CHAPTER 2

Assessment: Defining and Measuring Health and Determinants of Health

LEARNING OBJECTIVES

Given a social-ecological perspective of the varied influences on the health status of populations, incorporate appropriate measures to assess the health of a population. Key aspects of this competency expectation include being able to:

- Articulate a definition of health consistent with that of the World Health Organization.
- Identify measures of health status, including commonly used mortality and morbidity measures.
- Articulate a definition of "determinants of health."
- Identify four categories of determinants of health.
- Identify three or more commonly used measures within each category of determinants of health.
- Access and utilize comprehensive and current national data on health status and determinants of health in the United States.
- Describe major trends in health status for the United States over the past 100 years.
- Define health equity.
- Describe health inequity in the United States.

Introduction

Throughout modern history, there have been immense opportunities to advance the health of the public through actions that ensure conditions favorable for health and quality of life. Ideally, public health systems direct their efforts toward clearly defined and measurable outcomes and track progress to ensure that goals associated with these outcomes are met. In public health, this process is called assessment, one of the three core functions of public health. The two essential services that fall under this function are "monitoring health status to identify community health problems" and "diagnosing and investigating health problems and health hazards in the community."[1] The focus of this chapter will be on the definitions and measures of health and determinants of health that are commonly used in public health assessments. Specifically, this chapter will address the following questions:

- What is health?
- Which factors, also known as determinants, influence health and illness?

- How do we measure health and the determinants of health?
- How can this information be used to assess population and community health status and to develop effective public health interventions and public policy?

These questions address the heart of the assessment core function with recognition that an accurate and thorough assessment is essential to improving the public's health. In order to systematically address each of the questions, this chapter will refer to two models that make comprehensive use of data on health and determinants of health: the County Health Rankings and Healthy People 2020. Both frameworks will be discussed in detail in this chapter.

Defining Health

Traditionally, health has been difficult to define and even more difficult to measure. For much of history, in part due to the continual onslaught of epidemic diseases, the common understanding of health was that of living in a disease-free state; health and disease were considered opposite states, rather than points along a continuum. Using this notion of health, one needed only to look at measurements of disease to measure "health" and to describe how healthy, or unhealthy, people in a community were.

As knowledge of disease increased and methods of prevention and control improved, a more positive perspective interpretation of health emerged. In its 1946 constitution, the World Health Organization (WHO) recognized this changing perspective, defining health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."[2] This more positive definition of health advanced the concept of "well-being" and emphasized mental and social aspects of health in addition to physical health. This definition thus legitimizes the examination of all of the factors that influence an individual's sense of physical, mental, and social health well-being. One of the challenges that emerges with this broad and arguably more subjective definition of health is how to measure it. Public health practitioners need to carefully consider what is being measured in order to fully understand what these measures tell us about health, illness, and disease outcomes in a population as well as about the factors that influence these outcomes.

Defining Determinants of Health

As discussed in Chapter 1 with the introduction of the social-ecological model, the health of any individual is strongly influenced by many factors, commonly referred to as "determinants of health." There are many ways to frame the many different factors that influence health. In this section, we will explore three similar, but distinct, constructs of determinants of health: the social determinants of health model, the County Health Rankings (CHR) model, and finally, the social-ecological model.

Social Determinants of Health Model

Many public health practitioners use an overarching term, "social determinants of health" (SDH) to capture factors that influence health outcomes that are not related to an individual's biology (e.g., genetics, history of pre-existing diseases). The WHO uses this term to describe "the circumstances in which people are born, grow, live, work and age" that are shaped by "access to money, power, and resources" at global, national, and local levels.[3] **Figure 2-1** provides an example of how the Kaiser Family Foundation has framed social determinants of health and the health outcomes they influence.[4] The local availability and accessibility of resources in each of the categories in this model can positively influence the health of a population while a local absence of these factors can contribute to poor health outcomes. Using "Neighborhood and Physical Environment" as an example, some factors in this category include housing, transportation, safety, parks, playgrounds, and walkability, all culminating within the zip code or geographic area. In an impoverished rural zip code, health outcomes may be adversely influenced by substandard housing (perhaps leading to an increased risk of asthma) and lack of public transport (perhaps

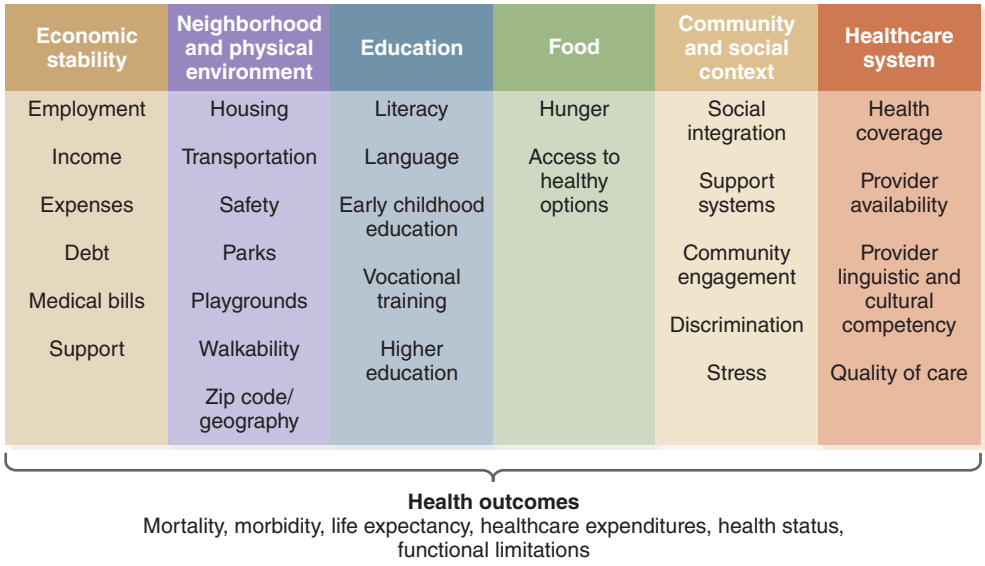


Figure 2-1 Social Determinants of Health.

Kaiser Family Foundation. Available at: https://www.kff.org/disparities-policy/issue-brief/beyond-health-care-the-role-of-social-determinants-in-promoting-health-and-health-equity/

leading to limited access to employment, food, health care, and perhaps even educational opportunities or opportunities for social cohesion among neighbors). Similarly, in that same zip code, health outcomes may be positively influenced by less exposure to pollution (perhaps leading to a decreased risk of asthma) and greater exposure to green space (perhaps leading to improved access to physical activity).

Local, state, and federal policies strongly influence all of these categories. As a contrasting example, consider a densely populated impoverished urban area. A policy that increases access to healthful foods by supporting community gardens and mobile markets or a policy that increases access to safe physical activity such as intentional creation of green spaces and rebuilding safe sidewalks can contribute to improving community health. Furthermore, policymaking has the potential to strengthen a culture of shared responsibility, which can in turn influence social integration and community engagement. Consider, for example, how community members may feel if they vote for, and witness, improvements in the physical infrastructure in their community. Such action can contribute to community resilience (the ability of a community to respond to and recover from threats) and social cohesion (the willingness of people within a community to work together for the well-being of all.)

Social determinants of health are clearly germane to public health interests and efforts. As illustrated in the health impact pyramid seen in Figure 1-6 in Chapter 1, efforts to change SDH have a much larger potential impact on the health of the whole population than efforts that focus on changing individuals' behaviors or health risks through one-on-one interactions. Focusing on the SDH provides a different perspective on the threats to personal and public health than that conveyed simply by focusing on disease-specific incidence or mortality data. Such a focus can ideally promote more rational policy development and interventions that will have potentially greater impact. Additionally, focusing on SDH highlights the need for the public health system to be viewed as a broad range of sectors working together to influence the social determinants.

In addition to it not addressing biologic determinants of health, one of the limitations of using an SHD model in isolation is that some of the SDH listed in Figure 2-1, such as "community engagement" or "social integration" can be extremely challenging to measure. Other models frame determinants of health in ways that are more amenable to measurement, as discussed in

the section on measuring determinants. Another limitation is that is does not fully capture the role of policy in influencing the determinants.

Outside-the-Book Thinking 2-1

Choose a nearby zip code of interest. Apply the social determinants of health model seen in Figure 2-1 to research and describe a neighborhood in that zip code, using photographs to support your findings.

County Health Rankings Model of Determinants of Health

The County Health Rankings & Roadmaps (CHR) program, which is shown in **Figure 2-2**, provides another approach to look at the breadth and scope of determinants of health. The CHR program is a collaboration between the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute and has several goals, including to be able to "provide a reliable,

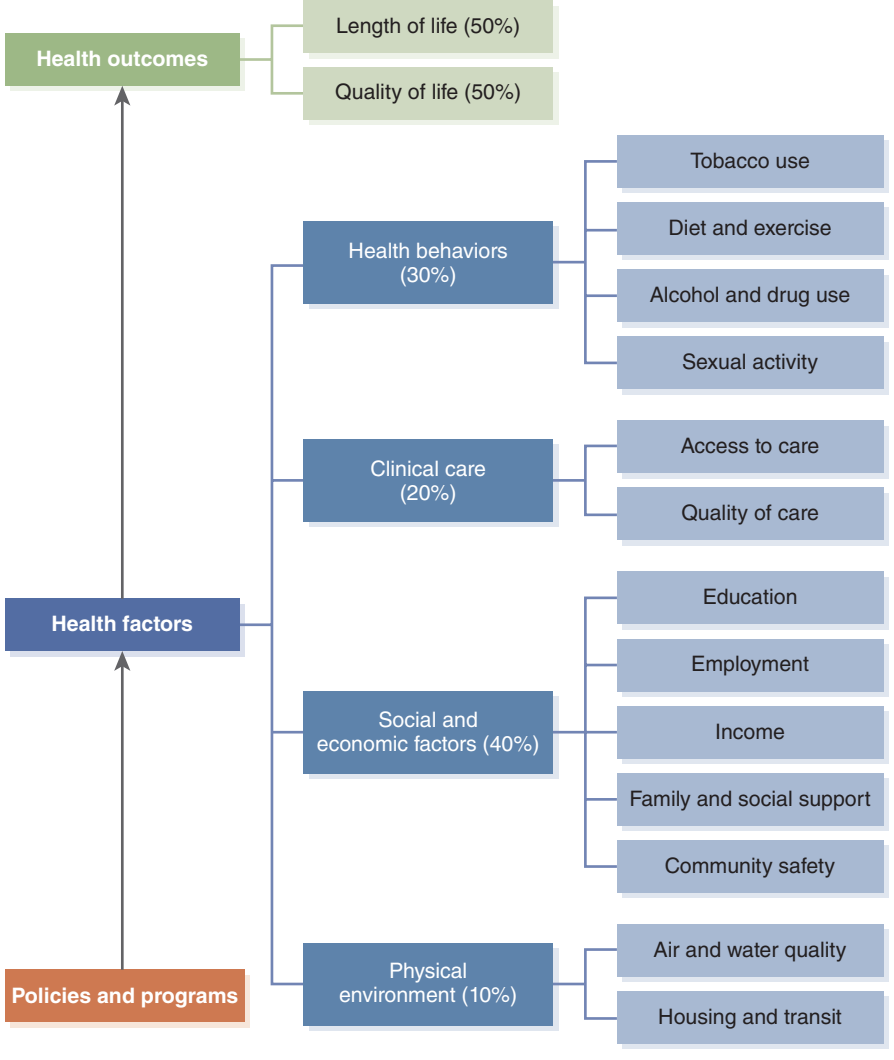


Figure 2-2 County Health Rankings Model.

sustainable source of local data" about health and its determinants.[5] As shown by the arrows on the left in Figure 2-2, the Roadmap describes how community and societal factors (policies and programs) influence health factors which in turn influence health outcomes. On the right side of the model, readily measurable health factors are shown in four categories: *behavioral factors* such as tobacco use, diet and exercise, sexual activity; *clinical care factors* such as the structure and accessibility of the healthcare delivery system; *social and economic factors* such as level of income and education; and *environmental factors* such as housing and neighborhood air quality.

While the model clearly illustrates how policies and programs influence health factors, it is also important to recognize how different categories of health factors influence each other. For example, a social and economic factor such as poverty or lack of family support may in turn influence an individual's behavior such as tobacco or illicit drug use. Similarly, an environmental factor, such as limited access to public transportation, may influence an individual's access to clinical care. The combination of health factors then impacts individuals' health outcomes, including their likelihood of developing disease, their functional capacity, and their sense of well-being, which in turn relate to length of life and quality of life.

Numerous local and state health departments use the CHR data on health determinants, which are updated and released annually, to develop evidence-informed policies and programs to improve public health and to argue for their adoption.[6] For example, a county with a low ranking may use the ranking to advocate for more funding for programs to address determinants of health. For these reasons, this model will be used later in this chapter to address measuring determinants of health.

Outside-the-Book Thinking 2-2

Go to the County Health Rankings and identify a county of your choice. Review the data for that county and develop priority areas for health improvement based on those data. Make sure to consider the strengths and limitations of the available data.

While the CHR model is widely referenced across the country and is very useful in demonstrating the complex set of interactions that impact health outcomes, it has some significant limitations with respect to its utility as a comprehensive framework for considering all determinants of health. Importantly, the model does not address biologic factors nor does it address some of the nuances within the "Policies and Programs" categorization. For these reasons, it is helpful to revisit the social-ecological model that was discussed in Chapter 1, Figure 1-5.

The Social-Ecological Model

The social-ecological model (SEM) includes biologic factors (the "individual") and takes into account the interplay between different levels of policies and programs (community and societal factors). A simplified version of this model is shown in **Figure 2-3**.

The SEM allows public health professionals to explore the relationships between factors in the chain of causation. Consider a behavior: smoking cigarettes. Smoking is known to directly contribute to numerous poor health outcomes and

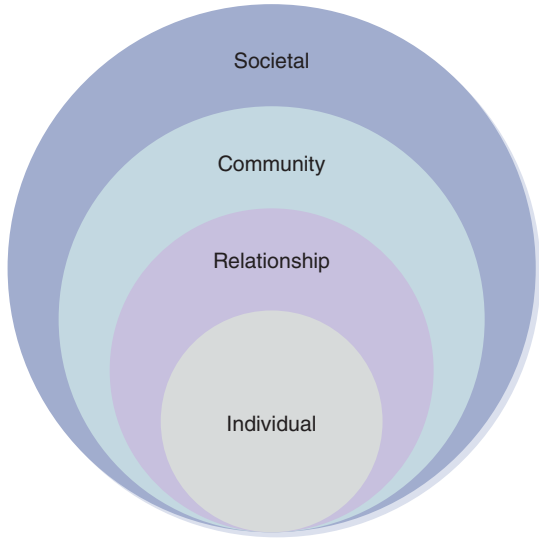


Figure 2-3 The Social-Ecological Model.

The Social-Ecological Model: A Framework for Prevention, CDC, Available at: https://www.cdc.gov/violenceprevention/publichealthissue/social-ecologicalmodel.html

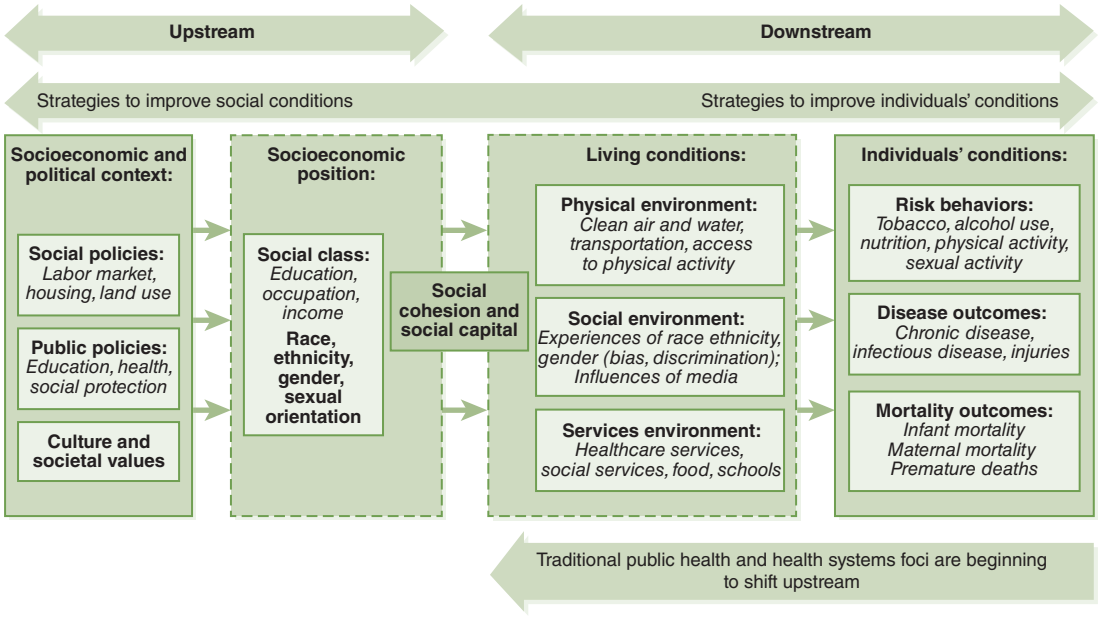


Figure 2-4 A Public Health Framework for Reducing Health Inequity.

Data from World Health Organization and Social Determinants of Health, What Are Social Determinants of Health. © 2016 Let's Get Healthy California.

is widely considered to be a leading preventable cause of death in the United States, yet people continue to smoke. What influences this behavior? In the individual sphere (the most "downstream" or "proximal" factor), consider the genetics of addiction; moving upstream to the relationship sphere, consider the prevalence of smoking among family and friends; in the community sphere, consider the density of tobacco retail outlets and exposure to images of smoking; and in the societal sphere (the most "upstream" or "distal" factor), consider the state's tax rate for cigarettes and clean indoor air laws. **Figure 2-4** adapted from the WHO and the Bay Area Regional Health Inequities Initiative provides a comprehensive illustration of determinants of health applying the upstream—downstream chain of causation approach.[7]

As another example of the SEM, air pollution is directly related to a wide range of diseases, including lung cancer, pulmonary emphysema, chronic bronchitis, and asthma. At the individual level, genetics are strongly linked to the likelihood of asthma and thus sensitivity to air pollution; at the relationship level, factors such as family income are linked to the type of neighborhood in which a family lives; at the community level, traffic congestion and density of certain industries influence the level of air pollution; and at a societal level, the setting of national standards by the federal Environmental Protection Agency impacts levels of air pollution.

All three of these models are useful in describing how different influences on health interact. They each provide valuable insight to inform the development and implementation of public health policies and programs to improve the public's health. Assessment, including measuring health and determinants of health, is the critical first step in health improvement.

Outside-the-Book Thinking 2-3

Using the examples shown for smoking and air pollution, apply the social-ecological model to a clinical care determinant of health and to a social and economic determinant of health.

Measuring Health

How do we measure "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"? Ideally, we have access to reliable, valid, and timely data to measure health outcomes that reflect the health status of individuals and their communities. The plethora of information on health outcomes suggests that measuring the health status of populations is a simple task. It is not. Commonly used measures of health status, also referred to as health indicators, typically reflect disease and mortality, rather than health itself. Such measures are often interesting and sometimes even dramatic, but they fail to paint a complete picture of health. The long-standing misperception that health is the absence of disease is reinforced in part by the relative ease of measuring indicators of mortality (death), morbidity (disease/illness), and disability (reduction in functioning) rather than well-being. As a result, we spend more time talking about those indicators that are more readily available than about more nebulous measures of well-being. In this section, we will address a wide range of health indicators, including mortality, morbidity, disability, and well-being.

Using Healthy People as a Framework to Measure Health Outcomes

While the County Health Rankings model is very helpful in framing determinants of health and will be used in the section on "Measuring Determinants of Health," it presents only a few measures on health outcomes. A different, more detailed framework for health outcomes that are widely available is the Healthy People framework. Healthy People is a national effort spearheaded by the U.S. Department of Health and Human Services (HHS) to improve the health and well-being of people in the United States. Every 10 years, Healthy People develops "a widely accessible plan containing achievable goals and objectives (that) can guide the action of individuals, communities, and stakeholders to improve health."[8] Healthy People 2020 (HP2020) provides targets for hundreds of health outcomes for which national level data are available. It has 12 leading health indicator topics, seven of which focus specifically on health outcomes and five of which address health factors, including behavioral, clinical care, or environmental determinants of health.

Understanding Health Outcome Data and Their Limitations

Before diving into data on health outcomes, it is important to understand how they are measured and what some of their limitations are.

Numbers and Rates

As mentioned earlier, in order to measure health, we need accessible, reliable, valid, and timely data on the health outcomes of which we are interested, but we also need accessible, reliable, valid, and timely data for the number of people at risk for that particular health indicator to calculate *rates* of health outcome indicators. Both prevalence (the number or rate of cases with the disease or condition at a specific point or period in time) and incidence (the number or rate of new cases occurring during a specific period) are commonly used rates. Rates for indicators are calculated by dividing the number of cases (the numerator) by the population at risk (the denominator) and are used to compare jurisdictions or to monitor trends over time in a single jurisdiction. While the prevalence and incidence of health outcomes are the cornerstone in understanding the health status of a community and will be discussed extensively in this chapter, it is important to recognize that sometimes a number, or case count, of a health indicator can be useful, particularly for determining resource allocation. Consider a local health department (LHD) that is responsible for ensuring that there are adequate resources for their early intervention program for children with developmental delays or disabilities. The LHD staff must know the projected number, not rate, of children in the community who are younger than 3 years old, have developmental delays or

disabilities, and need resources. Furthermore, policy makers may put a more human face on a problem by knowing the number of people with a health condition, not the rate of that health condition, when they seek resources to address it.

Quality of Data

The quality of data available to determine rates of health outcomes widely varies. Before using any data to describe a public health problem and develop public health priorities, public health practitioners should always consider these questions: Where do the data come from? Has the source of the data been evaluated for validity? What were the methods for obtaining the data? Are the data current or is there a lag? What are the limitations of the data? Are there any potential biases generated by the process used to collect the data? As an example, consider data obtained from electronic birth certificates. Generally, these data are an excellent source of information because there is standardized practice for data collection on every baby born across the United States. However, the quality of the data for each item on the birth certificate varies. The validity of health outcomes such as birth weight—an objective measure that is documented in hospital records—is high but there are significant limitations on the data that are self-reported such as alcohol or tobacco use by the mother during pregnancy.

Numerator Data

There are many sources for the numerator used to calculate rates for mortality, morbidity, and disability indicators. Examples of such sources include birth and death certificates; public health surveillance systems with mandated reporting (for example, reporting of selected communicable diseases like hepatitis or HIV infection); medical records from hospitals and other healthcare providers; health insurance data from payors such as the federal Centers for Medicare & Medicaid Services; and data derived from population surveys, businesses, schools, and other sources. Assessments of the health status of populations are increasingly utilizing measures from these sources. This chapter will focus on easily accessible national data sources; however, it is important to keep in mind that there are many other similar sources of data that are available at the state level and sometimes even at the local (city, county) level. An excellent compilation of data on both health status and health services, *Health, United States*, is published annually by the National Center for Health Statistics.[9] An example of the data that are available in this report is presented in **Table 2-1**.

Outside-the-Book Thinking 2-4

Locate the most recent National Center for Health Statistics *"Health, United States"* and choose a health indicator that is of interest to you. Review and interpret the data that are available for that health indicator and identify the strengths and the limitations of those data.

Denominator Data

In the United States, the primary source for the denominator used to calculate rates for most health outcome indicators is the Census Bureau which produces data that are critical to carry out the core public health function of assessment. The Census Bureau, part of the U.S. Department of Commerce, has a mission to "serve as the nation's leading provider of quality data about its people and economy."[10] It is the legal obligation of every U.S. resident to respond to surveys distributed by the Census Bureau. Every 10 years, the Census Bureau, through a mandatory survey, counts every resident of the United States. These surveys are the basis for determining the allocation of Congressional seats (and electoral votes) and the distribution of federal funding to states. Additionally, every year a small, randomly selected percentage of the U.S. population is required to respond to a more in-depth "American Community Survey."

With respect to public health, data obtained from the Census Bureau both inform the denominators for health outcome indicators and provide important information about some numerators, including disability and many social

Table 2-1 An Example of Data from Health, United States, 2017

	Value (year)			*Health, United States, 2017* Table No.
Life Expectancy and Mortality				
Life expectancy, in years				Table 15
At birth	76.8 (2000)	78.7 (2015)	78.6 (2016)	
Infant deaths per 1,000 live births				Table 11
All infants	6.91 (2000)	5.9 (2015)	5.87 (2016)	
Deaths per 100,000 population,[1] age-adjusted				Table 17
All causes	869.0 (2000)	733.1 (2015)	728.8 (2016)	
Heart disease	257.6 (2000)	168.5 (2015)	165.5 (2016)	
Cancer	199.6 (2000)	158.5 (2015)	155.8 (2016)	
Chronic lower respiratory diseases	44.2 (2000)	41.6 (2015)	40.6 (2016)	
Unintentional injuries	34.9 (2000)	43.2 (2015)	47.4 (2016)	
Stroke	60.9 (2000)	37.6 (2015)	37.3 (2016)	
Alzheimer's disease	18.1 (2000)	29.4 (2015)	30.3 (2016)	
Diabetes	25.0 (2000)	21.3 (2015)	21.0 (2016)	
Influenza and pneumonia	23.7 (2000)	15.2 (2015)	13.5 (2016)	
Nephritis, nephrotic syndrome and nephrosis	13.5 (2000)	13.4 (2015)	13.1 (2016)	
Suicide	10.4 (2000)	13.3 (2015)	13.5 (2016)	
Morbidity and Risk Factors				
Fair or poor health, percent				Table 45
All ages	8.9 (2000)	10.1 (2015)	9.9 (2016)	
65 years and over	26.9 (2000)	21.8 (2015)	21.6 (2016)	
Heart disease (ever told), percent				Table 38
18 years and over	11.3 (2000–2001)	11.5 (2013–2014)	11.6 (2015–2016)	
65 years and over	30.9 (2000–2001)	29.4 (2013–2014)	28.9 (2015–2016)	

(*continues*)

Table 2-1 **An Example of Data from Health, United States, 2017** ***(continued)***

	Value (year)			***Health, United States, 2017*** **Table No.**
Cancer (ever told), percent				Table 38
18 years and over	5.0 (2000–2001)	6.4 (2013–2014)	6.9 (2015–2016)	
65 years and over	15.2 (2000–2001)	18.2 (2013–2014)	19.2 (2015–2016)	
Diabetes,[2] percent				Table 40
20 years and over	9.8 (1999–2002)	12.0 (2007–2010)	12.6 (2011–2014)	
Hypertension,[3] percent				Table 54
20 years and over	30.2 (1999–2002)	32.2 (2009–2012)	33.4 (2013–2016)	
Hypercholesterolemia,[4] percent				Table 55
20 years and over	25.0 (1999–2002)	29.5 (2009–2012)	29.4 (2013–2016)	
Obesity, percent				Tables 58 and 59
Obesity,[5] 20 years and over	30.5 (1999–2002)	35.5 (2009–2012)	38.9 (2013–2016)	
Obesity (BMI at or above sex- and age-specific 95th percentile):				
2–5 years	10.3 (1999–2002)	10.2 (2009–2012)	11.6 (2013–2016)	
6–11 years	15.9 (1999–2002)	17.9 (2009–2012)	17.9 (2013–2016)	
12–19 years	16.0 (1999–2002)	19.4 (2009–2012)	20.6 (2013–2016)	
Cigarette smoking, percent				Table 47
18 years and over	23.2 (2000)	15.1 (2015)	15.5 (2016)	
Aerobic activity and muscle strengthening,[6] met both guidelines, percent				Table 57
18 years and over	15.1 (2000)	20.9 (2015)	21.9 (2016)	
Healthcare Utilization				
No healthcare visit in past 12 months, percent				Table 65
Under 18 years	12.3 (2000)	7.9 (2015)	8.3 (2016)	
18–44 years	23.4 (2000)	23.3 (2015)	22.0 (2016)	
45–64 years	14.9 (2000)	13.7 (2015)	12.8 (2016)	
65 years and over	7.4 (2000)	5.5 (2015)	6.4 (2016)	

Emergency room visit in past 12 months, percent				Tables 73 and 74
Under 18 years	20.3 (2000)	16.9 (2015)	17.5 (2016)	
18–44 years	20.5 (2000)	18.6 (2015)	18.8 (2016)	
45–64 years	17.6 (2000)	17.4 (2015)	18.1 (2016)	
65 years and over	23.7 (2000)	21.8 (2015)	23.3 (2016)	
Dental visit in past year, percent				Table 78
2–17 years	74.1 (2000)	84.7 (2015)	84.6 (2016)	
18–64 years	65.1 (2000)	64.0 (2015)	64.4 (2016)	
65 years and over	56.6 (2000)	62.7 (2015)	64.3 (2016)	
Prescription drug in past 30 days, percent				Table 79
Under 18 years	23.8 (1999–2002)	24.0 (2007–2010)	21.5 (2011–2014)	
18–44 years	35.9 (1999–2002)	38.7 (2007–2010)	37.1 (2011–2014)	
45–64 years	64.1 (1999–2002)	66.2 (2007–2010)	69.0 (2011–2014)	
65 years and over	84.7 (1999–2002)	89.7 (2007–2010)	90.6 (2011–2014)	
Hospitalization in past year, percent				Table 81
18–44 years	7.0 (2000)	5.8 (2015)	5.6 (2016)	
45–64 years	8.4 (2000)	7.7 (2015)	7.6 (2016)	
65 years and over	18.2 (2000)	15.2 (2015)	15.3 (2016)	
Health Insurance and Access to Care				
Uninsured, percent				Table 105
Under 65 years	17.0 (2000)	10.6 (2015)	10.3 (2016)	
Under 18 years	12.6 (2000)	4.5 (2015)	5.2 (2016)	
18–44 years	22.4 (2000)	15.9 (2015)	14.8 (2016)	
45–64 years	12.6 (2000)	9.0 (2015)	8.8 (2016)	
Delay or nonreceipt of needed medical care in past 12 months due to cost, percent				Table 63
Under 18 years	4.6 (2000)	2.7 (2015)	2.4 (2016)	
18–44 years	9.5 (2000)	9.5 (2015)	9.2 (2016)	
45–64 years	8.8 (2000)	10.3 (2015)	10.5 (2016)	
65 years and over	4.5 (2000)	4.1 (2015)	3.8 (2016)	

(*continues*)

Table 2-1 An Example of Data from Health, United States, 2017 *(continued)*

	Value (year)			*Health, United States, 2017* Table No.
Healthcare Resources				
Community hospital beds per 1,000 population[7]				Table 90
United States	2.9 (2000)	2.5 (2014)	2.4 (2015)	
Highest state	6.0 (ND) (2000)	5.4 (DC) (2014)	5.3 (DC) (2015)	
Lowest state	1.9 (NM,NV,OR, UT, WA) (2000)	1.7 (OR, WA) (2014)	1.7 (OR, WA (2015)	
Healthcare Expenditures				
Personal healthcare expenditures, in dollars				Table 95
Total, in trillions	$1.2 (2000)	$2.7 (2015)	$2.8 (2016)	
Per capita	$4,119 (2000)	$8,479 (2015)	$8,788 (2016)	

[1]Causes are ordered by the number of deaths in 2016.
[2]Includes physician-diagnosed and undiagnosed diabetes (fasting plasma glucose of at least 126 mg/dL or a hemoglobin A1c of at least 6.5%).
[3]Having measured high blood pressure (systolic pressure of at least 140 mm Hg or diastolic pressure of at least 90 mm Hg) and/or respondent report of taking antihypertensive medication.
[4]Having high serum total cholesterol of 240 mg/dL or greater and/or respondent report of taking cholesterol-lowering medication.
[5]Obesity is a body mass index (BMI) greater than or equal to 30.0 for adults. Height and weight are measured rather than self-reported.
[6]Federal guidelines recommend at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic physical activity a week, or an equivalent combination of moderate- and vigorous-intensity activity and muscle-strengthening activities at least twice a week.
[7]Copyright 2017. Used with permission of Health Forum LLC, an affiliate of the American Hospital Association.
NOTES: Estimates in this table are taken from the PDF or spreadsheet version of the cited tables, available from the Health, *United States*, 2017 website: https://www.cdc.gov/nchs/hus/contents2017.htm

Reproduced from Centers for Disease Control and Prevention. Health, United States, 2017.

determinants of health, as discussed later in this chapter. Generally, the Census Bureau is an excellent source of data because there is a legal obligation to participate and significant federal resources are employed to optimize participation, resulting in a very high response rate. In addition, the methodology for collecting the data has been validated. Limitations of census data to consider include that some individuals, for example individuals who are not legal residents of the United States, may not participate despite the law; that all responses are self-reported; and that the surveys are written so individuals with visual impairment or low literacy levels may have difficulty participating, although the Census Bureau does provide a phone-in option for those who need help.

Outside-the-Book Thinking 2-5

Identify a city or county of interest to you. Access and review Census Bureau data for that location. What do those data tell you about the city or county that you chose?

Inequity in Health

There are well-recognized differences (disparities) in the health status of different populations of people. It is important to capture such differences by using numerators and denominators that reflect the populations being compared. For example, it is common to see indicator rates that are specific to race/ethnicity, poverty status, gender, gender identity, sexual orientation, and disability. Health inequity is discussed in greater detail later in this chapter.

Mortality-Based Indicators

Systematic collection of death records began in 1837 in England and Wales and was spearheaded by William Farr.[11] Death certificates are the source of data for all mortality-based indicators. No data source is perfect, but death data are generally considered to be of good quality because they are systematically collected and are completed by health professionals. In addition, death certificates are designed to capture direct as well as underlying causes of death. A thoroughly completed death certificate will be able to trace some of the proximal determinants of health, for example, sudden unexpected death in infancy due to positional asphyxia due to co-sleeping with an adult.

Despite being measures of death, not health, mortality-based indicators continue to be widely used to describe the health status of populations. There are some important differences in the use and interpretation of commonly used mortality-based measures, including crude mortality, age-specific and age-adjusted mortality, infant and neonatal mortality, life expectancy, and years of potential life lost before a cut-off age, each of which will be described below.

Crude Mortality Rates

Crude mortality rates are calculated as deaths per capita within the entire population. They are not a good basis for comparing the health of different populations because they may capture differences in the age distribution of those different populations rather than differences in the risk of death. For example, consider a state that is known to attract retirees, it will likely have a greater proportion of older adults and thus have a higher overall crude mortality rate compared to a state that has a younger population, simply because the latter has fewer older adults.

Age-adjusted Mortality Rates

To allow greater comparability of the mortality rates between different populations at a given time or the same population over time, public health studies typically use age-adjusted mortality rates to compensate for different mixes of age groups within one population (e.g., a higher proportion of children) compared to another. Age-adjusted rates are calculated by determining the age-specific rate for each population being studied and multiplying that rate by the appropriate weight in a standardized population. In the United States, the Centers for Disease Control and Prevention (CDC) provides standard population weights that are based on the number of deaths that would be expected in a given age range in a standard population. This is referred to as direct age adjustment.

Direct age adjustment permits more meaningful comparisons of mortality experience between populations with different age distribution patterns than crude-mortality rates. Differences between crude and age-adjusted mortality rates can be substantial. The mortality comparisons presented in **Figure 2-5** comparing crude and age-adjusted death rates illustrate the limitations of using crude death rates to assess the mortality experience of the U.S. population over time.[12] Between 1935 and 2010, the number of deaths per year increased dramatically as the population grew. Looking at the crude mortality rates over this time frame, particularly between 1980 and 2010, we may erroneously conclude that death rates did not significantly improve. However, because there has been an increasing proportion of population in the older age groups over time, it is not useful to compare crude death rates from 1935 to 2010, nor, more specifically, from 1980 to 2010. Taking the age structure of the population into account, the trend line for age-adjusted mortality rate

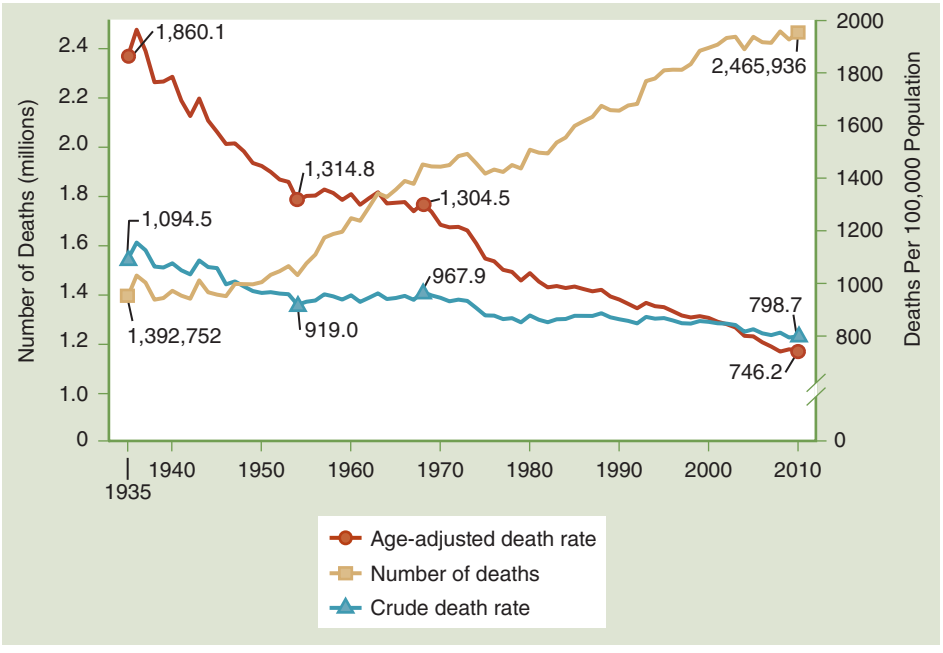


Figure 2-5 Age-adjusted Death Rates in the United States.

Donna L. Hoyert, Ph.D., 75 Years of Mortality in the United States, 1935–2010, NCHS Data Brief, No. 88, March 2012.

shows dramatic decrease in mortality rate over time, thus indicating significant improvement of the health of the population.

Outside-the-Book Thinking 2-6

What is indirect adjustment for calculating age-adjusted rates? When is it used?

Age-specific Mortality Rates

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. By focusing on just one age group, the measure is not affected by changes in the age structure of the whole population over time. Age-specific rates can therefore be compared over time and give a good indication of changes in the health of this slice of the population. The infant mortality rate is often considered to be a good indicator for the overall general health of a population.

Life Expectancy

Life expectancy, which is based on the mortality experience of a population, can be calculated in different ways but most commonly is considered to be the average number of years of life remaining at any given age for a hypothetical cohort. This statistic is typically based on period life table that takes actual mortality data over a certain period of time into account. As seen in **Figure 2-6**, life expectancy at birth increased steadily between 1970 and 2010 before leveling off for several years.[13] Beginning in 2015, there has been an alarming reversal in this trend, in large part because of deaths associated with unintentional injuries, including drug overdoses related to the opioid epidemic, and suicide. This will be discussed in greater detail in the discussion of the current health status of the United States at the end of this chapter.

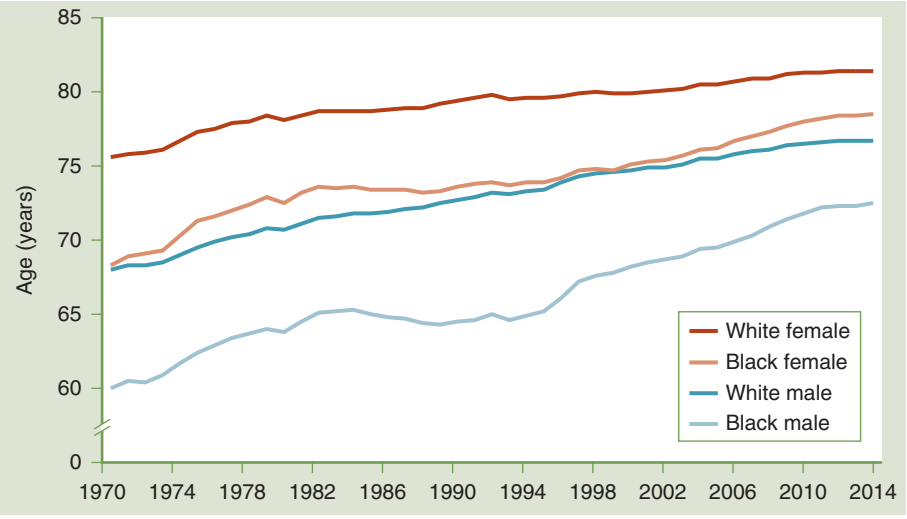


Figure 2-6 Life Expectancy in the United States.

Reproduced from Elizabeth Arias, Ph.D., Melonie Heron, Ph.D., and Jiaquan Xu, M.D., United States Life Tables, 2014, August 14, 2017, Volume 66, Number 4; Data from the National Vital Statistics System.

Years of Potential Life Lost (YPLL)

This measure is a mortality-based indicator that places greater weight on deaths that occur at younger ages. It is used to measure the relative impact on society of different causes of death, assuming that deaths at a younger age have a greater societal impact. In a population, YPLL is calculated by multiplying each death by the number of years the death occurred before a specified cut-off age. For example, if age 75 is used as the threshold for calculating YPLL, an infant death would contribute 75 YPLL while a homicide at age 25 would contribute 50 YPLL. A death due to stroke at age 76 would contribute no years of life lost before age 75, and so on. With life expectancy now exceeding 75 years at birth, YPLL calculations using age 75 as the threshold have become more common.

YPLL may be useful in describing the impact of homicide, unintentional injuries, or suicide since these indicators disproportionately impact people younger than 75. Data on YPLL before age 75 provide a different perspective on cause of death and may influence directing public health resources to address causes of death that impact younger age groups rather than those causes of death that impact older age groups. Select causes of deaths in the United States in 2016 are shown in **Table 2-2**, ranked by age-adjusted YPLL (right column) and by age-adjusted death rates (left column).[9] This table demonstrates that unintentional injuries (drug overdoses and motor vehicle-related injuries) were the leading cause of YPLL and the third leading cause of death by age-adjusted death rate. Conversely, deaths due to Alzheimer disease were the lowest ranked cause of YPLL while they were the sixth leading cause of death by age-adjusted death rate, because many deaths associated with Alzheimer disease occur after age 75 years.

Morbidity-Based Indicators

Morbidity indicators provide meaningful measures of health status in a population, including rates of disease, illness, and injury. Both prevalence and incidence are widely used measures of morbidity. The numerators for morbidity-based indicators come from a wide range of sources. One key consideration for assessing the quality of the numerators is whether the data are generated by the healthcare delivery system (e.g., from electronic health records) and are thus more likely to be both valid and reliable, or whether they are self-reported and thus more likely to be subject to bias.

Table 2-2 Select Causes of Death by Years of Potential Life Lost (YPLL) and by Death Rates, United State, 2016

Cause of Death	YPLL: Years Lost Before Age 75 Per 100,000 Population Under Age 75 (Age-Adjusted)	Cause of Death	Age-Adjusted Death Rate Per 100,000 Population
Unintentional injuries	1,334.0	Diseases of heart	165.5
Malignant neoplasms	1,262.4	Malignant neoplasms	155.8
Diseases of heart	958.9	Unintentional injuries	47.4
Suicide	438.9	Chronic lower respiratory diseases	40.6
Homicide	275.0	Cerebrovascular diseases	37.3
Chronic liver disease and cirrhosis	188.0	Alzheimer's disease	30.3
Diabetes mellitus	177.7	Diabetes mellitus	21.0
Chronic lower respiratory diseases	175.8	Suicide	13.5
Cerebrovascular diseases	164.3	Influenza and pneumonia	13.5
Influenza and pneumonia	79.9	Nephritis, nephrotic syndrome and nephrosis	13.1
Nephritis, nephrotic syndrome and nephrosis	70.0	Chronic liver disease and cirrhosis	10.7
Human immunodeficiency virus (HIV) disease	47.0	Homicide	6.2
Alzheimer's disease	13.9	Human immunodeficiency virus (HIV) disease	1.8

Data from https://www.cdc.gov/nchs/data/hus/2017/018.pdf and https://www.cdc.gov/nchs/products/databriefs/db293.htm

There are many commonly used categories of morbidity data. As discussed earlier, Healthy People 2020 (HP2020) provides a detailed framework for measurable health goals and objectives. It has 12 leading health indicator topics, seven of which focus specifically on health outcome data. These seven leading health indicator areas that include objectives using mortality and morbidity data are shown in **Table 2-3**.[14] These health indicator topic areas include "injury and violence," "maternal, infant, and child health," "mental health," "nutrition, physical activity, and obesity," "oral health," "reproductive and sexual health," and "substance abuse." With one exception, these seven leading health indicator topics will be used to provide examples of morbidity data (which are bolded in the table). The exception is inclusion of infectious disease as a morbidity category because, although it is not included as a specific leading topic area in HP2020, it is commonly used at the state and local level. It is important to recognize that there are often dozens of measures within each of these topic areas but only one will be addressed for each topic area. When available,

Table 2-3 ***Healthy People 2020*** **Leading Health Topics with Specific Mortality and Morbidity Indicators**

Leading Health Topic	Leading Health Indicators Within Topic	Select Other Indicators Related to Morbidity Within Topic Area
Injury and Violence	■ Fatal injuries ■ Homicides	■ **Hospitalizations and emergency department visits due to injuries, traumatic brain injuries, firearm injuries, poisonings**
Maternal, Infant, and Child Health	■ Infant deaths ■ **Preterm births**	■ **Maternal illness and complications associated due to pregnancy**
Mental Health	■ Suicides ■ **Adolescents who experience major depressive episodes**	■ **Adolescents who engage in disordered eating behaviors in an attempt to control weight**
Nutrition, Physical Activity, and Obesity	■ Adults who meet current Federal physical activity guidelines for aerobic physical activity and muscle-strengthening activity ■ **Adults who are obese** ■ **Children and adolescents who are considered obese** ■ Total vegetable intake for persons aged 2 years and older	■ **Iron deficiency in different age groups**
Oral Health	■ Persons aged 2 years and older who used the oral healthcare system in past 12 months	■ **Dental caries in different age groups** ■ **Permanent tooth extraction in adults**
Reproductive and Sexual Health	■ Sexually active females aged 15 to 44 years who received reproductive health services in the past 12 months ■ Persons living with HIV who know their serostatus	■ **Chlamydia, gonorrhea, syphilis (congenital, primary, and secondary), human papilloma virus, and genital herpes infections**
Substance Abuse	■ Adolescents using alcohol or any illicit drugs during the past 30 days ■ Adults engaging in binge drinking during the past 30 days	

Morbidity indicators are bolded.

Modified from U.S. Department of Health and Human Services. *Healthy People 2020* website. www.healthypeople.gov. Accessed February 4, 2019.

the "leading health indicator" is the measure that is provided. The remaining HP2020 leading health indicator topics—access to health services, clinical preventive services, environmental quality, social determinants, and tobacco use—are addressed in the section on measuring determinants of health.

The figures that follow are intentionally chosen to demonstrate different approaches to data visualization such as bar graphs, maps, linear trends, and so forth.

Communicable Diseases

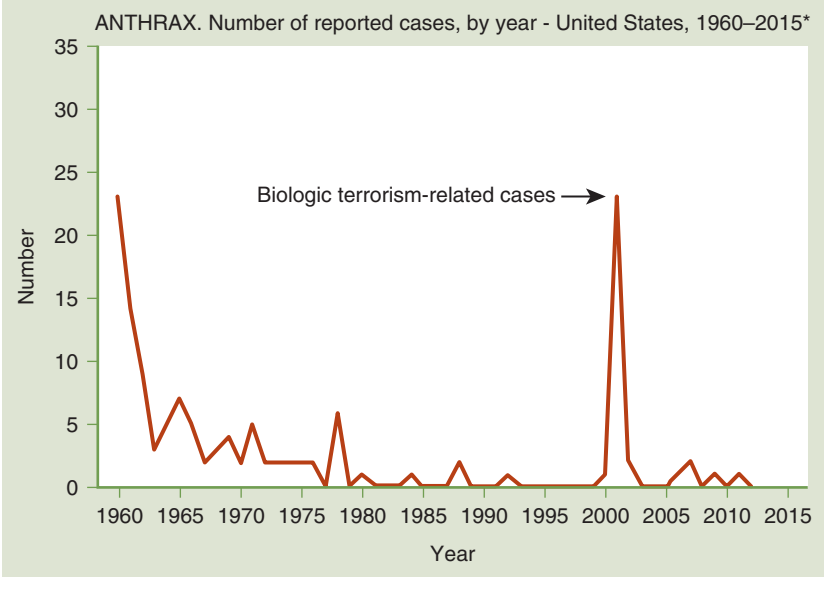
While not identified as a Leading Health Indicator topic in HP2020, rates of communicable disease morbidity are commonly used indicators in public health. In the United States, the CDC's National Notifiable Diseases Surveillance System (NNDSS)

works with health departments and partner agencies, including the Council of State and Territorial Epidemiologists (CSTE), a national professional organization representing epidemiologists who work in state and territorial health departments, to identify diseases, disease outbreaks, and selected environmental conditions for which active, timely surveillance is considered necessary to protect the public's health.[15] There are currently 120 diseases under surveillance through the NNDSS, such as tuberculosis, most vaccine preventable diseases, and healthcare associated infections. The CSTE adopts the list of reportable conditions, which then serves as a recommended list for state and local health departments, and adopts the surveillance case definitions for these diseases.[16] The CDC provides information, recommendations, guidance, and technical support for the system. Because the legal authority to mandate disease reporting lies with states, territories, and localities rather than the federal government, not all states' reportable disease lists are exactly the same.

Some of the strengths of these data are that they are systematically reported through the laboratories and healthcare practitioners. Some of the limitations are that infectious diseases tend to be under-reported because not all infected people become ill, not all ill people seek medical care, and not all people who do seek medical care are tested in the laboratory in order to make a specific diagnosis of a communicable disease that can be reported and meet the surveillance case definition. Additionally, there may be reporting biases on the part of the healthcare practitioner; some do not report or only report severe cases while others may over-report. Despite these limitations, trends can be interpreted over time. Such systems can usually identify a sudden increase in incidence, which in turn may indicate a disease outbreak. An example for the number of recently reported cases of anthrax is shown as a line graph in **Figure 2-7**.[17] The NNDSS table of notifiable diseases is published on the CDC website every year.

Injury and Violence

Much of the morbidity data for this HP2020 topic area come from the National Hospital Care Survey, a survey that integrates inpatient data formerly collected by the National Hospital Discharge Survey with the emergency department, outpatient department, and ambulatory surgery center data collected



*One epizootic-associated cutaneous case was reported in 2001 from Texas.

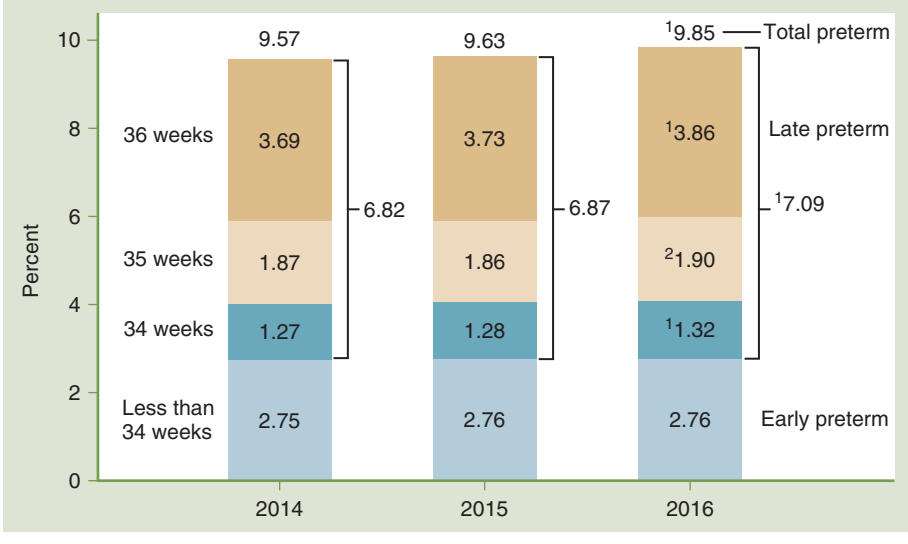
Figure 2-7 Cases of Anthrax.

Reproduced from Summary of Notifiable Diseases — United States, 2011, July 5, 2013/60(53);1-117.

by the National Hospital Ambulatory Medical Care Survey. Other sources of data that inform this category of morbidity include the CDC's National Center for Health Statistics (NCHS) and the Census Bureau. One example of an indicator in this topic is the rate of hospitalizations for nonfatal traumatic brain injury (TBI). Recent data from the CDC show that over the span of six years (2007–2013) the prevalence rate of TBI-related emergency department visits increased by 47% but hospitalization rates decreased by 2.5%.[18] The former statistic likely reflects an increase in falls in older adults while the latter likely reflects the impact of successful efforts to decrease motor-vehicle accidents. Depending on state law, non-accidental injuries also may be reportable to the health department or other state agency. For example, in every state healthcare practitioners are required to report injuries that are related to child abuse but there is wide variation in state law for reporting of other injuries. As with infectious diseases, not every person who sustains an injury will seek medical care and not everyone who seeks medical care will have the injury reported by the healthcare practitioner, which results in underreporting of injury and violence.

Maternal, Child, and Infant Health

A leading health indicator for measuring morbidity in this HP2020 topic area is the rate of preterm births (babies born before 37 weeks of gestation have been completed) per live births. Preterm births are a leading cause of infant deaths, developmental delay, and other adverse health outcomes such as reactive airway disease. Preterm births are frequently further categorized as early preterm (before 34 weeks) and late preterm (34–36 weeks).[19] This indicator can be interpreted as a reflection of how society and the healthcare system (e.g., access to prenatal care) impact the health of women and their babies. Data for preterm births, obtained through birth certificates, are available from the CDC's National Vital Statistics System (NVSS). The NVSS is populated with data from states/jurisdictions, each of which has a structure in place to systematically collect vital statistics (birth, death, fetal death, marriage, and divorce records). **Figure 2-8** uses a stacked bar graph to show recent trends in the prevalence of preterm births in the United States.[19]



[1]Significantly increasing linear trend for 2014–2016 ($p < 0.05$).
[2]Significant increase from 2014 and 2015 ($p < 0.05$).
NOTES: Figures may not add to totals because of rounding.

Figure 2-8 Preterm Birth Rates in the United States.

Joyce A. Martin, M.P.H., and Michelle J.K. Osterman, M.H.S., Describing the Increase in Preterm Births in the United States, 2014–2016, NCHS Data Brief No. 312, June 2018.

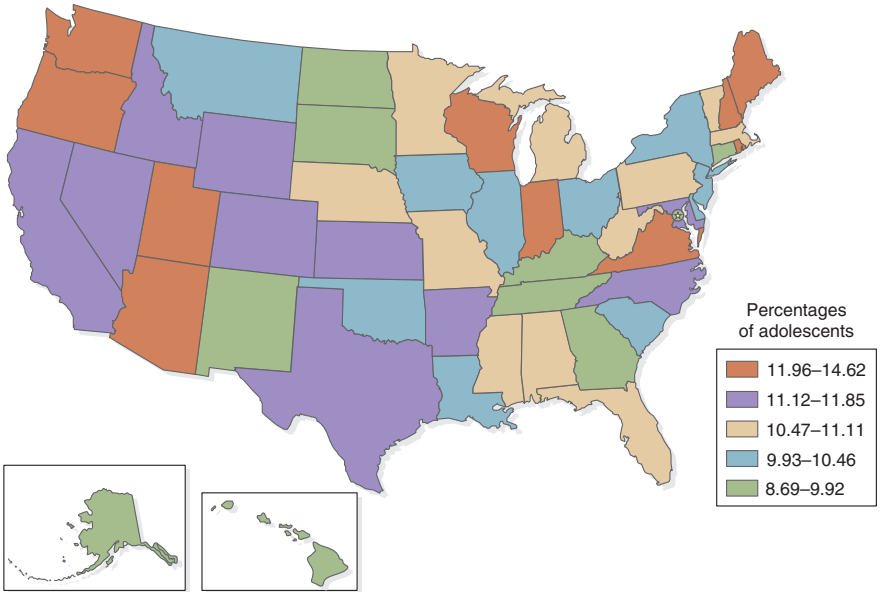


Figure 2-9 Major Depressive Episodes Among Adolescents.

Reproduced from Rachel N. Lipari, Ph.D., Arthur Hughes, M.S., and Matthew Williams, Ph.D., State Estimates of Major Depressive Episode Among Adolescents: 2013 and 2014. Substance Abuse and Mental Health Services Administration.

Mental Health

A leading HP2020 morbidity health indicator in this topic area is the rate of a major depressive episode in the prior 12 months in adolescents as seen in a map in **Figure 2-9**.[20] A key source of these data is the National Survey on Drug Use and Health (NSDUH) conducted annually by the Substance Abuse and Mental Health Service Administration (SAMSHA) on a small sample of the U.S. population.[20] Some limitations to consider are that small samples of the population may not be representative and that the data are self-reported. In addition, data from this survey are not available at the state or local level.

Nutrition, Physical Activity, and Obesity

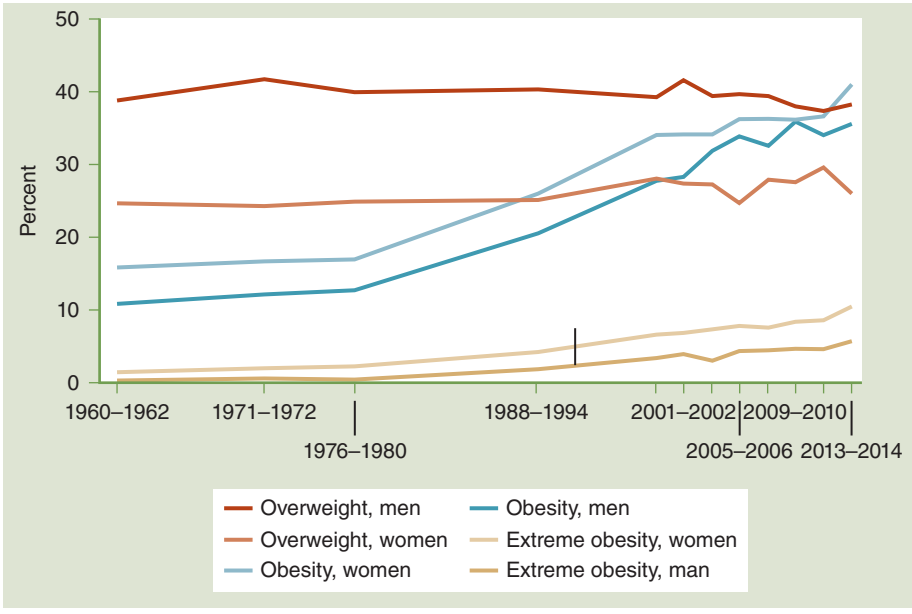
A morbidity indicator in this HP2020 topic area is the rate of obesity in adults. Trend lines for overweight, obesity, and extreme obesity are seen in **Figure 2-10**.[21] A key national source of data for this indicator is the National Health and Nutrition Examination Survey (NHANES), a program with the CDC that conducts interviews and physical examinations every few years on a small statistical sample of the U.S. population. Unlike other surveys of obesity, which collect self-reported data on height and weight, NHANES directly measures these data during the physical examination. Data from this survey are not available every year nor available at the state or local level.

Oral Health

A morbidity indicator in this HP2020 topic area that is commonly used is the rate of dental caries in children. As with obesity rates, a national data source for this indicator is NHANES, as discussed above, although some states also have state level data on this as well. As an example, based on these data from NHANES, between 2011–2014, almost 19% of children aged 5–19 years had untreated dental caries.[22]

Reproductive and Sexual Health

One of the key morbidity indicators in this topic is the birth rate for adolescent females. Because it can be difficult to compare young adolescents



NOTES: Age-adjusted by the direct method to the year 2000 U.S. Census Bureau estimates using age groups 20–39, 40–59, and 60–74. Overweight is body mass index (BMI)of 25 kg/m^2; obesity is BMI greater than or equal to 30; and extreme obesity is BMI greater than or equal to 40. Pregnant females were excluded from the analysis.

Figure 2-10 Trends in Adult Overweight, Obesity, and Extreme Obesity in the United States.

Overweight & Obesity Statistics, The National Institute of Diabetes and Digestive and Kidney Diseases Health Information Center.

to older adolescents, particularly with respect to sexual activity, this indictor is commonly divided into more specific age groups, for example, birth rate for females ages 15–17 years (8.8 live births per 1000 women in 2016) and ages 18–19 years (37.5 live births per 1000 women in 2016).[9] As with preterm birth rates, NVSS is the commonly used national data source.

Substance Abuse

As seen earlier in the discussion of mortality-based indicators, one of the significant contributors to decreasing life expectancy in the United States between 2015 and 2017 has been the rate of fatal drug overdoses. However, mortality rates reflect the tip of the iceberg of the drug abuse problem. An infographic from HHS that includes morbidity indicators and their sources of data, including NSDUH and NVSS, is shown in **Figure 2-11**.[23]

Disability-Based Indicators

There are many different definitions for disability, different levels of severity of disability, and different ways of measuring disability. The Census Bureau, through the ACS (described earlier), is a commonly used source of information about disability. The ACS asks about six categories of disability, including:[24]

- Hearing difficulty—being deaf or having serious difficulty hearing
- Vision difficulty—being blind or having serious difficulty seeing, even when wearing glasses
- Cognitive difficulty—having difficulty remembering, concentrating, or making decisions because of a physical, mental, or emotional problem
- Ambulatory difficulty—having serious difficulty walking or climbing stairs

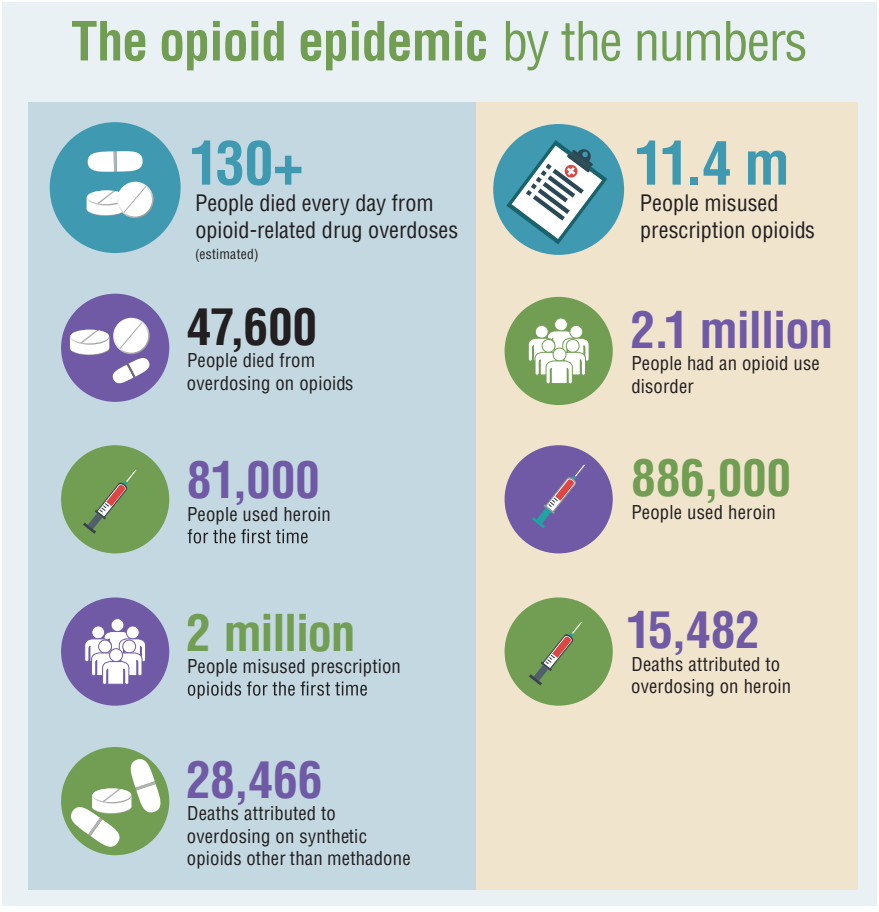


Figure 2-11 The Opioid Epidemic in the United States.

Reproduced from What is the U.S. Opioid Epidemic. U.S. Department of Health and Human Services. Retrieved from https://www.hhs.gov/opioids/about-the-epidemic/index.html

- Self-care difficulty—having difficulty bathing or dressing
- Independent living difficulty—having difficulty doing errands alone, such as visiting a doctor's office or shopping, because of a physical, mental, or emotional problem

The major limitation to the ACS data is that they are self-reported; people may underreport or over report their type or level of disability. In addition to the Census Bureau, other national sources of data on disability include the Bureau of Labor Statistics, the Behavior Risk Factor Surveillance System (discussed below), the National Health Survey, and the Social Security Administration.

A commonly used measure of aggregate disease burden is the disability-adjusted life-year or DALY. According to the WHO "one DALY can be thought of as one lost year of "healthy" life."[25] The DALY takes both years lost to premature mortality and years lost to disability into account. Other variants on this measure used by the WHO is healthy life expectancy at birth 'that applies disability weights to health states to compute the equivalent number of years of good health that a newborn can expect.'[26] In 2016, the healthy life expectancy at birth in the United States was 68.5, compared to an average life expectancy of 78.7, showing that Americans average about 10 years of poor health over their lifetimes.[26] The implication

is that healthy life expectancy can be extended by extending overall life expectancy; by reducing the measures of poor health, activity limitation, and chronic disease burden without increasing overall life expectancy; or by a combination. The optimal approach would accomplish both by extending life expectancy and reducing the burden of poor health, activity limitation, and chronic disease. The public health goal of reducing the proportion of the life span spent living in poor health and with disability is referred to as the compression of morbidity or disability—and there is evidence that this is occurring in the United States.[27]

Well-Being Indicators

"Well-being," being able to optimize physical, mental, and social functioning, is the cornerstone of WHO's definition of health. Ideally there would be standardized, easily accessible ways to measure well-being but, not surprisingly, there are not. The methodology is evolving with different organizations having different approaches. The County Healthy Rankings model include measures of self-reported "poor or fair health," and "poor physical health" and "poor mental health" in the last 30 days from the Behavioral Risk Factor Surveillance System (BRFSS) telephone survey in their ranking. However these emphasize absence, rather than presence, of well-being.[28] BRFSS is discussed in greater detail in the next section.

Healthy People 2020 is currently viewing health-related quality of life (HRQoL) as a "a multi-dimensional concept that includes domains related to physical, mental, emotional, and social functioning." As such, it goes further than direct measures of population health and explores the impact health status has on quality of life. HP2020 is evaluating three measurement systems for monitoring HRQoL and well-being in the United States:[29]

- Patient-Reported Outcomes Measurement Information System (PROMIS) Measure of Global Health—a standardized questionnaire that can be administered to a population of interest to measure self-reported assessments of health, mental health, pain, fatigue, emotional distress, and social activities.[30]
- Well-Being Measures—a system to assess a person's perception of their feeling healthy and satisfied or content; of meeting their potential; of having positive emotions and resilience, as well as assessments of the quality of their relationships.
- Participation Measures—a system to assess a person's assessment of how social participation (school, social, civic and so forth) impacts health.

These measures are in varying stages of being piloted and evaluated but are promising tools to help future public health practitioners to more accurately capture measures on quality of life.

Measuring Determinants of Health

Measuring and identifying which underlying factors are most important to an individual or a community's health can be daunting. While the broader term "social determinants of health" is a very important concept to illustrate how interconnected determinants are, it is useful to consider separate categories when it comes to actually trying to measure determinants of health. The CHR model (Figure 2-2) describes four categories of health factors, or determinants—health behavior, clinical care, social and economic factors, and the physical environment—and will be used as the framework for this section. Health behaviors and clinical care are often more proximal, downstream factors of the chain of causation and closer in time to the health outcomes of interest, while social and economic factors are usually on the more distal, upstream end, further back the chain of causation. Measuring and tracking such factors can provide an early indication as to the direction in which the health outcome is likely to change in the future.

Health Behaviors

Numerous studies have demonstrated how individual behaviors can directly influence health outcomes. The CHR specifically look at tobacco

use, diet and physical activity, alcohol and drug use, and sexual activity. The most commonly used national and state-specific source on health behaviors is the Behavioral Risk Factor Surveillance System (BRFSS), an annual telephone survey of a large sample of US residents that has collected data on health behaviors, chronic health conditions, and utilization of preventive services since 1984.[31] BRFSS data are collected by state, and some large city, health departments using a standard format developed by CDC. The data are available at the national, state, and even sometimes at the local level. CDC has aggregated state BRFSS data over multiple years to get adequate sample size for the 500 largest metropolitan areas in the country and some states have conducted county-specific BRFSS surveys).[31, 32] With respect to health behaviors, the most recent BRFSS base survey conducted by all states captured information on physical activity, sleep, tobacco and alcohol use, falls, seat belt use, immunizations, and cancer screening (breast, cervical, prostate, and colorectal). Additionally, there were optional modules to assess other health behaviors such as sun exposure.[31]

Outside-the-Book Thinking 2-7

Identify a city that is of interest to you. Access and review CDC 500 Cities BRFSS data for that location. What do those data tell you about the health status of the city you chose? How could these data be used to establish priorities for public health action?

In 2018, the U.S. Burden of Disease Collaborators released The State of US Health, 1990–2016, which looked at the burden of disease, injury, and risk factors in the United States.[33] The authors use the Global Burden of Disease Study, a project by the Institute for Health Metrics and Evaluation (IHME), an independent global health research center at the University of Washington, to assess health within states across the country. The authors used a wide range of data sources, including but not limited to survey data (e.g., NHANES, NSDUH, BRFSS) as well as healthcare utilization data (e.g., ambulatory data and inpatient hospital data). The authors conclude that the most significant behaviors that directly impact health are tobacco consumption, poor diet, and alcohol or other drug use.[33]

Outside-the-Book Thinking 2-8

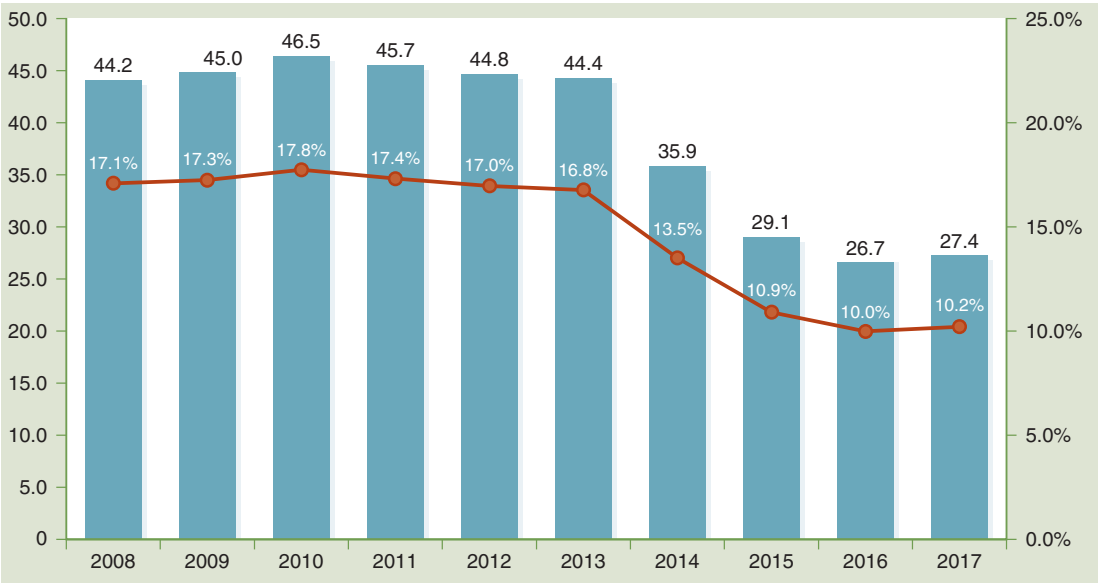
Visit the Global Burden of Disease website (www.healthdata.org/gbd). Explore and interact the "data visualization" section to get detailed health information about the behavioral and environmental causes of death in a country of interest.

Clinical Care Determinants

Clinical medical (health) care is a critical determinant of health for individuals and for populations. While the intersection and integration of public health and the health system is more thoroughly addressed in Chapter 3, this section will briefly address some key measures in this category of determinants.

The two broad areas of interest for clinical care determinants of health include access to health care and quality of health care. Access to care includes but is not limited to such determinants as health insurance coverage, how many healthcare providers accept all types of insurance, healthcare provider shortage areas, community-level utilization of clinical preventive services such as cancer screening and immunizations, access to reproductive health services, and access to oral health services. As an example, one measure of access to care used for ranking in the CHR is the number/rate of non-elderly persons without health insurance and is obtained from the U.S. Census, as shown in **Figure 2-12**.[28, 34]

Quality of care determinants include measuring how a healthcare provider or healthcare system performs with respect to rates of clinical preventive services for its covered population (e.g., what percentage of eligible patients are up-to-date on recommended health screenings, what percentage are up-to-date on recommended immunizations) and



NOTE: Includes nonelderly individuals ages 0 to 64.

Figure 2-12 The Number of Uninsured and the Uninsured Rate in the United States.

Reproduced from the Kaiser Family Foundation.

clinical care quality measure such as the proportion of patients with hypertension on treatment in a practice, clinic or health system, number and rates of preventable hospital stays, and 30-day mortality rates for patients following a stroke. As an example, a measure of quality of care used for ranking in the CHR is flu vaccination rates, using the percentage of fee-for-service (FFS) Medicare enrollees who had an annual flu vaccination.[28] The data source for this is the Centers for Medicare & Medicaid Services. The major limitation in such a database is that it only includes information on people who are covered by that insurer.

Social and Economic Determinants

The social and economic determinants considered in the CHR include income, employment, education, family and social support, and community safety. This combination of determinants can be thought of as a good measure of socioeconomic status (SES), a term with many possible definitions. The U.S. Census Bureau is the primary data source for this category of determinants. SES generally reflects position in society: the higher the educational status and the higher the income, the higher the social standing.

Social standing affects lifestyle, environment, and the utilization of services; it remains an important predictor of good and poor health in our society.[35, 36] The impact of 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."[37] Differences in mortality rates among the various social classes persist to the present day. The CHR include education, employment, income—all of which are fairly easy to measure—as well as family support and community safety, which are more difficult to measure. Education and income are discussed below. One of the limitations of using the CHR model for measures in this area is that social class often

coincides with characteristics at neighborhood level but this level of granularity may be lost at the county level.

Education

It has been long established that level of educational achievement is a significant predictor of a wide range of health outcomes. The higher the level of educational achievement, the better the health outcomes. The correlation between educational attainment and all-cause mortality rates is seen in **Figure 2-13**.[38] In a comprehensive article for the Agency for Healthcare Research and Quality (AHRQ), Zimmerman et al describe how the disparities in health status by education have increased over the past several decades.[39] The authors also report that while death rates for highly educated Americans have continued to decrease, death rates for Americans who have not graduated from high school have remained steady or have, in certain populations, actually increased.[39]

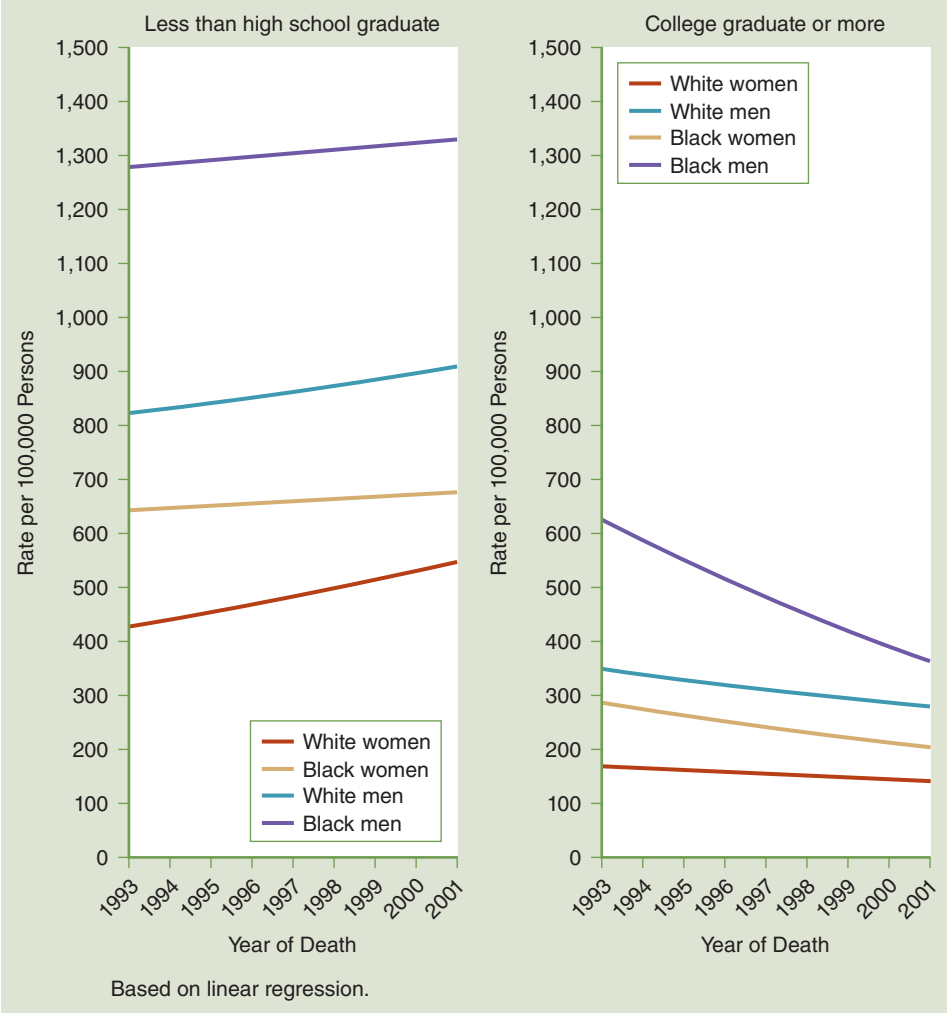


Figure 2-13 All-Cause Mortality by Educational Achievement.

Jemal A, Ward E, Anderson RN, Murray T, Thun MJ. Widening of Socioeconomic Inequalities in U.S. Death Rates, 1993–2001. *PLoS One*. 2008;3(5):e2181, Figure 1. https://doi.org/10.1371/journal.pone.0002181

Income

In the United States, epidemiologists have studied socioeconomic differences in health outcomes since the early 1900s. Low-income families in the United States have a lower life expectancy and an increased likelihood (or relative risk) of a wide variety of adverse health outcomes, often two to five times greater than that of higher-income families. In a 2016 landmark article, Chetty et al. conclude: "higher income was associated with greater longevity, and differences in life expectancy across income groups increased over time.[40] However, the association between life expectancy and income varied substantially across areas" as seen in **Figure 2-14**.[40] The authors emphasized that the differences in life expectancy were also associated with differences in health behaviors as well as in characteristics of different communities such as exposure to air pollution, access to medical care, or degree of social cohesion.

Physical Environmental Determinants of Health

As noted above, physical environment has a significant impact on the health of individuals and populations. Hippocrates, in his treatise, *On Airs, Water, and Places*, noted the association between quality of air and water on health. Today, of course, we have a much better understanding about the complex relationships between our environment and our health. The CHR look at indicators such as air pollution and drinking water violations as well as quality of housing and availability of public transport. There are different sources of information on these determinants of health, including the Environmental Public Health Tracking Network (air), the Safe Drinking Water Information System (water), the U.S. Department of Housing and Urban Development (housing), and the American Community Survey (transportation).

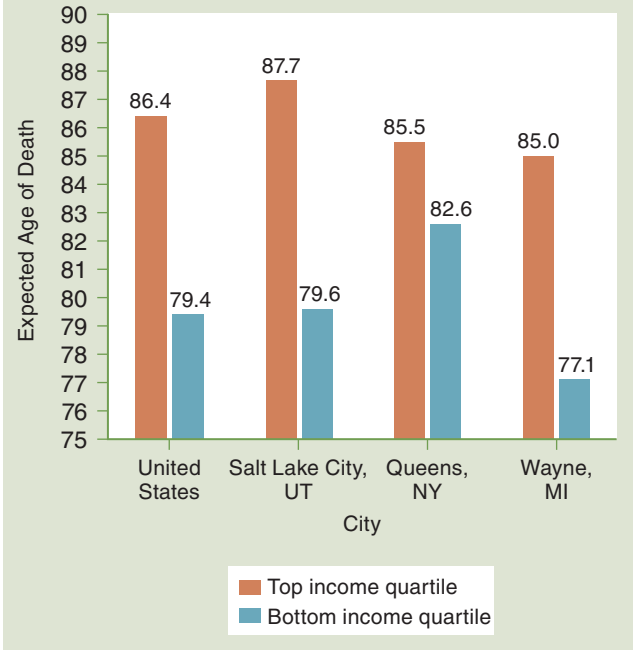


Figure 2-14 Age-adjusted Life Expectancy by Income and Location.

Data from Chetty, R., Stepner, M., Abraham, S., Lin, S., Scuderi, B., Turner, N., . . . Cutler, D. (2016). The Association Between Income and Life Expectancy in the United States, 2001–2014. *JAMA*. 2016;315(6):1750.

While historically the physical environment's impact on health has been focused on air and water quality, more recently there is growing consideration about the health consequences of the "built environment." The built environment includes "all of the physical parts of where we live and work (e.g., homes, buildings, streets, open spaces, and infrastructure)."[41] There are many examples of how the built environment can influence health.

- The availability of green spaces and safe sidewalks impacts the level of physical activity in a community.
- The density of full-service grocery stores impacts access to healthful food.
- The implementation of a Complete Streets approach assures safe access of all users (pedestrians, bicycles, public transport, drivers) of all levels of ability.[42]
- The adequacy of streetlights impacts the level of injury or violence in an urban area.

Outside-the-Book Thinking 2-9

Consider the community in which you currently live. Create an inventory of ways in which the built environment impacts the health of the residents of that community?

Measuring the "built environment" is extremely challenging but tools to do so are emerging.

Considering All Determinants of Health Together: Place Matters

Despite some of the limitations with measurement, the identification of determinants of health is essential for public health policy and interventions. Generally, public health approaches to dealing with community health problems must overcome formidable obstacles in the form of differences from place-to-place, including the inequitable and inefficient distribution of health care as well as public health and community services, including lack of infrastructure; lack of appropriate technology; poor management; poverty; inadequate or inappropriate government programs and funding to finance needed programs and services; and hazards in the environment. Much preventable disease is concentrated in areas in which the most profound inequities exist in terms of social and economic influences. Improved health status correlates more closely with changes in standards of living, education, literacy, and welfare policies than with specific preventive interventions. The complexities involved in identifying and understanding these forces and their interrelationships from place-to-place often confound comparisons of different communities within the United States. For this reason, it has become common in public health to say that your zip code is a better predictor of your long-term health than your genetic code, as illustrated by the map in **Figure 2-15**.[43]

Outside-the-Book Thinking 2-10

Access the Robert Wood Johnson Foundation's "Mapping life expectancy" website (www.rwjf.org/en/library/articles-and-news/2015/09/city-maps.html). Select and analyze the map for a city of your choice. Identify the greatest disparity in life expectancy on that map and consider what is contributing to that disparity.

Measuring Associations

The ability to identify determinants of health and pathways for causation is essential for making rational public health decisions and taking appropriate actions to address important health problems in a population. Untangling the complexity of the interrelationships between determinants of health and health outcomes is at the heart of public health. For example, consider a community with high neonatal mortality rates: the local health director wants to establish a multipronged approach to decrease these deaths. The director recognizes that neonatal mortality rates are closely associated with the low birth weight rate and that to significantly reduce the neonatal mortality rate,

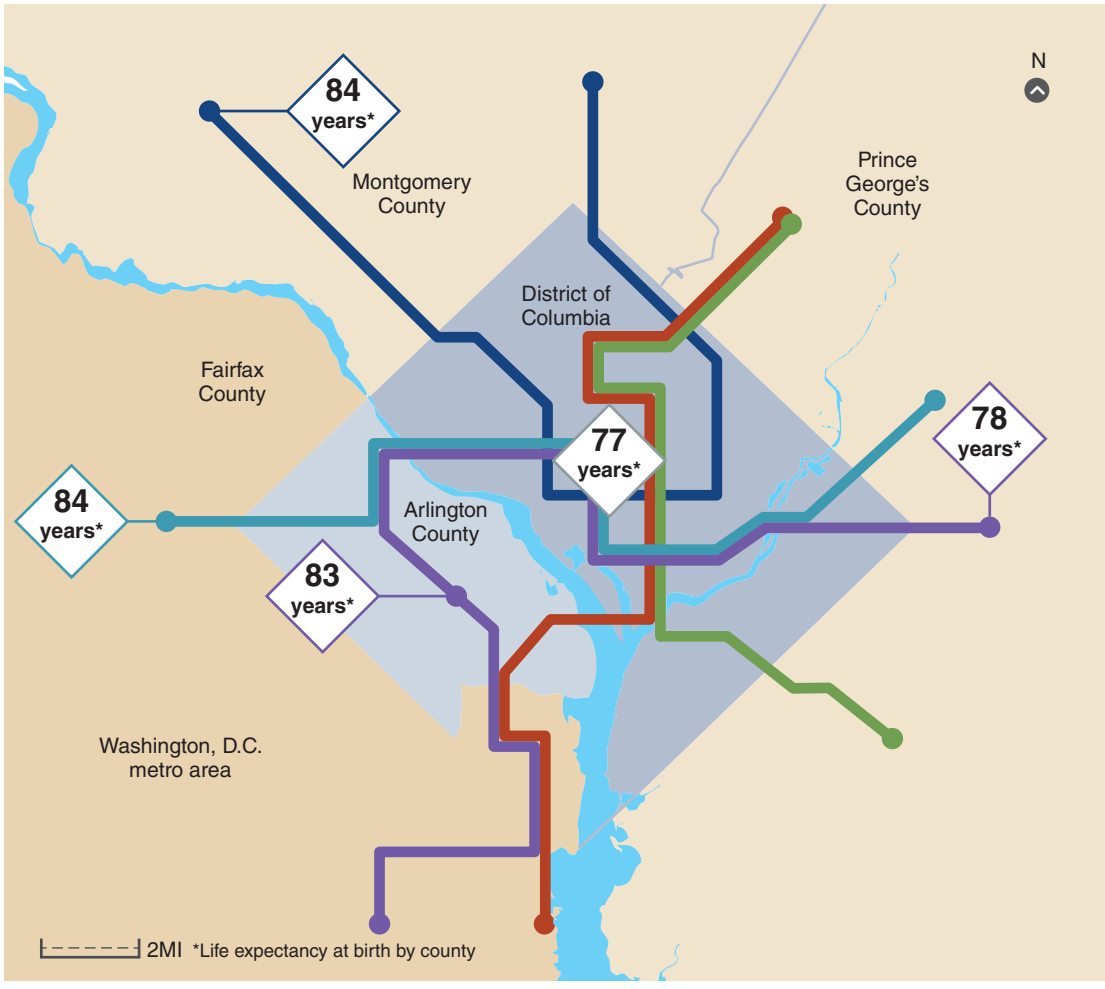


Figure 2-15 Mapping Life Expectancy.

she needs to consider what is then influencing low birth weight rate. This leads her to reflect on the impact of downstream factors, including preterm birth, tobacco use, and low maternal weight gain, which are in turn influenced by more upstream factors such as inadequate access to prenatal care among pregnant women, easy access to tobacco, lack of health education, and lack of smoking cessation programs.

Public health practitioners and researchers use biostatistics and epidemiology to better describe, understand, and quantify these complex relationships. Epidemiological studies are done to determine which of many possible risk factors are associated with the outcome of interest, and to what extent they are associated. However, as seen with the neonatal mortality example, this can often be difficult because of the many interrelated causes and complex interrelationships between factors that lead to this outcome. Biostatistics can help disentangle this complexity. While there is often no single answer, with different factors playing more or less important roles, depending on the circumstances, these tools are the best tools public health has. For this reason, all public health

learners and practitioners should become well-versed epidemiology and biostatistics and use the appropriate resources to gain knowledge and skills in these areas. For the purposes of this book, we will only address the three most commonly used measures of association, including the risk or rate ratio (relative risk), the odds ratio, and the attributable risk.

Relative Risk (RR)

This measure of association compares the risk of the health outcome in one group with the risk (usually an "exposed" group) among another group (usually the "unexposed" group) by dividing the incidence or prevalence in the first group by that of the second group. A RR=1 indicates that there is no association, a RR>1 indicates that there is a greater risk in the exposed group, and a RR<1 indicates that there is a lower risk in the exposed group. Relative risks are calculated in cohort studies, prospective or retrospective, where the exposure status of each member of the group or cohort under study is determined before the disease outcome occurs. The rates of the disease outcome in the exposed and non-exposed groups are then compared. Typically, 95% confidence limits are calculated to determine statistical significance (the range of plausible values for the relative risk) and P-values are calculated to determine the possibility that the measured relative risk could have occurred by chance alone, given a set of statistical assumptions.

Odds Ratio

The odds ratio is a measure of association that provides information similar to the relative risk except that it is used in case-control studies. In these studies, participants are defined by whether they have the disease outcome of interest (cases). Cases are compared to people without the outcome interest (controls) as to their exposure to the possible risk factor. When the disease outcome is rare (<10%) and the cases and controls being studied are representative of the general population with respect to exposure, the odds ratio will approximate the relative risk.

Attributable Risk

This term is most commonly used to assess how much any given risk factor contributes to a health outcome in a given population, in other words, the amount or proportion of disease that is attributed to a given risk. It is a useful tool to measure the potential impact of a public health intervention. Using the above example, considering the baseline rate of low birth weight in non-smokers, how much does smoking contribute to the low birthweight rate in smokers?

Ideally, public health practitioners use the knowledge that they have gained through such studies to inform rational decision-making. When looking at any of the above measures of association, it is important to recognize that a statistically significant association does not necessarily mean that the exposure caused the outcome of interest. Care to avoid biases, which can produce false associations, needs to be taken in the selection of study populations and the measurements of interest. Furthermore, despite the advancement of epidemiologic methods, studies often do not fully address all the contributing factors that affect key determinants of health, possibly leading to simplistic formulations of the role of multiple risk factors for health problems that exist at the community level.

Measuring Economic Dimensions of Health Outcomes

The key purpose of assessing a community's health by measuring and looking at the distribution of health outcomes and determinants of health is to inform rational decision-making and policy development. One important consideration in rational decision-making and policy development is cost, both the cost of the public health action being taken, or not taken, and the costs that will be incurred or avoided in the future by the action. For this reason, it is essential to understand the economic dimensions of public health.

There are different methods of analysis, such as cost-benefit and cost-effectiveness studies, to

assess the economic impact of adopting a public health policy or embarking on a public health program. Quality-adjusted life-years (QALYs) gained or YPLL (years of potential life lost or premature deaths) have become the common denominators or, in one sense, the common "currencies" by which to measure the economic impact of a public health measure. Health indicators can be translated into these currencies, which in turn can be calculated in actual currency, such as dollars. This translation allows for comparisons to be made among outcomes in terms of which option (e.g., to adopt or not adopt a policy) costs more per person or per episode, now and over time. These studies can be used to calculate the Return on Investment, or ROI, for investments in public health. Cost comparisons of health outcomes have become more common in public health over the years.

Cost-Benefit Analyses

These analyses provide comprehensive information on the costs, benefits, and harms of an intervention and the focus of the analysis is on net *monetary* benefit. All health outcomes and other relevant impacts are included in the determination of benefits and are assigned monetary values, which may be challenging. The results are expressed in terms of net costs, net benefits, and time required to recoup an initial investment. As an example of this, a study published in 2017 demonstrated the cost benefit of in-home asthma visits by a nurse or public health professional (to identify and address environmental determinants of asthma exacerbations such as dust or cigarette smoke). For people with an asthma event, the per person savings in medications and medical encounters was $1083, the average cost per visit was $302, resulting in a cost-benefit to $781 per asthma home visit.[44]

Cost-Effectiveness Analyses

Cost-effectiveness analyses provide comprehensive information on the costs, benefits, and harms of an intervention, but the net benefits have a nonmonetary value. Results are often specified as the cost per *case prevented*, cost per *life saved*, or cost per *QALY achieved*. As an example of this, a recent study by Jacob et al concludes "Interventions engaging community health workers are cost effective for cardiovascular disease prevention and type 2 diabetes management, based on a conservative $50,000 benchmark for cost per quality-adjusted life year gained. Two cost per quality-adjusted life year estimates for type 2 diabetes prevention were far below the $50,000 benchmark."[45]

To ensure appropriate use of scarce resources, policy makers should assess the economic benefits of public health interventions. A recent review of the economic impact of public health guidance issued by the National Institute of Health and Clinical Excellence (NICE) in England between 2011–2016 found that approximately 2/3 of public health interventions were cost-effective.[46]

Return on Investment (ROI)

This approach to economic analysis of public health policies and programs, which was discussed briefly in Chapter 1, is 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 many 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. Beyond the direct medical costs, there are often nonmedical costs related to lost wages, taxes, and productivity.

There is significant variation in the details of how any given ROI analysis takes all of these variables into account but the concept of ROI is increasingly being applied to public health policy and program decisions. As examples, ROI analysis has provided compelling supportive data for childhood vaccinations and implementation of maternal and child home visitation services. For vaccinations, in 2016, a study demonstrated anywhere from16–44:1 benefit to cost ratio for every dollar invested in vaccines, depending on what cost-savings were included.[47] Similarly, in 2017,

Nurse Family Partnership, a nursing home visitation model, touted a 6.4:1 benefit to cost ratio for every dollar invested.[48]

Additional Considerations in Economic Analyses

Three additional economic considerations are important for public health policy and practice. The first of these is what is known as opportunity cost, which represents the cost involved in choosing one course of action over another. It assumes that resources spent for one purpose will not be available to be spent for another. In order to fully assess opportunity costs, the costs of not realizing the benefits or gains from paths not chosen should be taken into account. The second 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. Thus, these savings or gains from investments in prevention do not necessarily actually benefit the practice of public health. Perhaps 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. The third consideration is the setting in which the economic analyses were performed. Were they examining the intervention's efficacy (did the intervention work in a controlled setting?) or its effectiveness (did it work when it was actually implemented in the real world?). This is important to determine the true impact of an intervention.

Finally, it is important to consider the limitations of these types of studies. They are based on assumptions which in turn are based on data that themselves have limitations. Are the data informing the analyses available, generalizable, valid, and timely?

Regardless of the methodology for measuring the economic dimensions of health and health policy, the stark reality that the United States spends far more per capita than any other country on health care while failing to achieve the highest levels of healthy years of life for its population. This should be enough of an imperative for policymakers to take a closer look at improving how to incorporate cost effective interventions into public health policy.

Using Indicators to Assess the Health of a Community

This chapter has provided background information on the types of demographic, health, determinants of health, and economic indicators that are used to assess health. As the field of data analytics continues to grow in health and public health, there has been an explosion of websites that provide data at different geographic and jurisdictional levels such as at the level of census block or tract, health system catchment area, city, county, region, state, and country. Widespread implementation of electronic health records and regional health information networks can facilitate standardizing and aggregating data for public health use. The CHR, which has been used to frame much of this chapter, is an important source of county level data.

Ideally, the community health assessment process, which is explored in great detail in Chapter 5, captures primary and secondary data from many different sources and utilizes a systematic approach to assess the community and identify a community health improvement process. Throughout this process, the data points for a community are benchmarked, or compared to an established standard or goal, to identify opportunities for community health improvement. As discussed earlier, Healthy People represents a nation-wide effort to establish feasible benchmarks that can be used to support efforts to improve the health and well-being of all Americans. It is considered the country's roadmap to health improvement and provides critical direction for communities undergoing a health assessment process. The Healthy People

Table 2-4 ***Healthy People 2020*** **Vision, Mission, and Goals**

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 actions 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.

Reproduced from U.S. Department of Health and Human Services. *Healthy People 2020* website. www.healthypeople.gov. Accessed June 3, 2014.

2020 Vision, Mission, and Goals are shown in **Table 2-4**. At the time of this writing, HP2030 was under development. It will provide the roadmap for the improvement of public health in the United States for the next decade.

Health in the United States

The last section of this chapter will apply measures of health and determinants of health to describe the status of health in the United States over the past 120 years. Many important indicators have dramatically improved over the past century. In 1900, the crude mortality rate was about 1,700 deaths per 100,000 population and life expectancy at birth was 47 years.[49] By 2000, the crude mortality rate was cut in half, to 872 per 100,000 and life expectancy at birth was almost 77 years.[50] Furthermore, these changes in crude death rates understate the gains in life expectancy realized for all age groups over the 20th century. On an age-adjusted basis, improvements were even more impressive, most significantly with infant and child mortality rates decreasing by 95%.

Changes in the Leading Causes of Death in the United States and Impact on Life Expectancy

Leading Causes of Death

The 10 leading causes of death changed dramatically over the 20th century, as demonstrated in **Table 2-5**, which depicts the leading causes of death in 1900, 2000, and 2016.[49–51] As the table shows, in 1900 four of the 10 leading causes of death were associated with infectious diseases: influenza and pneumonia; tuberculosis; diarrhea and related diseases; and diphtheria. Throughout the 20th century, improvements in the prevention and control of infectious diseases with advances in antibiotics and vaccinations led to significantly improved health status, especially for children and young adults. By 2000, the impact of infectious diseases on mortality had dropped precipitously and heart disease, cancer, cerebrovascular disease, and chronic obstructive pulmonary disease had emerged as the most significant leading causes of death.

Table 2-5 Leading Causes of Death in the United States, 1900, 2000, 2016

1990	% of Total Deaths	2000	% of Total Deaths	2016	% of Total Deaths
Influenza and pneumonia	**11.8**	Diseases of the heart	**29.6**	Diseases of the heart	**23.1**
Tuberculosis	**11.3**	Malignant neoplasms	**23.0**	Malignant neoplasms	**21.8**
Diarrhea and enteritis	**8.3**	Cerebrovascular diseases	**7.0**	Accidents (unintentional injuries)	**5.9**
Diseases of the heart	**8.0**	Chronic lower respiratory diseases	**5.1**	Chronic lower respiratory diseases	**5.6**
Cerebrovascular diseases	**6.2**	Accidents (unintentional injuries)	**4.1**	Cerebrovascular diseases	**5.2**
Nephritis (all kinds)	**5.2**	Diabetes mellitus	**2.9**	Alzheimer disease	**4.2**
Accidents (unintentional injuries)	**4.2**	Influenza and pneumonia	**2.7**	Diabetes mellitus	**2.9**
Malignant neoplasms	**3.7**	Alzheimer disease	**1.2**	Influenza and pneumonia	**1.9**
Senility	**2.9**	Nephritis, nephrotic syndrome, and nephrosis	**1.1**	Nephritis, nephrotic syndrome, and nephrosis	**1.8**
Diphtheria	**2.3**	Septicemia	**0.7**	Intentional self-harm	**1.6**

Modified from Centers for Disease Control and Prevention. Leading Causes of Death, 1900-1998; Deaths: Leading Causes for 2000 by Robert N. Anderson, Ph.D., Division of Vital Statistics; Deaths: Leading Causes for 2016 by Melonie Heron, Ph.D., Division of Vital Statistics.

Changes to the top leading causes of deaths occurred again in 2016, when unintentional injuries, a category that includes drug overdoses associated with the opioid epidemic, emerged as the third leading cause of death, displacing chronic obstructive pulmonary disease. The same year, intentional self- harm (suicide) entered into the field of the leading 10 causes of death in the United States, displacing septicemia.[51] These changes are discussed in further detail in discussions about current challenges to public health in Chapter 9.

Any discussion about leading causes of death would be incomplete without a discussion about some of the upstream factors that contribute to those causes. The trends in drug overdose deaths over the past several years, in large part reflecting patterns in drug use, specifically heroin and fentanyl, are a tragic example of this. **Figure 2-16** shows side by side comparisons of the number of deaths in 2016 by the primary cause of death and by the underlying preventable behavioral and environmental risk factors. It is important to both consider changes in trends such as those seen with drug use, as well as the overall burden to the general population. For the latter, tobacco has long been considered to be the leading preventable cause of death but these data, extracted from the previously mentioned, *State of US Health, 1990–2016* by the Global Burden of Disease Study, illustrate that

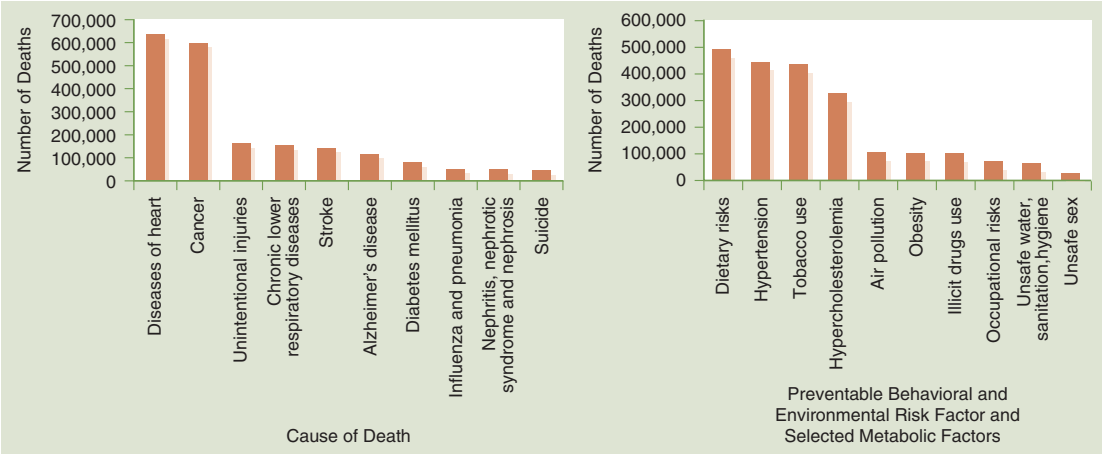


Figure 2-16 Leading Causes of Death and Risk Factors, United States, 2016.

Left: Data from Heron M. Deaths: Leading Causes for 2016. *Natl Vital Stat Rep*. 2018 Jul;67(6):1-77. Right: Data from The US Burden of Disease Collaborators. The State of US Health, 1990-2016: Burden of Diseases, Injuries, and Risk Factors Among US States. *JAMA*. 2018;319(14):1444-1472.

dietary risk factors are now the leading preventable cause of death in the United States.[20]

Life Expectancy

Year after year, the life expectancy in the United States has increased steadily, reflecting remarkable successes both in public health and in clinical care as progress accelerated in the medical management of some of the leading causes of death, including heart disease, stroke, and cancer. But this changed in 2015, when a small but significant decrease in life expectancy was noted, marking a reversal in the trend that continued in the following years. The same factors that led to shifts in the 10 leading causes of death, most notably deaths attributed to drug overdoses and suicide, have disproportionately impacted Americans younger than 65 years of age thereby impacting life expectancy. These recent trends in life expectancy and mortality rates should serve as a wake-up call for the nation to mount a comprehensive public health response to address the root causes of these health threats.

Health Equity

In addition to concerns about recent trends in life expectancy and age-adjusted mortality rates for certain conditions, a great threat to the public's health in the United States is the persistence, and in some case the worsening, of inequity as measured by disparities in many different health indicators among different populations. The WHO definition of equity is "the absence of avoidable, unfair, or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically or by other means of stratification."[52] Health equity is defined as individuals having "a fair opportunity to attain their full health potential."[52] Thus health inequity occurs when societies as a whole, not just their public health or health systems, fail to provide the social, economic, and other conditions for their residents to have such fair opportunities. The concept of health equity is consistent with the philosophy of health as a human right as declared at the International Conference on Primary Health Care in Alma Ata (then in the Union of Soviet Socialist Republics, now Kazakhstan) in 1978:

> "The Conference strongly reaffirms that health, which is a state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the action of many other social and economic sectors in addition to the health sector."[53]

With respect to measurement equity, public health practitioners often use the term "disparity" to describe a measurable difference in health indicators or in determinants of health among populations. Typically, but not always, disparities are themselves indicators of inequity.

In the United States, substantial differences in health indicators have been identified by race and ethnicity, geography, poverty status, disability classification, gender, and sexual orientation. These disparities are found not only in indicators of poor health outcomes, such as mortality and morbidity indicators, but also in the other determinants of health. **Figure 2-17** illustrates disparities in age-adjusted death rates by race and ethnicity while **Figure 2-18** is a map of the United States that illustrates geographic disparities in age-adjusted death rates.[54, 55]

There are many factors that contribute to the health inequity represented in these figures. As seen earlier in the chapter, disparities in social and economic factors such as education, income, and neighborhood all have a profound impact on the health of individuals. Importantly clinical care itself is a factor that contributes to health inequity. In 2003, the National Academy of Medicine published "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care," which addressed over 170 studies that identified racial and ethnic disparities in diagnosis and treatment within the U.S. healthcare system.[56] Disparities persisted even when insurance status, income,

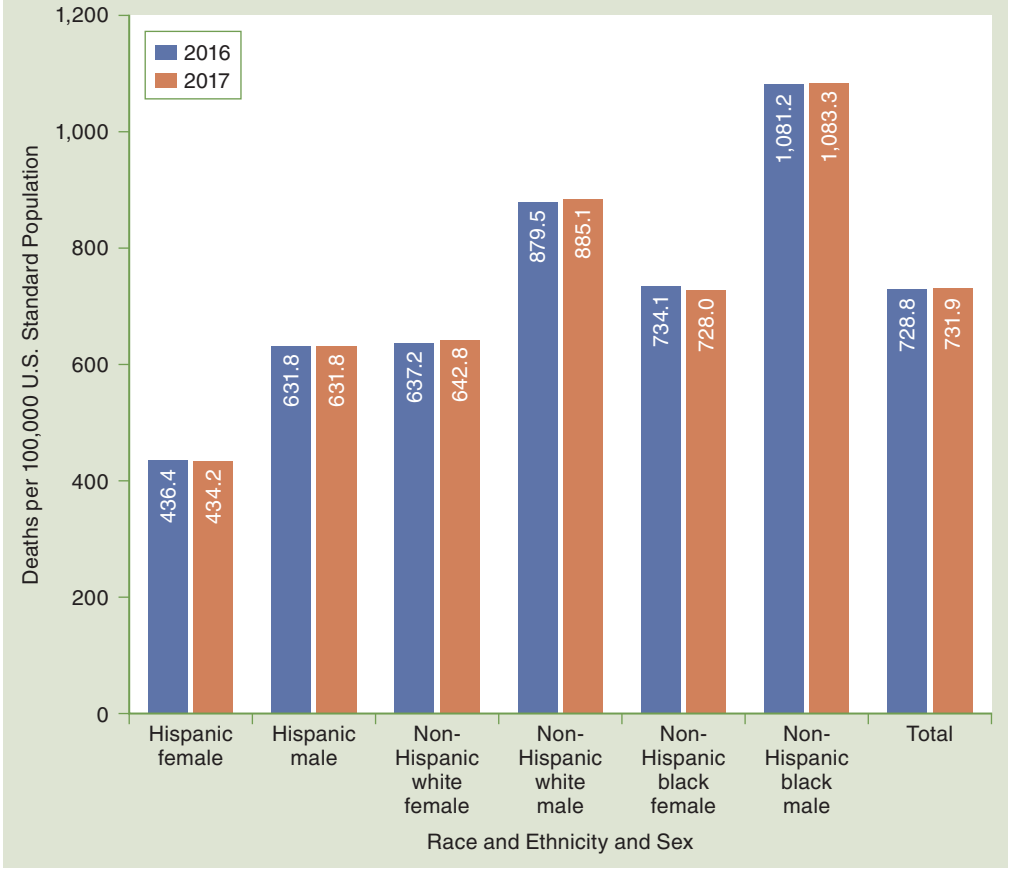


Figure 2-17 Age-adjusted Death Rate by Race and Ethnicity.

Reproduced from CDC/NCHS, National Vital Statistics System, Mortality.

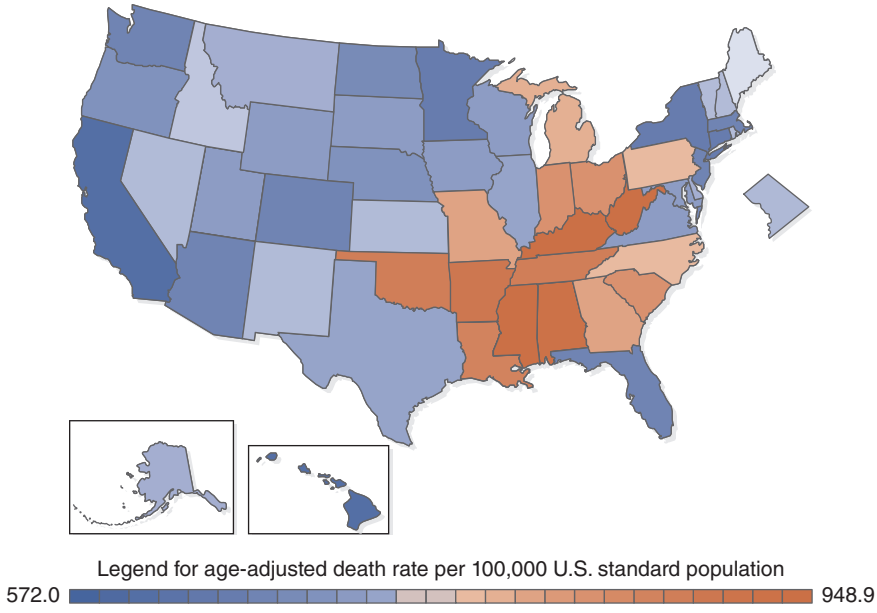


Figure 2-18 Age-adjusted Death Rate by State.

Leading Causes of Death in the United States, 1999-2016. CDC. Available at: https://www.cdc.gov/nchs/data-visualization/mortality-leading-causes/index.htm

and education were controlled for. Since its publication, there has been increasing awareness of the role that implicit or unconscious bias plays in contributing to these disparities. To ensure that policies and healthcare delivery systems continue to address inequity within health care, the Agency for Health Care Quality and Research now publishes an annual "National Healthcare Quality and Disparities Report" on its website.[57]

In sum, United States health indicators tell two very different tales. By many measures, the American population has never been healthier but the gains in health status over the past century have not been shared equally by all subgroups of the population. The greatest gains in improving the overall health status of the U.S. population can be made by closing these gaps and equalizing health status within the population. If health inequities were eliminated and all groups had the health status that the healthiest groups currently have, the health of the nation would be improved greatly. It is critical to continue to develop and sustain strategies that intentionally focus on impacting steady overall improvement among *all* groups in the population, which by necessity, includes strategies (some of which are discussed in Chapter 3) to level the playing field when it comes to addressing determinants of health, thereby creating "a fair opportunity" for every person to attain his or her full health potential.

Conclusion

From a social-ecological perspective, the health status of a population is influenced by many factors drawn from genetics, health behaviors, the physical and social environment, as well as the structure and function on the health system. There are many opportunities to measure these factors. Public health activities strive to improve population health status through cost-beneficial strategies and interventions that provide benefits for all segments of the population. Achieving health equity continues to be a critical national health goal. With the increasing availability and standardization of data on health status, as well as on determinants of health, the foundation for more rational policies and interventions has been established. Over the long term, public

policies that narrow income inequity and increase access to education, jobs, and housing will do far more to improve the health status of populations than will efforts to provide more healthcare services. Health improvement efforts require more than data, they require community engagement to develop comprehensive community health assessments and to allow informed decision-making. 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 human rights, lest quality of life be seriously compromised.[58] It is this right to health that energizes and challenges public health workers to measure health and quality of life in ways that promote its improvement.

Discussion Questions

1. Considering the WHO's definition of health and applying what you have learned about measurement of health, discuss your thoughts on the County Health Rankings use of poor or fair health, poor physical health days, poor mental health days, and low birth weight rates as the indicators for quality of life? What are the advantages of using these measures? What are the disadvantages?
2. Using the model of determinants of health seen in Figure 2-4, discuss the extent to which you believe individuals can and should take responsibility for their own health.
3. Discuss your reaction to learning about the current health status in the United States. What are your thoughts about decreasing life expectancy? What do you think some of the key underlying factors (determinants) are? What are your thoughts about health inequity? What do you think some of the key underlying factors (determinants) are? What role do you think public health has in addressing these issues?

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