occur at earlier ages. Years of life lost thus become a common denominator or, in one sense, a common currency. Health outcomes can be translated into this currency or into an actual currency, such as dollars. This translation allows for comparisons to be made among outcomes in terms of which costs more per person, per episode, or per another reference point. Cost comparisons of health outcomes and health events have become common in public health. Approaches include cost-benefit, cost-effectiveness, and cost-utility studies.

Cost-benefit analyses provide comprehensive information on both the costs and the benefits of an intervention. All health outcomes and other relevant impacts are included in the determination of benefits. The results are expressed in terms of net costs, net benefits, and time required to recoup an initial investment. If the benefits are expressed in health outcome terms, years of life gained or quality-adjusted life years may be calculated. This provides a framework for comparing disparate interventions. Quality-adjusted life years are calculated from a particular perspective that determines which costs and consequences are included in the analysis. For public health analyses, societal perspectives are necessary. When comprehensively performed, cost-benefit analyses are considered the gold standard of economic evaluations.

Cost-effectiveness analyses focus on one outcome to determine the most cost-effective intervention when several options are possible. Cost-effectiveness examines a specific option's costs to achieve a particular outcome. Results are often specified as the cost per case prevented or cost per life saved. For



example, screening an entire town for a specific disease might identify cases at a cost of \$150 per new case, whereas a screening program directed only at high-risk groups within that town might identify cases at a cost of \$50 per new case. Although useful for evaluating different strategies for achieving the same result, cost-effectiveness approaches are not very helpful in evaluating interventions intended for different health conditions.

Cost-utility analyses are similar to cost-effectiveness studies, except that the results are characterized as cost per quality-adjusted life years. These are most useful when the intervention affects both morbidity and mortality, and there are a variety of possible outcomes that include quality of life.

These approaches are especially important for interventions based on preventive strategies. The argument is frequently made that “an ounce of prevention is worth a pound of cure.” If this wisdom is true, preventive interventions should result in savings equal to 16 times their actual cost. Not all preventive interventions measure up to this standard, but even crude information on the costs of many health outcomes suggests that prevention has economic as well as human savings. Table 2-8 presents information from Healthy People 2000<sup>27</sup> (HP2000) regarding the economics of prevention for a number of common diseases and conditions; for each, the potential savings represents an enormous sum. Figure 2-14 illustrates that the impacts of disease and injuries can be many in terms of medical care costs for treatment in outpatient, emergency department, and hospital settings.<sup>28</sup> The U.S. Public Health Service has estimated that as much as 11% of projected health expenditures for the year 2000 could have been averted through investments in public health for six conditions: motor vehicle injuries, occupationally related injuries, stroke, coronary heart disease, firearms-related injuries, and low-birth-weight infants.<sup>29</sup> Beyond the direct medical effects, there are often nonmedical costs related to lost wages, taxes, and productivity.

Economists assert that the future costs for care and services that result from prevention of mortality must be considered a negative benefit of prevention. For example, the costs of preventing a death caused by motor vehicle injuries should include all subsequent medical care costs for that individual over his or her lifetime because these costs would not have occurred otherwise. They also argue that it is unfair to compare future savings to the costs of current prevention programs and that those savings must be discounted to their current value. If a preventive program will save \$10 million 20 years from now, that \$10 million must be translated into its current value in computing cost benefits, cost-effectiveness, or cost utility. It may be that the value of \$10 million 20 years from now is only \$4 million now. If the program costs \$1 million, its benefit/cost ratio would be 4:1 instead of 10:1 before we even added any additional costs associated with medical care for the lives that were saved. These economic considerations contribute to the difficulty of marketing preventive interventions.

Two additional economic considerations are important for public health policy and practice. The first of these is what economists term opportunity costs. These represent the costs involved in choosing one course of action over another. Resources spent for one purpose are not available to be spent for

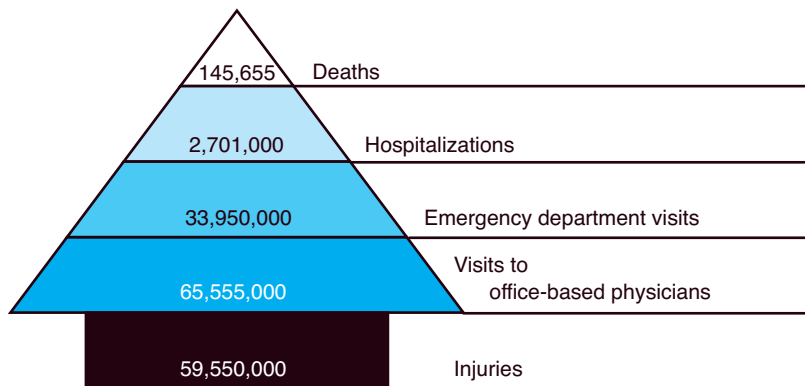
**Table 2-8** The Economics of Prevention

Condition	Overall Magnitude	Avoidable Intervention*	Cost/Patient†
Heart disease	7 million with coronary artery disease 500,000 deaths/year 284,000 bypass procedures/year	Coronary bypass surgery	\$30,000
Cancer	1 million new cases/year 510,000 deaths/year	Lung cancer treatment Cervical cancer treatment	\$29,000 \$28,000
Stroke	600,000 strokes/year 150,000 deaths/year	Hemiplegia treatment and rehabilitation	\$22,000
Injuries	2.3 million hospitalizations per year 142,500 deaths/year 177,000 persons with spinal cord injuries in the United States	Quadriplegia treatment and rehabilitation Hip fracture treatment and rehabilitation	\$570,000 (lifetime) \$40,000
HIV infection	1–1.5 million infected 118,000 AIDS cases (as of January 1990)	Severe head injury treatment and rehabilitation AIDS treatment	\$310,000 \$75,000 (lifetime)
Alcoholism	18.5 million abuse alcohol	Liver transplant	\$250,000
Drug abuse	105,000 alcohol-related deaths/year Regular users: 1 to 3 million, cocaine 900,000, IV drugs 500,000, heroin	Treatment of cocaine-exposed infant	\$66,000 (5 years)
LBW infants	Drug-exposed infants: 375,000 260,000 low birth weight infants/year	Neonatal intensive care for low birth weight infant	\$10,000
Inadequate immunization	23,000 deaths/year Lacking basic immunization series: 20% to 30% aged 2 and younger 3% aged 6 and older	Congenital rubella syndrome treatment	\$354,000 (lifetime)

\* Interventions represent examples (other interventions may apply).

† Representative first-year costs, except as noted. Not indicated are nonmedical costs, such as lost productivity to society.

Source: From *Healthy People 2000*. Washington, DC: U.S. Public Health Service; 1990.

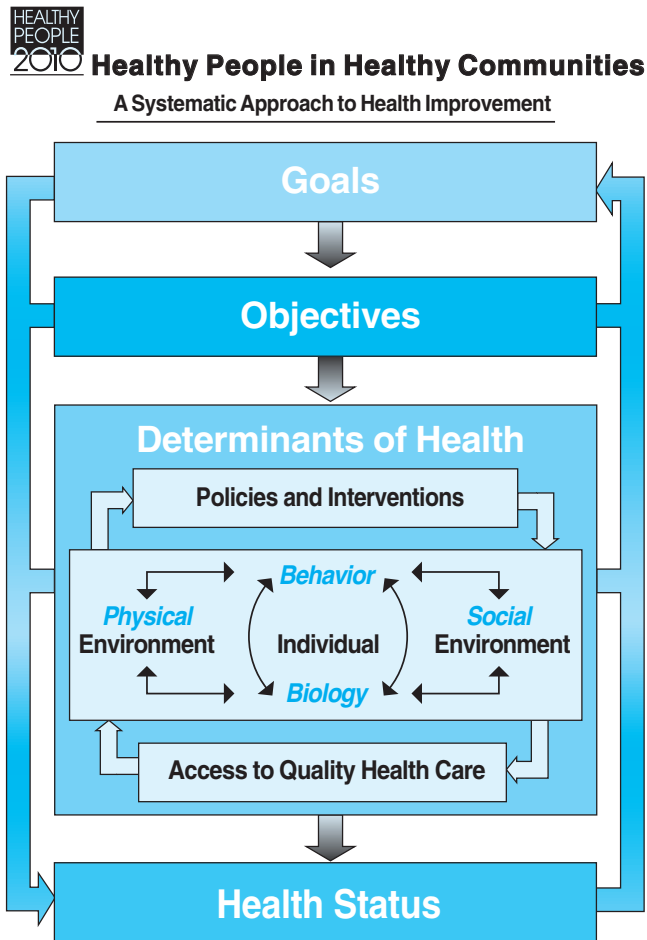


**Figure 2-14** Health impacts of injuries. *Source:* From Burt CW. Injury-related visits to hospital emergency departments: United States, 1992. *Adv Data.* 1995:1–20.

another. As a result, there is a need to consider the costs of not realizing the benefits or gains from paths not chosen. A second economic consideration important for public health is related to the heavy emphasis of public health on preventive strategies. The savings or gains from successful prevention efforts are generally not reinvested in public health or even other health purposes. These savings or gains from investments in prevention are lost. Maybe this is proper because the overall benefits accrue more broadly to society and public health remains, above all else, a social enterprise; however, imagine the situation for American industry and businesses if they could not reinvest their gains to grow their businesses. This is often the situation faced by public health, further exacerbating the difficulty of arguing for and securing needed resources.

## HEALTHY PEOPLE 2020

The data and discussion in this chapter only broadly describe health status measures in the United States in the early decades of the new century. Several common themes emerge, however, that form the basis for national health objectives focusing on the year 2020.<sup>30</sup> Figure 2-15 (similar to the model presented in Figure 2-11) depicts a national Healthy People process grounded in a broad view of the many factors influencing health. The year 2020 objectives build on the nation's experience with three previous panels of health objectives established for the years 1990, 2000, and 2010. The Healthy People 1990 effort was initiated in the late 1970s through the efforts of Surgeon General Julius Richmond and coordinated by the Office of Disease Prevention and Health Promotion within the Office of the Assistant Secretary for Health.



**Figure 2-15** The Healthy People 2010 model. *Source:* From U.S. Dept. of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010: Understanding and Improving Health*. Rockville, MD: ODPHP; 2000.

Assessments of the HP2000 and Healthy People 2010 (HP2010) efforts yielded similar findings. In general, progress was apparent for many of the broader goals, especially the age-adjusted mortality targets for age groups under age 70. Nonetheless, a substantial proportion of the objectives targeting special populations, especially African Americans and Native Americans, were found to be moving in the wrong direction. These findings fueled concerns that health inequities and disparities were persisting, if not increasing, in the United States. In addition, with nearly 500 objectives established in both the 2000 and 2010 efforts, tracking became a complex undertaking. Many objec-

tives could not be tracked because of the unavailability of or lack of consensus for the tracking measures.

The HP2010 process, for the first time, highlighted a panel of leading health indicators for 10 categories that would summarize and synthesize overall population health status and trends (Table 2-9). The Healthy People 2020 (HP2020) process will likely establish a similar panel of leading health indicators drawn from the objectives in the focus areas identified in Table 2-10. One of the Public Health Spotlights for this chapter provides additional information on the progress made toward achieving HP2010's overarching goals and objectives. A second Public Health Spotlight for this chapter reviews progress and problems related to achieving HP2020 objectives related to tobacco use, similar to the spotlight on infectious disease control and immunizations included in Chapter 1. Subsequent chapters spotlight other leading health indicator topics.

Central to the HP2020 effort are two of the four overarching goals, which focus on:

1. Attaining high-quality, longer lives free of preventable disease, disability, injury, and premature death; and
2. Achieving health equity, eliminating disparities, and improving the health of all groups.

Although these two overarching goals appear appropriate, they are only arguably linked. From one perspective, they represent two very different approaches to improving outcomes for the population as a whole. If we view the health status of the entire population as a Gaussian curve, one approach would be to shift the entire curve further toward better outcomes, and a second approach would be to change the shape of the curve, reducing the difference between the extremes. These represent quite different strategies that would be associated with quite different policies and interventions. Focusing on the tail end of the distribution of health requires investment in questionably effective attempts that benefit relatively few and fail to promote the health of the majority. On the other hand, even small improvements in overall society-wide health measures have provided greater gains for society than very perceptible improvements in the health of a few.<sup>31</sup> The choice is one that can be viewed as focusing on “epiphenomena,” such as risk factors or on the larger context and social environment. HP2010 ambitiously seeks to do both.

Monitoring all national health objectives is especially cumbersome at the state and local level. Instead, priorities linked to the national health objectives will likely be tracked. An Institute of Medicine committee in 1997 identified a basic set of indicators for use in community health improvement processes (Table 2-11). This panel is notably more comprehensive than one promoted for use with the HP2000 activities of the 1990s. Together with the catalog of leading health indicators from the current Healthy People process, these measures offer a useful starting point for population-based health improvement initiatives.

**Table 2-9** Healthy People 2010 Leading Indicators**Physical Activity**

- Proportion of adolescents who engage in vigorous physical activity that promotes cardio-respiratory fitness 3 or more days per week for 20 or more minutes per occasion
- Proportion of adults who engage regularly, preferably daily, in moderate physical activity for at least 30 minutes a day

**Overweight and Obesity**

- Proportion of children and adolescents who are overweight or obese
- Proportion of adults who are obese

**Tobacco Use**

- Proportion of adolescents who smoke
- Proportion of adults who smoke

**Substance Abuse**

- Proportion of adolescents not using alcohol or any illicit drugs during the past 30 days
- Proportion of adults using any illicit drug during the past 30 days
- Proportion of adults engaging in binge drinking of alcoholic beverages during the past month

**Responsible Sexual Behavior**

- Proportion of adolescents who abstain from sexual intercourse or use condoms if sexually active
- Proportion of sexually active persons who use condoms

**Mental Health**

- Proportion of adults with recognized depression who receive treatment

**Injury and Violence**

- Death rates caused by motor vehicle crashes
- Death rates caused by homicides

**Environmental Quality**

- Proportion of persons exposed to air that does not meet the U.S. Environmental Protection Agency's health-based standards for ozone
- Proportion of nonsmokers exposed to environmental tobacco smoke

**Immunization**

- Proportion of young children who receive all vaccines that have been recommended for universal administration for at least 5 years
- Proportion of noninstitutionalized adults who are vaccinated annually against influenza and ever vaccinated against pneumococcal disease

**Access to Health Care**

- Proportion of persons with health insurance
- Proportion of persons who have a specific source of ongoing care
- Proportion of pregnant women who begin prenatal care in the first trimester of pregnancy

Source: From the Office of Disease Prevention and Health Promotion. *Healthy People 2010: Understanding and Improving Health*. Rockville, MD: Office of Disease Prevention and Health Promotion; 2000.

**Table 2-10** Healthy People 2020 Vision, Mission, Goals, and Focus Areas**Vision**

A society in which all people live long, healthy lives.

**Mission**

Healthy People 2020 strives to:

- Identify nationwide health improvement priorities;
- Increase public awareness and understanding of the determinants of health, disease, and disability and the opportunities for progress;
- Provide measurable objectives and goals that are applicable at the national, state, and local levels;
- Engage multiple sectors to take action to strengthen policies and improve practices that are driven by the best available evidence and knowledge;
- Identify critical research, evaluation, and data collection needs.

**Overarching Goals**

- Attain high quality, longer lives free of preventable disease, disability, injury, and premature death.
- Achieve health equity, eliminate disparities, and improve the health of all groups.
- Create social and physical environments that promote good health for all.
- Promote quality of life, healthy development, and healthy behaviors across all life stages.

**Focus Areas**

1. Access to health services
2. Adolescent health
3. Arthritis, osteoporosis, and chronic back conditions
4. Blood disorders and blood safety
5. Cancer
6. Chronic kidney diseases
7. Diabetes
8. Disability and secondary conditions
9. Early and middle childhood
10. Educational and community-based programs
11. Environmental health
12. Family planning
13. Food safety
14. Genomics
15. Global health
16. Health communication and health IT
17. Healthcare-associated infections
18. Hearing and other sensory or communication disorders (ear, nose, throat—voice, speech, and language)
19. Heart disease and stroke
20. HIV
21. Immunization and infectious diseases
22. Injury and violence prevention
23. Maternal, infant, and child health
24. Medical product safety
25. Mental health and mental disorders
26. Nutrition and weight status
27. Occupational safety and health



**Table 2-10** Healthy People 2020 Vision, Mission, Goals, and Focus Areas (continued)

28. Older adults
29. Oral health
30. Physical activity and fitness
31. Public health infrastructure
32. Quality of life and well-being
33. Respiratory diseases
34. Sexually transmitted diseases
35. Social determinants of health
36. Substance abuse
37. Tobacco use
38. Vision

Source: Data from U.S. Department of Health and Human Services. Healthy People 2020 website. [www.healthypeople.gov](http://www.healthypeople.gov). Accessed May 2010.

## CONCLUSION

From an ecological perspective, the health status of a population is influenced by many factors drawn from biology, behavior, the environment, and the use of health services. Social and cultural factors also play an important role in the disease patterns experienced by different populations, as well as in the responses of these populations to disease and illness. Globally, risks associated with population growth, pollution, and poverty result in mortality and morbidity that are still associated with infectious disease processes. In the United States, behaviorally mediated risks, including tobacco, diet, alcohol, and injury risks, rather than infectious disease processes, remain major contributors to health status, and the considerable gap between low-income minority populations and other Americans continues to widen. Public health activities strive to improve population health status (effectiveness) through cost-beneficial strategies and interventions (efficiency) and with equal benefits for all segments of the population (equity). Elimination and reduction of the disparities in health status among population groups have emerged as perhaps the most critical national health goal for the year 2020. With the increasing availability of data on health status, as well as on determinants and contributing factors, the potential for more rational policies and interventions has increased. Over the long term, public policies that narrow income disparities and increase access to education, jobs, and housing will be more likely to improve the health status of populations than efforts to provide more health-care services. Health improvement efforts in the new century will require more than data on health problems and contributing factors, although these view health from a negative perspective. Also needed is information from a positive perspective, in terms of community capacities, assets, and willingness. More important still, there must be recognition and acceptance that the right to health is a basic human right and one inextricably linked to all other

**Table 2-11** Proposed Indicators for a Community Health Profile**Sociodemographic Characteristics**

1. Distribution of the population by age and race/ethnicity
2. Number and proportion of persons in groups such as migrants, homeless, or the non-English speaking for whom access to community services and resources may be a concern
3. Number and proportion of persons aged 25 and older with less than a high school education
4. Ratio of the number of students graduating from high school to the number of students who entered ninth grade 3 years previously
5. Median household income
6. Proportion of children less than 15 years of age living in families at or below the poverty level
7. Unemployment rate
8. Number and proportion of single-parent families
9. Number and proportion of persons without health insurance

**Health Status**

10. Infant mortality rate by race/ethnicity
11. Numbers of deaths or age-adjusted death rates for motor vehicle crashes, work-related injuries, suicide, homicide, lung cancer, breast cancer, cardiovascular diseases, and all causes by age, race, and gender, as appropriate
12. Reported incidence of AIDS, measles, tuberculosis, and primary and secondary syphilis by age, race, and gender, as appropriate
13. Births to adolescents (ages 10 to 17) as the proportion of total live births
14. Number and rate of confirmed abuse and neglect cases among children

**Health Risk Factors**

15. Proportion of 2-year-old children who have received all age-appropriate vaccines, as recommended by the Advisory Committee on Immunization Practices
16. Proportion of adults 65 years old and older who have ever been immunized for pneumococcal pneumonia; proportion who have been immunized in the past 12 months for influenza
17. Proportion of the population who smoke, by age, race, and gender, as appropriate
18. Proportion of the population aged 18 or older who are obese
19. Number and type of U.S. Environmental Protection Agency air quality standards not met
20. Proportion of assessed rivers, lakes, and estuaries that support beneficial uses (e.g., fishing and swimming approved)

**Healthcare Resource Consumption**

21. Per-capita healthcare spending for Medicare beneficiaries (the Medicaid-adjusted average per capita cost)

**Functional Status**

22. Proportion of adults reporting that their general health is good to excellent
23. During the past 30 days, the average number of days for which adults report that their physical or mental health was not good

**Quality of Life**

24. Proportion of adults satisfied with the healthcare system in the community
25. Proportion of persons satisfied with the quality of life in the community

*Source:* Data from the Institute of Medicine. *Using Performance Monitoring to Improve Community Health: A Role for Performance Monitoring*. Washington, DC: National Academy Press; 1997.

human rights, lest quality of life be seriously compromised.<sup>32</sup> It is this right to health that enables the practice of public health and challenges public health workers to measure health and quality of life in ways that promote its improvement.

### DISCUSSION QUESTIONS AND EXERCISES

1. Is poverty a cause of poor health in a community, or is poor health a cause of poverty? How would different views of this question influence public health policy?
2. You have been asked to review and improve the consensus list of important health status indicators (see Table 2-11). Identify and justify five indicators you would add to this list.
3. Visit the Internet website of one of the national print media and use the search features to identify articles on public health for a recent month. Catalog the health problems (both conditions and risks) from that search and compare this with the listing of health problems and issues on Table 2-4. Are the types of conditions and risks you encountered in the print media similar to those on Table 2-4? Were some conditions and risks either overrepresented or underrepresented in the media, in comparison with their relative importance as suggested by Table 2-4? What are the implications for the role of the media in informing and educating the public regarding public health issues?
4. Examine each of these websites. Which ones are most useful for the major topics examined in this part of the course? Why?
  - Healthfinder: <http://www.healthfinder.gov>, a Department of Health and Human Services-sponsored gateway site that provides links to more than 550 websites (including more than 200 federal sites and 350 state, local, not-for-profit, university, and other consumer health sources), nearly 500 selected online documents, frequently asked questions on health issues, and databases and Web search engines by topic and agency
  - Fedstats: <http://www.fedstats.gov>, a gateway to a variety of federal agency data and information, including health statistics
  - National Center for Health Statistics: <http://www.cdc.gov/nchswww>, an invaluable resource for data and information, especially "Health, United States," which can be downloaded from this site
  - CDC Mortality and Morbidity Weekly Report: <http://www2.cdc.gov/mmwr>, and MMWR morbidity and mortality data by time and place: <http://www2.cdc.gov/mmwr/distrnds.html>
  - U.S. Census data: <http://www.census.gov>, the best general denominator data anywhere

5. Compare the two 20th century public health achievements presented in the Public Health Spotlights for Chapter 1 (control of infectious diseases) and Chapter 2 (tobacco use). Which of these accomplishments, in your opinion, has had the greatest impact on the health status and quality of life of Americans living in the early 21st century? Justify your selection.
6. After reviewing the Chapter 2 Public Health Spotlight on Tobacco Use, select a health outcome related to tobacco use and analyze that problem for its determinants and contributing factors, using the method described in the text. Identify at least two major determinants for the problem that you select. For each determinant, identify at least two direct contributing factors, and for each direct contributing factor, identify at least two indirect contributing factors. At what level of your analysis does tobacco use appear as a risk factor?
7. The Public Health Spotlight on Tobacco Use presents data on several HP2020 objectives related to tobacco use. What are some important factors that must be addressed to achieve these targets in view of trends since 1990?
8. Population, poverty, and pollution are sometimes cited as the three most important factors influencing global health status today. After examining the WHO website (<http://www.who.ch>), cite reasons for agreeing or disagreeing with this assertion.
9. Great Debate: There are three propositions to be considered. Proposition A: Disease entities should be listed as official causes of death. Proposition B: Underlying factors that result in these diseases should be listed as official causes of death. Proposition C: No causes of death should be listed on death certificates. Select one of these positions and develop a position statement with your rationale.
10. Projections call for a continuing increase in life expectancy through the first half of the 21st century. What effect will increased life expectancy have on the major goals of HP2020—increasing the quality and years of healthy life and eliminating health disparities?

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## Public Health Spotlight on Healthy People 2010 Progress<sup>1</sup>

*The Healthy People 2020 process provides a comprehensive, national health promotion and disease prevention agenda and serves as a road map for improving the health of all people in the United States during the second decade of the 21st century. Table 2-10 summarizes the vision, mission, and overarching goals that provide structure and guidance for achieving the HP2020 objectives. While general in nature, they offer specific, important areas of emphasis where action must be taken if the United States is to achieve better health by the year 2020. Developed under the leadership of the Federal Interagency Workgroup, the HP2020 framework is the product of an exhaustive collaborative process among the U.S. Department of Health and Human Services (see Chapter 4) and other federal agencies, public stakeholders, and the Secretary's Advisory Committee on Health Promotion and Disease Prevention Objectives for 2020. In order to better appreciate where the Healthy People process is going, it is useful to see where it has been. This Public Health Spotlight traces the nation's progress toward achieving the objectives established for the year 2010. The midcourse review in 2005 provided an opportunity to assess the progress made during the first half of the decade. This assessment focused on 467 objectives and 2 overarching goals: increasing quality and years of healthy life and eliminating health disparities.*

### GOALS

The first HP2010 goal highlighted the importance of increasing and maximizing both years and quality of healthy life. Progress toward this goal was assessed by measuring life expectancy and healthy life expectancies. These assessments resulted in several conclusions, including:

- Life expectancy continues to improve for the populations that could be assessed in the midcourse review.
- Women continue to have a longer life expectancy than men, and the white population has a longer life expectancy than the African American population.
- Three different measures of healthy life expectancy demonstrate gender and racial differences: expected years in good or better health, expected years free of activity limitations, and expected years free of selected chronic diseases.
- Expected years in good or better health and expected years free of activity limitations increased slightly, and expected years free of selected chronic conditions decreased.

The second goal of HP2010 sought to address the substantial disparities among populations in specific measures of health, life expectancy,

and quality of life. That goal was to eliminate health disparities that occur by race and ethnicity, gender, education, income, geographic location, disability status, or sexual orientation. There has been widespread improvement in objectives for nearly all of the populations associated with these characteristics; however, progress toward the target for individual populations and progress toward the goal to eliminate disparities are independent of each other. Improvements for individual populations—even improvements for all of the populations for a characteristic—do not necessarily ensure the elimination of disparities. This section focuses specifically on relative disparities between populations and changes in these relative disparities over time, regardless of whether the rates for specific populations are moving toward or away from the targets for each objective.

Disparities between populations and the persistence of disparities over time have been well documented. Unlike previous Healthy People initiatives, HP2010 called for monitoring objectives for an extensive array of specific population characteristics. All population-based objectives and subobjectives were monitored by race and ethnicity, by income or education, and by gender (if applicable). Monitoring for other characteristics (i.e., geographic location and disability status) was optional. HP2010, therefore, provided the basis for a broad examination of disparities among populations and changes in disparities over time. The findings concerning disparities among populations are summarized here.

- Substantial disparities between populations were evident for many HP2010 objectives.
- Both increases and decreases in relative disparities were evident for individual populations for specific objectives and subobjectives; however, there was no change in disparity for most of the objectives and subobjectives with data for any group.
- Among 195 objectives and subobjectives with trend data for racial and ethnic groups, disparities decreased for 24 and increased for 14.
- Among 238 objectives and subobjectives with trend data for males and females, disparities decreased for 25 and increased for 15. Females more often had the best group rate, and reductions in disparity were more frequent among males.
- Among education groups, disparities decreased for 3 objectives and subobjectives and increased for 14.
- Among income groups, among geographic groups, and between persons with disabilities and persons without disabilities, there were few changes in disparities.

## OBJECTIVES

Through the midcourse review, the status of 467 specific objectives in 28 focus areas was assessed. One hundred forty-two of these objectives consisted of two or more subobjectives that identified specific aspects of an objective (such as types of vaccines and types of air pollutants). Altogether, there were 955 objectives and subobjectives. Baseline



values were established for each objective and subobjective with data at the beginning of the decade, and specific targets were set to be achieved by the year 2010. Progress was assessed for objectives and subobjectives with tracking data (i.e., with baseline data and data more recent than the baseline) as of January 2005. More recent data are monitored as they become available. The DATA2010 database is updated regularly.

The status of the 467 objectives as of January 2005 is shown in Table 2-12. Based on an evaluation of each objective and comments received from the public as part of the midcourse review process, 28 objectives were deleted because data were not available or because of a change in science. As of January 2005, tracking data were not available to assess progress for 158 objectives (34% of the total). Baseline data were not available but are anticipated by the end of the decade for 87 of these objectives. Timely availability of data continues to be an issue in monitoring the health of the nation.

Progress was assessed for the 281 objectives with tracking data available:

- Twenty-nine objectives (10%) met the target.
- One hundred thirty-eight objectives (49%) moved toward the target.
- Forty objectives (14%) demonstrated mixed progress because they included subobjectives that moved both toward and away from the target.
- Seventeen objectives (6%) demonstrated no change from the baseline.
- Fifty-seven objectives (20%) moved away from the target.

In Table 2-13, similar assessments are shown for each of the 28 focus areas. In all focus areas, there are some objectives that met, exceeded, or

**Table 2-12** Healthy People 2010 Objectives: Status at the Midcourse and Summary of Progress Toward Target Attainment

<i>467 Total Objectives in Healthy People 2010</i>		
	Percentage	Number of Objectives
Dropped at midcourse	6%	28
Could not be assessed	34%	158
Tracking data available (see following section of table)	60%	281
<i>281 Objectives with Tracking Data</i>		
	Percentage	Number of Objectives
Met or exceeded target	10%	29
Moved toward target	49%	138
Demonstrated no change	6%	17
Mixed (toward and away)	14%	40
Moved away from target	20%	57

*Source:* From U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010 Mid Course Review*. Rockville, MD: Office of Disease Prevention and Health Promotion; 2006.

**Table 2-13** Healthy People 2010 Objectives: Summary of Progress for Each Focus Area

Focus Area	Met or Exceeded Target	Moved Toward Target	Demonstrated No Change	Demonstrated Mixed Progress	Moved Away From Target	Could Not Be Assessed	Dropped at Midcourse	Total
1. Access to quality health services	1	4	1	2	1	6	1	16
2. Arthritis, osteoporosis, and chronic back conditions	0	4	2	1	2	2	0	11
3. Cancer	2	7	2	2	0	2	0	15
4. Chronic kidney disease	0	1	0	0	5	2	0	8
5. Diabetes	3	6	1	0	4	1	2	17
6. Disability and secondary conditions	0	4	0	1	2	6	0	13
7. Educational- and community-based programs	1	1	0	1	1	4	4	12
8. Environmental health	1	7	0	2	1	17	2	30
9. Family planning	0	4	0	0	4	5	0	13
10. Food safety	0	1	0	3	0	2	1	7
11. Health communication	0	1	0	0	1	4	0	6
12. Heart disease and stroke	1	6	1	1	1	6	0	16
13. HIV	1	7	1	1	1	3	4	18
14. Immunization and infectious diseases	8	15	0	2	1	4	1	31
15. Injury and violence prevention	2	15	0	2	11	9	0	39
16. Maternal, infant, and child health	1	4	0	5	3	10	0	23
17. Medical product safety	1	1	1	1	0	1	1	6
18. Mental health and mental disorders	1	2	2	0	3	6	0	14
19. Nutrition and overweight	0	1	1	1	5	9	1	18
20. Occupational safety and health	1	7	1	0	0	2	0	11
21. Oral health	0	6	1	2	1	7	0	17
22. Physical activity and fitness	0	7	0	0	3	5	0	15
23. Public health infrastructure	0	1	1	0	0	12	3	17
24. Respiratory diseases	0	6	1	3	0	2	0	12
25. Sexually transmitted diseases	2	4	0	2	0	3	7	18
26. Substance abuse	2	4	1	6	6	6	0	25
27. Tobacco use	1	9	0	1	1	9	0	21
28. Vision and hearing	0	3	0	1	0	13	1	18
Total	29	138	17	40	57	158	28	467

Source: From U.S. Dept. of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010 Mid Course Review*. Rockville, MD: Office of Disease Prevention and Health Promotion; 2006.

moved toward the target. In Cancer (Focus Area 3), Diabetes (Focus Area 5), Immunization and Infectious Diseases (Focus Area 14), and Occupational Safety and Health (Focus Area 20), more than half of the objectives met or moved toward their targets. The proportion of objectives that could not be assessed is relatively large in Environmental Health (Focus Area 8), Health Communication (Focus Area 11), Public Health Infrastructure (Focus Area 23), and Vision and Hearing (Focus Area 28).

Of the 955 objectives and subobjectives, a total of 67 objectives and subobjectives were dropped at the midcourse, and 381 objectives and subobjectives lacked tracking data. Progress was assessed for the 507 objectives and subobjectives with data at the baseline and data for the most recent data point available in the Healthy People data system as of January 2005:

- Seventy objectives and subobjectives (14%) met the target.
- Two hundred eighty-six objectives and subobjectives (56%) moved toward the target.
- Thirty-eight objectives and subobjectives (8%) demonstrated no change.
- One hundred thirteen objectives and subobjectives (22%) moved away from the target.

## POPULATIONS

Progress was also assessed for specific populations. For each population, the number of objectives and subobjectives is shown for each of the following: moved away from the target, demonstrated no change, moved toward the target, and met or exceeded the target. Because a single target was set for all populations, there are some instances where a population met the HP2010 target at the baseline. The numbers of these objectives and subobjectives are shown separately in Table 2-14.

In general, the number of population-based objectives and subobjectives that moved toward the target or for which the target was met at baseline exceeds the number that moved away from the target. For the American Indian or Alaska Native population, for example, 87 objectives and subobjectives moved toward their respective targets, whereas 41 moved away. This population demonstrated no change between the baseline and the most recent data point for 10 objectives and subobjectives. The number of objectives and subobjectives that moved toward the target or met the target at baseline exceeds the number that moved away from the target by a ratio of at least 2:1 for all but the following: the Asian or Pacific Islander population, the Asian population, the Native Hawaiian or other Pacific Islander population, persons identifying with two or more races, persons with less than a high school education, high school graduates, and persons in both the poor and near-poor income groups. For the Native Hawaiian or other Pacific Islander population, there were more objectives and subobjectives that moved away from the target (19) than moved toward the target (15).

**Table 2-14** Number of Objectives and Subobjectives with Tracking Data According to the Progress Quotient for Population Groups

Characteristics and Groups	Moved Away from Target		Demonstrated No Change			Moved Toward Target					
	Total	Target Met at Baseline*	Percent of Targeted Change Achieved							Target Met at Baseline	Total
			100+	50 to 99	1 to 49	0	1 to 49	50 to 99	100+		
(Number of Objectives)											
Race and Ethnicity											
American Indian or Alaska Native	41	1	5	3	32	10	54	17	7	9	87
Asian or Pacific Islander	26	1	12	3	10	3	15	10	11	10	46
Asian	28	0	12	4	12	7	23	8	15	5	51
Native Hawaiian or other Pacific Islander	19	3	2	5	9	5	9	3	2	1	15
Two or more races	21	2	4	4	11	6	18	2	7	3	30
Hispanic	77	0	10	8	59	19	104	38	19	13	174
Black non-Hispanic <sup>†</sup>	86	2	18	17	49	24	126	38	33	2	199
White non-Hispanic <sup>†</sup>	94	3	26	22	43	29	90	43	50	12	195
Gender											
Female	81	5	16	16	44	27	103	44	31	22	200
Male	78	7	13	5	53	18	116	40	21	10	187
Education											
Less than high school	27	0	2	2	23	10	44	6	1	0	51
High school graduate	32	0	3	8	21	14	34	7	1	1	43
At least some college	22	2	5	2	13	9	28	10	9	11	58

(continues)

**Table 2-14** Number of Objectives and Subobjectives with Tracking Data According to the Progress Quotient for Population Groups (continued)

Income											
Poor	27	2	1	3	21	5	31	9	5	3	48
Near poor	25	0	3	4	18	8	22	8	3	6	39
Middle/high	21	3	5	4	9	9	20	6	11	8	45
Location											
Urban/metropolitan	11	0	0	2	9	7	13	6	3	2	24
Rural/nonmetropolitan	10	0	5	3	2	7	14	7	1	3	25
Disability status											
Persons with disabilities	15	0	1	1	13	4	23	5	5	2	35
Persons without disabilities	14	0	2	5	7	7	21	7	5	1	34

\* Among population groups, the target for some objectives and subobjectives was met at the baseline, but more recent data indicate that the target was no longer achieved. The percentage of target achieved could not be calculated.

† For some objectives and subobjectives, data include persons of Hispanic origin.

Source: From the U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010 Mid Course Review*. Rockville, MD: Office of Disease Prevention and Health Promotion; 2006.

In Table 2-14, a progress quotient is used to quantify the degree of progress toward or away from the target for those population-based objectives and subobjectives with tracking data. The progress quotient measures the percent of targeted change that has been achieved. The baseline value, the most recent value, and the target are used to compute the progress quotient. A progress quotient of 50%, for example, indicates that the difference between the baseline and the target has been reduced by 50% or by one half. A progress quotient greater than 100% indicates that the target has been exceeded. Negative progress quotients indicate that the change from the baseline is away from the target.

### LEADING HEALTH INDICATORS

The national agenda for disease prevention and health promotion also identified 10 leading indicators of population health and measures that would assist communities and the nation in tracking progress toward improved health status. Table 2-15 provides a composite look at the 10 leading indicators and 22 measures related to those indicators in terms of progress being made toward achieving national targets estab-

**Table 2-15** Healthy People 2010 Leading Health Indicators**Immunization**

- Objective 14-24: Increase the proportion of young children and adolescents who receive all vaccines that have been recommended for universal administration for at least 5 years.
- Objective 14-29a: Increase the proportion of noninstitutionalized adults who are vaccinated annually against influenza.
- Objective 14-29b: Increase the proportion of noninstitutionalized adults who are ever vaccinated against pneumococcal disease.

**Tobacco Use**

- Objective 27-1a: Reduce tobacco use by adults—cigarette smoking.
- Objective 27-2b: Reduce tobacco use by adolescents—cigarettes.

**Access to Health Care**

- Objective 1-1: Increase the proportion of persons with health insurance.
- Objective 1-4a: Increase the proportion of persons of all ages who have a specific source of ongoing care.
- Objective 16-6a: Increase the proportion of pregnant women who receive early and adequate prenatal care beginning in the first trimester of pregnancy.

**Environmental Quality**

- Objective 8-1a: Reduce the proportion of persons exposed to air that does not meet the U.S. Environmental Protection Agency's health-based standards for harmful air pollutants—ozone.
- Objective 27-10: Reduce the proportion of nonsmokers exposed to environmental tobacco smoke.

**Physical Activity**

- Objective 22-2: Increase the proportion of adults who engage in moderate physical activity for at least 30 minutes per day 5 or more days per week or vigorous physical activity for at least 20 minutes per day 3 or more days per week.
- Objective 22-7: Increase the proportion of adolescents who engage in vigorous physical activity that promotes cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion.

**Overweight and Obesity**

- Objective 19-2: Reduce the proportion of adults who are obese.
- Objective 19-3c: Reduce the proportion of children and adolescents aged 6 to 19 who are overweight or obese.

**Injury and Violence**

- Objective 15-5: Reduce deaths caused by motor vehicle crashes.
- Objective 15-32: Reduce homicides.

**Mental Health**

- Objective 18-9b: Increase the proportion of adults aged 18 years and older with recognized depression who receive treatment.

**Substance Abuse**

- Objective 26-10a: Increase the proportion of adolescents not using alcohol or any illicit drugs during the past 30 days.

*(continues)*

**Table 2-15** Healthy People 2010 Leading Health Indicators (continued)

- Objective 26-10c: Reduce the proportion of adults using any illicit drug during the past 30 days.
- Objective 26-11c: Reduce the proportion of persons aged 18 years and older engaging in binge drinking of alcoholic beverages.

**Responsible Sexual Behavior**

- Objective 13-6: Increase the proportion of sexually active persons who use condoms.
- Objective 25-11: Increase the proportion of adolescents who abstain from sexual intercourse or use condoms if currently sexually active.

*Source:* Data from the U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010 Mid Course Review*. Rockville, MD: Office of Disease Prevention and Health Promotion; 2006.

lished for the year 2010. Baseline data for these measures come from a variety of sources and generally describe levels in the late 1990s when the HP2010 planning process was taking place. Figure 2-16 is a virtual scorecard of progress made from the baseline years through about the year 2005, delineating the percent of the targeted change that had been achieved at that time. Arguably, to be on track to achieve the year 2010 targets, about half of the targeted change should have been achieved by 2005.

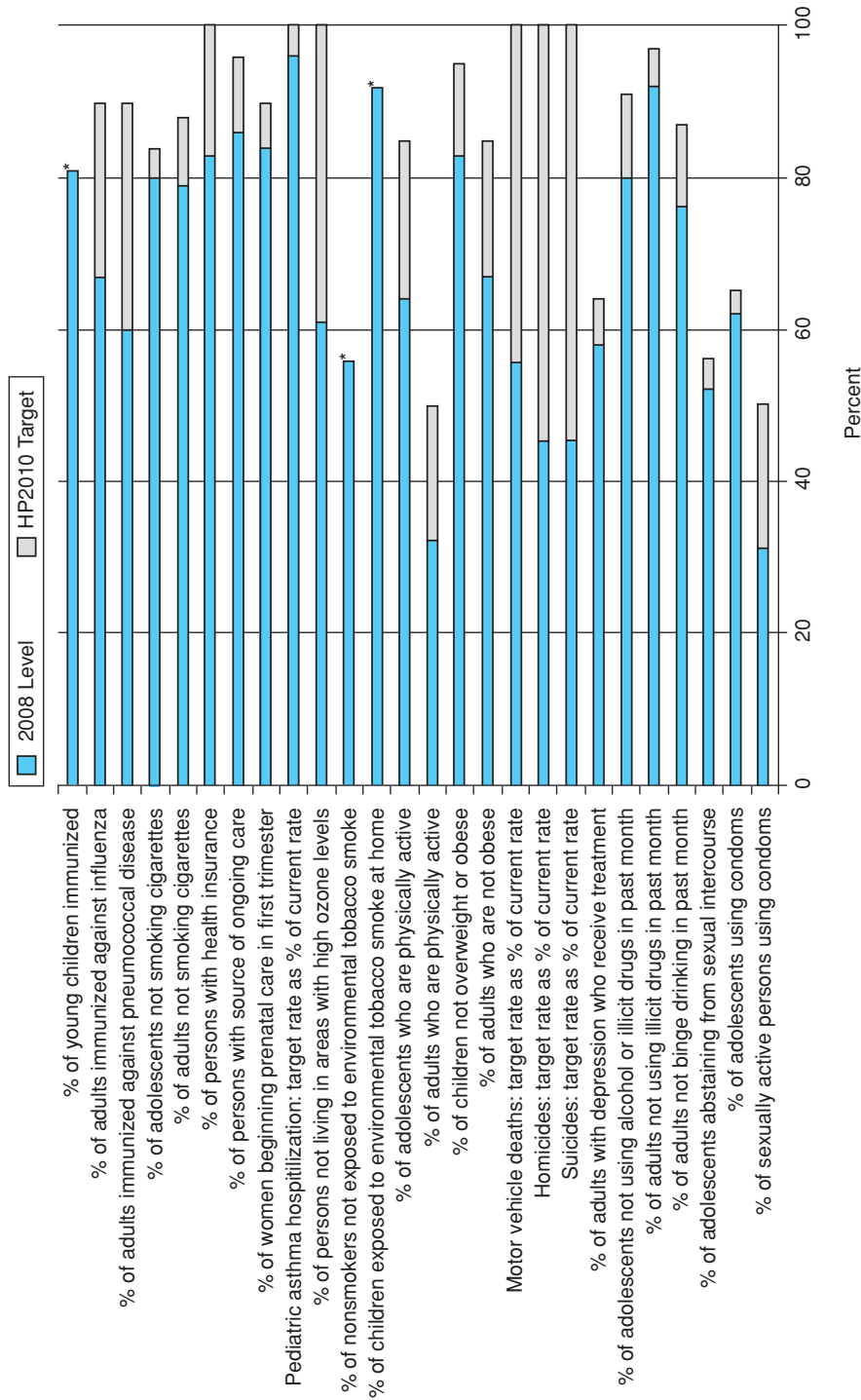
Figure 2-16 summarizes the progress and problems the nation faced in achieving its public health aspirations for the year 2010. Progress was substantial for some leading indicators and their associated measures but not all. Some have actually experienced negative trends, moving further away from the year 2010 targets than we were in the late 1990s. The stories behind these developments and obstacles are included in the various chapters of this text. Chapter 1, for example, examined the leading indicator that focuses on immunizations and infectious diseases. Another Public Health Spotlight in this chapter looks at tobacco use in greater detail.

Although the list of leading indicators offers focus and consistency to state and local health improvement initiatives, some believe that 10 indicators and two dozen measures are too cumbersome and that a single public health index would be better. An index of leading health indicators (similar to the widely respected index of leading economic indicators) may be an element added to the national planning process for future iterations of the Healthy People Process. What that may look like challenges us all.

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**Figure 2-16** Scorecard for Healthy People 2010 leading indicators comparing 2008 levels with 2010 targets. *Source:* Data from Data 2010, Healthy People 2010 database. <http://wonder.cdc.gov/data2010/ftpselec.htm>. Accessed May 31, 2010.

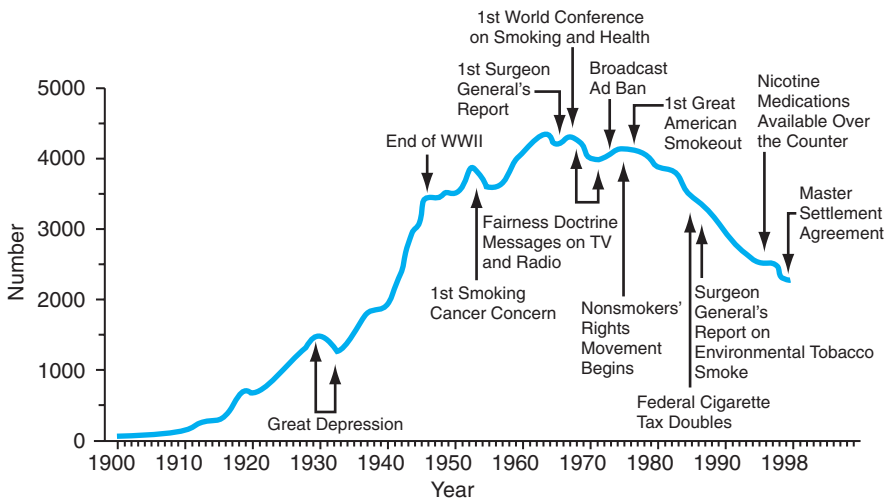
\*Indicates that 2010 targets had been reached and exceeded by 2008.

## Public Health Spotlight on Tobacco Use

*Initial suspicions that tobacco was harmful to humans were confirmed by epidemiologic studies in the mid 20th century, stimulating new interest in measures of health, illness, and their related factors. Since the 1990s, when the prevalence of tobacco use, a risk behavior, became a reportable condition, the deployment of a wide array of behavioral, social, legislative, and economic strategies to reduce tobacco use has become commonplace in public health practice. Highlights of these developments and today's challenges are captured in this Public Health Spotlight.*

### PUBLIC HEALTH ACHIEVEMENTS IN 20TH CENTURY AMERICA<sup>1</sup>

Smoking—once a socially accepted behavior—is the leading preventable cause of death and disability in the United States. During the first decades of the 20th century, lung cancer was rare; however, as cigarette smoking became increasingly popular, first among men and later among women, the incidence of lung cancer became epidemic (Figure 2-17). In 1930, the lung cancer death rate for men was 4.9 per 100,000; in 1990, the rate had increased to 75.6 per 100,000.<sup>2</sup> Other diseases and conditions now known to be caused by tobacco use include heart dis-



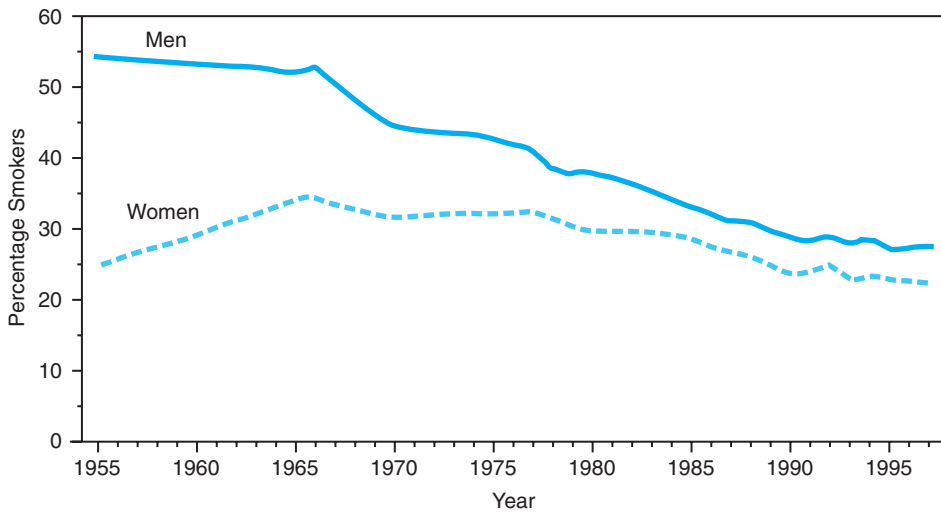
**Figure 2-17** Annual adult per capita cigarette consumption and major smoking and health events, United States, 1900–1998. *Source:* From Centers for Disease Control and Prevention. Public health achievements, United States, 1900–1999: tobacco use. *MMWR*. 1999;48(43):986–993.

ease, atherosclerotic peripheral vascular disease, laryngeal cancer, oral cancer, esophageal cancer, chronic obstructive pulmonary disease, intrauterine growth retardation, and low birth weight. During the latter part of the 20th century, the adverse health effects from exposure to environmental tobacco smoke also were documented. These include lung cancer, asthma, respiratory infections, and decreased pulmonary function.<sup>3</sup>

Large epidemiologic studies conducted in the 1940s and 1950s linked cigarette smoking and lung cancer. In 1964, on the basis of approximately 7,000 articles relating to smoking and disease, the Advisory Committee to the U.S. Surgeon General concluded that cigarette smoking is a cause of lung and laryngeal cancer in men, a probable cause of lung cancer in women, and the most important cause of chronic bronchitis in both sexes.<sup>4</sup> The committee stated that “cigarette smoking is a health hazard of sufficient importance in the United States to warrant appropriate remedial action.” Substantial public health efforts to reduce the prevalence of tobacco use began shortly after the risk was described in 1964. With the subsequent decline in smoking, the incidence of smoking-related cancers (including cancers of the lung, oral cavity, and pharynx) has also declined (with the exception of lung cancer among women).<sup>5</sup> In addition, age-adjusted death rates per 100,000 persons (standardized to the 1940 population) for heart conditions (i.e., coronary heart disease) have decreased from 307.4 in 1950 to 134.6 in 1996.<sup>5</sup> During 1964 to 1992, approximately 1.6 million deaths caused by smoking were prevented.<sup>6</sup>

Early in the 20th century, several events coincided that contributed to increases in annual per capita consumption, including the introduction of blends and curing processes that allowed the inhalation of tobacco, the invention of the safety match, improvements in mass production, transportation that permitted widespread distribution of cigarettes, and the use of mass media advertising to promote cigarettes.<sup>7,8</sup> Cigarette smoking among women began to increase in the 1920s, when targeted industry marketing and social changes reflecting the liberalization of women’s roles and behavior led to the increasing acceptability of smoking among women.<sup>9,10</sup> Annual per capita cigarette consumption increased from 54 cigarettes in 1900 to 4,345 cigarettes in 1963 and then decreased to 2,261 in 1998.<sup>11,12</sup> Some decreases correlate with events, such as the first research suggesting a link between smoking and cancer in the 1950s, the 1964 Surgeon General’s report, the 1968 Fairness Doctrine, and increased tobacco taxation and industry price increases during the 1980s (Figure 2-17).

An important accomplishment of the second half of the 20th century has been the reduction of smoking prevalence among persons aged greater than or equal to 18 years from 42.4% in 1965 to 24.7% in 1997, with the rate for men (27.6%) higher than for women (22.1%) (Figure 2-18). The percentage of adults who never smoked increased from 44% in the mid-1960s to 55% in 1997. In 1998, tobacco use varied within



**Figure 2-18** Trends in cigarette smoking among persons over 18 years by gender, United States, 1955–1997. *Source:* From Centers for Disease Control and Prevention. Public health achievements, United States, 1900–1999: tobacco use. *MMWR*. 1999;48(43):986–993.

and among racial/ethnic groups. The prevalence of smoking was highest among American Indians/Alaska Natives and second highest among black and Southeast Asian men. The prevalence was lowest among Asian American and Hispanic women.<sup>13</sup> Smokeless tobacco use has changed little since 1970, with a 5% prevalence in 1970 and a 6% prevalence in 1991 among men and 2% and 1%, respectively, for women. The prevalence of smokeless tobacco use is highest among high school males, with prevalence being 20% among white males, 6% among Hispanic males, and 4% among African American males. The prevalence of use tends to be lower in the northeastern region and higher in the southern region of the United States. Total consumption of cigars decreased from 8 million in 1970 to 2 million in 1993 but increased 68% to 3.6 million in 1997.<sup>14</sup>

Reductions in smoking result from many factors, including scientific evidence of the relationship among disease, tobacco use, and environmental exposure to tobacco; dissemination of this information to the public; surveillance and evaluation of prevention and cessation programs; campaigns by advocates for nonsmokers' rights; restrictions on cigarette advertising; counter advertising; policy changes (i.e., enforcement of minors' access laws, legislation restricting smoking in public places, and increased taxation); improvements in treatment and prevention programs; and an increased understanding of the economic costs of tobacco.

The cigarette itself has changed. When cigarettes were first associated with lung cancer in the early 1950s, most U.S. smokers smoked

unfiltered cigarettes. With a growing awareness of the danger of smoking came the first filter, which was designed to reduce the tar inhaled in the smoke. Later, low-tar cigarettes were marketed; however, many smokers compensated by smoking more intensely and by blocking the filter's ventilation holes.<sup>14</sup> Adenocarcinoma has replaced squamous cell carcinoma as the leading cause of lung cancer-related death in the United States. This increase in adenocarcinoma parallels the changes in cigarette design and smoking behavior.<sup>14</sup>

Changes in the social norms surrounding smoking can be documented by examining changes in public policy, including availability of Fairness Doctrine counter advertising messages on television and radio and increased restrictions on tobacco advertising, beginning with the ban on broadcast advertising in 1971. Cigarette advertising no longer appears on television or billboards, and efforts to restrict sales and marketing to adolescents have increased. Indoor air policies switched from favoring smokers to favoring nonsmokers. Smoking is no longer permitted on airplanes, and many people, including 12.5% of adult smokers with children, do not smoke at home.<sup>15</sup> By 1999, 42 states had restrictions on smoking at government work sites, and 20 states had restrictions at private work sites.

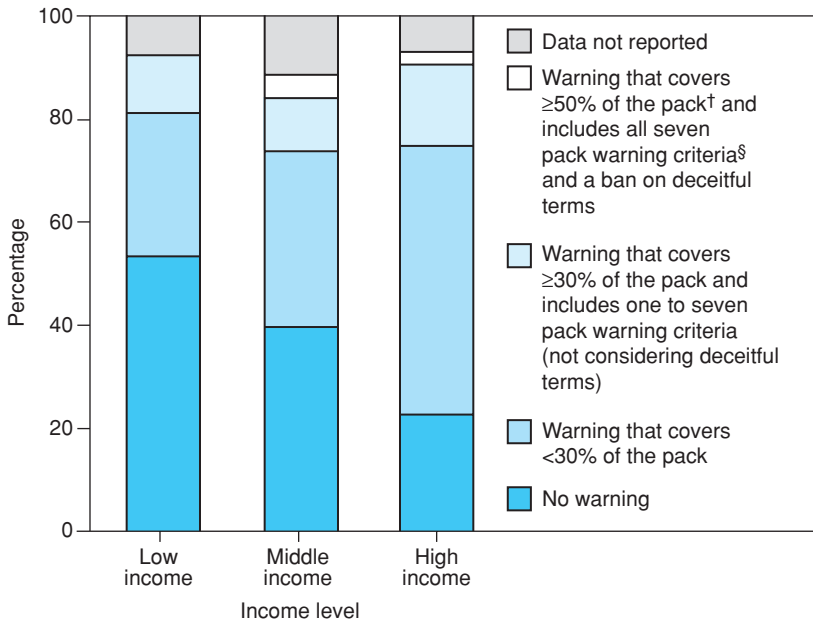
One of the most effective means of reducing the prevalence of tobacco use is by increasing federal and state excise tax rates. A 10% increase in the price of cigarettes can lead to a 4% reduction in the demand for cigarettes. This reduction is the result of people smoking fewer cigarettes or quitting altogether.<sup>16</sup> Studies show that low income, adolescent, Hispanic, and African American smokers are more likely than others to stop smoking in response to a price increase.<sup>16</sup>

The November 1998 Master Settlement Agreement marked the end of the 20th century with an unprecedented event. Although admitting no wrongdoing, the tobacco companies signed an agreement with the attorneys general of 46 states. This agreement settled lawsuits totaling \$206 billion; however, the agreement did not require that any of the state money be spent for tobacco use prevention and control.

## 21ST CENTURY PUBLIC HEALTH CHALLENGES

By the end of the 20th century, the tide had clearly turned in the war against tobacco, the nation's public health enemy number 1. Nevertheless, the United States still had nearly 50 million smokers and more than 400,000 tobacco-related deaths each year. Too many adolescents were initiating the tobacco habit, and the rate of adult smokers was no longer steadily falling. Tobacco use rates were substantially higher for African American and Native American males, and the harmful effects of environmental exposure to tobacco products, often known as second-hand smoke, for children and coworkers of smokers increased. Perhaps even more alarming, a dramatic increase in tobacco use was occurring worldwide. These and other trends are highlighted in the series of figures that follow.

Figure 2-19 highlights one of the reasons why tobacco consumption represents an imminent threat to developing countries where health warnings on tobacco packaging are much less frequent and effective. Figure 2-20 traces increases in federal and state excise taxes on tobacco products in the United States since 1995. Recent increases in federal excise taxes, coupled with the steady rise in state excise taxes, resulted in the combined federal and state excise tax rates achieving the \$2-per-pack target established for the year 2010.



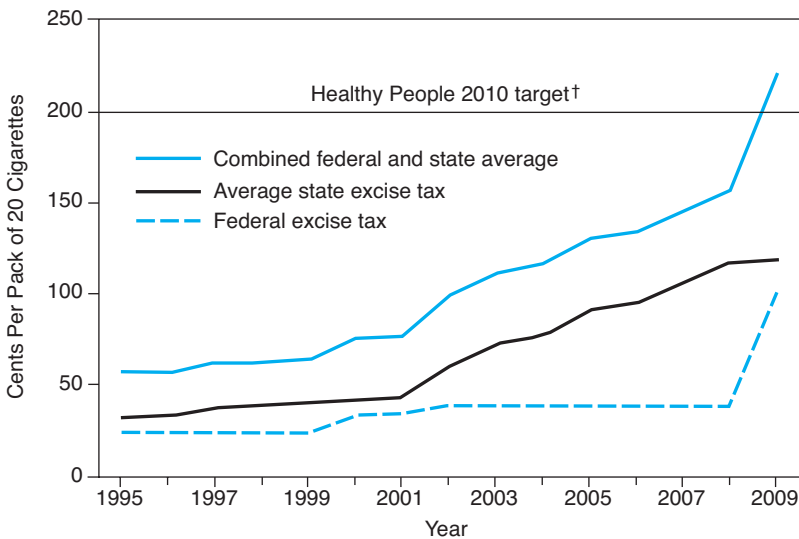
**Figure 2-19** Percentage of countries that require health warnings on tobacco packaging, by extent of warning required and country income level\*, World Health Organization, 2008.

\* Countries are classified according to their 2007 gross national income per capita, calculated using the World Bank Atlas method, as low income ( $\leq$ \$935), middle income (\$936–\$11,455), and high income ( $\geq$  \$11,456). Additional information is available at <http://www.worldbank.org> under Data and Research. Accessed May 31, 2010.

† [http://www.who.int/tobacco/mpower/mpower\\_report\\_full\\_2008.pdf](http://www.who.int/tobacco/mpower/mpower_report_full_2008.pdf). Accessed May 31, 2010.

§ Data specific to health warnings were collected for seven criteria: (1) mandate of specific tobacco use health warnings; (2) inclusion of health warnings on tobacco packs and outside packaging; (3) use of large, clear, and visible health warnings; (4) rotation of health warnings; (5) use of the principal languages of the country; (6) inclusion of pictorial warnings; and (7) descriptions of specific harmful effects of tobacco use in health.

Source: From Centers for Disease Control and Prevention. Health warnings on tobacco products, worldwide, 2007. *MMWR*. 2009;58(19):528–529.



**Figure 2-20** State and federal cigarette excise taxes, by year, United States,\* 1995–2009.

\* District of Columbia is included among results for states.

† Objective 27-21a: to increase the combined federal and average state cigarette excise tax to at least \$2 per pack.

Source: From Centers for Disease Control and Prevention. Federal and state cigarette excise taxes, United States, 1995–2009. *MMWR*. 2009; 58(19):524–527.

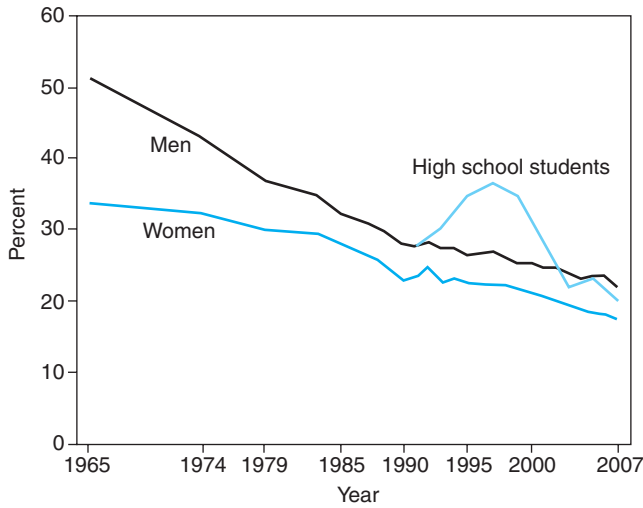
Figures 2-21 and 2-22 illustrate current tobacco use rates among various segments of the population and document that the problem persists with about 438,000 deaths each year attributed to tobacco use.

Many different strategies and interventions appeared over recent decades to battle the huge tobacco threat. The Task Force on Community Preventive Services<sup>17</sup> systematically reviewed the effectiveness of a variety of strategies, including:

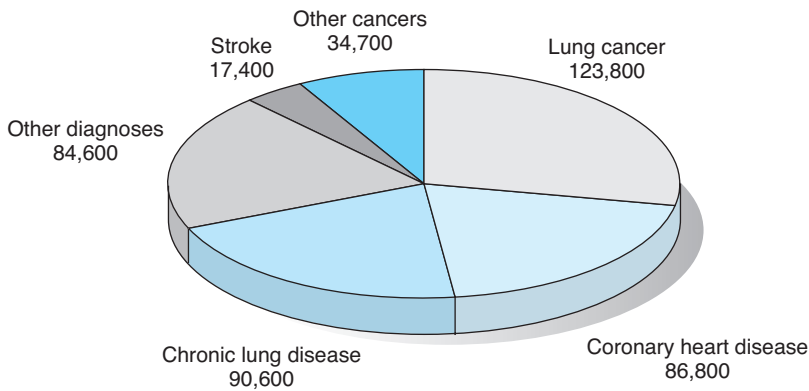
- Reducing tobacco use initiation
- Increasing tobacco use cessation
- Reducing exposure to environmental tobacco smoke
- Reducing minors' access to tobacco products
- Decreasing tobacco use in worksite settings, and
- Incentives and competitions to increase tobacco cessation

The task force found strong evidence of the effectiveness of several population-based interventions as of June 2010, including:

- Increasing the unit price for tobacco products
- Mass media campaigns when combined with additional interventions
- Provider reminder systems when used alone
- Provider reminder systems with provider education



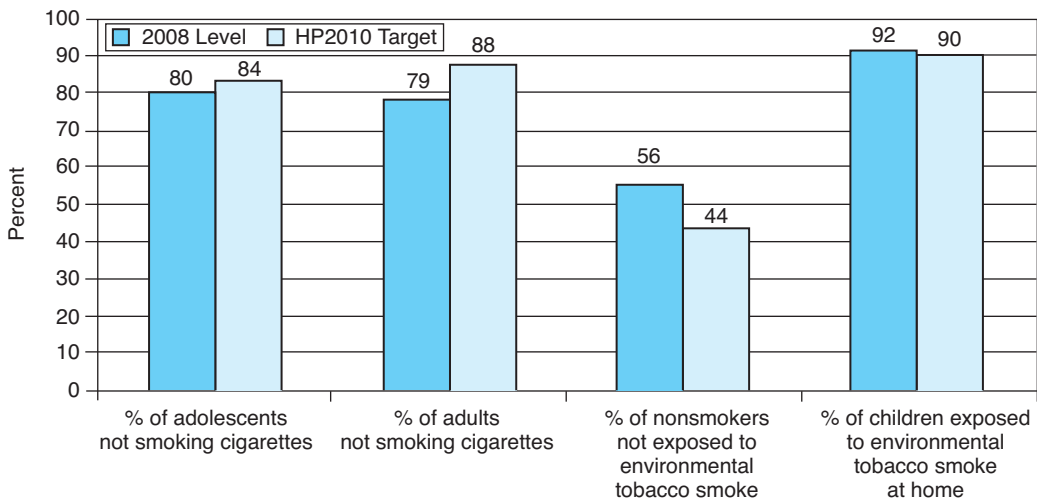
**Figure 2-21** Cigarette smoking, selected populations, United States, 1965–2007. *Source:* From Centers for Disease Control and Prevention, National Center for Health Statistics, *Health, United States 2009*, Figure 6. Hyattsville, MD: NCHS; 2009.



**Figure 2-22** The tobacco problem persists: 438,000 deaths per year (average annual number of deaths 1997–2001). *Source:* From Centers for Disease Control and Prevention. *MMWR*. 2005;54(25):625–628.

- Reducing client out-of-pocket costs for cessation therapies
- Multicomponent interventions that include telephone support
- Smoking bans and restrictions
- Community mobilization with additional interventions
- Smoke-free policies to reduce tobacco use among workers
- Incentives and competitions when combined with additional interventions





**Figure 2-23** Scorecard for selected Healthy People 2010 leading indicators related to tobacco use comparing 2008 levels with 2010 targets. *Source:* Data from Data 2010, Healthy People 2010 database. <http://wonder.cdc.gov/data2010/ftpselec.htm>. Accessed May 31, 2010.

Figure 2-23 demonstrates progress toward measures for two HP2010 leading indicators related to tobacco use and environmental tobacco smoke exposure. Notably the year 2010 targets for environmental tobacco smoke exposure were achieved, but the targets for adolescent and adult smoking rates were not.

In the second decade of the 21st century, tobacco remains the leading cause of preventable death in the United States and continues to take an immense toll in terms of quality of life and impact on society. Expanding the use of interventions known to be effective will be necessary but will not likely be sufficient to make the elimination of the tobacco threat one of the crowning achievements of 21st century public health in America.

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