

# What Is Public Health?

### OBJECTIVES

After completing Chapter 1, learners will be proficient in describing what public health is, including its unique and important features, to general audiences. Key aspects of this competency expectation include the following:

- Articulating several different definitions of public health
- Describing the origins and content of public health responses over history
- Tracing the development of the public health system in the United States
- Broadly characterizing the contributions and value of public health
- Identifying three or more distinguishing features of public health
- Describing public health as a system with inputs, processes, outputs, and results, including the role of core functions and essential public health services
- Identifying five or more Internet websites that provide useful information on the U.S. public health system

The passing of one century and the early decades of another afford a rare opportunity to look back at where public health has been and forward to the challenges that lie ahead. Imagine a world 100 years from now where life expectancy is 30 years longer and infant mortality rates are 95% lower than they are today. The average human life span would be more than 107 years, and less than 1 of every 2,000 infants would die before their first birthday. These seem like unrealistic expectations and unlikely achievements; nevertheless, they are no greater than the gains realized during the 20th century in the United States. In 1900, few envisioned the century of progress in public health that lay ahead; yet by 1925, public health leaders such as C.E.A. Winslow were noting a nearly 50% increase in life expectancy (from 36 years to 53 years) for residents of New York City between the years 1880 and 1920.<sup>1</sup> Accomplishments such as these caused Winslow to speculate what might be possible through widespread application of scientific knowledge. With the

even more spectacular achievements over the rest of the 20th century, we all should wonder what is possible in the century that has just begun.

This year will be remembered for many things, but it is unlikely that many people will remember it as a spectacular year for public health in the United States. No major discoveries, innovations, or triumphs are likely to set the year apart from other years in recent memory. Nevertheless, on closer examination, maybe there are! Like the story of the wise man who invented the game of chess for his king and asked for payment by having the king place one grain of wheat on the first square of the chessboard, two on the second, four on the third, eight on the fourth, and so on, the small victories of public health over the past century have resulted in cumulative gains so vast in scope that they are difficult to comprehend.

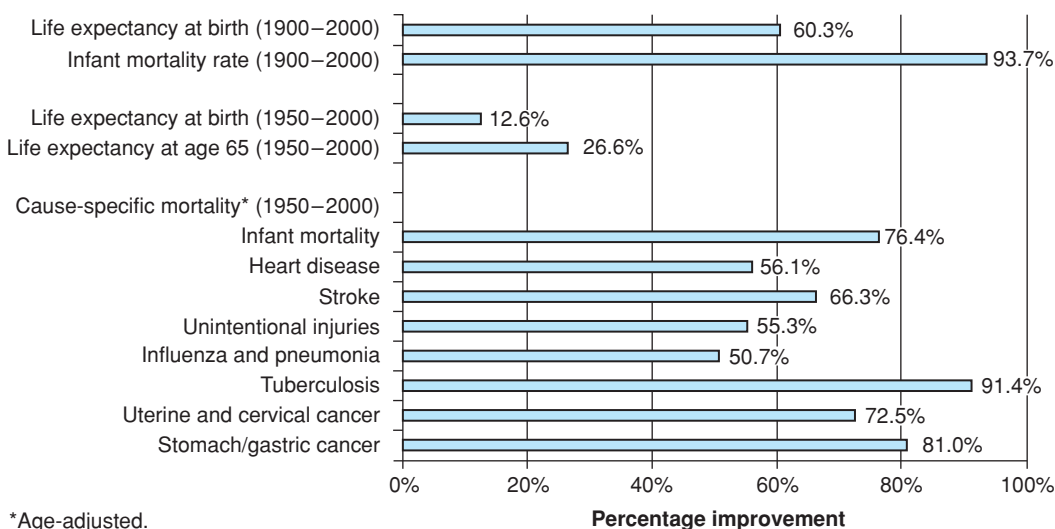
This year there will be nearly 900,000 fewer cases of measles reported than in 1941, 200,000 fewer cases of diphtheria than in 1921, more than 250,000 fewer cases of whooping cough than in 1934, and 21,000 fewer cases of polio than in 1951.<sup>2</sup> The early years of the new century are witnessing 50 million fewer smokers than would have been expected, given trends in tobacco use through 1965. More than 2 million Americans are alive today who otherwise would have died from heart disease and stroke, and nearly 100,000 Americans are alive as a result of automobile seatbelt use. Protection of the U.S. blood supply has prevented more than 1.5 million hepatitis B and hepatitis C infections and more than 50,000 human immunodeficiency virus (HIV) infections, as well as more than \$5 billion in medical costs associated with these three diseases.<sup>3</sup> Today, the average blood lead levels in children are less than one third of what they were a quarter century ago. This catalog of accomplishments could be expanded many times over. Figure 1-1 summarizes this progress, including two of the most widely followed measures of a population's health status: life expectancy and infant mortality.

These results did not occur by themselves. They came about through decisions and actions that represent the essence of what is public health. It is the story of public health and its immense value and importance in our lives that is the focus of this text. With this impressive litany of accomplishments, it would seem that public health's story would be easily told. For many reasons, however, it is not. As a result, public health remains poorly understood by its prime beneficiary—the public—as well as many of its dedicated practitioners. Although public health's results, as measured in terms of improved health status, diseases prevented, scarce resources saved, and improved quality of life, are more apparent today than ever before, society seldom links the activities of public health with its results. This suggests that the public health community must more effectively communicate what public health is and what it does so that its results can be readily traced to their source.

This chapter is an introduction to public health that links basic concepts to practice. It considers three questions:

- What is public health?
- Where did it come from?
- Why is it important in the United States today?

To address these questions, this chapter begins with a sketch of the historical development of public health activities in the United States. It then exam-



\*Age-adjusted.

**Figure 1-1** Percentage improvement in selected measures of life expectancy and age-adjusted, cause-specific mortality for the time periods 1900–2000 and 1950–2000, United States. *Source:* Data from Centers for Disease Control and Prevention, National Center for Health Statistics. *Health, United States 2009*. Hyattsville, MD: NCHS; 2009 and Rust G, Satcher D, Fryer GE, Levine RS, Blumenthal DS. Triangulating on success: innovation, public health, medical care, and cause-specific U.S. mortality over a half century (1950–2000). *Am J Public Health*. 2010; 100:S95–S104.

ines several definitions and characterizations of what public health is and explores some of its unique features. Finally, it offers insights into the value of public health in biologic, economic, and human terms.

Taken together, the topics in this chapter provide a foundation for understanding what public health is and why it is important. A conceptual framework that approaches public health from a systems perspective is introduced to identify the dimensions of the public health system and facilitate an understanding of the various images of public health that coexist in the United States today. We see that, as in the story of the blind men examining the elephant, with each blind person describing the animal in terms of the part that they encountered, various sectors of our society have mistaken separate components of public health for the entire system. Later chapters more thoroughly examine and discuss the various components and dimensions of the public health system.

## A BRIEF HISTORY OF PUBLIC HEALTH IN THE UNITED STATES

### Early Influences on American Public Health

Although the complete history of public health is a fascinating saga in its own right, this section presents only selected highlights. When ancient cultures perceived illness as the manifestation of supernatural forces, they also felt that little in the way of either personal or collective action was possible.

For many centuries, disease was synonymous with epidemic. Diseases, including horrific epidemics of infectious diseases such as the Black Death (plague), leprosy, and cholera, were phenomena to be accepted. It was not until the so-called Age of Reason and the Enlightenment that scholarly inquiry began to challenge the “givens” or accepted realities of society. Eventually, the expansion of the science and knowledge base would reap substantial rewards.

With the advent of industrialism and imperialism, the stage was set for epidemic diseases to increase their terrible toll. As populations shifted to urban centers for purpose of commerce and industry, public health conditions worsened. The mixing of dense populations living in unsanitary conditions and working long hours in unsafe and exploitative industries with wave after wave of cholera, smallpox, typhoid, tuberculosis, yellow fever, and other diseases was a formula for disaster. Such disaster struck again and again across the globe, but most seriously and most often at the industrialized seaport cities that provided the portal of entry for diseases transported as stowaways alongside commercial cargo. The experience and subsequent susceptibility of different cultures to these diseases partly explain how relatively small bands of Europeans were able to overcome and subjugate vast Native American cultures. Seeing the Europeans unaffected by scourges such as smallpox served to reinforce beliefs that these light-skinned visitors were supernatural figures, unaffected by natural forces.<sup>4</sup>

The British colonies in North America and the fledgling United States certainly bore their share of the burden. American diaries of the 17th and 18th centuries chronicle one infectious disease onslaught after another. These epidemics left their mark on families, communities, and even history. For example, the national capital had to be moved out of Philadelphia because of a devastating yellow fever epidemic in 1793. This epidemic also prompted the city to develop its first board of health in that same year.

The formation of local boards of distinguished citizens, the first boards of health, was one of the earliest organized responses to epidemics. This response was revealing in that it represented an attempt to confront disease collectively. Because science had not yet determined that specific microorganisms were the causes of epidemics, avoidance had long been the primary tactic used. Avoidance meant evacuating the general location of the epidemic until it subsided or isolating diseased individuals or those recently exposed to diseases on the basis of a mix of fear, tradition, and scientific speculation. Several developments, however, were swinging the pendulum ever closer to more effective counteractions.

The work of public health pioneers such as Edward Jenner, John Snow, and Edwin Chadwick illustrates the value of public health, even when its methods are applied amid scientific uncertainty. Long before Koch’s postulates established scientific methods for linking bacteria with specific diseases and before Pasteur’s experiments helped to establish the germ theory, both Jenner and Snow used deductive logic and common sense to do battle with smallpox and cholera, respectively. In 1796, Jenner successfully used vaccination for a disease that ran rampant through communities across the globe. This was the initial shot in a long and arduous campaign that by the year 1977 had totally eradicated smallpox from all of its human hiding places in

every country in the world. The potential for its reemergence through the actions of terrorists is a topic left to Chapter 8.

Snow's accomplishments even further advanced the art and science of public health. In 1854, Snow traced an outbreak of cholera to the well water drawn from the pump at Broad Street and helped to prevent hundreds, perhaps thousands, of cholera cases. In that same year, he demonstrated that another large outbreak could be traced to one particular water company that drew its water from the Thames River, downstream from London, and that another company that drew its water upstream from London was not linked with cholera cases. In both efforts, Snow's ability to collect and analyze data allowed him to determine causation, which in turn allowed him to implement corrective actions that prevented additional cases. All of this occurred without the benefit of the knowledge that there was an odd-shaped little bacterium that was carried in water and spread from person to person by hand-to-mouth contact!

England's General Board of Health conducted its own investigations of these outbreaks and concluded that air, rather than contaminated water, was the cause.<sup>5</sup> Its approach, however, was one of collecting a vast amount of information and accepting only that which supported its view of disease causation. Snow, on the other hand, systematically tested his hypothesis by exploring evidence that ran in contrast to his initial expectations.

Chadwick was a more official leader of what has become known as the sanitary movement of the latter half of the 19th century. In a variety of official capacities, he played a major part in structuring government's role and responsibilities for protecting the public's health. Because of the growing concern over the social and sanitary conditions in England, the National Vaccination Board was established in 1837. Shortly thereafter, Chadwick's "Report on an Inquiry into the Sanitary Conditions of the Laboring Population of Great Britain" articulated a framework for broad public actions that served as a blueprint for the growing sanitary movement. One result was the establishment in 1848 of the General Board of Health. Interestingly, Chadwick's interest in public health had its roots in Jeremy Bentham's utilitarian movement. For Chadwick, disease was viewed as causing poverty, and poverty was responsible for the great social ills of the time, including societal disorder and high taxation to provide for the general welfare.<sup>6</sup> Public health efforts were necessary to reduce poverty and its wider social effects. This view recognizes a link between poverty and health that differs somewhat from current views. Today, it is more common to consider poor health as a result of poverty, rather than as its cause.

Chadwick was also a key participant in the partly scientific, partly political debate that took place in British government as to whether deaths should be attributed to clinical conditions or to their underlying factors, such as hunger and poverty. It was Chadwick's view that pathologic, as opposed to less proximal social and behavioral, factors should be the basis for classifying deaths.<sup>6</sup> Chadwick's arguments prevailed, although aspects of this debate continue to this day. William Farr, sometimes called the father of modern vital statistics, championed the opposing view.

In the latter half of the 19th century, as sanitation and environmental engineering methods evolved, more effective interventions became available against

epidemic diseases. Furthermore, the scientific advances of this period paved the way for modern disease control efforts targeting specific microorganisms.

### **Growth of Local and State Public Health Activities in the United States**

In the United States, Lemuel Shattuck's "Report of the Sanitary Commission of Massachusetts" in 1850 outlined existing and future public health needs for that state and became America's blueprint for development of a public health system. Shattuck called for the establishment of state and local health departments to organize public efforts aimed at sanitary inspections, communicable disease control, food sanitation, vital statistics, and services for infants and children. Although Shattuck's report closely paralleled Chadwick's efforts in Great Britain, acceptance of his recommendations did not occur for several decades. In the latter part of the century, his farsighted and far-reaching recommendations came to be widely implemented. With greater understanding of the value of environmental controls for water and sewage and of the role of specific control measures for specific diseases (including quarantine, isolation, and vaccination), the creation of local health agencies to carry out these activities supplemented—and, in some cases, supplanted—local boards of health. These local health departments developed rapidly in the seaports and other industrial urban centers, beginning with a health department in Baltimore in 1798, because these were the settings where the problems were reaching unacceptable levels. An illustration of such local public health efforts is presented at the end of this chapter in a Public Health Spotlight, which traces public health activities in Chicago from 1834 to 2003. The history summarized in this case study parallels that of other American cities through the 19th and 20th centuries.

Because infectious and environmental hazards are no respecters of local jurisdictional boundaries, states began to develop their own boards and agencies after 1870. These agencies often had very broad powers to protect the health and lives of state residents, although the clear intent at the time was that these powers be used to battle epidemics of infectious diseases. In later chapters, we revisit these powers and duties because they serve as both a stimulus and a limitation for what can be done to address many contemporary public health issues and problems.

### **Federal Public Health Activities in the United States**

This sketch of the development of public health in the United States would be incomplete without a brief introduction to the roles and powers of the federal government. Federal health powers, at least as enumerated in the U.S. Constitution, are minimal. It is surprising to some to learn that the word health does not even appear in the Constitution. As a result of not being a power granted to the federal government (such as defense, foreign diplomacy, international and interstate commerce, or printing money), health became a power to be exercised by states or reserved to the people themselves.

Two sections of the Constitution have been interpreted over time to allow for federal roles in health, in concert with the concept of the so-called implied

powers necessary to carry out explicit powers. These are the ability to tax in order to provide for the “general welfare” (a phrase appearing in both the preamble and body of the Constitution) and the specific power to regulate commerce, both international and interstate. These opportunities allowed the federal government to establish a beachhead in health, initially through the Marine Hospital Service (eventually to become the Public Health Service). After the ratification of the 16th Amendment in 1916, authorizing a national income tax, the federal government acquired the ability to raise vast sums of money, which could then be directed toward promoting the general welfare. The specific means to this end were a variety of grants in aid to state and local governments. Beginning in the 1960s, federal grant-in-aid programs designed to fill gaps in the medical care system nudged state and local governments further and further into the business of medical service provision. Federal grant programs for other social, substance abuse, mental health, and community prevention services soon followed. The expansion of federal involvement into these areas, however, was not accomplished by these means alone.

Before 1900, and perhaps not until the Great Depression, Americans did not believe that the federal government should intervene in their social circumstances. Social values shifted dramatically during the Depression, a period of such great social insecurity and need that the federal government was now permitted—indeed, expected—to intervene. Chapters 4, 5, and 8 expand on the growth of the federal government’s influence on public health activities and its impact on the activities of state and local governments.

To explain more easily the broad trends of public health in the United States, it is useful to delineate distinct eras in its history. One simple scheme, illustrated in Table 1-1, uses the years 1850, 1950, and 2000 as approximate dividers. Prior to 1850, the system was characterized by recurrent epidemics of infectious diseases, with little in the way of collective response possible. During the sanitary movement in the second half of the 19th and first half of the 20th century, science-based control measures were organized and deployed through a public health infrastructure that was developing in the form of local and state health departments. After 1950, gaps in the medical care system and federal grant dollars acted together to increase public provision of a wide range of health services. That increase set the stage for the current reexamination of the links between medical and public health practice. Some retrenchment from the direct service provision role has occurred since about 1990. As we will examine in subsequent chapters, a new era for public health that seeks to balance community-driven public health practice with preparedness and response for public health emergencies lies ahead.

**Table 1-1** Major Eras in Public Health History in the United States

Before 1850	Battling epidemics
1850–1949	Building state and local infrastructure
1950–1999	Filling gaps in medical care delivery
After 1999	Preparing for and responding to community health threats

## IMAGES AND DEFINITIONS OF PUBLIC HEALTH

The historical development of public health activities in the United States provides a basis for understanding what public health is today. Nonetheless, the term public health evokes several different images among the general public and those dedicated to its improvement. To some, the term describes a broad social enterprise or system.

To others, the term describes the professionals and workforce whose job it is to solve certain important health problems. At a meeting in the early 1980s to plan a community-wide education and outreach campaign to encourage early prenatal care in order to reduce infant mortality, a community relations director of a large television station made some comments that reflected this view. When asked whether his station had been involved in infant mortality reduction efforts in the past, he responded, “Yes, but that’s not our job. If you people in public health had been doing your job properly, we wouldn’t be called on to bail you out!” Obviously, this man viewed public health as an effort of which he was not a part.

Still another image of public health is that of a body of knowledge and techniques that can be applied to health-related problems. Here, public health is seen as what public health does. Snow’s investigations exemplify this perspective.

Similarly, many people perceive public health primarily as the activities ascribed to governmental public health agencies. For the majority of the public, this latter image represents public health in the United States, resulting in the common view that public health primarily involves the provision of medical care to indigent populations. Since 2001, however, public health has also emerged as a front-line defense against bioterrorism and other threats to personal security and safety.

A final image of public health is that of the intended results of these endeavors. In this image, public health is literally the health of the public, as measured in terms of health and illness in a population. The term population health, often defined as health outcomes and their distribution in a population, is increasingly used for this image of public health.<sup>7</sup>

This chapter focuses primarily on the first of these images, public health as a social enterprise or system. It is important to understand what people mean when they speak of public health. As presented in Table 1-2, the profession, the methods, the governmental services, the ultimate outcomes, and even the broad social enterprise itself are all commonly encountered images of what public health is today.

With varying images of what public health is, we would expect no shortage of definitions. There have been many, and it serves little purpose to try to catalog all of them here. Three definitions, each separated by a generation, provide important insights into what public health is; these are summarized in Table 1-3.

In 1988, the prestigious Institute of Medicine (IOM) provided a useful definition in its landmark study of public health in the United States, “The Future of Public Health.” The IOM report characterized public health’s mis-



**Table 1-2** Images of Public Health

- Public health: the system and social enterprise
- Public health: the profession
- Public health: the methods (knowledge and techniques)
- Public health: governmental services (especially medical care for the poor)
- Public health: the health of the public

**Table 1-3** Selected Definitions of Public Health

- “The science and art of preventing disease, prolonging life, and promoting health and efficiency through organized community effort . . .”<sup>9</sup> (Winslow, 1920)
  - “. . . successive re-definings of the unacceptable”<sup>10</sup> (Vickers, 1958)
  - “fulfilling society’s interest in assuring conditions in which people can be healthy”<sup>8</sup> (IOM, 1988)
- Source:* Data from Institute of Medicine, National Academy of Sciences. *The Future of Public Health*, Washington, DC: National Academy Press; 1988; Winslow CEA. The untilled field of public health. *Mod Med.* 1920;2:183–191; and Vickers G. What sets the goals of public health? *Lancet.* 1958;1: 599–604.

sion as “fulfilling society’s interest in assuring conditions in which people can be healthy.”<sup>8</sup> This definition directs our attention to the many conditions that influence health and wellness, underscoring the broad scope of public health and legitimizing its interest in social, economic, political, and medical care factors that affect health and illness. The definition’s premise that society has an interest in the health of its members implies that improving conditions and health status for others is acting in our own self-interest. The assertion that improving the health status of others provides benefits to all is a core value of public health.

Another core value of public health is reflected in the IOM definition’s use of the term *assuring*. Assuring conditions in which people can be healthy means vigilantly promoting and protecting everyone’s interests in health and well-being. This value echoes the wisdom in the often-quoted African aphorism that “it takes a village to raise a child.” Former Surgeon General David Satcher, the first African American to head this country’s most respected federal public health agency, the Centers for Disease Control and Prevention (CDC), once described a visit to Africa in which he met with African teenagers to learn firsthand of their personal health attitudes and behaviors. Satcher was struck by their concerns over the rapid urbanization of the various African nations and the changes that were affecting their culture and sense of community. These young people felt lost and abandoned; they questioned Satcher as to what the CDC, the U.S. government, and the world community would be willing to do to help them survive these changes. As one young man put it, “Where will we find our village?” Public health’s role is one of serving us all as our village, whether we are teens in

Africa or adults in the United States. The IOM report's characterization of public health advocated for just such a social enterprise and stands as a bold philosophical statement of mission and purpose.

The IOM report also sought to define the boundaries of public health by identifying three core functions of public health: assessment, policy development, and assurance. In one sense, these functions are comparable to those generally ascribed to the medical care system involving diagnosis and treatment. Assessment is the analogue of diagnosis, except that the diagnosis, or problem identification, is made for a group or population of individuals. Similarly, assurance is analogous to treatment and implies that the necessary remedies or interventions are put into place. Finally, policy development is an intermediate role of collectively deciding which remedies or interventions are most appropriate for the problems identified (the formulation of a treatment plan is the medical system's analogue). These core functions broadly describe what public health does (as opposed to what it is) and are examined more thoroughly in Chapters 5 and 6.

The concepts embedded in the IOM definition are also reflected in Winslow's definition, developed nearly a century ago. His definition describes both what public health does and how this gets done. It is a comprehensive definition that has stood the test of time in characterizing public health as

The science and art of preventing disease, prolonging life, and promoting health and efficiency through organized community effort for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and for the development of the social machinery to insure everyone a standard of living adequate for the maintenance of health, so organizing these benefits as to enable every citizen to realize his birthright of health and longevity.<sup>9</sup>

There is much to consider in Winslow's definition. The phrases "science and art," "organized community effort," and "birthright of health and longevity" capture the substance and aims of public health. Winslow's catalog of methods illuminates the scope of the endeavor, embracing public health's initial targeting of infectious and environmental risks, as well as current activities related to the organization, financing, and accountability of medical care services. His allusion to the "social machinery to insure everyone a standard of living adequate for the maintenance of health" speaks to the relationship between social conditions and health in all societies.

There have been many other attempts to define public health, although these have received less attention than either the Winslow or IOM definitions. Several build on the observation that, over time, public health activities reflect the interaction of disease with two other phenomena that can be roughly characterized as science and social values: what do we know and what do we choose to do with that knowledge?

A prominent British industrialist, Geoffrey Vickers, provided an interesting addition to this mix a half century ago while serving as secretary of the

Medical Research Council. In identifying the forces that set the agenda for public health, Vickers noted, "The landmarks of political, economic, and social history are the moments when some condition passed from the category of the given into the category of the intolerable. I believe that the history of public health might well be written as a record of successive re-definings of the unacceptable."<sup>10</sup>

The usefulness of Vickers' formulation lies in its focus on the delicate and shifting interface between science and social values. Through this lens, we can view a tracing of public health over history, facilitating an understanding of why and how different societies have reacted to health risks differently at various points in time and space. In this light, the history of public health is one of blending knowledge with social values to shape responses to problems that require collective action after they have crossed the boundary from the acceptable to the unacceptable.

Each of these definitions offers important insights into what public health is and what it does. Individually and collectively, they describe a social enterprise that is both important and unique, as we see in the sections that follow.

## **PUBLIC HEALTH AS A SYSTEM**

So what is public health? Maybe no single answer will satisfy everyone. There are, in fact, several views of public health that must be considered. One or more of them may be apparent to the inquirer. The public health described in this chapter is a broad social enterprise, more akin to a movement, that seeks to extend the benefits of current knowledge in ways that will have the maximum impact on the health status of a population. It does so by identifying problems that call for collective action to protect, promote, and improve health, primarily through preventive strategies. This public health is unique in its interdisciplinary approach and methods, its emphasis on preventive strategies, its linkage with government and political decision making, and its dynamic adaptation to new problems placed on its agenda. Above all else, it is a collective effort to identify and address the unacceptable realities that result in preventable and avoidable health and quality of life outcomes, and it is the composite of efforts and activities that are carried out by people and organizations committed to these ends.

With this broad view of public health as a social enterprise, the question shifts from what public health is to what these other images of public health represent and how they relate to each other. To understand these separate images of public health, a conceptual model would be useful. Surprisingly, an understandable and useful framework to tie these pieces together has been lacking. Other enterprises have found ways to describe their complex systems, and from what appears to be an industrial production model, we can begin to look at the various components of our public health system.

This framework brings together the mission and functions of public health in relationship to the inputs, processes, outputs, and outcomes of the system. Table 1-4 provides general descriptions for the terms used in this framework. It is sometimes easier to appreciate this model when a more familiar industry, such as the automobile industry, is used as an example.

**Table 1-4** Dimensions of the Public Health System**Capacity (Inputs):**

- The resources and relationships necessary to carry out the core functions and essential services of public health (e.g., human resources, information resources, fiscal and physical resources, and appropriate relationships among the system components)

**Process (Practices and Outputs):**

- Those collective practices or processes that are necessary and sufficient to assure that the core functions and essential services of public health are being carried out effectively, including the key processes that identify and address health problems and their causative factors and the interventions intended to prevent death, disease, and disability and to promote quality of life

**Outcomes (Results):**

- Indicators of health status, risk reduction, and quality-of-life enhancement outcomes are long-term objectives that define optimal, measurable future levels of health status; maximum acceptable levels of disease, injury, or dysfunction; or prevalence of risk factors

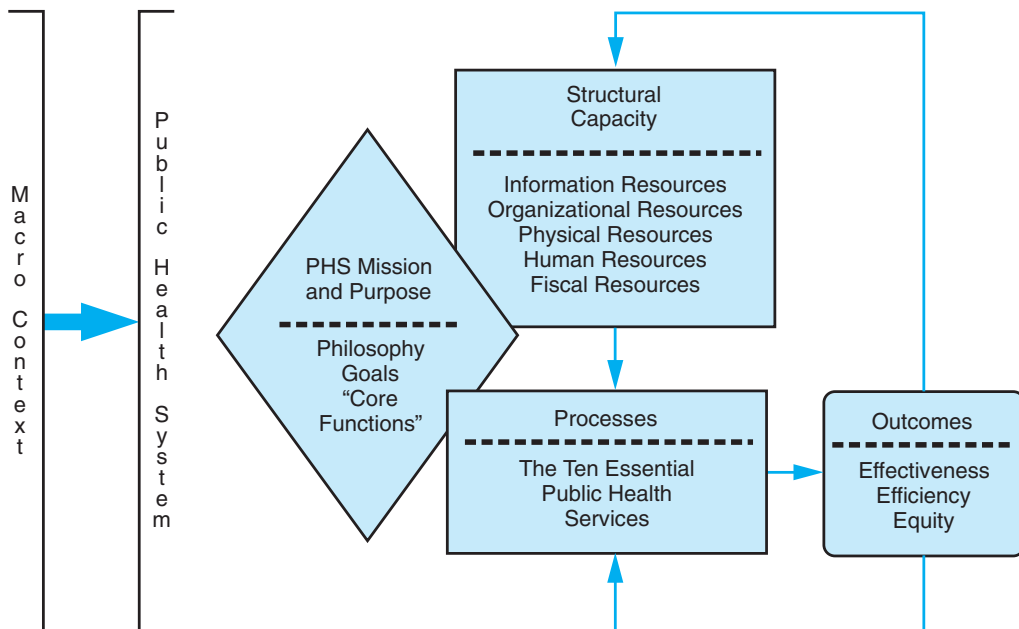
*Source:* Adapted from Centers for Disease Control and Prevention, Public Health Program Office, 1990.

The mission or purpose might be expressed as meeting the personal transportation needs of the population. This industry carries out its mission by providing passenger cars to its customers; this characterizes its function. In this light, we can now examine the inputs, processes, outputs, and outcomes of the system set up to carry out this function. Inputs would include steel, rubber, plastic, and so forth, as well as the workers, know-how, technology, facilities, machinery, and support services necessary to allow the raw materials to become automobiles. The key processes necessary to carry out the primary function might be characterized as designing cars, making or acquiring parts, assembling parts into automobiles, moving cars to dealers, and selling and servicing cars after purchase. No doubt this is an incomplete listing of this industry's processes; it is oversimplified here to make the point. In any event, these processes translate the abstract concept of getting cars to people into the operational steps necessary to carry out this basic function. The outputs of these processes are cars located where people can purchase them. The outcomes include satisfied customers and company profits.

Applying this same general framework to the public health system is also possible but may not be so obvious to the general public. The mission and functions of public health are well described in the IOM report's framework. The core functions of assessment, policy development, and assurance are considerably more abstract functions than making cars but can still be made operational through descriptions of their key steps or practices.<sup>11,12</sup> The inputs of the public health system include its human, organizational, informational, fiscal, and other resources. These resources and relationships are structured to carry out public health's core functions through a variety of processes that can also be termed essential public health practices or services. These processes include a variety of interventions that result from some of the more basic

processes of assessing health needs and planning effective strategies.<sup>13</sup> These outputs or interventions are intended to produce the desired results, which, with public health, might well be characterized as health or quality-of-life outcomes. Figure 1-2 illustrates these relationships.

In this model, not all components are as readily understandable and measurable as others. Several of the inputs are easily counted or measured, including human, fiscal, and organizational resources. Outputs are also generally easy to recognize and count (e.g., prenatal care programs, number of immunizations provided, health messages on the dangers of tobacco). Health outcomes are also readily understood in terms of mortality, morbidity, functional disability, time lost from work or school, and even more sophisticated measures, such as years of potential life lost and quality-of-life years lost. At an aggregate level, outcomes reflect how effective the system is (improved population health status), how equitable it is (eliminating or reducing disparities among segments of the population), and how efficiently (or cost beneficially) the system performs. The elements that are most difficult to understand and visualize are the processes or essential services of the public health system. Although this is an evolving field, there have been efforts to characterize these operational aspects of public health. By such efforts, we are better able to understand public health practice, to measure it, and to relate it to its outputs and outcomes. A national work group was assembled by the U.S. Public Health Service in 1994 in an attempt to develop a consensus statement of what public health is and does in language understandable to those both



**Figure 1-2** Conceptual framework of the public health system as a basis for measuring system performance. *Source:* From Handler A, Issel LM, Turnock BJ. A conceptual framework to measure performance of the public health system. *Am J Public Health.* 2001;91(8):1235–1239. © 2001, American Public Health Association.

inside and outside the field of public health. Table 1-5 presents the result of that process in a statement entitled “Public Health in America.”<sup>14</sup> The conceptual framework identified in Figure 1-2 and the narrative representation in the “Public Health in America” statement are useful models for understanding the public health system and how it works, as we see throughout this text.

This framework attempts to bridge the gap between what public health is, what it does (purpose/mission and functions, Figure 1-2), and how it does what it does (through its capacity, processes, and outcomes). It also allows us to examine the various components of the system so that we can better appreciate how the pieces fit together. Subsequent chapters refer back to this model as the capacity, processes, and outcomes of the public health system are examined in greater depth.

**Table 1-5** Public Health in America

<p>Vision: <i>Healthy People in Healthy Communities</i></p> <p>Mission: <i>Promote Physical and Mental Health and Prevent Disease, Injury, and Disability</i></p>
<p><i>Public Health</i></p> <ul style="list-style-type: none"> <li>• Prevents epidemics and the spread of disease</li> <li>• Protects against environmental hazards</li> <li>• Prevents injuries</li> <li>• Promotes and encourages healthy behaviors</li> <li>• Responds to disasters and assists communities in recovery</li> <li>• Assures the quality and accessibility of health services</li> </ul>
<p><i>Essential Public Health Services</i></p> <ul style="list-style-type: none"> <li>• Monitor health status to identify community health problems</li> <li>• Diagnose and investigate health problems and health hazards in the community</li> <li>• Inform, educate, and empower people about health issues</li> <li>• Mobilize community partnerships to identify and solve health problems</li> <li>• Develop policies and plans that support individual and community health efforts</li> <li>• Enforce laws and regulations that protect health and ensure safety</li> <li>• Link people with needed personal health services and assure the provision of health care when otherwise unavailable</li> <li>• Assure a competent public health and personal healthcare workforce</li> <li>• Evaluate effectiveness, accessibility, and quality of personal and population-based health services</li> <li>• Research for new insights and innovative solutions to health problems</li> </ul>
<p><i>Source:</i> From Essential Public Health Services Working Group of the Core Public Health Functions Steering Committee, U.S. Public Health Service, 1994.</p>

**Table 1-6** Selected Unique Features of Public Health

- Basis in social justice philosophy
- Inherently political nature
- Dynamic, ever-expanding agenda
- Link with government
- Grounding in the sciences
- Use of prevention as a prime strategy
- Uncommon culture and bond

## UNIQUE FEATURES OF PUBLIC HEALTH

Several unique features of public health individually and collectively serve to make understanding and appreciation of this enterprise difficult (Table 1-6). These include the underlying social justice philosophy of public health; its inherently political nature; its ever-expanding agenda, with new problems and issues being assigned over time; its link with government; its grounding in a broad base of biologic, physical, quantitative, social, and behavioral sciences; its focus on prevention as a prime intervention strategy; and the unique bond and sense of mission that links its proponents.

### Social Justice Philosophy

It is vital to recognize the social justice orientation of public health and even more critical to understand the potential for conflict and confrontation that it generates. Social justice is the foundation of public health. The concept first emerged around 1848, a time that might be considered the birth of modern public health. Social justice argues that public health is properly a public matter and that its results in terms of death, disease, health, and well-being reflect the decisions and actions that a society makes, for good or for ill.<sup>15</sup> Justice is an abstract concept that determines how each member of a society is allocated his or her fair share of collective burdens and benefits. Societal benefits to be distributed may include happiness, income, or social status. Burdens include restrictions of individual action and taxation. Justice dictates that there is fairness in the distribution of benefits and burdens; injustices occur when persons are denied some benefit to which they are entitled or when some burden is imposed unduly. If access to health services, or even health itself, is considered to be a societal benefit (or if poor health is considered to be a burden), the links between the concepts of justice and public health become clear. Market justice and social justice represent two forms of modern justice.

Market justice emphasizes personal responsibility as the basis for distributing burdens and benefits. Other than respecting the basic rights of others,

individuals are responsible primarily for their own actions and are free from collective obligations. Individual rights are highly valued, whereas collective responsibilities are minimized. In terms of health, individuals assume primary responsibility for their own health. There is little expectation that society should act to protect or promote the health of its members beyond addressing risks that cannot be controlled through individual action.

Social justice argues that significant factors within the society impede the fair distribution of benefits and burdens.<sup>16</sup> Examples of such impediments include social class distinctions, heredity, racism, and ethicism. Collective action, often leading to the assumption of additional burdens, is necessary to neutralize or overcome those impediments. In the case of public health, the goal of extending the potential benefits of the physical and behavioral sciences to all groups in the society, especially when the burden of disease and ill health within that society is unequally distributed, is largely based on principles of social justice. It is clear that many modern public health (and other public policy) problems disproportionately affect some groups, usually a minority of the population, more than others. As a result, their resolution requires collective actions in which those less affected take on greater burdens, while not commensurately benefiting from those actions. When the necessary collective actions are not taken, even the most important public policy problems remain unsolved, despite periodically becoming highly visible.<sup>16</sup> This scenario reflects responses to such intractable American problems as inadequate housing, poor public education systems, unemployment, racial discrimination, and poverty; however, it is also true for public health problems such as tobacco-related illnesses, infant mortality, substance abuse, mental health services, long-term care, and environmental pollution. The failure to effect comprehensive national health reform in 1994 is an example of this phenomenon. At that time, middle-class Americans deemed the modest price tag of health reform to be excessive, refusing to pay more out of their own pockets when they perceived that their own access and services were not likely to improve. The bitter political conflict accompanying the enactment of national health reform legislation in 2010 further illustrated these sentiments.

These and similar examples suggest that a critical challenge for public health as a social enterprise lies in overcoming the social and ethical barriers that prevent us from doing more with the tools already available to us.<sup>16</sup> Extending the frontiers of science and knowledge may not be as useful for improving public health as shifting the collective values of our society to act on what we already know. Recent public health successes, such as public attitudes toward smoking in both public and private locations and operating motor vehicles after alcohol consumption, provide evidence in support of this assertion. These advances came through changes in social norms, rather than through bigger and better science.

### **Inherently Political Nature**

The social justice underpinnings of public health serve to stimulate political conflict. Public health is both public and political in nature. It serves populations, which are composites of many different communities, cultures, and values. Politics allows for issues to be considered, negotiated, and finally



determined for populations. At the core of political processes are differing values and perspectives as to both the ends to be achieved and the means for achieving those ends. Advocating causes and agitating various segments of society to identify and address unacceptable conditions that adversely affect health status often lead to increased expectations and demands on society, generally through government. As a result, public health advocates appear at times as antigovernment and anti-institutional. Governmental public health agencies seeking to serve the interests of both government and public health are frequently caught in the middle. This creates tensions and conflict that can put these agencies at odds with governmental leaders on the one hand and external public health advocates on the other.

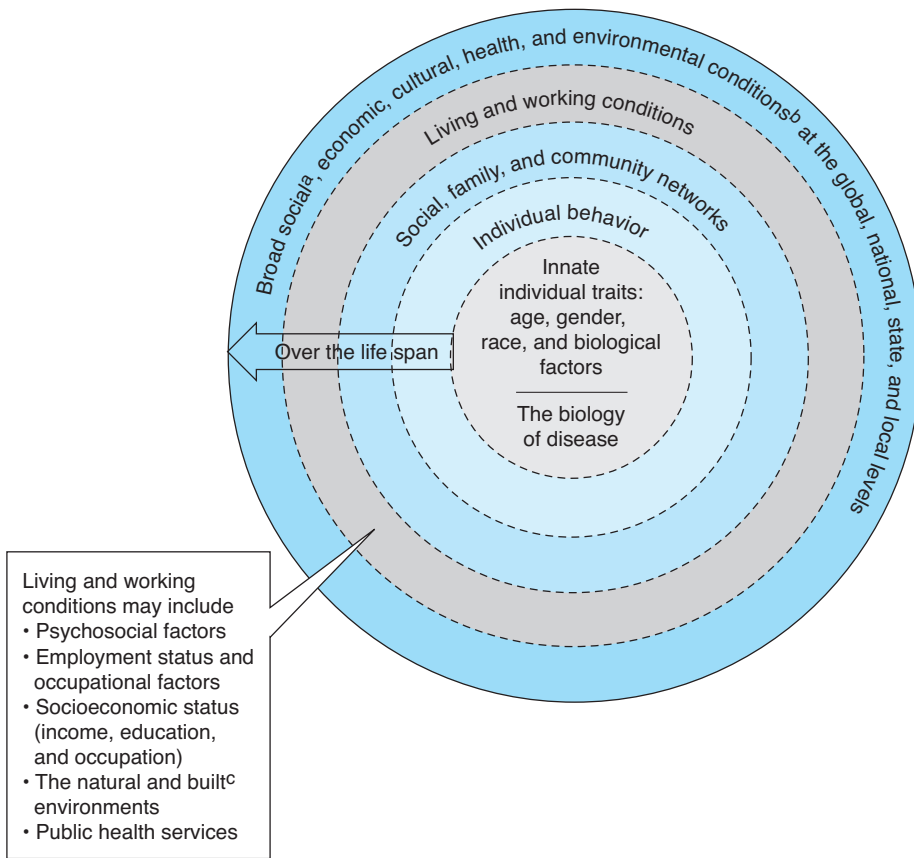
### **Expanding Agenda**

A third unique feature of public health is its broad and ever-increasing scope. Traditional domains of public health interest include biology, environment, lifestyle, and health service organization. Within each of these domains are many factors that affect health status; in recent decades, many new public policy problems have been moved onto the public health agenda as their predisposing factors have been identified and found to fall into one or more of these domains. A multilevel, multidimensional view of health, often termed an ecological model of health (Figure 1-3), has emerged to guide public health practice. Chapter 2 examines this model in some depth.

The assignment of new problems to the public health agenda is an interesting phenomenon. For example, before 1900, the primary problems addressed by public health were infectious diseases and related environmental risks. After 1900, the focus expanded to include problems and needs of children and mothers to be addressed through health education and maternal and child health services as public sentiment over the health and safety of children increased. In the middle of the century, chronic disease prevention and medical care fell into public health's realm as an epidemiologic revolution began to identify causative agents for chronic diseases and links between use of health services and health outcomes. Later, substance abuse, mental illness, teen pregnancy, long-term care, and other issues fell to public health, as did several emerging problems, most notably the epidemics of violence and HIV infections, including acquired immune deficiency syndrome (AIDS). The public health agenda expanded even further as a result of the recent national dialogue over health reform and how health services will be organized and managed. Bioterrorism preparedness is an even more recent addition to this agenda amid heightened concerns and expectations after the events of September 11, 2001, and the anthrax attacks the following month.

### **Link with Government**

A fourth unique facet of public health is its link with government. Although public health is far more than the activities of federal, state, and local health departments, many people think only of governmental public health agencies when they think of public health. Government does play a unique role in seeing that the key elements are in place and that public



**Figure 1-3** A guide to thinking about the determinants of population health.

*Notes:* Adapted from Dahlgren and Whitehead, 1991. The dashed lines between levels of the model denote interaction effects between and among the various levels of health determinants (Worthman, 1999).

- a. Social conditions include, but are not limited to: economic inequality, urbanization, mobility, cultural values, attitudes, and policies related to discrimination and intolerance on the basis of race, gender, and other differences.
- b. Other conditions at the national level might include major sociopolitical shifts, such as recession, war, and governmental collapse.
- c. The built environment includes transportation, water and sanitation, housing, and other dimensions of urban planning.

*Source:* From The Committee on Assuring the Health of the Public in the 21st Century, Institute of Medicine. *The Future of the Public's Health in the 21st Century*. Washington, DC: National Academy Press; 2003. Reprinted with permission, copyright 2003, National Academy of Sciences.

health's mission gets addressed. Only government can exercise the enforcement provisions of our public policies that limit the personal and property rights of individuals and corporations in areas such as retail food establishments, sewage and water systems, occupational health and safety, consumer product safety, infectious disease control, and drug efficacy and safety. Gov-

ernment also can play the convener and facilitator role for identifying and prioritizing health problems that might be addressed through public resources and actions. These roles derive from the underlying principle of beneficence, in that government exists to improve the well-being of its members. Beneficence often involves a balance between maximizing benefits and minimizing harms on the one hand and doing no harm on the other.

Two general strategies are available for governmental efforts to influence public health. At the broadest level, governments can modify public policies that influence health through social and environmental conditions, such as policies for education, employment, housing, public safety, child welfare, pollution control, workplace safety, and family support. In line with the IOM report's definition of public health, these actions seek to ensure conditions in which people can be healthy. Another strategy of government is to provide directly the programs and services that are designed to meet the health needs of the population. It is often easier to garner support for relatively small-scale programs directed toward a specific problem (such as tuberculosis or HIV infections) than to achieve consensus around broader health and social issues. This strategy is basically a "command-and-control" approach, in which government attempts to increase access to and use of services largely through deployment of its own resources rather than through working with others. A variation of this strategy for government is to ensure access to healthcare services through public financing approaches (Medicare and Medicaid are prime examples) or through specialized delivery systems (such as the Veterans Administration facilities, the Indian Health Service, and federally funded community health centers).

Whereas the United States has generally opted for the latter of these strategies, other countries have acted to place greater emphasis on broader social policies. Both the overall level of investment for and relative emphasis between these strategies contribute to the widely varying results achieved in terms of health status indicators among different nations (discussed in Chapter 2).

Many factors dictate the approaches used by a specific government at any point in time. These factors include history, culture, the structure of the government in question, and current social circumstances. There are also several underlying motivations that support government intervention. For paternalistic reasons, governments may act to control or restrict the liberties of individuals to benefit a group, whether or not that group seeks these benefits. For utilitarian reasons, governments intervene because of the perception that the state as a whole will benefit in some important way. For equality considerations, governments act to ensure that benefits and burdens are equally distributed among individuals. For equity considerations, governments justify interventions in order to distribute the benefits of society in proportion to need. These motivations reflect the views of each society as to whether health itself or merely access to health services is to be considered a right of individuals and populations within that society. Many societies, including the United States, act through government to ensure equal access to a broad array of preventive and treatment services. Equity in health status for all groups within the society may not be an explicit aspiration, however, even where efforts are in place to ensure equality in access. Even more important for achieving equity in health status are concerted efforts to improve health status in population groups with the greatest disadvan-

tage, mechanisms to monitor health status and contributing factors across all population groups, and participation of disadvantaged population groups in the key political decision-making processes within the society.<sup>17</sup> To the extent that equity in health status among all population groups does not guide actions of a society's government, these other elements will be only marginally effective.

As noted previously, the link between government and public health makes for a particularly precarious situation for governmental public health agencies. The conflicting value systems of public health and the wider community generally translate into public health agencies having to document their failure in order to make progress. It is said that only the squeaky wheel gets the grease; in public health, it often takes an outbreak, disaster, or other tragedy to demonstrate public health's value. Since 1985, increased funding for basic public health protection programs quickly followed outbreaks related to bacteria-contaminated milk in Illinois, tainted hamburgers in Washington State, and contaminated public water supplies in Milwaukee. Following concerns over preparedness of public health agencies to deal with bioterrorism and other public health threats, a massive infusion of federal funding occurred.

The assumption and delegation of public health responsibilities are quite complex in the United States, with different patterns in each of the 50 states (described in Chapter 4). Over recent decades, the concept of a governmental presence in health has emerged and gained widespread acceptance within the public health community. This concept characterizes the role of local government, often, but not necessarily always, operating through its official health agencies, which serve as the residual guarantors that needed services will actually be there when needed. In practice it means that, no matter how duties are assigned locally, there is a presence that ensures that health needs are identified and considered for collective action. We return to this concept and how it is operationalized in Chapters 4, 5, and 6.

## Grounded in Science

One of the most unique aspects of public health—and one that continues to separate public health from many other social movements—is its grounding in science.<sup>18</sup> This relationship is clear for the medical and physical sciences that govern our understanding of the biologic aspects of humans, microorganisms, and vectors, as well as the risks present in our physical environments; however, it is also true for the social sciences of anthropology, sociology, and psychology that affect our understanding of human culture and behaviors influencing health and illness. The quantitative sciences of epidemiology and biostatistics remain essential tools and methods of public health practice. Often five basic sciences of public health are identified: epidemiology, biostatistics, environmental science, management sciences, and behavioral sciences. These constitute the core education of public health professionals.

The importance of a solid and diverse scientific base is both a strength and weakness of public health. Surely there is no substitute for science in the modern world. The public remains curiously attracted to scientific advances, at least in the physical and biologic sciences, and this base is important to market and promote public health interventions. For many years, epidemiology

has been touted as the basic science of public health practice, suggesting that public health itself is applied epidemiology. Modern public health thinking views epidemiology less as the basic science of public health than as one of many contributors to a complex undertaking. In recent decades, knowledge from the social sciences has greatly enriched and supplemented the physical and biologic sciences. Yet these are areas less familiar to and perhaps less well appreciated by the public, making it difficult to garner public support for newer, more behaviorally mediated public health interventions. The old image of public health based on the scientific principles of environmental sanitation and communicable disease control is being superseded by a new image of public health approaches more grounded in what the public perceives to be “softer” science. This transition, at least temporarily, threatens public understanding and confidence in public health and its methods.

### **Focus on Prevention**

If public health professionals were pressed to provide a one-word synonym for public health, the most frequent response would probably be prevention. In general, prevention characterizes actions that are taken to reduce the possibility that something will happen or in hopes of minimizing the damage that may occur if it does happen. Prevention is a widely appreciated and valued concept that is best understood when its object is identified. Although prevention is considered by many to be the purpose of public health, the specific intentions of prevention can vary greatly. Prevention can be aimed at deaths, hospital admissions, days lost from school, consumption of human and fiscal resources, and many other ends. There are as many targets for prevention as there are various health outcomes and effects to be avoided.

Prevention efforts often lack a clear constituency because success results in unseen consequences. Because these consequences are unseen, people are less likely to develop an attachment for or support of the efforts preventing them. Advocates for such causes as mental health services, care for individuals with developmental disabilities, and organ transplants often make their presence felt; however, few state capitols have seen candlelight demonstrations by thousands of people who did not get diphtheria. This invisible constituency for prevention is partly a result of the interdisciplinary nature of public health. With no predominant discipline, it is even more difficult for people to understand and appreciate the work of public health. From one perspective, the undervaluation of public health is understandable; the majority of the beneficiaries of recent and current public health prevention efforts have not yet been born! Despite its lack of recognition, prevention as a strategy has been remarkably successful and appears to offer great potential for future success, as well. Chapter 3 in particular explores this potential in greater depth.

### **Uncommon Culture**

The final unique feature of public health to be discussed here appears to be both a strength and weakness. The tie that binds public health professionals is neither a common preparation through education and training nor a

common set of work experiences and work settings. Public health is unique in that the common link is a set of intended outcomes toward which many different sciences, strategies, and methods can contribute. As a result, public health professionals include anthropologists, sociologists, psychologists, physicians, nurses, nutritionists, lawyers, economists, political scientists, social workers, laboratorians, managers, sanitarians, engineers, epidemiologists, biostatisticians, gerontologists, disability specialists, and dozens of other professions and disciplines. All are bound to common ends, and all employ somewhat different perspectives from their diverse education, training, and work experiences. “Whatever it takes to get the job done” is the theme, suggesting that the basic task is one of problem solving around health issues. This aspect of public health is the foundation for strategies and methods that rely heavily on collaborations and partnerships.

This multidisciplinary and interdisciplinary approach is unique among professions, calling into question whether public health is really a profession at all. There are several strong arguments that public health is not a profession. There is no minimum credential or training that distinguishes public health professionals from either other professionals or nonprofessionals. Only a tiny proportion of those who work in organizations dedicated to improving the health of the public possess one of the academic public health degrees (the master’s of public health degree and several other master’s and doctoral degrees granted by schools of public health and other institutions). With the vast majority of public health workers not formally trained in public health, it is difficult to characterize its workforce as a profession. In many respects, it is more reasonable to view public health as a movement than as a profession.

## VALUE OF PUBLIC HEALTH

How can we measure the value of public health efforts? This question is addressed both directly and indirectly throughout this text. Chapters 2 and 3 examine the dimensions of public health’s value in terms of lives saved and diseases prevented, as well as in dollars and cents. Nonetheless, some initial information will set the stage for greater detail later.

Public opinion polls conducted in recent years suggest that public health is highly valued in the United States.<sup>19</sup> The overwhelming majority of the public rated a variety of key public health services as “very important.”

- Ninety-one percent of all adults believe that prevention of the spread of infectious diseases such as tuberculosis, measles, flu, and AIDS is very important.
- Eighty-eight percent also believe that conducting research into the causes and prevention of disease is very important.
- Eighty-seven percent believe that immunization to prevent diseases is very important.
- Eighty-six percent believe that ensuring that people are not exposed to unsafe water, air pollution, or toxic waste is very important.
- Eighty-five percent believe that it is very important to work to reduce death and injuries from violence.

- Sixty-eight percent believe that it is important to encourage people to live healthier lifestyles, to eat well, and not to smoke.
- Sixty-six percent believe that it is important to work to reduce death and injuries from accidents at work, in the home, and on the streets.

In a related poll conducted in 1999, the Pew Charitable Trusts found that 46% of all Americans thought that “public health/protecting populations from disease” was more important than “medicine/treating people who are sick.” Almost 30% thought medicine was more important than public health; 22% said both were equally important, and 3% had no opinion. Public opinion surveys suggest that public health’s contributions to health and quality of life have not gone unnoticed. Other assessments of the value of public health support this contention.

In 1965, McKeown concluded, “Health has advanced significantly only since the late 18th century and until recently owed little to medical advances.”<sup>20</sup> This conclusion is bolstered by more recent studies finding that public health’s prevention efforts are responsible for 25 years of the nearly 30-year improvement in life expectancy at birth in the United States since 1900. This bold claim is based on evidence that only 5.2 years of the 30-year improvement are the result of medical care.<sup>21</sup> Of these 5.2 years, medical treatment accounts for 3.7 years, and clinical preventive services (such as immunizations and screening tests) account for 1.5 years. The remaining 25 years have resulted largely from prevention efforts in the form of social policies, community actions, and personal decisions. Many of these decisions and actions targeted infectious diseases affecting infants and children early in the 20th century. Later in that century, gains in life expectancy have also been achieved through reductions in chronic diseases affecting adults, including cardiovascular disease. A study of life years gained from modern coronary heart disease treatments and changes in population risk factors in England and Wales from 1981 to 2000 concluded that 79% of the increase in life years gained was attributed to reductions in major risk factors. Only 21% of the life years gained could be attributed to medical and surgical treatments of coronary heart disease.<sup>22</sup>

Many notable public health achievements occurred during the 20th century (Table 1-7). This text spotlights many of these achievements to illustrate the value of public health to American society in the 21st century by telling the story of its accomplishments in the preceding century. The first of these chronicles the prevention and control of infectious diseases in 20th-century America (see the Public Health Spotlight on the Control of Infectious Diseases, which appears at the end of this chapter).

The value of public health in our society can be described in human terms as well as by public opinion, statistics of infections prevented, and values in dollars and cents. A poignant example dates from the 1950s, when the United States was in the midst of a terrorizing polio epidemic (Table 1-8). Few communities were spared during the periodic onslaughts of this serious disease during the first half of the 20th century in America. Public fear was so great that public libraries, community swimming pools, and other group activities were closed during the summers when the disease was most feared.

**Table 1-7** Ten Great Public Health Achievements—United States, 1900–1999

1. Vaccination
2. Motor-vehicle safety
3. Safer workplaces
4. Control of infectious diseases
5. Decline in deaths from coronary heart disease and stroke
6. Safer and healthier foods
7. Healthier mothers and babies
8. Family planning
9. Fluoridation of drinking water
10. Recognition of tobacco use as a health hazard

Source: Data from Centers for Disease Control and Prevention. Ten great public health achievements—United States, 1900–1999. *MMWR*. 1999;48:241–243.

**Table 1-8** The Value of Public Health: Fear of Polio, United States, 1950s

“I can remember no experience more horrifying than watching by the bedside of my five-year-old stricken with polio. The disease attacked his right leg, and we watched helplessly as his limb steadily weakened. On the third day, the doctor told us that he would survive and that paralysis was the worst he would suffer. I was grateful, although I continued to agonize about whether my wife and unborn child would be affected. What a blessing that no other parent will have to endure the terror that my wife and I and thousands of others shared that August.”

—Morton Chapman, Sarasota, Florida

Source: From U.S. Public Health Service. *For a Healthy Nation: Returns on Investment in Public Health*. Washington, DC: Public Health Service; 1994.

Biomedical research had discovered a possible weapon against epidemic polio in the form of the Salk vaccine, however, which was developed in 1954 and licensed for use 1 year later. A massive and unprecedented campaign to immunize the public was quickly undertaken, setting the stage for a triumph of public health. The real triumph came in a way that might not have been expected, however, because soon into the campaign, isolated reports of vaccine-induced polio were identified in Chicago and California. Within 2 days of the initial case reports, action by governmental public health organizations at all levels resulted in the determination that these cases could be traced to one particular manufacturer. This determination was made only a few hours before the same vaccine was to be provided to hundreds of thousands of California children. The result was prevention of a disaster and rescue of the credibility of an immunization campaign that has virtually cut this disease off at its knees. The campaign proceeded on schedule, and 5 decades later, wild poliovirus has been eradicated from the Western hemisphere.



Similar examples have occurred throughout history. The battle against diphtheria is a case in point. A major cause of death in 1900, diphtheria infections are virtually unheard of today. This achievement cannot be traced solely to advances in bacteriology and the antitoxins and immunizations that were deployed against this disease. Neither was it defeated by brilliant political and programmatic initiatives led by public health experts. It was the confluence of scientific advances and public perception of the disease itself that resulted in diphtheria's demise as a threat to entire populations. These forces shaped public health policies and the effectiveness of intervention strategies. In the end, diphtheria made some practices and politics possible, whereas it constrained others.<sup>23</sup> The story is one of science, social values, and public health.

## CONCLUSION

Public health evokes different images for different people, and even to the same people, it can mean different things in different contexts. The intent of this chapter has been to describe some of the common perceptions of public health in the United States. Is it a complex, dynamic, social enterprise, akin to a movement? Or is it best characterized as a goal of the improved health outcomes and health status that can be achieved by the work of all of us, individually and collectively? Or is public health some collection of activities that move us ever closer toward our aspirations? Or is it the profession that includes all of those dedicated to its cause? Or is public health merely what we see coming out of our official governmental health agencies—a strange mix of safety-net medical services for the poor and a variety of often-invisible community prevention services?

Although it is tempting to consider expunging the term public health from our vocabularies because of the baggage associated with these various images, this would do little to address the obstacles to accomplishing our central task because public health encompasses all of these images and perhaps more!

Based on principles of social justice, inherently political in its processes, addressing a constantly expanding agenda of problems, inextricably linked with government, grounded in science, emphasizing preventive strategies, and with a workforce bound by common aspirations, public health is unique in many ways. Its value, however, transcends its uniqueness. Public health efforts have been major contributors to recent improvements in health status and can contribute even more as we approach a new century with new challenges.

By carefully examining the various dimensions of the public health system in terms of its inputs, practices, outputs, and outcomes, we can gain insights into what it does, how it works, and how it can be improved. Better results do not come from setting new goals; they come from understanding and improving the processes that will then produce better outputs, in turn leading to better outcomes. This theme of understanding the public health system and public health practice as a necessary step toward its improvement recurs throughout this text.

**DISCUSSION QUESTIONS AND EXERCISES**

1. What definition of public health best describes public health in the 21st century?
2. To what extent has public health contributed to improvement in health status and quality of life over history?
3. What historical phenomena are most responsible for the development of public health responses?
4. Which features of public health make it different from other fields? Which features are most unique and distinctive? Which are most important?
5. Because of your interest in a public health career, a producer working at a local television station has asked you to provide input into the development of a video explaining public health to the general public. What themes or messages would you suggest for this video? How would you propose presenting or packaging these messages?
6. There is little written in history books about public health problems and responses, suggesting that these issues have had little impact on history. Consider the European colonization of the Americas, beginning in the 16th century. How was it possible for Cortez and other European figures to overcome immense Native American cultures with millions of people? What role, if any, did public health themes and issues play?
7. Choose a relatively recent (within the last 3 years) occurrence/event that has drawn significant media attention to a public health issue or problem (e.g., bioterrorism, contaminated meat products, tobacco settlement, hurricane, and flooding). Have different understandings of what public health is influenced public, as well as governmental responses, to this event? If so, in what ways?
8. Review the history of public health activities in your state or community, and describe how public health strategies and interventions have changed over time in the United States. What influences were most responsible for these changes? Does this suggest that public health functions have changed over time, as well? (If no such history or time line is available, review the Public Health Spotlight on the History of Public Health in Chicago, which appears later in this chapter.)
9. Access the website of Delta Omega, the national honorary society for public health (at [www.deltaomega.org](http://www.deltaomega.org)) and select one of the public health classics that are available there. Then describe the significance of this classic in terms of the history of modern public health practice.
10. Examine each of the websites listed later here, and become familiar with their general contents. Which ones are most useful for providing information and insights related to the question “what is

public health?" Why? Are there other websites you would suggest adding to this list?

- American Public Health Association: <http://www.apha.org>
- Association of State and Territorial Health Officials: <http://www.astho.org>
- National Association of County and City Health Officials: <http://www.naccho.org>
- Public Health Foundation: <http://www.phf.org>
- U.S. Department of Health and Human Services: <http://www.dhhs.gov> and its various Public Health Service Agencies (e.g., Centers for Disease Control and Prevention, <http://www.cdc.gov>; Food and Drug Administration, <http://www.fda.gov>; Health Resources and Services Administration, <http://www.hrsa.dhhs.gov>; National Institutes of Health, <http://www.nih.gov>; and Agency for Healthcare Research and Quality, <http://www.ahrq.gov>)
- U.S. Environmental Protection Agency: <http://www.epa.gov>
- State health departments, available through the Association of State and Territorial Health Officials website at [www.astho.org](http://www.astho.org)
- Local health departments, available through the websites of state health departments, the National Association of County and City Health Officials, and other national public health organizations
- Association of Schools of Public Health (ASPH): <http://www.asph.org> and individual schools, available through the ASPH website

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## Public Health Spotlight on the History of Public Health in Chicago

*The history of public health events in Chicago tells the story of how public health responses and activities have changed over the past 175 years in the United States. What influences have been most responsible for these changes? Does this history suggest that public health functions have changed over time, as well? Consider these questions as you review this history.*

### SELECTED HISTORY OF PUBLIC HEALTH EVENTS IN CHICAGO, 1834–2003

- 1834 A temporary board of health was formed to fight the threat of cholera.
- 1835 Chicago Board of Health was established by the state legislature to secure the general health of the inhabitants because of the threat of cholera epidemic. Chicago, then a town, had an estimated 3,265 residents.
- 1837 Chicago was incorporated as a city of 4,170 residents. Three health commissioners and a health officer were named to inspect marketplaces, prepare death certificates, construct a pest house, visit persons suffering from infectious diseases in

- their homes, and board vessels in the harbor to check on the health of crews.
- 1841 Vital statistics started in a limited way with collection of data (age, gender, disease) related to deaths; an ordinance requiring reports of death was passed but not enforced for several years.
- 1846 A committee of the Chicago Medical Society reported the mortality rates through 1850.
- 1848 The first cooperative effort of the medical profession and city officials was begun to prevent the spread of smallpox as physicians volunteered to vaccinate the poor without charge.
- 1849 Cholera was brought to Chicago by the emigrant boat John Drew from New Orleans, killing 1 in 36 of the entire population. A district health officer was appointed for each city block.
- 1851 A new city charter provided greater powers in health matters to the City Council. In the mid 1850s, with the city free from smallpox and cholera, the powers of the Board of Health were reduced accordingly.
- 1855 Sewerage became an issue; the Board of Sewerage Commissioners was appointed, and the first sewers were constructed the following year. The quarantine placard was introduced with signs reading "Smallpox Here" after 30 died of the disease.
- 1857 The financial depression of 1857 caused the Board of Health to be viewed as a luxury; it was abolished, and its duties were transferred to the Police Department. A new permanent city hospital was completed at a cost of \$75,000 (later taken over by Cook County Hospital as one of its earlier buildings).
- 1862 A smallpox outbreak caused the city council to appoint a health officer to work with the police department, but severely circumscribed tenure and duties rendered the position meaningless.
- 1867 A new Board of Health was established in response to the 1866 cholera outbreak with authority independent of the city council and police department.
- 1868 A meat inspection was initiated at Union Stock Yards.
- 1869 The Board of Health required vaccination of all children.
- 1870 The first milk ordinance was instituted, making it illegal to sell skim milk unless so labeled.
- 1871 Help was given to refugees of Chicago fire; camps of homeless were inspected, and controls were initiated for food supply and epidemic prevention. Birth and death records were lost in the fire.
- 1872 In aftermath of the Great Fire, the death rate increased 32.6% to 27.6 deaths per 1,000 persons. Smallpox attacked 2,382 and killed 655. Fatalities among children under 5 years old were the highest ever recorded. (For the period 1843 to 1872, children under 5 years old accounted for half of all deaths occurring in the city.)
- 1876 The health functions of city government were reorganized under a department of health, and the Commissioner of Health position was established.

- 1877 The Commissioner of Health required the reporting of contagious diseases by physicians, a move opposed by many physicians.
- 1885 A cholera and typhoid epidemic killed 90,000 Chicagoans when a heavy storm washed sewage into Lake Michigan, the city's source of drinking water.
- 1888 The Chicago Visiting Nurse Association was founded.
- 1889 Drainage and plumbing regulations were issued, and five women inspectors of tenements were appointed.
- 1890 Garbage disposal was placed under the direction of a general sanitary officer in the health department.
- 1892 Full milk inspection started. Laws requiring reporting of communicable diseases existed; however, doctors argued that they should receive payments for reporting as they received under state law for reporting births. Without this reimbursement, many physicians refused to comply and were prosecuted.
- 1893 Bacteriological laboratory opened to conduct microscopic examinations of milk samples and examine throat cultures for diphtheria. A "Boil the Water" crusade against typhoid was conducted.
- 1893/94 The last smallpox epidemic to cause great loss of life occurred (1,033 died in its second year). Vigorous vaccination efforts (1,084,500 given) resulted in a reduction of cases to seven in 1897. During this period, the department was the first to proclaim the superiority of hermetically sealed glycerinated vaccine. Circulars distributed on hot weather care of babies were one of the first public education efforts. The health department began publishing a monthly statement of mortality.
- 1895 The first diphtheria antitoxin was issued, and a corps of antitoxin administrators was appointed. Daily analysis of the water supply was inaugurated.
- 1896 Medical school inspections were inaugurated—the second city in the United States to do so. Rules regulating the practice of midwifery were promulgated.
- 1899 A campaign against infant mortality enlisted support of a voluntary corps of 73 physicians.
- 1900 Sanitary engineers reversed the flow of the Chicago River to prevent a recurrence of epidemics, giving the city the world's only river that runs backward. Department published a study reporting that the average span of life in Chicago more than doubled in a generation.
- 1901 An ordinance was passed prohibiting spitting in public places. The health department began publishing the state of the city's health every week in the newspapers; the monthly statement of mortality was discontinued.
- 1902 The Milk Commission of Chicago was established to ensure that pasteurized milk was made available for needy children; dairy inspections were started with the salaries of two dairy inspectors

- initially paid for by the Chicago Civic Federation. Fourth of July “Don’ts” were first promulgated to prevent accidents.
- 1903 A tuberculosis committee of the Visiting Nurse Association was established; it reorganized in 1906 as the Chicago Tuberculosis Institute.
- 1905 The 39th Street intercepting sewer opened, resulting in a marked decrease in typhoid deaths.
- 1906 The city council passed an ordinance providing for the licensing and control of restaurants.
- 1907 The Chicago Tuberculosis Institute opened dispensaries for the diagnosis and treatment of tuberculosis cases.
- 1908 A full communicable disease program was inaugurated, and 100 physicians were sent to congested districts during July and August to instruct mothers in baby care. Forty nurses were loaned to the department by the Visiting Nurses Association of Chicago to help in a scarlet fever epidemic. They were so effective that the city council appropriated funds to hire the department’s first nurses to work in maternal and child welfare and communicable and venereal diseases.
- 1909 Chicago became the first city in the United States to adopt a compulsory milk pasteurization ordinance. Public health nurses from the Board of Health, Visiting Nurse Association, and United Charities collaborated to become “finders of sick infants” and referred these babies and their mothers to tent camps where treatment was provided and hygiene classes were held.
- 1910 The Municipal Social Hygiene Clinic was established, and dispensaries were required to report venereal diseases. New milk standards were applied to ice cream. Health Department nurses were assigned to conduct intensive follow-up on babies in hospital wards where infant death rates were high; the Infant Welfare Society was organized as the successor to the Milk Commission.
- 1911 Common drinking cups and common roller towels were prohibited by ordinance.
- 1912 Sterilization of Chicago’s water began, and within 4 years, the entire supply was being treated, causing a dramatic decline in the city’s typhoid fever rate—from second highest among the 20 largest U.S. cities in 1881 to the lowest by 1917.
- 1915 The Eastland, a lake excursion boat docked at the Clark Street bridge, rolled over while loaded with passengers; 812 died, 300 more than the Titanic. Dental services were provided in Chicago public schools after a 3-year introductory pilot program was funded by a local philanthropist. The Municipal Tuberculosis Sanitarium opened.
- 1916 A policy was initiated to hospitalize all cases of infantile paralysis (polio) after 34 of 254 afflicted patients died.
- 1917 The Municipal Contagious Disease Hospital was established. New health ordinances ranged from requiring the reporting

- and treatment of venereal diseases to requiring the screening of residence, stables, and barns against fleas. Immunization against diphtheria with von Behring's toxin-antitoxin started in public schools and institutions.
- 1918 Influenza became a reportable disease with the pandemic of influenza reaching Chicago, to cause 381 deaths on one day (October 17) alone.
- 1919 The department won its first case in the prosecution of landlords for failure to provide sufficient heat to tenants.
- 1920 The right of the department to quarantine carriers of contagion was upheld in the Superior Court of Cook County.
- 1922 A new health commissioner began a campaign against venereal disease, proposing education and distribution of prophylactic outfits in brothels; opposition from the medical profession was based more on moral than medical grounds.
- 1923 A committee was appointed on prenatal care in the first concerted effort to coordinate the activities of all agencies doing prenatal work in the city. Inspection of summer camps for children was inaugurated. Venereal disease clinics were established at the Cook County Jail and House of Correction.
- 1924 Venereal disease prevention literature was distributed to 500,000 homes in Chicago.
- 1925 The department instituted a regular schedule of home visits by nurses during the first 6 months of an infant's life. Conferences were inaugurated for care of preschool children. Installation of sanitary types of drinking fountains was ordered.
- 1927 The health commissioner was forced to resign when the mayor directed that the health department include political literature with information about baby care being distributed to all Chicago mothers.
- 1930 An intensive campaign against diphtheria resulted in 400,219 injections being given in 3 months.
- 1932 The staff of 300 nurses were carried throughout the city on buses to give diphtheria inoculations. Physicians were sent to the homes of mothers unable to take children to welfare stations for shots. After the campaign, cases dropped to 154 with nine deaths compared with 1,266 cases with 68 deaths the previous year.
- 1933 There is an outbreak of amebic dysentery among out-of-town guests who came to the Century of Progress (1,409 cases and 98 deaths scattered in 43 states, the Territory of Hawaii, and three Canadian provinces) in the first recognized waterborne epidemic of the disease in a civilian population. The cause was traced to water contamination through faulty plumbing.
- 1934 A plumbing survey for cross-connections in hotels and mercantile buildings was begun to prevent future amebic dysentery outbreaks. As a result of drinking from contaminated water supply at the Union Stock Yards fire on May 19, 69 persons contracted typhoid fever, 11 of whom died.



- 1935 An ordinance was passed requiring that only grade A milk and milk products could be sold in Chicago. A premature-infant welfare program was initiated. A mother's milk station started operating to supply breast milk to premature, sick, or debilitated infants whose parents could not afford this expense.
- 1936 Summer brought 210 deaths from sunstroke and exhaustion compared with 11 from the same cause in 1935. With 1,000 premature infants under supervision, two additional premature stations opened, making 31 conferences available each week.
- 1937 Chicago public schools opened 3 weeks late because of a polio scare. The Chicago Syphilis Control Project was established, with the emphasis on breaking the chain of infection.
- 1942 The Chicago Intensive Treatment Center for venereal disease launched an effort so successful that it won a War Department commendation in 1943 and recorded a declining venereal disease rate after World War II demobilization, in contrast to soaring rates in other large cities.
- 1946 The Chicago-Cook County health survey was undertaken by the U.S. Public Health Service, including an audit of all city and county facilities conducted by outside experts. Various recommendations were made, including more food inspection staff, establishment of district health centers, restructuring of the Board of Health with an executive director and deputies in charge of engineering, preventive medicine, and district health services.
- 1947 The mental health section for the health department was approved.
- 1948 A federal grant of \$46,270 was made available through the state to subsidize a psychiatric program. A comprehensive food ordinance was adopted by the city council.
- 1952 Chicago counted 1,203 cases of polio, including 82 deaths and hundreds of persons with paralysis. Frightened parents kept their youngsters out of movies and swimming pools. Beaches closed. An insect and rodent control program started.
- 1955 Chicago was one of the first cities in the United States to introduce the Salk vaccine after it was pronounced safe and effective against the polio virus on April 12.
- 1956 With warning signs of an approaching polio epidemic, mass inoculations of Salk vaccine were given in all parts of the city, with department staff working in vacant stores, garages, and street corners, from the backs of trucks, and in park field houses. Chicago took the lead among major American cities in introducing a water fluoridation program, which reduced tooth decay among children.
- 1957 The Nursing Home Section and Hospital Inspection Unit was initiated.
- 1958 A section for chronic illness was activated, with mental health as one of its activities.

- 1959 The First Community Mental Health Center started on the south side.
- 1960 The Bureau of Institutional Care consolidated nursing home and hospital inspection services.
- 1961 The Division of Adult Health and Aging began consolidating activities of chronic diseases, cardiovascular diseases, diabetes, cervical cancer, rheumatic heart fever, and nutrition. A lead poison survey began on Chicago's West Side.
- 1962 The mental health division, with more than 15 community-based mental health centers, was established in the health department.
- 1965 Family planning was initiated in limited number of clinics.
- 1966 Testing for sickle cell was initiated; citywide lead poisoning screening and treatment began.
- 1968 Planning for Comprehensive Neighborhood Health Centers in four areas began in cooperation with the Chicago Model Cities program.
- 1970 First Model Cities Neighborhood Health Center opened in Uptown. A record 1.2 million inoculations were provided for Chicago children in immunization drive.
- 1973 Englewood Neighborhood Health Center opened. Forty hospitals were approved as trauma centers in accordance with state statute on emergency medical services.
- 1974 The Women, Infant, and Children supplemental nutrition program was initiated. Senior citizen clinic and new hypertension center opened while plans were unveiled to phase out the Tuberculosis Sanitarium.
- 1975 The city council revised the municipal code to delineate the duties of the nine-member board of health as a policy making body and the department of health as the agency administering health programs and enforcing regulations. Outpatient tuberculosis services were decentralized to five health centers.
- 1976 The health department formed interdisciplinary committee on child abuse with representatives from health, law enforcement, and welfare agencies.
- 1979 The first Hispanic health commissioner was appointed.
- 1981 The Chicago Alcohol Treatment Center came under the jurisdiction of the health department, only to be closed several years later with its funding used to support community-based providers of substance abuse treatment services. The refugee health program was initiated.
- 1983 The Chicago Area AIDS Task Force was established, and the health department created the AIDS Activity Office.
- 1984 The first African American health commissioner was appointed.
- 1984 The Partnerships in Health program was initiated with hospitals to ensure continuity of care for health department patients.
- 1985 The health department sponsored the city's first major pastoral conference on religion and health.

- 1986 An infant mortality reduction strategic plan was developed.
- 1987 The first child lead poisoning death in nearly a decade led to the establishment of the Mayor's Task Force on Lead Poisoning.
- 1989 The health department coordinated development of the Chicago AIDS Strategic Plan through a multidisciplinary advisory council of 125 individuals.
- 1990 The Chicago/Cook County Health Care Summit produced a plan to improve local delivery of health services, calling for ambulatory care reforms, restructuring of inpatient care, and changes in system financing. As a result, the Chicago and Cook County Ambulatory Care Council was established to assess health needs and undertake initiatives.
- 1991 The Epidemiology Office was established in the health department.
- 1993 The first woman and nonphysician health commissioner was appointed.
- 1995 Extreme heat conditions in Chicago during July resulted in 514 heat-related deaths. The Violence Prevention Office was established.
- 1997 The city council passed the Managed Care Consumer Protection ordinance, calling for the health department to create the Office of Managed Care—the nation's first municipal effort to monitor the managed care industry.
- 1998 The health department coordinated the development of the Chicago Violence Prevention Strategic Plan, developed by more than 150 participants.
- 1999 The Chicago Turning Point Partnership convened to develop a plan to strengthen the public health infrastructure in Chicago.
- 2001 The Bioterrorism Preparedness unit was established.
- 2002 The health department received its first federal grant for bioterrorism preparedness and response.
- 2003 Chicago participated in national bioterrorism response exercise involving top officials of city, state, and federal government.

*Sources:* Data from Chicago Department of Health. *150 Years of Municipal Health Care in the City of Chicago: Board of Health, Department of Health 1835–1985*. Chicago, IL: Chicago Department of Health; 1985. Bonner TN. *Medicine in Chicago: 1850–1950*. In: *The Social and Scientific Development of a City*. Urbana, IL: University of Illinois Press; 1991. Rawlings ID. *The Rise and Fall of Disease in Illinois*. Springfield, IL: Illinois Department of Public Health; 1927.

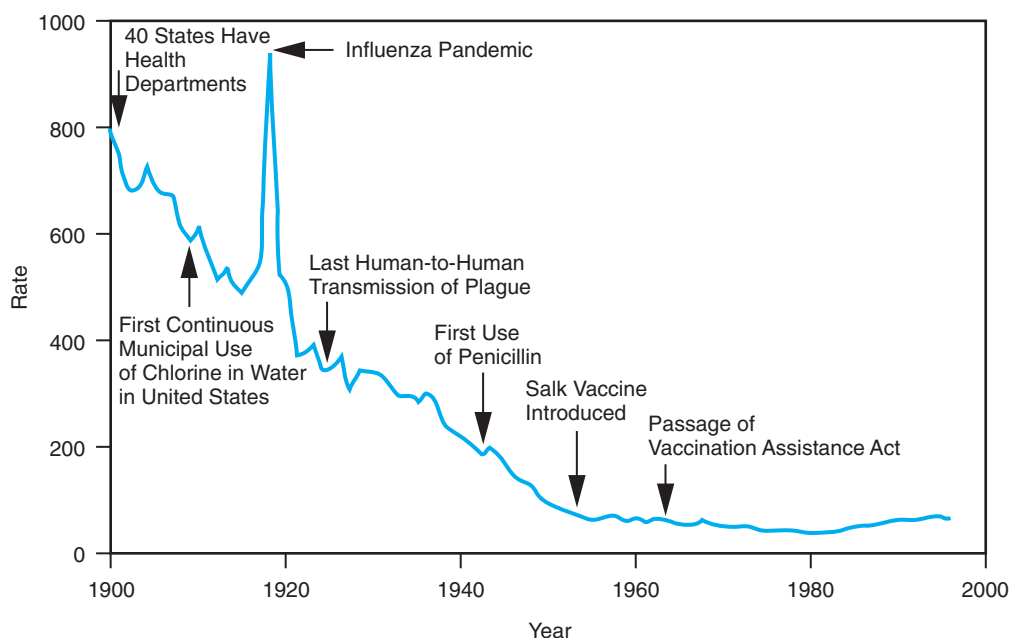
## Public Health Spotlight on the Control of Infectious Diseases

*Prior to 1900, infectious diseases represented the most serious threat to the health of populations in the United States and across the globe. The 20th century witnessed a dramatic shift in the balance of power in the centuries-long battle between humans and microorganisms. Advances in both science and social values contributed to the assault on microbes, setting into motion the forces of organized community efforts to improve the health of the public. This approach served as a model for later public health initiatives targeting other major threats to health and well-being. This Public Health Spotlight examines this achievement as well as the unfinished agenda that lies ahead in the early decades of the 21st century.*

### **PUBLIC HEALTH ACHIEVEMENTS IN 20TH CENTURY AMERICA<sup>1,2</sup>**

Before 1900, infectious diseases represented the most serious threat to the health of populations across the globe. The 20th century witnessed a dramatic shift in the balance of power in the centuries-long battle between humans and microorganisms. Changes in both science and social values contributed to the assault on microbes, setting into motion the forces of organized community efforts to improve the health of the public. This approach served as a model for later public health initiatives targeting other major threats to health and well-being.

Deaths from infectious diseases declined markedly in the United States during the 20th century (Figure 1-4). This decline contributed to a sharp drop in infant and child mortality<sup>3,4</sup> and to the 29.2-year increase in life expectancy.<sup>4</sup> In 1900, 30.4% of all deaths occurred among children less than 5 years old; in 1997, that percentage was only 1.4%. In 1900, the three leading causes of death were pneumonia, tuberculosis, and diarrhea and enteritis, which (together with diphtheria) caused one third of all deaths. Of these deaths, 40% were among children less than 5 years old.<sup>3</sup> In 1997, heart disease and cancers accounted for 54.7% of all deaths, with 4.5% attributable to pneumonia, influenza, and HIV infection.<sup>4</sup> Despite this overall progress, one of the most devastating epidemics in human history occurred during the 20th century—the 1918 influenza pandemic that resulted in 20 million deaths, including 500,000 in the United States, in less than 1 year. These total more than have died in as short a time during any war or famine in the world.<sup>5</sup> HIV infection, first recognized in 1981, has caused a pandemic that is still in progress, affecting 33 million people



**Figure 1-4** Crude death rate (per 100,000) for infectious diseases, United States, 1900–1996. *Source:* From Centers for Disease Control and Prevention. Public health achievements, United States, 1900–1999: control of infectious diseases. *MMWR*. 1999;48:621–629.

and causing an estimated 13.9 million deaths.<sup>6</sup> These episodes illustrate the volatility of infectious disease death rates and the unpredictability of disease emergence.

Public health action to control infectious diseases is based on the 19th century discovery of microorganisms as the cause of many serious diseases (e.g., cholera and tuberculosis). Disease control resulted from improvements in sanitation and hygiene, the discovery of antibiotics, and the implementation of universal childhood vaccination programs. Scientific and technologic advances played a major role in each of these areas and are the foundation for today's disease surveillance and control systems. Scientific findings also have contributed to a new understanding of the evolving relation between humans and microbes.<sup>7</sup>

At the beginning of the 20th century, infectious diseases were widely prevalent in the United States and exacted an enormous toll on the population (Table 1-9). In 1900, for example, 21,064 smallpox cases were reported, and 894 patients died.<sup>8</sup> In 1920, there were 469,924 measles cases reported, and 7,575 patients died; 147,991 diphtheria cases were reported, and 13,170 patients died. In 1922, the total number of pertussis cases reported was 107,473, and 5,099 patients died.<sup>9,10</sup>

The 19th century shift in population from country to city that accompanied industrialization and immigration led to overcrowding in

**Table 1-9** Baseline 20th Century Annual Morbidity, 2005 Morbidity, and 2010 Targets for Nine Diseases with Vaccines Recommended Before 1990 for Universal Use for Children, United States

	<i>Baseline 20th Century Annual Morbidity</i>	<i>2007 Morbidity</i>	<i>Percentage Decrease Baseline 20th Century to 2007</i>	<i>2010 Target</i>
Smallpox	48,164	0	100%	0
Diphtheria	175,885	0	100%	0
Pertussis	147,271	10,454	92.9%	2,000
Tetanus	1,314	28	97.9%	0
Poliomyelitis (paralytic)	16,316	0	100%	0
Measles	503,282	43	100%	0
Mumps	152,209	800	99.5%	0
Rubella	47,745	12	100%	0
Congenital rubella syndrome	823	0	99.9%	0
<i>Haemophilus influenzae</i> type b infection (children <5 yrs)	20,000	226	98.9%	0

*Sources:* Data from Centers for Disease Control and Prevention. Public health achievements, United States, 1900–1999: impact of vaccines universally recommended for children. *MMWR*. 1999;48: 243–248; Centers for Disease Control and Prevention. Summary of notifiable diseases, United States, 2009. *MMWR*. 2009;56(53):1–94; and U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010: Understanding and Improving Health*. Rockville, MD: ODPHP; 2000.

poor housing served by inadequate or nonexistent public water supplies and waste-disposal systems. These conditions resulted in repeated outbreaks of cholera, dysentery, tuberculosis, typhoid fever, influenza, yellow fever, and malaria.

By 1900, however, the incidence of many of these diseases had begun to decline because of public health improvements, implementation of which continued into the 20th century. Local, state, and federal efforts to improve sanitation and hygiene reinforced the concept of collective “public health” action (e.g., to prevent infection by providing clean drinking water). By 1900, of the 45 states, 40 had established health departments. The first county health departments were established in 1908.<sup>11</sup> From the 1930s through the 1950s, state and local health departments made substantial progress in disease prevention activities, including sewage disposal, water treatment, food safety, organized solid waste disposal, and public education about hygienic practices (e.g., food handling and hand washing). Chlorination and other treatments of drinking water began in the early 1900s and became widespread public health practices, further decreasing the incidence of water-borne diseases. The incidence of tuberculosis also

declined as improvements in housing reduced crowding and tuberculosis control programs were initiated. In 1900, of every 100,000 U.S. residents, 194 died from tuberculosis; most were residents of urban areas. In 1940 (before the introduction of antibiotic therapy), tuberculosis remained a leading cause of death, but the crude death rate had decreased to 46 per 100,000 persons.<sup>12</sup>

Animal and pest control also contributed to disease reduction. Nationally sponsored, state-coordinated vaccination and animal-control programs eliminated dog-to-dog transmission of rabies. Malaria, once endemic throughout the southeastern United States, was reduced to negligible levels by the late 1940s; regional mosquito-control programs played an important role in these efforts. Plague also diminished; the U.S. Marine Hospital Service (which later became the Public Health Service) led quarantine and ship inspection activities and rodent- and vector-control operations. The last major rat-associated outbreak of plague in the United States occurred during 1924 to 1925 in Los Angeles. This outbreak included the last identified instance of human-to-human transmission of plague (through inhalation of infectious respiratory droplets from coughing patients) in this country.

In 1900, few effective treatment and preventive measures existed to prevent infectious diseases. Although the first vaccine against smallpox was developed in 1796, more than 100 years later, its use had not been widespread enough to control the disease fully.<sup>13</sup> Four other vaccines—against rabies, typhoid, cholera, and plague—had been developed late in the 19th century but were not used widely by 1900.

Between 1900 and 2000, vaccines were developed or licensed against 21 other diseases.<sup>14</sup> Ten of these vaccines have been recommended for use only in selected populations at high risk because of area of residence, age, medical condition, or risk behaviors. The other 11 have been recommended for use in all U.S. children.<sup>15</sup>

During the 20th century, substantial achievements have been made in the control of many vaccine-preventable diseases. Smallpox has been eradicated. Poliomyelitis caused by wild-type viruses has been eliminated, and measles and *Haemophilus influenzae* type b invasive disease among children aged less than 5 years old have been reduced to record low numbers of cases.

National efforts to promote vaccine use among all children began with the appropriation of federal funds for polio vaccination after introduction of the vaccine in 1955.<sup>14</sup> Since then, federal, state, and local governments and public and private healthcare providers have collaborated to develop and maintain the vaccine-delivery system in the United States. Dramatic declines in morbidity have been reported for the nine vaccine-preventable diseases for which vaccination was universally recommended for use in children before 1990 (excluding hepatitis B, rotavirus, and varicella). Morbidity associated with smallpox and polio caused by wild-type viruses has declined 100% and nearly 100% for each of the other seven diseases.

Penicillin was developed into a widely available medical product that provided quick and complete treatment of previously incurable bacterial illnesses, with a wider range of targets and fewer side effects than sulfa drugs. Discovered fortuitously in 1928, penicillin was not developed for medical use until the 1940s, when it was produced in substantial quantities and used by the U.S. military to treat sick and wounded soldiers.

Technologic changes that increased capacity for detecting, diagnosing, and monitoring infectious diseases included development early in the century of serologic testing and, more recently, the development of molecular assays based on nucleic acid and antibody probes. The use of computers and electronic forms of communication enhanced the ability to gather, analyze, and disseminate disease surveillance data.

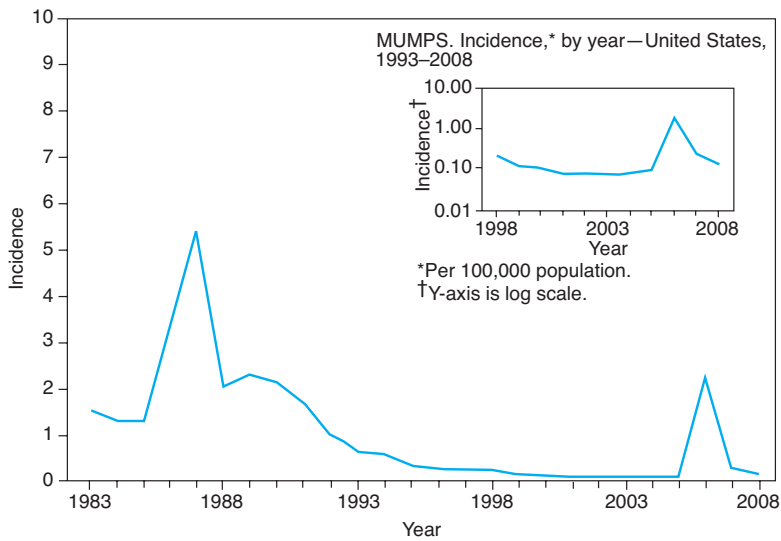
During the last quarter of the 20th century, molecular biology has provided powerful new tools to detect and characterize infectious pathogens. The use of nucleic acid hybridization and sequencing techniques has made it possible to characterize the causative agents of previously unknown diseases (e.g., hepatitis C, human ehrlichiosis, hantavirus pulmonary syndrome, AIDS, and Nipah virus disease). Molecular tools have enhanced capacity to track the transmission of new threats and find new ways to prevent and treat them. Had AIDS emerged 100 years ago, when laboratory-based diagnostic methods were in their infancy, the disease might have remained a mysterious syndrome for many decades. Moreover, the drugs used to treat HIV-infected persons and prevent perinatal transmission (e.g., replication analogues and protease inhibitors) were developed based on a modern understanding of retroviral replication at the molecular level.

## **21ST CENTURY PUBLIC HEALTH CHALLENGES**

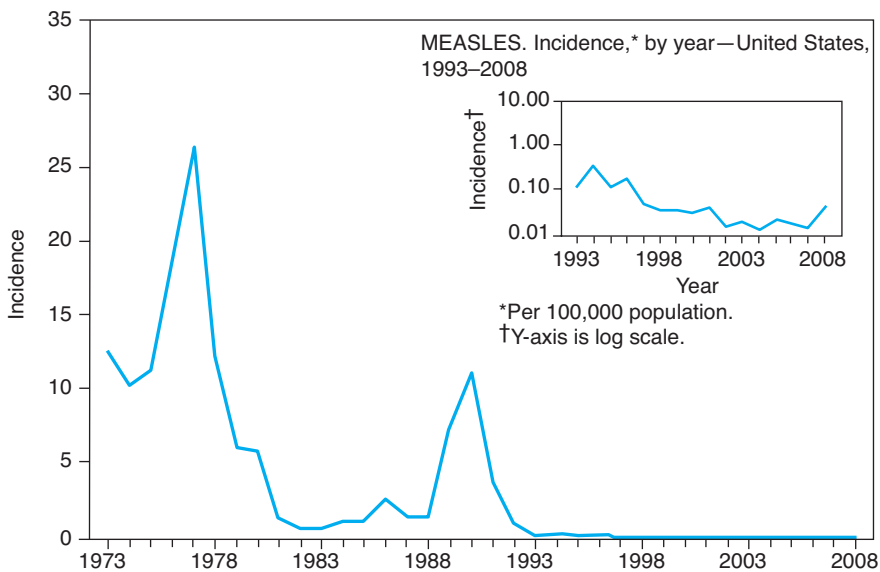
Success in reducing morbidity and mortality from infectious diseases during the first three quarters of the 20th century placed infectious disease control low on the public agenda in the 1980s and 1990s, but then the HIV/AIDS epidemic appeared and tuberculosis reemerged with multidrug-resistant strains resulting in an overall increase in infectious disease mortality. It soon became clear that new diseases will appear because microbes can evolve. This underscores the importance of disease prevention through continual monitoring of underlying factors that may encourage the emergence or reemergence of diseases. With advances in molecular genetics came a new appreciation of the remarkable ability of microbes to evolve, adapt, and develop drug resistance in an unpredictable and dynamic fashion.

Reemergence of infectious diseases, however, has not been limited only to uncommon microorganisms. This phenomenon also occurs with common childhood infections for which immunizations have been remarkably effective in reducing infections to such levels that the occurrence of a few thousand cases of mumps in 2006 was regarded as a significant public health event (Figure 1-5).

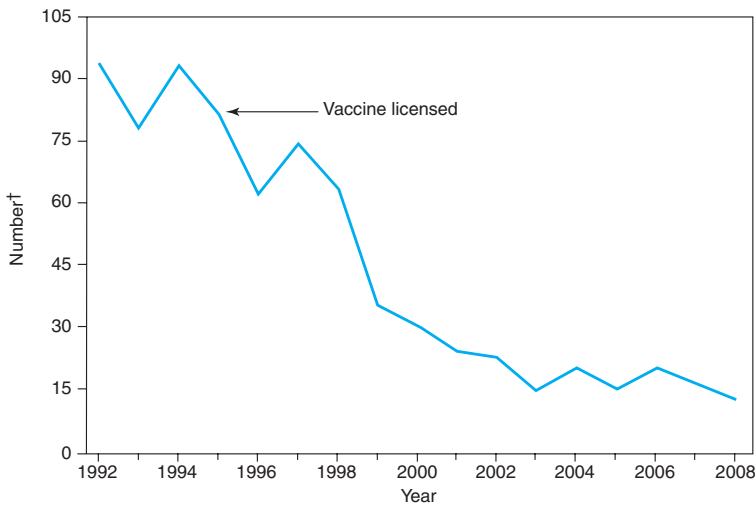




**Figure 1-5** Mumps incidence (per 100,000 population), by year, United States, 1983–2008. *Source:* From Centers for Disease Control and Prevention. Summary of notifiable diseases, United States, 2008. *MMWR*. 2010;57(54):1–94. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5754a1.htm>. Accessed July 6, 2010.



**Figure 1-6** Measles incidence (per 100,000 population), by year, United States, 1973–2008. *Source:* From Centers for Disease Control and Prevention. Summary of notifiable diseases, United States, 2008. *MMWR*. 2010;57(54):1–94. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5754a1.htm>. Accessed July 6, 2010.

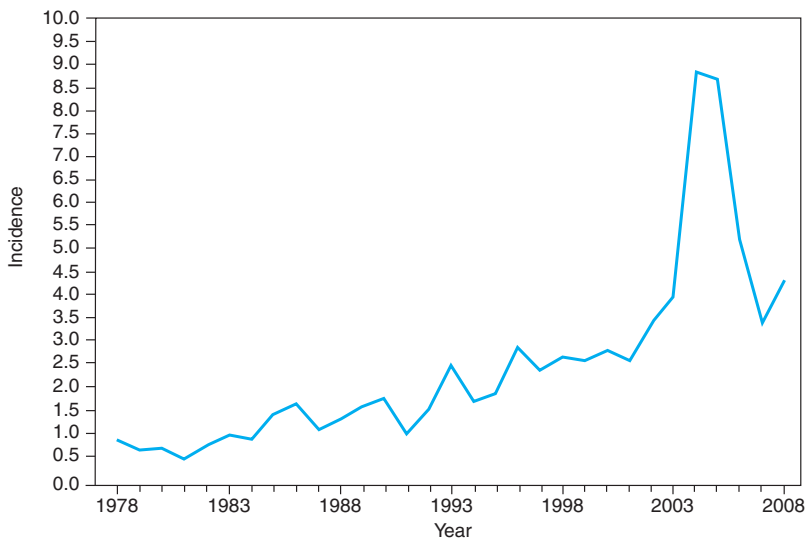


**Figure 1-7** Varicella (chickenpox). Number of reported cases, Illinois, Michigan, Texas, and West Virginia\*, 1992–2008.

\*These four states maintained consistent and adequate surveillance by reporting cases constituting  $\geq 5\%$  of their birth cohort during 1990–1995 (Source: CDC. National Immunization Program 1994–2005).

† in thousands

Source: From Centers for Disease Control and Prevention. Summary of notifiable diseases, United States, 2008. *MMWR*. 2010;57(54):1–94. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5754a1.htm>. Accessed July 6, 2010. Data from National Center for Immunization and Respiratory Diseases.



**Figure 1-8** Pertussis incidence (per 100,000 population) by year, United States, 1978–2008. Source: From Centers for Disease Control and Prevention. Summary of notifiable diseases, United States, 2008. *MMWR*. 2010;57(54):1–94. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5754a1.htm>. Accessed July 6, 2010.

Vigilance remains a critical component of today's arsenal to combat infectious disease threats, including the emergence of new infectious diseases, the reemergence of old diseases (sometimes in drug-resistant forms), large food-borne outbreaks, and acts of bioterrorism. Continuous surveillance and outbreak response capacity at all levels, combined with ongoing research into causes and countermeasures, comprise our 21st century challenges for controlling infectious diseases.

Vaccines and immunizations have been potent weapons in the war against infectious diseases. Figures 1-6 and 1-7 demonstrate reductions in the incidence of measles and chickenpox in recent decades. Figure 1-8 highlights recent trends for pertussis, a persistent infectious disease, to say the least.

The Task Force on Community Preventive Services' systematic reviews of the effectiveness of selected population-based interventions (see Chapter 7) focused on strategies aimed at improving coverage of universally recommended vaccines in children, adolescents, and adults and targeted vaccines for high-risk populations. The task force found strong evidence of the effectiveness of several population-based interventions, while other interventions lacked sufficient evidence or reviews were pending as of June 2010.<sup>16</sup>

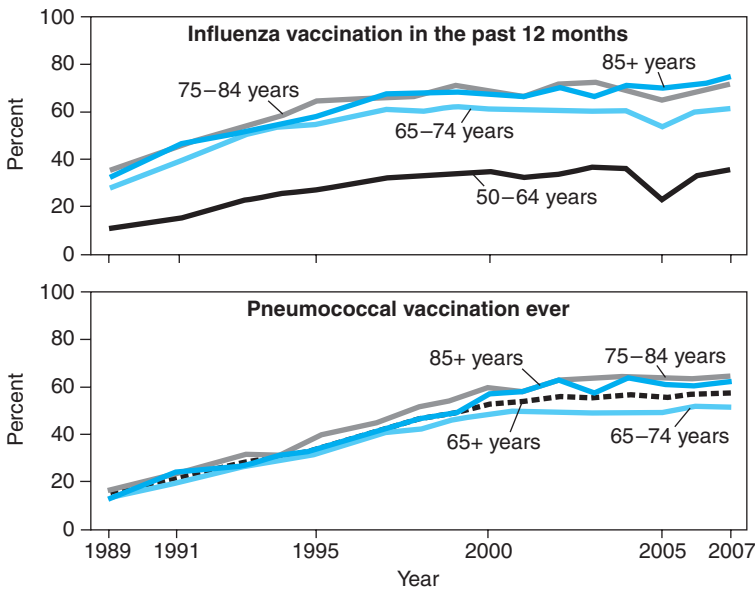
Strategies examined included increasing access to vaccination services, increasing community demand for vaccinations, and expanded provider- or system-based interventions. For universally recommended vaccines for all individuals in a specified age range, the Task Force on Community Preventive Services rated the following community-oriented interventions as effective and evidence based:

- Home visits to increase vaccination coverage
- Multicomponent interventions for expanding access in healthcare settings
- Reducing client out-of-pocket costs
- Vaccination programs in schools
- Vaccination programs in Women, Infants, and Children settings
- Client reminder and recall systems
- Multicomponent interventions that include education
- Vaccination requirements for child-care, school, and college attendance
- Provider assessment and feedback when used alone
- Provider reminder systems when used alone
- Standing orders when used alone

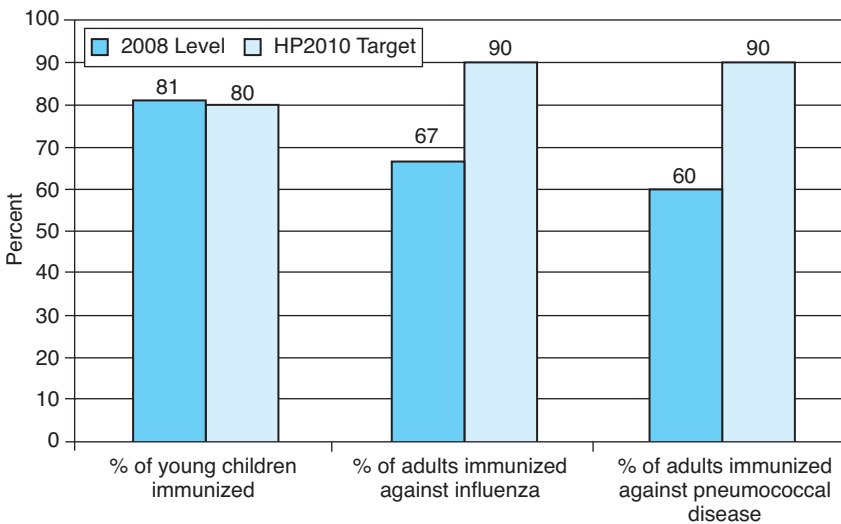
For targeted vaccine coverage for individuals at higher risk of contracting a specific disease, the Task Force on Community Preventive Services classified the following community-oriented interventions as effective and evidence based:

- Multiple interventions implemented in combination
- Provider reminder systems when used alone
- Vaccination programs in schools and organized child-care settings

The U.S. agenda for disease prevention and health promotion included in the Healthy People 2020 effort (see Chapter 2) identifies immunizations



**Figure 1-9** Influenza and pneumococcal vaccinations among adults. *Source:* From Centers for Disease Control and Prevention, National Center for Health Statistics. *Health, United States 2009*, Figure 9. Hyattsville, MD: NCHS; 2009. Data from the National Health Interview Survey.



**Figure 1-10** Scorecard for selected Healthy People 2010 leading indicators for immunizations comparing 2008 levels with 2010 targets. *Source:* Data from Data 2010, Healthy People 2010 database. <http://wonder.cdc.gov/data2010/ftpselec.htm>. Accessed May 31, 2010.

and infectious disease control as a continuing national health priority. Leading indicators for this priority focus on both childhood and adult immunizations. Figure 1-9 traces progress toward the year 2010 adult immunization targets, which were set at 90% for the 65 and older population for both influenza and pneumococcal vaccinations. Figure 1-10 demonstrates the gap between achieved levels and the year 2010 targets for adult immunizations and the achievement of the target for childhood immunizations. Together these figures suggest the war against infectious disease threats continues into the second decade of the 21st century.

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