SECOND EDITION

INTRODUCTION TO PUBLIC HEALTH

Promises and Practices

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INTRODUCTION TO PUBLIC HEALTH

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This book is dedicated to public health professionals everywhere who care deeply about the people they serve and strive daily to make the conditions in which they live healthful.

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PREFACE

This book describes the public health system in broad strokes in order to focus the reader on basic public health goals, principles, structures, and practices. The context in which public health is practiced today has changed considerably since its historic roots in the Industrial Revolution of the 18th and 19th centuries. As a result, public health practices are changed and changing still. However, the overarching goal of public health systems remains the same—to ensure through collective action a healthful environment for all.

The 21st century offers incredible challenges to public health. The disparity in access to healthy environments is widening, and the threats to health concern the foundations of health, including adequate and nutritious food, clean and sufficient water, and shelter. Moreover, these are global problems that touch every country to some extent and threaten to affect all countries within our lifetimes.

In order to meet these challenges, our goals in the coming years will be to embrace how, when, and where to improve the quality and value of public health received by the populations served. There will be more emphasis on unbiased decisions, fully integrated analytical information technology and computational expertise, and a systems orientation toward population health improvement. In addition, we will need to mobilize the public to support the work that must be done in order to provide a safe and healthy environment for all people.

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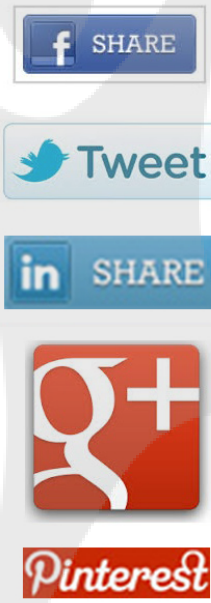

ONE

INTRODUCTION AND OVERVIEW

OBJECTIVES

Readers will understand . . .

1. How the fields of medicine and public health are different and complementary.
2. How health is defined, theoretically and in practice.
3. The multiple determinants of health and the impact of each.
4. The models that have been used to integrate the determinants of health.
5. How public health interventions have changed over the past century.

THE PROMISE OF PUBLIC HEALTH

Every year since 1873, the American Public Health Association (APHA) has held an annual meeting—a huge event attended by thousands of people, containing hundreds of sessions, over a period of nearly a week. The meeting expresses the public health priorities for that year and gives forum to the full range of current public health issues and activities. Current scientific and educational programs represent all sections, special interest groups, and caucuses. In the 2012 APHA annual meeting in San Francisco, a typical recent year, the 32 sections, three special primary interest groups (SPIGs), and 20 caucuses were represented.

Among the sections were the following:

- Aging and Public Health
- Alcohol, Tobacco, and Other Drugs
- Chiropractic Health Care
- Community Health Planning and Policy Development
- Community Health Workers
- Disability
- Environment
- Epidemiology
- Food and Nutrition
- Health Administration
- Health Informatics Information Technology Center (HIIT Center)
- HIV/AIDS
- Injury Control and Emergency Health Services
- International Health
- Law
- Maternal and Child Health
- Medical Care
- Mental Health
- Occupational Health and Safety
- Oral Health
- Physical Activity
- Podiatric Health
- Population Health Education and Health Promotion
- Population, Reproductive, and Sexual Health
- School Health Education and Services
- Social Work
- Statistics
- Vision Care

The SPIGs included:

- Alternative and Complementary Health Practices
- Ethics
- Veterinary Public Health

Some of the caucuses were:

- Academic Public Health Caucus
- American Indian, Alaska Native, and Native Hawaiian Caucus
- Asian Pacific Islander Caucus for Public Health
- Black Caucus of Health Workers
- Caucus on Homelessness
- Caucus on Public Health and the Faith Community
- Caucus on Refugee and Immigrant Health

- Community-Based Public Health Caucus
- Health Equity and Public Hospitals Caucus
- Labor Caucus
- Latino Caucus
- Lesbian, Gay, Bisexual, Transgender (LGBT) Caucus of Public Health Professionals
- Men's Health Caucus
- Peace Caucus
- Socialist Caucus
- Spirit of 1848 Caucus
- Vietnam Caucus
- Women's Caucus

The theme of the 2012 APHA Annual Meeting was *Prevention and Wellness Across the Lifespan*, and sessions spanned a wide array of topics, including this sampling from among the hundreds of presentations:

- Measuring the Food Environment
- Changing Planet, Changing Health: The Climate Crisis
- More Than Oil: Health and Environmental Disasters
- Addressing Health Inequities: Health Department Strategies
- Immigrant, Migrant, and Transnational Perspectives on Asian and Pacific Islander Health
- Fat or Fiction: Connections Between Tobacco Use and Weight
- Chiropractic, Public Health, and Under-Served Communities
- The Politics of Culture, Economics, and Religion in the Prevention and Wellness of Refugee and Immigrant Communities
- Healthier Communities Through Sodium Reduction in Restaurants: Evaluation Approaches to Build Practice-Based Evidence
- The Role of Public Health in Green Building Policy
- Access to Genomic Services Across the Lifespan

This small sample of topics at one meeting indicates the diversity and abundance of subjects that concern public health professionals.

In reviewing the topics from the APHA Annual Meeting in 2009 and noting their scope and variety, we may be motivated to ask, "What does teaching human genetics have in common with purchasing healthy foods?" "What is the link between international trade regulations and youth suicide prevention?" "How are climate change and community capacity building connected?" "What is the link between intimate partner violence and drinking water?" Similarly, when we examine the composition of the public health workforce through job postings at the APHA Annual Meeting and other public health employment sites, we see positions as different as sanitarian, community organizer, health educator, environmental safety specialist, infectious disease manager, epidemiologist, microbiologist, data analyst, and reproductive health specialist. Again, we may ask, "What is the common thread that connects these disparate types of employment?"

The answer to these questions lies in the following statement written in 1988 by the Institute of Medicine's (IOM) Committee for the Study of the Future of Public Health:

> The broad mission of public health is to "fulfill society's interest in assuring conditions in which people can be healthy." (p. 1)

This statement was intended to capture the essence of the historical and present work of public health, and it binds us together by identifying our common bond. It asserts that we, in the field of public health, are engaged in a great societal endeavor to create the circumstances that make health possible. We may have little in common on a day-to-day basis with our fellow public health professionals, and our knowledge base and skills may vary widely from others in our field. However, our mission is the same, and each of us contributes to that mission in some important way, which we will begin to explicate in the coming pages. Before proceeding, though, we need to examine this statement more closely to understand its assumptions and implications. By examining these, we understand our commonalities with other professionals focused on health—particularly the clinical professions such as medicine, nursing, dentistry, physical therapy, and others—as well as our unique role among health professionals.

First, the idea of assuring health for all people—the entire population—is embedded in the mission statement. Although public health will focus on different populations within the larger population when planning services, we are obligated to ensure health-producing conditions for all people—not just the poor, not just the rich, but people of all incomes; not only the young or the old, but people of all ages; not exclusively Whites or Blacks, but people of all races and ethnicities.

Second, the belief that a society benefits from having a healthy populace is clear in the public health mission's phrase "to fulfill society's interest." The work of public health is a societal effort with a societal benefit. Public health takes the view held by many professions and societies throughout human history that healthy people are more productive and creative, and these attributes create a strong society. Healthy people lead to better societies. For the welfare of the society, as a whole, it is better for people to be healthy than sick. There will be less dependence, less lost time from productive work, and a greater pool of productive workers, soldiers, parents, and others needed to accomplish society's goals. Thus, as public health professionals, we believe that society has an interest in the health of the population; it benefits the society, as a whole, when people are healthy.

Third, the public health mission acknowledges that health is not guaranteed. The mission states that "people *can* (not *will*) be healthy." Health is a possibility, although we intend through our actions to make it highly probable. However, not everyone will be healthy, even if each one exists in health-producing conditions. Public health efforts will not result in every person being healthy—although we certainly would not object to that kind of success.

Rather, public health creates conditions in which people can be healthy. Whether any single individual is healthy, we acknowledge, will vary.

The fourth and fifth assumptions differentiate public health from the healing, or clinical, professions—medicine, nursing, dentistry, physical therapy, physician assistant, and others—that we will refer to for simplicity throughout the remainder of this book as the clinical professions. All clinical professions believe in the obligation of their practitioners to care for all people in need of their services. Further, they accept the fallibility of their professions; not every patient will be "cured" regardless of the effort expended by the practitioner to bring about this outcome. Finally, all health care professions believe that improving health is a benefit, not only to the individuals treated, but also to the society as a whole. These beliefs, for example, are evident in the widely referenced Physician's Oath adopted by the World Medical Association Declaration of Geneva (1948 and amended by the 22nd World Medical Assembly in 1968):

> At the time of being admitted as a member of the medical professions:
>
> - I solemnly pledge myself to consecrate my life to the service of humanity;
> - I will give to my teachers the respect and gratitude which is their due;
> - I will practice my profession with conscience and dignity; the health of my patient will be my first consideration;
> - I will maintain by all the means in my power, the honor and the noble traditions of the medical profession; my colleagues will be my brothers;
> - I will not permit considerations of religion, nationality, race, party politics, or social standing to intervene between my duty and my patient;
> - I will maintain the utmost respect for human life from the time of conception, even under threat. I will not use my medical knowledge contrary to the laws of humanity;
> - I make these promises solemnly, freely, and upon my honor. (*Declaration of Geneva* [1948]. Adopted by the General Assembly of World Medical Association at Geneva Switzerland, September 1948.)

Thus, public health shares with the clinical professions a fundamental caring for humanity through concern for health. For these reasons, public health is sometimes viewed as a type of clinical profession.

Prevention: The Cornerstone of Public Health

However, if we examine the public health mission closely, we find that public health is complementary to the clinical professions, but not subsumed by them. The critical differences between public health and the clinical professions

relate to their strategies for creating a healthy populace. The fourth and fifth assumptions embedded in the public health mission are that prevention is the preferred strategy, and to be successful, prevention must address the "conditions," that is, environment, in the fullest sense, in which people live. The classic and defining public health strategy is to prevent poor health by "assuring conditions in which people can be healthy."

This choice of a prevention- and environment-based strategy clearly distinguishes public health from the clinical professions, which focus on diagnosing individuals and treating them when they have health problems detectable by clinical methods—history, physical examinations, laboratory tests, imaging, and so forth. Here, an understanding of the different types of prevention—primary, secondary, and tertiary—is necessary to distinguish between public health and the clinical professions.

Primary, Secondary, and Tertiary Prevention

There are three types of prevention: primary, secondary, and tertiary. Fos and Fine (2000) define primary, secondary, and tertiary prevention as follows:

> Primary prevention is concerned with eliminating risk factors for a disease. Secondary prevention focuses on early detection and treatment of disease (subclinical and clinical). Tertiary prevention attempts to eliminate or moderate disability associated with advanced disease. (Fine, 2000, pp. 108–109)

Primary prevention intends to prevent the development of disease and the occurrence of injury, and thus, to reduce their incidence in the population. Examples of primary prevention include the use of automobile seat belts, condom use, skin protection from ultraviolet light, and tobacco-use cessation programs. Secondary prevention is concerned with treating disease after it has developed so that there are no permanent adverse consequences; early detection is emphasized. Secondary prevention activities are intended to identify the existence of disease early so that treatments that might not be as effective when applied later can be of benefit. Tertiary prevention focuses on the optimum treatment of clinically apparent and clearly identified disease to reduce complications to the greatest possible degree. Tertiary prevention often involves limiting disability that occurs if disease and injury are not effectively treated.

The central focus of clinical professions is to restore health or prevent exacerbation of health problems. Thus, health care is primarily concerned with secondary and tertiary prevention: (a) early detection, diagnosis, and treatment of conditions that can be cured or reversed (secondary prevention); and (b) treatment of chronic diseases and other conditions to prevent exacerbation and minimize future complications (tertiary prevention). The health care system undoubtedly has its smallest impact on primary prevention, once again that group of interventions that focus on preventing disease, illness, and injury from occurring. Moreover, as Evans and Stoddart (1994) argue, other than for

immunization, the major focus of the health care system's primary prevention activities is on the behavioral determinants of health, rather than structural or policy factors:

> The focus on individual risk factors and specific diseases has tended to lead not away from but back to the health care system itself. Interventions, particularly those addressing personal lifestyles, are offered in the form of "provider counseling" for smoking cessation, seat belt use, or dietary modification. These in turn are subsumed under a more general and rapidly growing set of interventions attempting to modify risk factors through transactions between clinicians and individual patients.
>
> The "product line" of the health care system is thus extended to deal with a more broadly defined set of "diseases": unhealthy behaviors. The boundary becomes blurred between, e.g., heart disease as manifest in symptoms, or in elevated serum cholesterol measurements, or in excessive consumption of fats. All are "diseases" and represent a "need" for health care intervention. . . . The behaviors of large and powerful organizations, or the effects of economic and social policies, public and private, [are] not brought under scrutiny. (pp. 43–44)

Another often-quoted modern version of the Hippocratic Oath written by Lasagna (1962) in *The Doctor's Dilemma* provides an example of the difference between the clinical professional, whose improvement strategy is based on diagnosis and treatment of individuals, and the public health professional.

> I swear to fulfill, to the best of my ability and judgment, this covenant:
>
> - I will respect the hard-won scientific gains of those physicians in whose steps I walk, and gladly share such knowledge as is mine with those who are to follow.
> - I will apply, for the benefit of the sick, all measures [that] are required, avoiding those twin traps of overtreatment and therapeutic nihilism.
> - I will remember that there is art to medicine as well as science, and that warmth, sympathy, and understanding may outweigh the surgeon's knife or the chemist's drug.
> - I will not be ashamed to say "I know not," nor will I fail to call in my colleagues when the skills of another are needed for a patient's recovery.
> - I will respect the privacy of my patients, for their problems are not disclosed to me that the world may know. Most especially must I tread with care in matters of life and death. If it is given me to save a life, all thanks. But it may also be within my power to take a life; this awesome responsibility must be faced with

great humbleness and awareness of my own frailty. Above all, I must not play at God.
- I will remember that I do not treat a fever chart, a cancerous growth, but a sick human being, whose illness may affect the person's family and economic stability. My responsibility includes these related problems, if I am to care adequately for the sick.
- I will prevent disease whenever I can, for prevention is preferable to cure.
- I will remember that I remain a member of society, with special obligations to all my fellow human beings, those sound of mind and body as well as the infirm.
- If I do not violate this oath, may I enjoy life and art, respected while I live and remembered with affection thereafter. May I always act so as to preserve the finest traditions of my calling and may I long experience the joy of healing those who seek my help.

Although it contains one statement about the importance of primary prevention—"I will prevent disease whenever I can"—it is clear that the physician is viewed as a healer of individuals. The idea conveyed by this statement is that the physician uses clinical tools to treat health problems that have already begun, which is very different from the public health professional whose main goal is primary prevention of health problems employing strategies based on improving the circumstances in which people live.

Secondary and Tertiary Prevention and Public Health

The public health emphasis on primary prevention does not mean that public health has no role or interest in secondary and tertiary prevention. On the contrary, public health professionals are vitally interested and involved in secondary and tertiary prevention. However, their focus is on ensuring access to effective clinical care, rather than on providing the care itself. Preventing long-term consequences of health problems and limiting the progression of illness, disability, and disease is dependent on access to excellent medical care. Thus, ensuring that all people have health insurance has been an important issue for public health in the United States, as has health care reform that improves the quality and efficiency of health care. Access to primary care and the specialties has historically been a target of public health initiatives. Other issues that impact on people's ability to access and use health care appropriately are important, as well. These include such concerns as transportation to health care providers, cultural competence of health care providers, health literacy of patients, and the efficiency and effectiveness of health care delivery.

An example of public health's interest in secondary and tertiary prevention is the development of Medically Underserved Areas (MUAs), Medically

Underserved Populations (MUPs), and Health Professional Shortage Areas (HPSAs):

> Medically Underserved Areas/Populations are areas or populations designated by HRSA as having: too few primary care providers, high infant mortality, high poverty and/or high elderly population. Health Professional Shortage Areas (HPSAs) are designated by HRSA as having shortages of primary medical care, dental or mental health providers and may be geographic (a county or service area), demographic (low income population), or institutional (comprehensive health center, federally qualified health center or other public facility). (U.S. Department of Health & Human Services [DHHS], 2010)

Through designation of areas and populations as medically underserved, programs responding to their medical needs have been developed. These programs address the concerns about access to quality medical care in specific populations and geographic areas, which is necessary for secondary and tertiary prevention. Public health is vitally interested and involved in the identification of MUPs and MUAs, as well as in the development of programs to meet these needs.

If we were to apply the language of the clinical professions to public health, we might say that classic public health "diagnoses" and "treats" the circumstances in which people live, and the success of public health is measured by the health of the populations living in the "treated" circumstances. However, the languages of epidemiology and ecology are preferred to describe the work of public health professionals, as we explore later in this chapter. In summary, public health is proactive, rather than curative: Do not wait until people get sick and then treat them. Rather, go out and create conditions that promote health and prevent disease, injury, and disability.

An infectious disease outbreak provides an example of the complementary roles played by public health and clinical professionals:

> In early December 2009, the Centers for Disease Control and Prevention's (CDC's) PulseNet staff identified a multistate cluster of 14 *E. coli O157:H7* isolates with a particular DNA fingerprint or pulsed-field gel electrophoresis (PFGE) pattern reported from 13 states. CDC's OutbreakNet team began working with state and local partners to gather epidemiologic information about persons in the cluster to determine if any of the ill individuals had been exposed to the same food source(s). Health officials in several states who were investigating reports of *E. coli* O157:H7 illnesses in this cluster found that most ill persons had consumed beef, many in restaurants. CDC is continuing to collaborate with state and local health departments in an attempt to gather additional epidemiologic information and share this information with FSIS. At this time, at least some of the illnesses appear to be associated with products subject to a recent FSIS recall. (Centers for Disease Control and Prevention, 2010a)

Thus, public health officials collaborated with physicians, who had diagnosed and treated patients with the disease, as well as with officials from the U.S. Department of Agriculture's Food Safety and Inspection Service to determine the source of the infection and how to prevent recurrence of infection in other people. Public health officials addressed the circumstances in which the infection developed so that others would be spared the illness resulting from exposure to the pathogen.

Summary

The control of an infectious disease outbreak is an example of the promise of public health—collective action that prevents the occurrence of disease, disability, and premature death by "assuring conditions in which people can be healthy." Because of public health, people will have the opportunity, to the best of our knowledge and capabilities, to be healthy. Public health, as a field and as a collection of practicing professionals, will ensure that the environment in which people lead their lives promotes health.

Underlying this mission is a commitment to social justice because it assumes that all people are deserving of healthy conditions in which to live—not just the rich, but people of all incomes; not only the young or the old, but people of all ages; not exclusively the majority race or ethnicity, but people of all races and ethnicities. Public health is a leader and plays an integral role in carrying out this societal obligation. For this reason, public health is often associated with advocating and providing services for the structurally disadvantaged—those with the least power in their social circumstances. As Krieger and Birn (1998) argue powerfully:

> Social justice is the foundation of public health. This powerful proposition—still contested—first emerged around 150 years ago during the formative years of public health as both a modern movement and a profession. It is an assertion that reminds us that public health is indeed a public matter, that societal patterns of disease and death, of health and well-being, of bodily integrity and disintegration, intimately reflect the workings of the body politic for good and for ill. It is a statement that asks us, pointedly, to remember that worldwide dramatic declines—and continued inequalities—in mortality and morbidity signal as much the victories and defeats of social movements to create a just, fair, caring, and inclusive world as they do the achievements and unresolved challenges of scientific research and technology. To declare that social justice is the foundation of public health is to call upon and nurture that invincible human spirit that led so many of us to enter the field of public health in the first place: a spirit that has a compelling desire to make the world a better place, free of misery, inequity, and preventable suffering, a world in which we all can live, love, work, play, ail and die with our dignity intact and our humanity cherished. (p. 1603)

The cornerstone of public health is prevention, particularly primary prevention. Prevention is public health's historic and ideal approach to promoting health, and the distinguishing public health prevention strategy is to influence the "conditions" (i.e., the environment, in the fullest sense) in which people live. The classic and defining public health strategy to prevent poor health is to ensure "conditions in which people can be healthy." A commitment to social justice underlies the public health mission to achieve health-promoting conditions for all. How public health has attempted to ensure conditions that promote health is the story of the practice of public health, which we will introduce next.

THE PRACTICE OF PUBLIC HEALTH

What is entailed in "ensuring conditions in which people can be healthy?" In the answer to this question lies the source of the varied interests, knowledge, and skills that differentiate public health professionals from each other. The causes of poor health are many and complex, and therefore, solutions are complex and diverse, as well. Public health conceptualizes and organizes this complexity by applying the concepts and principles of ecology, which views individuals as embedded within their environment, or context. The ecological approach to understanding how health is either fostered or undermined is fundamental to public health practice.

However, before we can discuss the practice of public health, that is, the ways that public health professionals attempt to influence context and promote health, we will discuss how we define health and conceptualize the complex set of factors that affect health, called the determinants of health.

How Do We Define Health?

The most famous and influential definition of health is the one developed by the World Health Organization (WHO) in the 1940s: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." It was adopted in 1946 and has not been amended since 1948 (WHO, 1946). Many subsequent definitions have taken an equally broad view of health, including that of the Association of Teachers of Preventive Medicine (Stokes, Noren, & Shindell, 1982): "A state characterized by anatomical, physiological, and psychological integrity; ability to perform personally valued family, work, and community roles; ability to deal with physical, biological, psychological, and social stress; a feeling of well-being; and freedom from the risk of disease and untimely death" (p. 34).

Both definitions exemplify the tendency over the second half of the 20th century to enlarge the definition of health beyond morbidity, disability, and premature mortality to include sense of well-being, ability to adapt to change, and social functioning. However, in practice, the more limited view of health as diagnosable morbidity, mortality, and disability usually guides public

health efforts to improve health status. As Young (1998) writes, "Indeed, the WHO definition is 'honored in repetition, rarely in application.' Health may become so inclusive that virtually all human endeavors, including the pursuit of happiness, are considered within its domain" (p. 2). In this book, as in general public health practice, the term *health* will refer to the more restricted definition—diagnosable morbidity, disability, and premature mortality.

The Determinants of Health

There are many influences on individual and population health. As the WHO (2010) puts it:

> Many factors combine together to affect the health of individuals and communities. Whether people are healthy or not, is determined by their circumstances and environment. To a large extent, factors such as where we live, the state of our environment, genetics, our income and education level, and our relationships with friends and family all have considerable impacts on health, whereas the more commonly considered factors such as access and use of health care services often have less of an impact.

It is generally accepted that the determinants of health include the physical environment—natural and built—and the social environment, as well as individual behavior, genetic inheritance, and health care (Evans & Stoddart, 1994). Note that although we talk about the "determinants of health," they are usually discussed in terms of how they relate to poor health—the determinants of poor health. A brief overview of the determinants of health follows.

Physical Environment

Physical environment includes both the natural and built environments. The natural environment is defined by the features of an area that include its topography, weather, soil, water, animal life, and other such attributes; the built environment is defined by the structures that people have created for housing, commerce, transportation, government, recreation, and so forth. Health threats arise from both the physical and built environments. Common health threats related to the natural environment include weather-related disasters such as tornados, hurricanes, and earthquakes, as well as exposure to infectious disease agents that are endemic in a region, such as *Plasmodium falciparum*, the microbe that causes malaria and is endemic in Africa.

Health threats related to the built environment include exposure to toxins and unsafe conditions, particularly in occupational and residential settings where people spend most of their time. Many occupations expose workers to disease-causing substances, high risk of injury, and other physical risks. For example, the greatest health threats to U.S. farm workers are injuries

from farm machinery and falls that result in sprains, strains, fractures, and abrasions (Myers, 2001). There are well-documented health threats to office workers from indoor air pollution, found by research beginning in the 1970s, including passive exposure to tobacco smoke, nitrogen dioxide from gas-fueled cooking stoves, formaldehyde exposure, "radon daughter" exposure, and other health problems encountered in sealed office buildings (Samet, Marbury, & Spengler, 1987; U.S. Environmental Protection Agency [EPA], 2006). In residential settings, exposure to pollutants from nearby industrial facilities, power plants, toxic waste sites, or a high volume of traffic presents hazards for many. In the United States, these threats are increasingly known to have a disproportionately heavy impact on low-income and minority communities (CDC, 2003; Institute of Medicine [IOM], 1999).

Social Environment

The social environment is defined by the major organizing concepts of human life: society, community, religion, social network, family, and occupation. Individuals' lives are governed by religious, political, economic, and organizational rules—formal and informal—that reflect the cultural norms, values, and beliefs of their particular social context. These formal and informal rules—the values, beliefs, and norms they reflect—have historical roots, and they affect how individuals live and behave; their relationships with others; and what resources and opportunities individuals have to influence their lives. They shape the relationship between individuals and the natural environment and how the built environment is conceived and developed.

An important aspect of the social environment is the status, resources, and power that individuals have within their social environment or context. In the United States and other Western countries, this aspect is indicated by an individual's socioeconomic status—a combination of education, occupation, and income/wealth—and an individual's race and/or ethnicity. Socioeconomic status is associated with significant variations in health status and risk for health problems. There is a large literature demonstrating the relationship between socioeconomic status and health, including a gradient in which the higher the socioeconomic status, the better the health (Lynch, Smith, Kaplan, & House, 2000). The famous Whitehall Study of English civil servants in the 1970s was one of the first and most influential to demonstrate this relationship:

> The Whitehall Study consists of a group of people of relatively uniform ethnic background, all employed in stable office-based jobs and not subject to industrial hazards, unemployment, or extremes of poverty or affluence; all live and work in Greater London and adjoining areas. Yet in this relative homogeneous population, we observed a gradient in mortality—each group experiencing a higher mortality than the one above it in the hierarchy. The difference in mortality between the highest and lowest grades was threefold. (Marmot, Bobak, & Smith, 1995, p. 173)

Similarly, much research indicates that disparities in health status exist between racial and ethnic minority groups. Minority Americans, including African Americans, Hispanics/Latinos, Native Americans, and Pacific Islanders, generally have poorer health outcomes than do Whites. The preventable and treatable conditions for which disparities between majority and minority Americans have been shown include (CDC, 2011):

- Preventable hospitalizations
- HIV/AIDS
- Infant mortality
- Deaths due to motor vehicle crashes
- Suicide
- Drug-induced deaths
- Coronary heart disease
- Stroke
- Hypertension
- Asthma/poor air quality
- Diabetes
- Cancer

Although race and ethnicity do not "explain" these disparities, they point to the need for explanations. Discrimination and its consequences are a recent focus for investigations attempting to explain racial and ethnic disparities (Krieger, 2000; Mays, Cochran, & Barnes, 2007).

Nonphysical occupational factors also affect health. For example, a great deal of research demonstrates the relationship between poor health outcomes and the psychosocial work environment. The demand–control model is one well-known theory, hypothesizing that employees with the highest psychological demands and the lowest decision-making latitude are at the highest risk for poor health outcomes (Karasek, Baker, Marxer, Ahlbom, & Theorell, 1981; Karasek et al., 1998; Theorell, 2000). In addition, job loss and threat of job loss also have a negative impact on health. Evidence suggests that transitions from employment to unemployment adversely affect physical health and psychological well-being among working-age persons (Dooley, Fielding, & Levi, 1996; Kasl & Jones, 2000; Kasl, Rodriguez, & Lasch, 1998).

Another large body of research on the social environment and health focuses on social integration, social networks, and social support (Berkman & Glass, 2000). For example, numerous studies over the past 20 years have found that people who are isolated or disengaged from others have a higher risk of premature death. In addition, research has found that survival of cardiovascular disease events and stroke is higher among people with close ties to others, particularly emotional ties. Social relations have been found to predict compliance with medical care recommendations, adaptation to adverse life events such as death of a loved one or natural disaster, and coping with long-term difficulties such as caring for a dependent parent or a disabled child.

A great deal of research in the area of social support was conducted during the 1960s and 1970s. A seminal review article published in 1977 by Kaplan,

Cassel, and Gore identified methodological issues that needed to be addressed. Since then, there has been further specification of the relationship between social support and health to explain the relationship. For example, Cohen (2004) discusses three factors that indicate different aspects of social relationships: social integration, negative interaction, and social support, each influencing health through different mechanisms. Thoits (1982) reanalyzed data to test the hypothesis that disadvantaged sociodemographic groups such as low-income women are more vulnerable to the effects of life events because they experience more negative events and have fewer psychological resources to cope with them. Although the relationship between social support and health is still not well understood, it is found over and over again in health studies.

Genetic Inheritance

Our knowledge about the effects of genetic inheritance on health is growing rapidly. It is understood that, with few exceptions, disease processes "are determined both by environmental and by genetic factors. These usually interact, and individuals with a particular set of genes may be either more or less likely, if exposed, to be at risk of developing a particular disease. These effects can be measured by showing that the relative risk of exposure to an environmental factor is significantly greater (or lesser) for the subgroup with the abnormal gene, than the risk in those without" (Pencheon, Guest, Melzer, & Gray, 2001, p. 544).

Health Behavior

The term *health behavior* can refer to behaviors that are beneficial to health. However, the term is generally used in the negative to refer to behaviors that harm health, including smoking, abusing alcohol or other substances, failing to use seat belts or practicing other unsafe behaviors, making unhealthy food choices, and not engaging in adequate physical activity.

The effect of health behaviors on health status has been widely studied and found to be an important determinant of health. Consider the 10 leading causes of death, as of 2006, as characterized by diagnosed disease or condition in the general population: diseases of the heart, malignant neoplasms (cancer), cerebrovascular diseases (stroke), chronic lower respiratory diseases, unintentional injuries (accidents), diabetes mellitus, Alzheimer's disease, influenza and pneumonia, nephritis, nephrotic syndrome and nephrosis, and septicemia. The next five leading causes of death were intentional self-harm (suicide), chronic liver disease and cirrhosis, essential hypertension and hypertensive renal disease, Parkinson's disease, and assault (homicide; CDC, 2010b). In one way or another, personal health behavior has an impact on the occurrence in any given individual of most of the diseases and conditions on this list. Further, looking at the cause of death in a different way, that is, by major contributing cause of the disease to which the death was attributed rather than by the disease itself, in the first study of its kind, McGinnis and Foege (1993) showed that, as of 1990, the leading factors were tobacco use, dietary patterns,

sedentary lifestyle, alcohol consumption, microbial agents, toxic agents, firearms, sexual behavior, motor vehicles, and use of illicit drugs. As of 2002, the situation remained the same (McGinnis, Williams-Russo, & Knickman, 2002).

Health Care as a Determinant of Health

If we argue that health is the product of multiple factors including genetic inheritance, the physical environment, and the social environment, as well as an individual's behavioral and biologic response to these factors, we see that health care has an impact late in the causal chain leading to disease, illness, and injury. Often by the time the individual interacts with the health care system, the determinants of health have had their impact on their health status, for better or for worse. Thus, the need for health care may be seen as a failure to prevent the determinants of health from adversely affecting the individual patient.

The success of any health care system is affected by the other determinants of health. Genetic predisposition to breast cancer may limit the long-term success rates of cancer treatment. Continued exposure to toxins in the environment or at work may decrease the likelihood that the physician can stabilize an individual with allergies. Health behaviors, such as smoking or substance abuse, may stymie the best health care system when treating an individual with lung disease. The lack of support at home for changes in behaviors or adherence to medical regimens may undermine the ability of the health care system to successfully treat an individual with diabetes. Poverty, race, and ethnicity often limit access to health care, and therefore, the ability of physicians to diagnose and treat health problems effectively (Smedley, Stith, & Nelson, 2003). We recognize that health, as well as health care, exist within a biological, physical, and social context, and all of these factors influence the level of probability of success of a health care system. Health care is only one determinant of health.

Relationship Among the Determinants of Health

The determinants of health do not act independently of each other. They are interconnected, and the concepts of ecology provide the framework for understanding how to model their interconnectedness. In the most general sense, the ecological approach means that the person is viewed as embedded in the environment—both social and physical—and is both influenced by and influences that environment. Stokols (1996) outlines the history of ecology, and social ecology, which are fundamental to the public health perspective and its practice:

> The term ecology refers to the study of the relationships between organisms and their environments. Early ecological analyses of the relations between plant and animal populations and their natural

> habitats were later extended and applied to the study of human communities and environments within the fields of sociology, psychology, and public health. The field of social ecology, which emerged during the mid-1960s and early 1970s, gives greater attention to the social, institutional, and cultural contexts of people–environment relations than did earlier versions of human ecology, which focused primarily on biologic processes and the geographic environment. (p. 285)

Stokols (1996) identifies core principles of social ecology that make it an appropriate overarching paradigm for public health. First, ecological models may include all aspects of the environment that impact health, including physical, social, and cultural aspects. Second, ecological models include characteristics of individuals, and, for example, can incorporate their genetic heritage, psychological attributes, and behavioral practices. Third, concepts from systems theory are used to understand the interplay between environmental and individual characteristics and their mutual influence on health.

> For instance, people–environment transactions are characterized by cycles of mutual influence, in which the physical and social features of settings directly influence occupants' health and, concurrently, the participants in settings modify the healthfulness of their surroundings through their individual and collective actions. (p. 286)

Fourth, the ecological perspective emphasizes the interdependence of all factors contributing to health, including the nearby and distant factors, as well as those in different domains such as family, work, neighborhood, and community.

> Thus, efforts to promote human health must take into account the interdependencies that exist among immediate and more distant environments (e.g., the "spill-over" of workplace and commuting stress to residential environments, and the influence of state and national ordinances on the healthfulness of occupational settings). (Stokols, 1996, p. 286)

Fifth, the ecological perspective is interdisciplinary, which is required for public health practice. With the multitude of factors that affect human health, many disciplines are required to understand the interplay between them and their effect on health and to bring about health improvement. "Thus, ecologically based health research incorporates multiple levels of analysis and diverse methodologies . . . for assessing the healthfulness of settings and the well-being of persons and groups" (Stokols, 1996, p. 286).

The classic 1959 book, *Mirage of Health*, by Rene Dubos provides an example of how the ecological approach is applied to human health. Dubos describes

the causes of the tuberculosis epidemic in the tenements of 1900 New York City and other U.S. cities. He recounts

> The story of the roundabout way in which a microscopic fungus probably native to Central America destroyed the potato crop in Ireland and exerted thereby a dramatic influence on the destiny of the Irish people, illustrating the complexity of the interplay between the external environment and the affairs of man. (pp. 96–97)

Dubos's description of the factors contributing to the development of the tuberculosis epidemic includes international exploration and trade by Europeans subsequent to the 15th century that transported a native plant, the wild potato, from the Andes to Ireland and elsewhere in Europe; the improvement of the wild potato in Europe for large yields, which made the plant more susceptible to infection than the wild varieties; a fungus that accompanied the potato to Europe and was benign until it was enabled by unusually wet weather conditions to proliferate and destroy the potato crop in 1845 and 1846 in Ireland; the growth of the Irish population from 3.5 to 8 million between 1700 and 1840; the dependence on the potato for sustenance among the burgeoning Irish population; the political and economic dependence of Ireland on England that resulted in the food shortage following the destruction of the 1845 and 1846 potato crops; the disaster that followed in which a million Irish died of starvation and many more became susceptible to disease; and finally, the mass emigration from Ireland to the United States in the middle of the 19th century, when the immigrants took up residence in the crowded and unhealthy conditions of the tenements of industrial cities along the Atlantic coast.

> The profound upheaval in their way of life made them ready victims to all sorts of infection. The sudden and dramatic increase of tuberculosis mortality in the Philadelphia, New York, and Boston Areas around 1850 can be traced in large part to the Irish immigrants who settled in these cities at that time. (Dubos, 1959, p. 100)

Dubos's account included many determinants of health, including aspects of the social environment, the physical environment, and individual behavior. Interestingly, he does not mention health care, or its absence, as a factor leading to the tuberculosis epidemic, but then there was little that medicine offered at that time for the treatment of tuberculosis. His analysis of events incorporated the "causes of causes," which were political, economic, and cultural. These included the impetus among Europeans to explore and trade that caused the transport of the wild potato from Central America to Europe; the application of scientific principles to farming that caused the improvement of the potato; the political and economic relationships between Ireland and England that caused the dependence of the Irish on the potato for food; and so forth. We understand the disease, not only in terms of immediate individual actions, for example, sanitary habits of the individuals with tuberculosis, but in terms of societal attributes that reach back into history and relate to political and economic events and policies of the times.

Dubos's account exemplifies the ecological approach to understanding the causes of poor health—in this case, tuberculosis—which is the foundation of the public health orientation. Dubos's account links the determinants of health in a causal chain that ends in illness, disability, and premature death in the tenements of 19th-century American cities.

Ecological Models and Public Health Practice

The environment, or context, influences the way people live and their health outcomes, for better or for worse. That is, context can have positive or negative impacts on the health of individuals.

> As a field, public health attempts to maintain or create healthy contexts in which people live and prevent or dismantle unhealthy contexts—to promote health and reduce morbidity, disability, and premature mortality.

The way in which public health attempts to affect contexts is the story of public health practice, and public health practice reflects public health ecological models. However, the ecological models in use change over time to respond to the health problems predominant in their day and incorporate the knowledge, beliefs, values, and resources of that time and place.

For example, in times and places where infectious diseases are predominant, models reflect the issues required to understand their spread and control. A classic public health model that uses the ecological approach for understanding and preventing disease is the epidemiological triangle with its agent–host–environment triad. The epidemiological triangle (see Figure 1.1) was developed and is used to understand infectious disease transmission and to provide a model for preventing transmission, and thus, infectious disease outbreaks. The three points of the triangle are the agent, host, and environment. The agent is the microbial organism that causes the infectious disease—virus, bacterium, protozoan, or fungus; the host is the organism that harbors the agent; and the environmental aspects included in an epidemiological

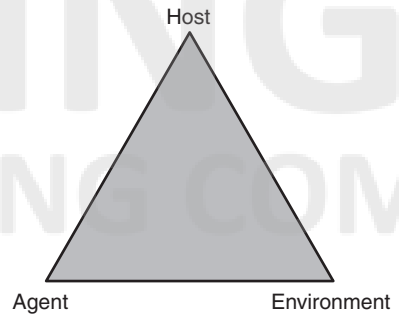

FIGURE 1.1 Epidemiological triangle.

triangle are those factors that facilitate transmission of the agent to the host. These could be aspects of the natural environment, the built environment, or the social environment, including policies. Time is considered in the triangle as the period between exposure to the agent and when the illness occurs; the period that it takes to recover from illness; or the period it takes an outbreak to subside. Prevention measures are those that disrupt the relationship between at least two of the factors in the triangle—agent, host, and environment.

Although there are no explicitly specified environmental factors included in the epidemiological triangle, the environment is central to conceptualizing disease transmission among individuals at risk (the hosts). The environment is the total of factors that enable the agent to infect the host. The environmental factors specified in the model can include, depending upon the disease itself, an array of social and physical attributes that permit the agent to infect the host. For example, Friis and Sellers (1996) write:

> The external environment is the sum total of influences that are not part of the host and comprises physical, climatologic, biologic, social, and economic components. The physical environment includes weather, temperature, humidity, geologic formations, and similar physical dimensions. Contrasted with the physical environment is the social environment, which is the totality of the behavioral, personality, attitudinal, and cultural characteristics of a group of people. Both these facets of the external environment have an impact on agents of disease and potential hosts because the environment may either enhance or diminish the survival of disease agents and may serve to bring agent and host into contact. (p. 315)

Because infectious diseases have a single agent, the epidemiological triangle works well as a model for understanding the development of these diseases. In the case of other kinds of diseases or health problems, it is not as helpful because of its emphasis on a single agent, its isolation of the agent from the environment, and its conceptually unspecified environment.

The wheel of causation is another model exemplifying the ecological approach (see Figure 1.2). It has also been used, but not as extensively as the epidemiological triangle, for explaining infectious disease transmission. However, it has some advantages over the epidemiological triangle, as Peterson (1995) notes,

> Although it is not used as often as the epidemiological triangle model, it has several appealing attributes . . . For instance, the wheel contains a hub with the host at its center. For our use, humans represent the host. Also, surrounding the host is the total environment divided into the biological, physical, and social environments. These divisions, of course, are not true divisions—there are considerable interactions among the environment types. Although it is a general model, the wheel of causation does illustrate the multiple etiological factors of human infectious diseases. (p. 147)

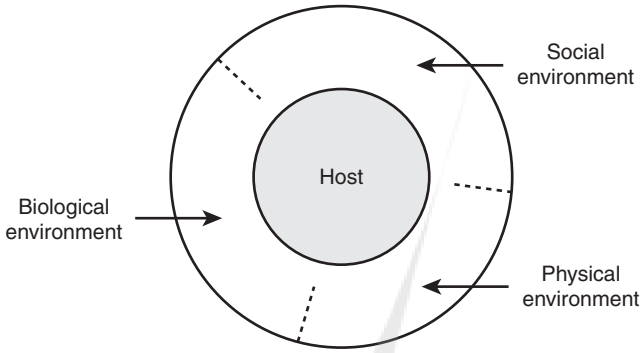

FIGURE 1.2 Wheel of causation.

In general, every ecological model explaining the development of health (or poor health) contains a set of distal causes related to the environment—physical and/or social—and a set of proximal causes related to the individual—primarily behavioral. One of the major issues in developing public health models is where to place the emphasis and, thus, where to intervene to improve health. Is it at the individual level or at the environmental level? This issue is at the heart of public health practice.

Therefore, in the simplest conceptualization of prevention strategies, we have two choices: We can focus our efforts on changing individual behavior directly or on changing the environment in which individual behavior occurs. For example, after examining Dubos's description of the development of the tuberculosis epidemics of the 1850s in the northeastern cities of the United States, we might decide that tuberculosis should have been prevented by focusing on the sanitary habits of the Irish immigrants, which would have reduced the spread of disease from person to person. These habits might have included handwashing, housekeeping, food preparation practices, and so forth. Changing behavior might have taken the form of encouraging compliance through education or coercing compliance through surveillance and laws.

On the other hand, we might decide that the tuberculosis epidemics should have been prevented by changing the social, political, or physical environments. For instance, if the cities to which the Irish emigrated had provided more healthful housing and working conditions, the Irish immigrants would not have been as susceptible to illness, including tuberculosis. We might have targeted the crowding and other relevant conditions in the neighborhoods where the immigrants came to live. Thus, instead of motivating individuals to change their behavior—through education—we might argue that we could have changed the physical environment to reduce the spread of tuberculosis.

Alternatively, stepping further back in the causal chain, we might decide that the political environment in Ireland should have been the focus of intervention. If England had provided aid to the Irish during the potato blight, the Irish would not have perished in such numbers, and survivors, poor and already weakened by famine, would not have been motivated to emigrate to the United States where they were highly susceptible to tuberculosis. On the

other hand, going back even further, we might decide that the undiversified diet of the Irish should have been the subject of intervention. If the Irish food supply had been diversified, the potato blight would not have become a crisis for the people of that country. Again, this was a political decision on the part of the English. Thus, political strategies might be proposed that would have changed the environment, and, thus, prevented the tuberculosis epidemics of the 1850s in the United States.

The general ecological model is extremely flexible and can assume many different forms. The model becomes differentiated when a specific health problem is identified for intervention in a particular time and place. The ecological models developed beginning in the 1960s in response to the increased importance of chronic diseases made a significant departure from the classic models such as the epidemiological triangle and the wheel of causation (see Figure 1.2) used for infectious disease control and prevention. Let us explain.

Health Promotion and the Ecological Models in Public Health Since 1960

Beginning in the 1960s, the models explaining health status became increasingly limited to the behavioral determinants of health such as smoking, sedentary lifestyle, poor dietary habits, unprotected sexual activity, and failure to use seat belts, which placed the focus of public health interventions on changing individuals rather than their context. The watchwords of this trend were health promotion and disease prevention. As Green (1999) states, 1974 was a turning point when health promotion was accepted as a significant component of health policy. In a classic review of the rise in importance of health promotion, McLeroy, Bibeau, Steckler, and Glanz (1988) summarized the events and initiatives characterizing the ascendance during the 1970s and 1980s:

> Within the private sector, this interest in health promotion has led to the extensive development and implementation of health promotion programs in the worksite, increases in the marketing of "healthy" foods, and increased societal interest in fitness. In the public sector this interest has led to national campaigns to control hypertension and cholesterol, the establishment of the Office of Disease Prevention and Health Promotion within the Public Health Service and the Center for Health Promotion and Education within the Centers for Disease Control, the development and implementation of community-wide health promotion programs by both governmental agencies and private foundations, and the establishment and monitoring of the 1990 Objectives for the Nation in health promotion. Within the professions, interest in health promotion led to the publication of the Lalonde Report in Canada, John Knowles' work on "The Responsibility of the Individual" and the Surgeon General's report on Health Promotion/Disease Prevention in the United States, and "Health Promotion: A Discussion Document on the Concept and Principles" in Europe. More recently, journals have appeared which are devoted exclusively to articles on health

> promotion programs and activities; existing journals both within and outside of traditional public health disciplines have devoted theme issues to health promotion topics; international conferences on health promotion have been held; and health education training programs have begun to focus more extensively on health promotion topics and issues. (p. 352)

The emphasis on health promotion, however, increasingly emphasized public health initiatives at the individual behavior level, rather than the environmental level. Programs to help people stop smoking, lose weight, increase exercise, eat healthier foods, and so forth proliferated, and these programs were predominantly aimed at educating and motivating individuals to change unhealthy behaviors. These initiatives were in contrast to historic interventions such as sewage disposal or food inspection, which emphasized changing the environment, as we will explore in the next chapter.

PRECEDE–PROCEED and Health Promotion

By and large, health promotion programs used the now well-known model for conceptualizing community health promotion and planning: Green and Kreuter's (1991, 1999) PRECEDE–PROCEED model. The PRECEDE–PROCEED model was developed in the 1970s and has been applied since then with a few modifications in the 1990s, which we discuss shortly. PRECEDE stands for *P*redisposing, *R*einforcing, and *E*nabling *C*onstructs in *E*ducational *D*iagnosis and *E*valuation. Green and Kreuter (1991) define predisposing factors as:

> A person's or population's knowledge, attitudes, beliefs, values, and perceptions that facilitate or hinder motivation for change. Enabling factors are those skills, resources, or barriers that can help or hinder the desired behavioral changes as well as environmental changes. . . . Reinforcing factors, the rewards received, and the feedback the learner receives from others following adoption of the behavior, may encourage or discourage continuation of the behavior. (pp. 28–29)

PROCEED stands for *P*olicy, *R*egulatory, and *O*rganizational *C*onstructs in *E*ducational and *E*nvironmental *D*evelopment.

As the acronym PRECEDE denotes, the model is oriented toward improving health by changing individuals' behavior through education, and not toward intervening at the environmental level to change conditions or structures. The question structured by the PRECEDE–PROCEED model is, "Why do people behave badly, that is, engage in unhealthy behaviors?" In addition, the first part of the two-part answer to this question, which is emphasized by PRECEDE–PROCEED, is lack of knowledge. Thus, education about the risks of certain behaviors and the benefits of others is a primary component of health promotion initiatives. These include initiatives to modify unfavorable dietary habits, sedentary lifestyle, substance abuse, smoking, and unsafe practices such as failure to use seat belts or follow safety precautions at work.

The second part of the answer structured by the PRECEDE–PROCEED model is related to attributes of the individual that hinder behavior change, including motivation to change, appraisal of threat, self-efficacy, response efficacy, and so forth. That is, once the knowledge about health behaviors is conveyed, the challenge is to motivate individuals to change their behavior from risky to healthy. Knowledge alone is not sufficient to bring about change in health behaviors. Thus, a major tool of health promotion is the application of psychological theories to understand why people engage in unhealthy behaviors and how to stimulate them to modify these behaviors. A number of the most influential theories applied to health behavior are the Health Belief Model developed by Becker (1974); the Theory of Reasoned Action (Ajzen & Fishbein, 1980); the Protection Motivation Theory (Rogers, 1983); Bandura's (1986) Social Cognitive Theory, which emphasizes self-efficacy; and Social Learning Theory (Rosenstock, Strecher, & Becker, 1988). These theories underlie the methods used in health promotion initiatives to motivate health behavior change.

The original PRECEDE–PROCEED model was described by Green in 1974. The model visualizes the assumed causal chain, which shows that behavioral problems produce health problems, which then, in turn, produce social problems, such as illegitimacy, unemployment, absenteeism, hostility, alienation, discrimination, riots, and crime. The effect of the environment on individual behavior is assumed under enabling factors such as availability of resources, accessibility, and referrals and reinforcing factors such as attitudes of program personnel. However, note that this is a very restricted environment, which is limited to the immediate setting of the health education program. There is also a nonbehavioral factors box, which contributes to health problems and could contain larger environmental factors, but is not the main focus of the model and is not seen as contributing to behavior problems.

As an example of the use of the PRECEDE–PROCEED model, DeJoy (1996) describes how the model would be applied to workplace safety:

> In the PRECEDE model, three sets of diagnostic or behavioral factors drive the development of prevention strategies. Predisposing factors are the characteristics of the individual (beliefs, attitudes, values, etc.) that facilitate or hinder self-protective behavior. Predisposing factors are conceptualized as providing the motivation for behavior. The threat-related beliefs and efficacy expectancies that are prominent features of the value-expectancy models (psychological theories for health behavior) would be included here. Enabling factors refer to objective aspects of the environment or system that block or promote self-protective action. Green and colleagues define enabling factors as "factors antecedent to behavior that allow motivation or aspiration to be realized." The skill and knowledge necessary to follow prescribed actions would be included here, as would the availability and accessibility of protective equipment and other resources. Most barriers or costs would be classified as enabling factors. Reinforcing factors involve

> any reward or punishment that follows or is anticipated as a consequence of the behavior. Performance feedback and the social approval/disapproval received from coworkers, supervisors, and managers would qualify as reinforcing factors in workplace settings. (p. 66)

Clearly, the target for intervention in this example is the worker and his or her motivation to avoid workplace injuries. This orientation is apparent, when the author describes the predisposing factors as "providing the motivation for behavior," and also includes the worker's psychological factors such as beliefs about threat and efficacy. Enabling factors "allow motivation or aspiration to be realized" and include the worker's skill and knowledge. It is plain that the intervention strategy is to induce the practice of safety through education that enables the worker; application of psychological theories that address the worker's predisposing attitudes, beliefs, and values related to safety practices; and rewards or punishments that reinforce the worker's safety-related behavior.

Importantly, the environment—in this case, the physical workplace and the people who manage it—is seen as reinforcing and enabling the worker to engage in safety habits, but not as the target of the intervention. Rather, improving workplace safety is focused on motivating the individual worker to practice safety habits, not motivating the employer or the larger society to modify the workplace. The individual worker's motivation to practice workplace safety is the subject of the intervention, and the worker is viewed as the accountable party.

Also, note that the environment is quite proscribed. Its bounds are the specific workplace itself. The environment, in this example, does not include larger political and economic factors that may affect what occurs within the workplace. For instance, the political and economic factors that impact the availability of protective equipment and other resources required for safety are not considered. Regulations governing safety in the workplace are not considered, nor are the enforcement of regulations. This example is typical of health promotion programs, particularly through the 1990s. The larger environment could certainly be incorporated into the model, but it usually was not.

Why Health Promotion?

The health promotion trend, whereby the target of public health interventions was individuals' behavior instead of the environment, was, in part, because of the view that the distal causes of poor health—physical and social environmental factors including cultural, economic, and political factors—were too difficult to change.

Also, health promotion was tied to the desire for health care cost containment. Educating individuals about health was seen as a way to make people more self-sufficient in health, engage in self-care, and become better informed consumers of health services. Because of concern about spiraling health care costs in the 1960s and onward, health promotion was presented as a means

to control costs through the demand side (Green, 1999). This can be seen in the proliferation of research studies undertaken to improve health care utilization and decrease unhealthy behaviors through educational interventions for patients/consumers:

> It caused them to reason by analogy from medical successes that our scientific quest should be to find the best intervention to achieve a specific type of health-related behavior change. Practitioners and the agencies funding health services and public health research eagerly embraced this search for magic-bullet solutions to the behavioral change problems presented by medical care and public health. A generation of highly controlled randomized trials and fine-grained behavioral research ensued. These tested, by trial and error, specific ways to improve patient compliance. They included ways to reduce broken appointments, educate mothers to restrain their tendency to bring a child to health maintenance organization or pediatric services for each earache or sore throat, improve smoking cessation, and modify a range of specific consumer and self-care behaviors. The targets of the magic bullet interventions were as much those behaviors thought to account for some of the unnecessary and inappropriate uses of health services as those accounting for leading causes of death or disability. (p. 75)

It was also apparent that individual behaviors such as smoking, sedentary lifestyle, and poor dietary habits were highly related to the onset and progression of chronic diseases such as heart disease, pulmonary disease, and diabetes. If risky health behaviors could be changed, it was argued, the incidence of chronic diseases would be reduced. Of course, this is true.

The question, however, is whether trying to motivate individuals to change their behavior—through education, incentives, and disincentives—is the most effective and just means of accomplishing this goal. Is placing accountability for behavior change onto the individual, without changing the environment in which that behavior occurs, realistic and fair?

Criticisms of Health Promotion

Placing the locus of accountability for poor health on the individual is one of the major criticisms of the health promotion movement. Viewing the individual's behavior as the problem to be "fixed," rather than the context in which that behavior occurs, is seen as "blaming the victim." Under this view, the context of people's lives structures their health behaviors to a large degree, and so blaming individuals for having poor health behaviors is ineffective and unfair. For example, poor people and those of minority groups

often live in neighborhoods with supermarkets that carry limited amounts of healthy foods, especially fruits and vegetables. Their shelves predominate, instead, with high-fat, high-sodium snack foods that have little nutritional value (Moore & Roux, 2006). Does the fairer and more effective public health intervention, aimed at improving the diet of people in such neighborhoods, target the residents themselves or the supermarkets? These are the kinds of questions that arise from the debate over the PRECEDE–PROCEED model.

Not surprisingly, beginning in the 1980s, the pendulum began to swing back to a focus on environmentally targeted interventions and an interest in understanding the interaction between individuals and their environment. Because of the "blaming-the-victim" argument, as well as the recognition that health education was not as effective as it had once been thought to be, interest in alternatives to the health promotion approach intensified. As Green himself noted in 1999, "The dominant emphasis has shifted from psychological and behavioral factors, which lend themselves to precise measure, to more difficult to measure and control factors, such as social, cultural, and political ones" (Green & Kreuter, 1999, p. 8). Further:

> In 1986, the First International Conference on Health Promotion produced the Ottawa Charter, which helped reorient policy, programs, and practices away from these proximal risk factors. The shift that followed was to the more distal risk factors in time, space, or scope, which we shall call risk conditions. These also influence health, either through the risk factors or by operating directly on human biology over time, but they are less likely than risk factors to be under the control of the individual at risk. (p. 10)

Consistent with the pendulum swing, Green and Kreuter revised the PRECEDE–PROCEED model (see Figure 1.3) in 1991 to place more emphasis on the context of behavior. With respect to incorporating environmental influences, the model now contains a box labeled *environment*, which notably both influences and is influenced by behavior and lifestyle. This change in the PRECEDE–PROCEED model makes it in keeping with the general ecological model, which assumes that individuals are affected by their environment. In addition, the model now includes a policy regulation organization factor, which impacts the enabling factors and, through these, the environment. The main features and causal asassumptions of the 1974 PRECEDE–PROCEED model remain the same—predisposing, reinforcing, and enabling factors affect behavior and lifestyle, which, in turn, impact health.

In 1999, Green and Kreuter made minor modifications to the PRECEDE–PROCEED model, and enlarged the role of the environment in their description of the factors influencing behavior. The risk factors and risk conditions, together with factors predisposing, enabling, and reinforcing them, are referred to in the PRECEDE–PROCEED model collectively as the determinants of health.

> These include adequate housing; secure income; healthful and safe community and work environment; enforcement of policies and

> regulations controlling the manufacture, marketing, labeling, and sale of potentially harmful products; and the use of these products (such as alcohol and tobacco) where they can harm others. (p. 10)

Although the revised model placed more emphasis on the environment, the focus was still on providing a blueprint for changing the individual's behavior through education and relying on psychological theories for understanding how to motivate behavioral change. The context was identified in the model as necessary to achieve individual behavioral changes. However, in practice,

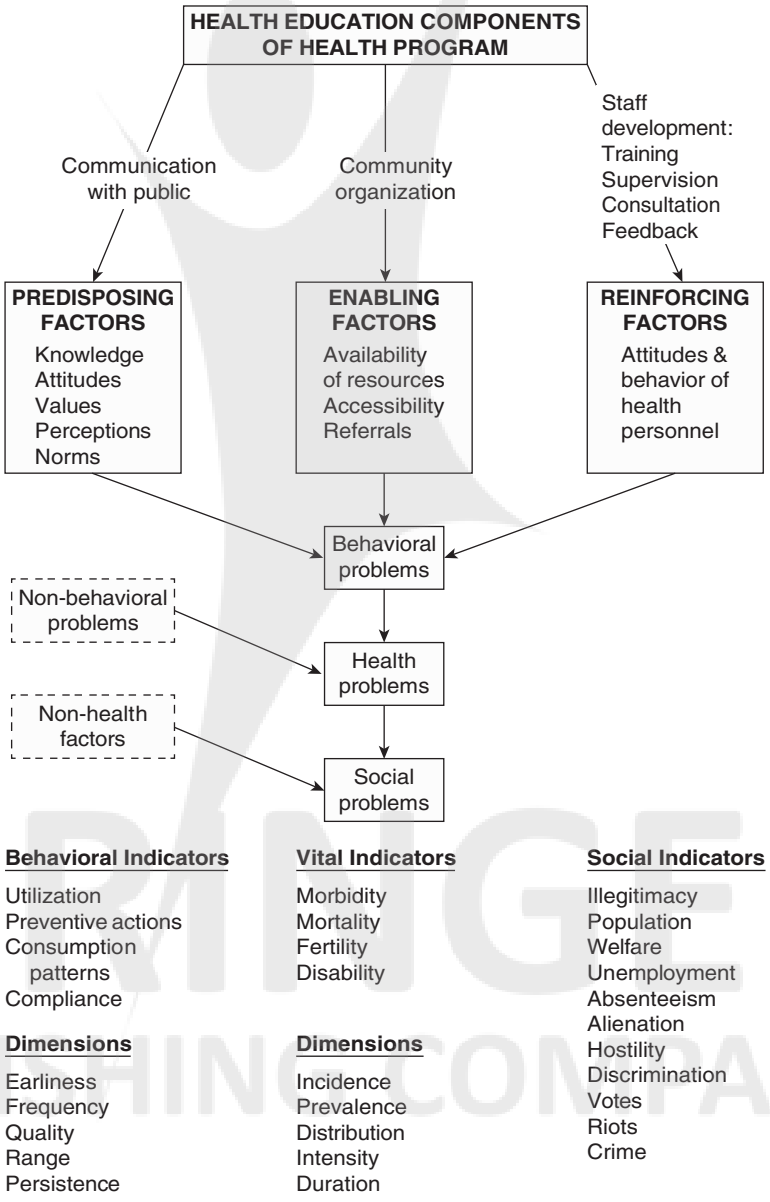

FIGURE 1.3 PRECEDE-PROCEED model (1991).

changes to the context within health promotion programs were usually still limited and proscribed to the immediate setting. They did not aim to change underlying social structures or other larger environmental factors. See, for example, Lieberman, Golden, and Earp (2013) for a discussion.

Population Health and Reemphasis of the Social Environment in Public Health Models

At the same time that health promotion was coming under attack, the population health approach was introduced and began to gain followers in the field of public health. Stirred by antipathy toward the emphasis on interventions that used education and psychologically based strategies to motivate individuals to change their behavior rather than changing the context or structure in which behavior occurs, this approach to public health focused on the distal social environment—power, wealth, and status—as the root cause of health problems. The evidence supporting this approach is the large body of research on disparities or inequalities in health status between the rich and the poor, the powerful and powerless, and those of high social status and those of low status. Incontrovertible findings that an individual's social status, wealth, and power have a profound influence on his or her chances of being healthy underwrite the population health approach to public health. The Whitehall study was one of the first to demonstrate what has become a consistent finding—people who are structurally disadvantaged are far more likely than the advantaged to have poor health.

Studies have asked, "Why do some people exercise and others do not?" "Why do some people eat nutritious foods and others do not?" "Why do some people lead sedentary lives and others do not?" "Why do some communities have support groups for behavior change and others do not?" "Why do some communities have opportunities for exercise and relaxation and others do not?" "Why are some communities free from toxic substances in the environment and others are not?" The answers are in the unequal distribution of power, wealth, and status that give the advantaged the opportunities and resources to live in healthier environments, engage in healthier behaviors, and have access to better health care.

As Marmot (2005) states,

> The gross inequalities in health that we see within and between countries present a challenge to the world. That there should be a spread of life expectancy of 48 years among countries and 20 years or more within countries is not inevitable. A burgeoning volume of research identifies social factors (i.e., wealth, power, and status) at the root of much of these inequalities in health. Social determinants are relevant to communicable and non-communicable disease alike. (p. 1099)

The population health approach has led to studies such as the following by Pickard, Miller, and Kirkpatrick (2009) that offer explanations for undesirable health behaviors in terms of the social context of the individual. That is, the social context is viewed as having a causal impact on health behaviors.

> Social determinants of health are widely described, but few researchers have more than cursory contact with those whose lives fall into the most impoverished, epidemiological categories. Framing the problems as inappropriate emergency room visits and non-compliance with treatment regimens sheds little light on the choices driving such behaviors. Drawing on 11 years of working continually among residents of a highly diverse and grindingly poor urban neighborhood, this paper examines the meanings people assign to their health behaviors. It presents a new "care-seeking typology" based on a content analysis of accounts shared in nearly 400 in-depth neighborhood interviews. When combined with close observations of patients in a small university-affiliated, community-based safety-net clinic, 10 health seeker types emerge. Each type is illustrated with authentic stories rarely surfaced by traditional scientific methods and validated through reviews by community participants. While several resulting composites mirror frequently cited stereotypes of downtrodden lives, others challenge prevailing beliefs about why and how the poor make health care decisions. Not surprisingly, money plays a central role in care seeking among the population studied. However, the connection is frequently misunderstood by health providers and policymakers, with frustratingly predictable results. Opportunities for more successful therapeutic engagement emerge from this new mapping of social perceptions. (Pickard et al., 2009)

The population health perspective is leading to more complex public health models that integrate distal and proximal social factors, physical environmental factors, and behavioral factors to predict disease, disability, and premature death. Health behaviors are viewed as patterned by the social environment, not "free-standing" (Chan, Gordon, Chong, & Alter, 2008; Purslow et al., 2008). For example, a recent study of the original Whitehall participants who have been followed for 24 years (Stringhini et al., 2010) investigated the role of health behaviors in the relationship between socioeconomic position and mortality. The behaviors studied included smoking, alcohol consumption, diet, and physical activity. The authors found that "there was an association between socioeconomic position and mortality that was substantially accounted for by adjustment for health behaviors, particularly when the behaviors were assessed repeatedly." (p. 1159)

Among champions of population health, the commitment to social justice is at the heart of public health's promise.

> Health disparities/inequalities include differences between the most advantaged group in a given category—e.g., the wealthiest, the most powerful racial/ethnic group—and all others, not only between the best and worst-off groups. Pursuing health equity means pursuing the elimination of such health disparities/inequalities. (Braveman, 2006, p. 167)

Everyone, not only the rich, the powerful, or those with social standing, is entitled to the conditions that produce health. It is in the tradition of public health to advocate for those who have unequal access to opportunities and resources in society as well as those with advantages, following in the footsteps of the public health engineering era, when people in all stations of life were provided with clean water, sewage and garbage disposal, and a clean food supply in the cities of industrializing nations.

Summary

Over the last 50 years, the emphasis of public health initiatives on behavior, rather than on environment, became widespread. Even though the ecological approach of public health views the individual as embedded in a physical and social environment and affected by it, the health promotion orientation led to an emphasis on behavior and a de-emphasis on the environment—both physical and social. The recent President's Cancer Panel (2010) report provides an example of the divergence in orientation that has occurred and still exists. The report, *Reducing Environmental Cancer Risk: What We Can Do Now*, is unlike previous president's reports, which focused on individual behaviors, diagnosis, and treatment rather than the risk of environmental exposures. The 2010 report found that "a growing body of research documents myriad established and suspected environmental factors linked to genetic, immune, and endocrine dysfunction that can lead to cancer and other diseases." The panel advised that the "true burden of environmentally induced cancers has been grossly underestimated," and that the current estimates of 2% of all cancers caused by environmental toxins and 4% by occupational exposures is outdated. Of the more than 80,000 chemicals used in the United States today, only a few hundred have been tested for health effects. Environmental contaminants come from industrial and manufacturing processes, agriculture, household products, medical technologies, military practices, and the natural environment. The report argues that the problem has not been addressed adequately by the National Cancer Program, which has focused on individual behaviors, screening, diagnosis, and treatment. It finds the current regulatory approach reactionary rather than precautionary—a substance's danger must be demonstrated incontrovertibly before action is taken to reduce exposure to it. Therefore, the "public bears the burden of proving that a given environmental exposure is harmful" (President's Cancer Panel, p. ii).

The still-existing tension between those who emphasize behavioral and those who emphasize environmental causes is demonstrated in the reaction to the 2010 President's Report. The panel urged the president to act on its findings, but reaction to the report was critical from Michael Thun, Vice President of Epidemiology and Surveillance Research at the American Cancer Society, who tried to bring the focus back to behavior. As reported in *The New York Times* (Grady, 2010), Dr. Thun stated that the report was "unbalanced by its implication that pollution is the major cause of cancer." Further,

> . . . Suggesting that the risk is much higher, when there is no proof, may divert attention from things that are much bigger causes of

> cancer, like smoking. "If we could get rid of tobacco, we could get rid of 30 percent of cancer deaths," he said, adding that poor nutrition, obesity, and lack of exercise are also greater contributors to cancer risk than pollution.

This discussion exemplifies some of the complexities of taking a primary prevention approach to health, that is, to prevent health problems from beginning. There are many choices made when determining how to improve or maintain health, and one is the choice between an individual or environmental-level intervention. Given the premise of the ecological model—that individuals are embedded in an environment, which they both influence and are influenced by—both components of the model are relevant. Within the ecological model, both the individual and the context are potential sites of public health interventions, and both have been employed throughout the history of public health. For example, in the early part of the 20th century, there were interventions that focused on the individual level—teaching and encouraging individuals in immigrant communities to engage in certain health behaviors, such as handwashing, that prevent infectious diseases—and those that focused on the environmental level, notably the environmental engineering interventions that brought clean water, safe food supply, and sanitary disposal of waste to these communities and also prevented the spread of infectious diseases. The emphasis on environmental over individual-level interventions changes over time, as we have seen in the discussion of public health models since 1960. Neither approach is ever entirely abandoned, but in different eras, one may be emphasized over the other. Indeed, a study of tuberculosis control in the 19th and 20th centuries led Fairchild and Oppenheimer (1998) to argue for a more nuanced approach to public health practice in which strategies that address both individual and environmental causes of disease with broad and targeted interventions are employed: "If the relative contribution of different interventions and factors is to be sorted out, pursuit of monocausal explanations for the retreat of TB, like monotypic intervention, is insufficient" (p. 1113).

These and other decisions about how to promote and maintain health in populations go to the heart of public health practice. Public health, as a field, plans and initiates prevention activities—primary, secondary, and tertiary. However, many important choices about these activities translate the public health mission into public health practice. Several choices are central to the actuality of public health:

- What health problems are addressed?
- Where are interventions targeted—environmental, individual, or multilevel?
- If targeted at the environmental level, are interventions focused on distal or proximal factors?
- Are methods voluntary or coercive?
- Are activities public or private enterprises?
- If private, are activities nonprofit or profit-making?

To clarify these choices and how they impact practice, we can examine the provision of clean water in the United States. Although water treatment has been practiced throughout human history as far back as 2000 BCE in ancient Greece and India, before the mid-1850s, the motivation to treat water, usually with some form of filtering, was to improve taste and reduce turbidity. In the mid-1800s, the need to treat water to prevent infectious disease outbreaks was beginning to be understood, even before we knew that water could contain microorganisms that caused these diseases. How water became associated with specific diseases is the story of one of the most famous public health achievements—John Snow's identification, through application of epidemiological principles, of the Broad Street pump as the source of the 1853 cholera epidemic in London. Here is the story as told by Summers (1989):

> When a wave of Asiatic cholera first hit England in late 1831, it was thought to be spread by "miasma in the atmosphere." By the time of the Soho outbreak 23 years later, medical knowledge about the disease had barely changed, though one man, Dr. John Snow, a surgeon (actually an anesthesiologist) and pioneer of the science of epidemiology, had recently published a report speculating that it was spread by contaminated water—an idea with which neither the authorities nor the rest of the medical profession had much truck. Whenever cholera broke out—which it did four times between 1831 and 1854—nothing whatsoever was done to contain it, and it rampaged through the industrial cities, leaving tens of thousands dead in its wake. The year 1853 saw outbreaks in Newcastle and Gateshead as well as in London, where a total of 10,675 people died of the disease. In the 1854 London epidemic the worst-hit areas at first were Southwark and Lambeth. Soho suffered only a few, seemingly isolated, cases in late August. Then, on the night of the 31st, what Dr. Snow later called "the most terrible outbreak of cholera which ever occurred in the kingdom" broke out.
>
> It was as violent as it was sudden. During the next three days, 127 people living in or around Broad Street died. Few families, rich or poor, were spared the loss of at least one member. Within a week, three-quarters of the residents had fled from their homes, leaving their shops shuttered, their houses locked and the streets deserted. Only those who could not afford to leave remained there. It was like the Great Plague all over again.
>
> By 10 September, the number of fatal attacks had reached 500 and the death rate of the St Anne's, Berwick Street and Golden Square subdivisions of the parish had risen to 12.8 percent—more than double that for the rest of London. That it did not rise even higher was thanks only to Dr. John Snow.
>
> Snow lived in Frith Street, so his local contacts made him ideally placed to monitor the epidemic which had broken out on his doorstep. His previous researches had convinced him that cholera, which, as he had noted, "always commences with disturbances of the

> functions of the alimentary canal," was spread by a poison passed from victim to victim through sewage-tainted water; and he had traced a recent outbreak in South London to contaminated water supplied by the Vauxhall Water Company—a theory that the authorities and the water company itself were, not surprisingly, reluctant to believe. Now he saw his chance to prove his theories once and for all, by linking the Soho outbreak to a single source of polluted water.
>
> From day one he patrolled the district, interviewing the families of the victims. His research led him to a pump on the corner of Broad Street and Cambridge Street, at the epicenter of the epidemic. "I found," he wrote afterwards, "that nearly all the deaths had taken place within a short distance of the pump." In fact, in houses much nearer another pump, there had only been 10 deaths—and of those, five victims had always drunk the water from the Broad Street pump, and three were schoolchildren, who had probably drunk from the pump on their way to school.
>
> Dr. Snow took a sample of water from the pump, and, on examining it under a microscope, found that it contained "white, flocculent particles." By 7 September, he was convinced that these were the source of infection, and he took his findings to the Board of Guardians of St James's Parish, in whose parish the pump fell.
>
> Though they were reluctant to believe him, they agreed to remove the pump handle as an experiment. When they did so, the spread of cholera dramatically stopped. [Actually the outbreak had already lessened for several days.] (pp. 113–117)

Knowledge about disease-causing microorganisms increased dramatically during the remainder of the 19th century because of advances in the microscope and other instruments. Cholera, typhoid, hepatitis, and other infectious diseases were understood to be waterborne and controllable through water treatment. Because of the tremendous death toll from such diseases, by the advent of the 20th century, water purification was considered an important public health issue, and methods to provide clean water were underway. The filtration systems of the past had been somewhat, but not entirely, effective against waterborne diseases. The first widely used method to eliminate waterborne disease organisms was chlorination. In 1970, public health concerns shifted from waterborne illnesses caused by microorganisms, to water pollution from pesticide residues, industrial waste, and organic chemicals. Regulations and water treatment plants were developed to respond to this source of water contamination as well (Jesperson, 2004).

In the United States, as in many other countries, providing clean water was viewed as a public good or utility. As a result, government at every level invested in water purification systems, and water treatment became a staple public health service. Government regulations set standards for water used for human consumption, and clean water was provided throughout the country by public or publicly regulated organizations. The exceptions were for people who lived in remote areas and obtained their water from private wells.

With respect to public health choices about how to improve health, this approach to preventing waterborne infectious diseases may be viewed as an

archetypical primary prevention; purifying water supplies is intended to prevent infectious diseases such as cholera, typhoid, and hepatitis from occurring at all. As for the strategy chosen to prevent waterborne infectious diseases, water treatment systems such as those in the United States are environmental-level interventions. Our systems of preventing exposure to unclean water do not depend on individual behaviors such as boiling water or adding chlorine to water for individual use. Under the environmental-level approach that we have followed, clean water is delivered to individuals through a system that is planned, installed, monitored, and maintained by an organization, irrespective of an individual user's actions. Using and/or creating clean water is not the responsibility of the individual. In addition, the water treatment organization in the United States is generally a public utility, not a private enterprise.

HEALTH IMPACT PYRAMID

The health impact pyramid developed by Frieden (2010) provides a very useful framework for integrating these ideas into public health practice (see Figure 1.4).

> "A 5-tier pyramid best describes the impact of different types of public health interventions and provides a framework to improve health. At the base of this pyramid, indicating interventions with the greatest potential impact, are efforts to address socio-economic determinants of health. In ascending order are interventions that change the context to make individuals' default decisions healthy, clinical interventions that require limited contact but confer long-term protection, and ongoing direct clinical care, and health education and counseling." (Frieden, 2010, p. 590)

Note that the author accepts the population health perspective that structural inequality embodied in socioeconomic factors is the level with the most potential to improve health—a primary prevention strategy. Also note that the second level—changing the context—is a primary prevention strategy, which includes provision of clean water and safe food, as well as passage of laws that prevent injuries and exposure to disease-producing agents. Interventions at the top tiers are a mix of primary, secondary, and tertiary prevention "designed to help individuals, rather than entire populations, but they could theoretically have a large population impact if universally and effectively applied. In practice, however, even the best programs at the pyramid's higher levels achieve limited public health impact, largely because of their dependence on long-term individual behavior change." (Frieden, 2010, p. 591)

Since its publication in 2010, the Health Impact Pyramid has begun to be used as a tool for describing different types of public health interventions. For example, an American Heart Association publication states, "The improvement in socioeconomic status (first level) is a worthy goal for any society and the AHA Community Guide fully recognizes the critical importance of the social determinants of CVD" (Pearson et al., 2013). The report further argues that a combination of policies and programs at all five tiers will be the best way to improve health outcomes in populations.

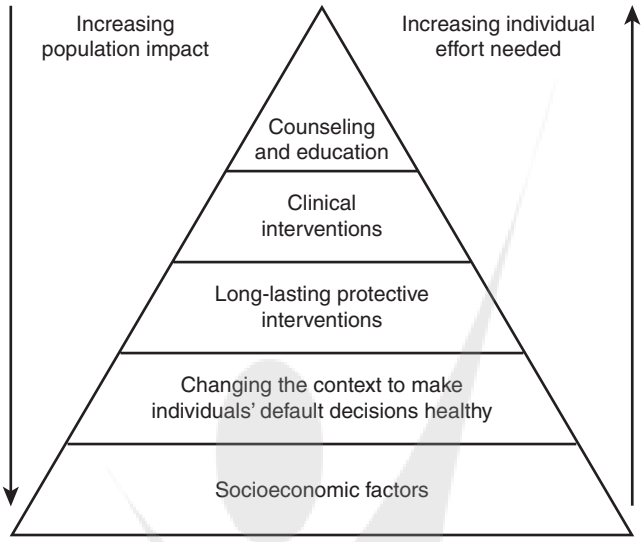

FIGURE 1.4 The Health Impact Pyramid.

Source: Frieden., T. R. (2010). A framework for public health action: The Health Impact Pyramid. American Journal of Public Health, 100, 591.

In the following chapters, we discuss the practice of public health. We examine what public health practitioners actually do and how their practice relates to the mission of public health and to primary, secondary, and tertiary prevention. So far, we have discussed public health in the ideal. However, the actual practice of public health does not always attain the ideal. In the next set of chapters, we discuss the public health system as it is currently practiced in the United States and its historical origins. This involves discussing the components of the public health system, including organization, financing, management, and performance, as well as the health problems that are addressed by public health. In this review, we will see how public health practice today in the United States compares to the ideal of "assuring conditions in which people can be healthy."

THE PROSPECTS FOR PUBLIC HEALTH

In the final chapter of the book, we discuss the prospects for the field of public health.

The promise of public health rests on social justice—everyone is entitled to the conditions that can maintain health. In practice, public health is a loose confederation of organizations and public agencies that are often not in a position to maintain or create the conditions that lead to health. Therefore, what are the prospects for public health? What conditions can public health affect? There is evidence that public health practice is on the cusp of change that will return the field to more politically oriented action aimed at changing underlying

structures of society that maintain inequalities throughout the world in morbidity, disability, and premature death between rich and poor, powerful and powerless, and high and low status. As Marmot (2005) writes:

> Health status, therefore, should be of concern to policy makers in every sector, not solely those involved in health policy. As a response to this global challenge, WHO (World Health Organization) is launching a Commission on Social Determinants of Health, which will review the evidence, raise societal debate, and recommend policies with the goal of improving health of the world's most vulnerable people. A major thrust of the commission is turning public health knowledge into political action. (p. 1099)

On the other hand, the pressure to continue emphasizing interventions that motivate people to change their behavior through traditional health promotion has wide support because it does not challenge existing power structures. It will be easier to maintain a focus on motivating individuals to change their own behavior, rather than taking on the difficult task of providing, in the broadest sense, the conditions in which people can be healthy. These issues are considered in the final chapter.

Another issue considered is who will provide public health services. Much of the work of public health is done by the public sector, but as the IOM emphasized in *The Future of the Public's Health in the 21st Century*, public health extends beyond government to encompass, "the efforts, science, art, and approaches used by all sectors of society (public, private, and civil society) to assure, maintain, protect, promote, and improve the health of the people" (IOM, 2003). Consistent with this view, public health "can be seen as an ideology, a profession, a movement, or a set of actions, but not as a single scientific discipline" (Savitz, Poole, & Miller, 1999, p. 1158).

For example, we, in the United States, where access to clean water is guaranteed by public utilities through environmental-level structures that deliver potable water to individuals in their homes, worksites, and public places, may assume that our system was the only way the goal of providing water free from disease-producing agents could have been achieved. However, this is not the case. Other models have been developed and are being tried throughout the world, mostly in poor countries and poor communities. They include water systems developed by the private sector such as in Bolivia, where the government licensed water distribution in the 1990s to private companies, headed by Bechtel (Salzman, 2006). Alternate approaches include individual-level strategies whereby people are responsible for filtering their own water using small-scale technologies such as the UV Waterworks, a portable, low-maintenance, energy-efficient water purifier, which uses ultraviolet light to render viruses and bacteria harmless (National Academy of Engineering, 2010). They include the Acumen Fund water initiatives that provide potable water in poor countries using market-based concepts and private investment without government help (Acumen Fund,

2010). These alternative strategies to providing potable water that is free from water-borne disease agents illustrate the variety of ways that public health problems can be addressed.

However, the questions that must be raised about the selection of strategies to achieve public health goals are related to their effectiveness, efficiency, and equity.

The purpose of this book is to open the field of public health to those new to it. Many complexities are not discussed in this attempt to make the overall values, goals, and practices of the field accessible to those unfamiliar with public health. With broad strokes, we hope to develop in the reader an appreciation of public health and an interest in learning more about the challenges and complexities of providing conditions in which people can be healthy.

STUDY QUESTIONS

Q: What is the most important difference between the fields of medicine and public health?

Q: What do we mean by the determinants of health?

Q: What does research indicate is the impact of each determinant on human health?

Q: What are the major differences among the Epidemiological Triangle, the PRECEDE-PROCEED model, and the Health Impact Pyramid?

Q: What types of public health interventions are considered to be most effective?

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TWO

ORIGINS OF PUBLIC HEALTH

OBJECTIVES

Readers will learn . . .

1. The broad classifications of health problems.
2. How the Industrial Revolution affected health and quality of life for average persons.
3. How life expectancy and cause of death during the Industrial Revolution differ from today.
4. What classic public health practices began during the Industrial Revolution.
5. The 10 greatest achievements of public health and which of these began during the Industrial Revolution.

How is public health practiced in the United States today? To examine this issue, we will first discuss the origins of public health in the Industrial Revolution of the 18th and 19th centuries. Early industrialization, and the human misery that was its consequence, set the stage for public health as a professional field—its sense of identity, organization, goals, methods, and "sensibility." In previous eras, societies have practiced "public health" in that they may have provided healthful conditions for their people. The Romans built the great aqueducts, for instance, to bring clean water to the

city. The Venetians during the 17th and 18th centuries controlled plague through public measures, including surveillance and control of travel:

> During the 17th and 18th centuries, measures were taken by the Venetian administration to combat plague on the Ionian Islands. At that time, although the scientific basis of plague was unknown, the Venetians recognized its infectious nature and successfully decreased its spread by implementing an information network. Additionally, by activating a system of inspection that involved establishing garrisons along the coasts, the Venetians were able to control all local movements in plague-infested areas, which were immediately isolated. In contrast, the neighboring coast of mainland Greece, which was under Ottoman rule, was a plague-endemic area during the same period. . . . even in the absence of scientific knowledge, close observation and social and political measures can effectively restrain infectious outbreaks to the point of disappearance. (Konstantinidou, Mantadakis, Falagas, Sardi, & Samonis, 2009, p. 39)

However, modern public health aims are, in addition to the prevention and control of disease and injury in populations—a goal in evidence throughout human history—the aspiration for social justice. This public health "sensibility" is intolerant of disparities in health between those who have wealth, power, and status, and those who do not (Krieger & Birn, 1998). This "sensibility" was clearly apparent in the early period of the Industrial Revolution and led to the great achievements that we ascribe to public health in the 19th and 20th centuries and strive to emulate today.

CLASSIFICATION OF HEALTH PROBLEMS

Before considering the origins of modern public health, we need a classification scheme for health problems. We can consider health problems to be of two broad types: diseases and injuries. Diseases can be classified as infectious or noninfectious, with infectious diseases caused by pathogenic microorganisms—bacteria, viruses, fungi, multicellular parasites, and prions—that can be transmitted from person to person or from other species to persons. The term "communicable disease" is used interchangeably with infectious disease as a result. Examples of infectious diseases are tuberculosis, plague, cholera, influenza, and human immunodeficiency virus (HIV). Noninfectious diseases are those that are not caused by a pathogenic microbe, but by factors that are not communicable or contagious such as environmental exposures to toxins, nutritional deficiencies, health behaviors, and genetic inheritance. They include dietary and autoimmune conditions, as well as hereditary diseases such as hemophilia, diabetes, cardiovascular disease, and cancer. Mental health conditions such as depression, anxiety, and others are noninfectious.

Noninfectious diseases are sometimes referred to as chronic diseases. However, the concept of chronic and acute may be applied to either infectious or noninfectious diseases. For example, HIV infection has become a chronic condition, at least in developed countries such as the United States, and nutritional deficiency diseases, once diagnosed, can be acute; that is, curable without lingering or permanent effects.

Injuries are the other broad category of health problems. Useful classifications of injuries for public health practice are identifying them as intentional and unintentional. Intentional injuries are self-inflicted, such as suicide, or inflicted by a person or persons on others, such as homicide. Intentional injuries may result in death or morbidity. Domestic violence, child abuse, and elder abuse are intentional injuries. Unintentional or accidental injuries, again, can be self-inflicted or inflicted by others and result in mortality or morbidity. The most common unintentional injuries result from motor vehicle crashes, but the home and workplace are sites of a great many unintentional injuries as well, including burns, falls, drownings, poisonings, and lacerations.

Distinguishing between diseases and injuries, infectious and noninfectious diseases, and intentional and unintentional injuries facilitates an understanding of the causes of health problems, and, therefore, strategies to prevent them.

LIFE DURING THE INDUSTRIAL REVOLUTION

The history of modern public health in the United States and elsewhere has its roots in the Industrial Revolution. The exemplar is Britain. During industrialization, cities grew rapidly as factories replaced the domestic system of production, beginning with textiles. The poor living and working conditions in the burgeoning industrial cities, where infectious diseases were prevalent and frequently epidemic, are well documented. Housing was crowded, sanitation was grossly inadequate, clean water was scarce, and a healthful diet was beyond the means of most people. Work consisted of long days in unsafe and poorly ventilated factories, often exposed to toxic substances (Thompson, 1964; Toynbee, 1957)';. Following are descriptions of housing and factory conditions in Britain, where industrialization first took root and had a profound effect on public health everywhere, including the United States, particularly in the development of the public health "sensibility."

Living Conditions

In the 1800s, London was an unsavory place to live for most people. The smells of raw sewage, horse and cattle manure, slaughter houses, unwashed bodies, and coal fires filled the air. Fog from the smoke of these fires made breathing difficult. Housing was cramped, often airless, and without a clean water supply or sanitary disposal of garbage and sewage. Diet was poor. On housing in

London, Dr. Vinen, a medical officer of health, reported in 1856 on the living conditions typical of the day:

> In one small miserably dirty dilapidated room, occupied by a man, his wife and four children, in which they live day and night, was a child in its coffin that had died of measles eleven days before and, although decomposition was going on, it had not even been fastened down. The excuse made for its not having been buried before was that burials by the parish did not take place unless there were more than one to convey away at a time . . . In another miserable apartment scarce seven feet wide lived five persons and in which there was not one atom of furniture of any kind; the room contained nothing but a heap of filthy rags on the floor . . . The front door is never closed day or night and in consequence the staircase and landing form a nightly resort for thieves and prostitutes, where every kind of nuisance is committed . . . There are two yards at the back of this house, in each of which is an open privy; one of them is so abominably filthy and emitted a smell so foul that I was almost overpowered. (Spartacus Educational, 2010f, Dr. Vinen, para. 1)

Factory Life

Factories of the period were grim places to work. Many interviews with adult and child laborers testify to the conditions that often led to injury, permanent disability, and disease. Long hours, little rest, poor ventilation, exposure to dangerous equipment and chemicals, and harsh enforcement of workplace rules were the norm. There is no substitute for the words of those who experienced the conditions themselves.

John Birley, a worker in a 19th-century mill, was interviewed by *The Ashton Chronicle* in 1849 about his life in Cressbrook Mill, where he began working when he was about 7 years old (Spartacus Educational, 2010e):

> Our regular time was from five in the morning till nine or ten at night; and on Saturday, till eleven, and often twelve o'clock at night, and then we were sent to clean the machinery on the Sunday. No time was allowed for breakfast and no sitting for dinner and no time for tea. We went to the mill at five o'clock and worked till about eight or nine when they brought us our breakfast, which consisted of water-porridge, with oatcake in it and onions to flavour it. Dinner consisted of Derbyshire oatcakes cut into four pieces, and ranged into two stacks. One was buttered and the other treacled. By the side of the oatcake were cans of milk. We drank the milk and with the oatcake in our hand, we went back to work without sitting down. (John Birley, para. 1)

A child who was interviewed by Michael Sadler's Parliamentary Committee in 1832 gave the following account of how factory hours were kept (Spartacus Educational, 2010i):

> I worked at Mr. Braid's Mill at Duntruin. We worked as long as we could see. I could not say at what hour we stopped. There was no clock in the mill. There was nobody but the master and the master's son [who] had a watch and so we did not know the time. The operatives were not permitted to have a watch. There was one man who had a watch but it was taken from him because he told the men the time. (James Patterson, para. 1)

Factory accidents were a major safety problem.

> Unguarded machinery was a major problem for children working in factories. One hospital reported that every year it treated nearly a thousand people for wounds and mutilations caused by machines in factories. A report commissioned by the House of Commons in 1832 said that: "there are factories, no means few in number, nor confined to the smaller mills, in which serious accidents are continually occurring, and in which, notwithstanding, dangerous parts of the machinery are allowed to remain unfenced." The report added that the workers were often "abandoned from the moment that an accident occurs; their wages are stopped, no medical attendance is provided, and whatever the extent of the injury, no compensation is afforded." In 1842 a German visitor noted that he had seen so many people in the streets of Manchester without arms and legs that it was like "living in the midst of the army just returned from a campaign." (Spartacus Educational, 2010c, paras. 1–3)

Poorly ventilated factory buildings were another serious problem (Spartacus Educational, 2010d).

> A report published in July 1833 stated that most factories were "dirty; low-roofed; ill-ventilated; ill-drained; no conveniences for washing or dressing; no contrivance for carrying off dust and other effluvia."
>
> Sir Anthony Carlisle, a doctor at Westminster Hospital, visited some textile mills in 1832. He later gave evidence to the House of Commons on the dangers that factory pollution was causing for the young people working in factories: "labour is undergone in an atmosphere heated to a temperature of 70 to 80 and upwards." He pointed out that going from a "very hot room into damp cold air will inevitably produce inflammations of the lungs."
>
> Doctors were also concerned about the "dust from flax and the flue from cotton" in the air that the young workers were breathing in. Dr. Charles Aston Key told Michael Sadler that this "impure air

> breathed for a great length of time must be productive of disease, or exceedingly weaken the body."

Dr. Thomas Young, who studied textile workers in Bolton, reported that factory pollution was causing major health problems.

> Most young workers complained of feeling sick during their first few weeks of working in a factory. Robert Blincoe said he felt that the dust and flue was suffocating him. This initial reaction to factory pollution became known as *mill fever*. Symptoms included sickness and headaches. The dust and floating cotton fibre in the atmosphere was a major factor in the high incidence of tuberculosis, bronchitis, asthma, and byssinosis[1] amongst cotton workers. (paras. 1–5)

Child Labor

Child labor in textile factories and coal mines was perhaps the most appalling fact of the early period of industrialization. Following are interviews with two children about their experiences in the textile factories of London. The interviews were conducted for government investigations into the working conditions of children (Spartacus Educational, 2010b). Again, there is no substitute for the words of those who experienced these conditions themselves.

> Charles Aberdeen was interviewed by Michael Sadler and his House of Commons Committee on 23rd July, 1832.
>
> Question: How young have you known children go into silk mills?
>
> Answer: I have known three at 6 [years of age]; but very few at that age.
>
> Question: What were your hours of labour?
>
> Answer: From six in the morning till seven at night.
>
> Question: Was it found necessary to beat children to keep them up to their employment?
>
> Answer: Certainly.
>
> Question: Did the beating increase towards evening?
>
> Answer: Their strength relaxes more towards the evening; they get tired, and they twist themselves about on their legs, and stand on the sides of their feet.
>
> Question: As an overlooker did you stimulate them to labour by severity?
>
> Answer: Certainly, my employer always considered this indispensable.
>
> Question: Did you not find it very irksome to your feelings, to have to take those means of urging the children to the work?

Answer: Extremely so; I have been compelled to urge them on to work when I knew they could not bear it; but I was obliged to make them strain every nerve to do the work, and I can say I have been disgusted with myself and with my situation; I felt myself degraded and reduced to the level of a slave driver in such cases.

Question: Is not tying the broken ends, or piecing, an employment that requires great activity?

Answer: Yes.

Question: Does not the material often cut the hands of those poor children?

Answer: Frequently; but some more than others. I have seen them stand at their work, with their hands cut, till the blood has been running down to the ends of their fingers.

Question: Is there more work required of the children than there used to be when you first knew the business?

Answer: Yes; on account of the competition [that] exists between masters. One undersells the other; consequently the master endeavours to get an equal quantity of work done for less money. (Spartacus Educational, 2010b, Factory Workers section, William Rastrick)

Eliza Marshall was born in Doncaster in 1815. At the age of 9 her family moved to Leeds, where she found work at a local textile factory. Eliza was interviewed by Michael Sadler and his House of Commons Committee on 26th May, 1832.

Question: What [were] your hours of work?

Answer: When I first went to the mill we worked [from] six in the morning till seven in the evening. After a time we began at five in the morning, and worked till ten at night.

Question: Were you very much fatigued by that length of labour?

Answer:Yes.

Question: Did they beat you?

Answer: When I was younger they used to do it often.

Question: Did the labour affect your limbs?

Answer: Yes, when we worked over-hours I was worse by a great deal; I had stuff to rub my knees; and I used to rub my joints a quarter of an hour, and sometimes an hour or two.

Question: Were you straight before that?

Answer: Yes, I was; my master knows that well enough; and when I have asked for my wages, he said that I could not run about as I had been used to do.

Question: Are you crooked now?

Answer: Yes, I have an iron on my leg; my knee is contracted.

Question: Have the surgeons in the Infirmary told you by what your deformity was occasioned?

> Answer: Yes, one of them said it was by standing; the marrow is dried out of the bone, so that there is no natural strength in it.
>
> Question: You were quite straight till you had to labour so long in those mills?
>
> Answer: Yes, I was as straight as anyone. (Spartacus Educational, 2010b, Factory Workers section, Eliza Marshall, para. 2)

Following is an interview with a man who became a piecer in a mill as a child (Spartacus Educational, 2010h):

> When I achieved the manly age of 10 I obtained half-time employment at Dowry Mill as a "little piecer." . . . The noise was what impressed me most. Clatter, rattle, bang, the swish of thrusting levers and the crowding of hundreds of men, women and children at their work. Long rows of huge spinning frames, with thousands of whirling spindles, slid forward several feet, paused and then slid smoothly back again, continuing the process unceasingly hour after hour while cotton became yarn and yarn changed to weaving material. Often the threads on the spindles broke as they were stretched and twisted and spun. These broken ends had to be instantly repaired; the piecer ran forward and joined them swiftly, with a deft touch that is an art of its own. I remember no golden summers, no triumphs at games and sports, no tramps through dark woods or over shadow-racing hills. Only meals at which there never seemed to be enough food, dreary journeys through smoke-fouled streets, in mornings when I nodded with tiredness and in evenings when my legs trembled under me from exhaustion. (J. R. Clynes, paras. 1–4)

Finally, here is another account of childhood spent in a mill from a young man interviewed by William Dodd in 1842 (Spartacus Educational, 2010a):

> I am about twenty-five years old. I have been a piecer at Mr. Cousen's worsted mill; I have worked nowhere else. I commenced working in a worsted mill at nine years of age. Our hours of labour were from six in the morning to seven and eight at night, with thirty minutes off at noon for dinner. We had no time for breakfast or drinking. The children conceive it to be a very great mischief; to be kept so long in labour; and I believe their parents would be very glad if it was not so. I found it very hard and laborious employment. I had 2s. per week at first. We had to stoop, to bend our bodies and our legs.
>
> I was a healthy and strong boy, when I first went to the mill. When I was about eight years old, I could walk from Leeds to Bradford (ten miles) without any pain or difficulty, and with a little fatigue; now I cannot stand without crutches! I cannot walk at all!

Perhaps I might creep up stairs. I go up stairs backwards every night! I found my limbs begin to fail, after I had been working about a year. It came on with great pain in my legs and knees. I am very much fatigued towards the end of the day. I cannot work in the mill now.

The overlooker beat me up to my work! I have been beaten till I was black and blue and I have had my ears torn! Once I was very ill with it. He beat me then, because I mixed a few empty bobbins, not having any place to put them in separate. We were beaten most at the latter end of the day, when we grew tired and fatigued. The highest wages I ever had in the factory, were 5s. 6d. per week.

My mother is dead; my father was obliged to send me to the mill, in order to keep me. I had to attend at the mill after my limbs began to fail. I could not then do as well as I could before. I had one shilling a week taken off my wages. I had lost several inches in height. I [frequently] had to stand thirteen and fourteen hours a day, and to be continually engaged. I was perfectly straight before I entered on this labour.

Other boys were deformed in the same way. A good many boys suffered in their health, in consequence of the severity of their work. I am sure this pain, and grievous deformity, came from my long hours of labour. My father, and my friends, believe so too. It is the opinion of all the medical men who have seen me. (Benjamin Gomersal, paras. 1–5)

Health Problems of the Times

The squalid and unsafe living and working conditions in industrialized cities of 19th-century Britain led to infectious disease outbreaks and epidemics, especially among the poor. Children were at most risk of death from infectious disease. The appalling working and living conditions of the poor and working classes during the industrialization of Europe, the United States, and similar countries also had a profound impact on the risk of injuries and noninfectious diseases. Lack of attention to safety in the workplace was a major cause of injuries and disabilities. In addition, the wages that families had for necessities were often unable to pay for healthful foods, and nutritional deficiency diseases were common.

MODERN PUBLIC HEALTH IS BORN

Public Outcry

The living and working conditions for the ordinary person during this period provoked a progressive outcry for change. Child labor was especially galvanizing. Work in the factories and coal mines was long, hard, and dirty for all

laborers. However, protection of children and women became a cause for many progressive leaders of the time. The following excerpt from a poem written in 1836 by Caroline Sheridan Norton (anonymous at the time) is an example of the sentiments held by many persons about child labor practices in Britain at the time (Norton, 1836). Prefacing the poem, which was meant to be presented in Parliament, the author stated the following:

> The abuses even, of such a business, must be cautiously dealt with; lest, in eradicating them, we shake or disorder the whole fabric. We admit, however, that the case of CHILDREN employed in the Cotton Factories is one of those that call fairly for legislative regulation (para. 1):
>
> > These then are his Companions: he, too young
> > To share their base and saddening merriment,
> > Sits by: his little head in silence hung;
> > His limbs cramped up; his body weakly bent;
> > Toiling obedient, till long hours so spent
> > Produce Exhaustion's slumber, dull and deep.
> > The Watcher's stroke–bold–sudden–violent–
> > Urges him from that lethargy of sleep,
> > And bids him wake to Life–to labour and to weep!
> > But the day hath its End. Forth then he hies
> > With jaded, faltering step, and brow of pain;
> > Creeps to that shed–his HOME–where happy lies
> > The sleeping babe that cannot toil for Gain;
> > Where his remorseful Mother tempts in vain
> > With the best portion of their frugal fare:
> > Too sick to eat–too weary to complain–
> > He turns him idly from the untasted share,
> > Slumbering sinks down unfed, and mocks her useless care.
>
> (Norton, 1836, A Voice from the Factories, paras. 48–49)

The author added about the poem:

> I will only add, that I have in *no* instance overcharged or exaggerated, by poetical fictions, the picture drawn by the Commissioners appointed to inquire into this subject. I have strictly adhered to the printed Reports; to that which I believe to be the melancholy truth; and that which I have, in some instances, myself had an opportunity of witnessing.
>
> I earnestly hope I shall live to see this evil abolished. There will be delay—there will be opposition: such has ever been the case with all questions involving interests, and more especially where the preponderating interest has been on the side of the existing abuse. Yet, as the noble-hearted and compassionate Howard became immortally connected with the removal of the abuses which for centuries disgraced our prison discipline; as the

> perseverance of Wilberforce created the dawn of the long-delayed emancipation of the negroes; so, my Lord, I trust to see *your* name enrolled with the names of these great and good men, as the Liberator and Defender of those helpless beings, on whom are inflicted many of the evils both of slavery and imprisonment, without the odium of either. (Norton, 1836, Dedicated to the Right Honourable Lord Ashley, paras. 7–8)

Another famous speech, given by Lord Byron before the House of Lords in 1812, defended the Luddites who had engaged in violence provoked by the loss of employment due to the industrialization of textile manufacture:

> During the short time I recently passed in Nottingham, not twelve hours elapsed without some fresh act of violence; and on that day I left the county I was informed that forty Frames had been broken the preceding evening, as usual, without resistance and without detection.
>
> Such was the state of that county, and such I have reason to believe it to be at this moment. But whilst these outrages must be admitted to exist to an alarming extent, it cannot be denied that they have arisen from circumstances of the most unparalleled distress: the perseverance of these miserable men in their proceedings, tends to prove that nothing but absolute want could have driven a large, and once honest and industrious, body of the people, into the commission of excesses so hazardous to themselves, their families, and the community.
>
> They were not ashamed to beg, but there was none to relieve them: their own means of subsistence were cut off, all other employment preoccupied; and their excesses, however to be deplored and condemned, can hardly be subject to surprise.
>
> As the sword is the worst argument that can be used, so should it be the last. In this instance it has been the first; but providentially as yet only in the scabbard. The present measure will, indeed, pluck it from the sheath; yet had proper meetings been held in the earlier stages of these riots, had the grievances of these men and their masters (for they also had their grievances) been fairly weighed and justly examined, I do think that means might have been devised to restore these workmen to their avocations, and tranquillity [*sic*] to the country. (Spartacus Educational, 2010g, Lord Byron, paras. 1–4)

Public Response to Infectious Disease Outbreaks

The high rate of infectious diseases in the industrializing British cities, including the cholera outbreaks of 1817, 1849, and 1854 in London, brought about a public health response. The 1854 outbreak was the one for which John Snow

identified the Broad Street pump as the cause, and although it was not known that the bacteria *Vibrio cholera* was present in the water gathered at the pump, it was evident from Snow's epidemiological investigation that it was the source of the disease outbreak.

The method used to address the problem of infectious diseases in Britain and other industrializing countries during the 1800s was environmental engineering—the archetypical primary prevention strategy—which modified the environment for all persons at risk. Although the microbial agents of infectious diseases were unknown at the time, public health engineering programs in the 1800s provided clean water and removal of sewage and garbage to reduce the problem of infectious disease outbreaks.

> By the 1800s, people began to understand that unsanitary living conditions and water contamination contributed to disease epidemics. This new awareness prompted major cities to take measures to control waste and garbage. In the mid-1850s, Chicago built the first major sewage system in the United States to treat wastewater. Soon, many other U.S. cities followed Chicago's lead. (National Oceanic and Atmospheric Administration [NOAA], 2010, para. 2)

Later in the century, the discoveries that led to vaccines and antimicrobial therapies, such as penicillin, resulted in further reduction in the threat of infectious diseases.

Public Response to Injuries and Noninfectious Diseases

The working conditions that led to injury and disability during the Industrial Revolution in Britain also produced a public response. Many people, as we have seen, wished to see an end to the abuse of workers under the factory system. With respect to child labor, the public response was an investigation of conditions by officials in the government and eventual passage of legislation. In 1831, the Sadler Committee, chaired by Michael Thomas Sadler, was charged with investigating conditions of child labor in cotton and linen factories. In 1833, a parliamentary commission was appointed to investigate working conditions in other textile industries. In 1842, a committee chaired by Lord Ashley investigated conditions in coal mines. Following is a summary of the laws enacted in Britain from 1819 to 1891 to protect workers, particularly children:

> 1819—Cotton Mills Act: Limits working days for children in cotton mills to 16 hours for those under 16 years. Children younger than the age of 9 should not be employed, but magistrates did not enforce this.
> 1833—Factory Act: Improves conditions for children working in cotton and woolen factories. Young children were working very long hours in workplaces where conditions were often terrible. The basic act was as follows:

1. There should be no child workers younger than 9 years of age.
2. Employers must have a medical or age certificate for child workers.
3. Children between the ages of 9 and 13 to work no more than 8 hours a day.
4. Children between the ages of 13 and 18 to work no more than 12 hours a day.
5. Children are not to work at night.
6. There should be two hours [of] schooling each day for children under 13 years.
7. Four factory inspectors must be appointed to enforce the law throughout the whole of the country.

However, the passing of this Act did not mean that the mistreatment of children stopped overnight.

> 1842—Mines and Collieries Act: Women and girls, and boys younger than the age of 10, are not allowed to work underground. Boys younger than the age of 15 are not allowed to work on machinery.
> 1844—Factory Act: Children younger than 13 years to work no more than 6.5 hours a day. Women and children aged 13 to 18 to work no more than 12 hours a day.
> 1847—Factory Act: Women and children younger than 18 years are limited to a 10 hour work day.
> 1860—Coal Mines Regulation Act: Boys younger than 12 years are not allowed underground unless they can read and write.
> 1867—Factory Act Extension: Extended existing legislation to all factories with 50 or more people employed. Specific industries included some with even less than 50 employees. These were blast furnaces, iron and steel mills, glass, paper making, tobacco, printing and bookbinding.
> 1875—Chimney Sweep Act: Requires that all chimney sweeps be licensed. Licenses were issued only to sweeps not using climbing boys.
> 1878—Factory and Workshops Act: Employment of children younger than 10 years is banned. Regulations of control safety, ventilation, and meals.
> 1891—Factory Act: This made the requirements for fencing machinery more stringent. Under the heading "Conditions of Employment," two considerable additions were included to previous legislation. The first is the prohibition on employers to employ women within 4 weeks after confinement; the second is the raising of minimum age at which a child can be set to work from 10 to 11 years old (United Kingdom Parliament, 2014).

Public response to the health problems brought about by the Industrial Revolution—both diseases and injuries—laid the foundation for public health as a professional field in Britain and other industrializing countries in Europe and the Americas. From the cauldron, which was the industrializing

cities of the 19th century, came what have become permanent public health commitments to workplace safety, child and maternal health, safe and healthful housing conditions, sanitary disposal of waste, and a safe and nutritious food supply. Concern for "vulnerable" populations and the desire to reduce health disparities and increase health equity are at the heart of many, if not most, public health goals and activities today. This "public health sensibility", it also can be argued, arose among progressive elites in response to the inequities and hardships of the poor and working people during the Industrial Revolution.

SUCCESS OF PUBLIC HEALTH MEASURES

Infectious diseases were the major cause of morbidity and mortality in Britain, as well as the rest of the world, through the end of the 19th century. Common infectious diseases included smallpox, chicken pox, cholera, malaria, diphtheria, and scarlet fever. Some diseases were not fatal, but others were responsible for most of the deaths at the turn of the century. Some, such as smallpox, could be disfiguring for life.

Environmental engineering projects that were begun in the 1800s resulted in improved control of infectious diseases and some of the greatest successes of public health. Later, advancements in the microscope and microbiology led to effective treatments for infectious diseases that in the past were death sentences. They also led to the development of vaccines to prevent infectious diseases from occurring.

> Control of infectious diseases has resulted from clean water and improved sanitation. Infections such as typhoid and cholera transmitted by contaminated water, a major cause of illness and death early in the 20th century, have been reduced dramatically by improved sanitation. In addition, the discovery of antimicrobial therapy has been critical to successful public health efforts to control infections such as tuberculosis and sexually transmitted diseases (STDs). (Centers for Disease Control and Prevention [CDC], 1999, p. 242)

These developments—primary prevention through sanitary engineering and vaccines, and secondary prevention through antibiotics and other antimicrobial drugs—changed dramatically the causes of death for people in the 20th century, as well as their age of death. Thus, the success of public health efforts with regard to infectious diseases—through primary and secondary prevention—is evident in changes in the leading causes of death and in life expectancy since the 19th century.

Information about the causes of death is obtained from death certificates and how they are coded and compiled:

> For the purpose of national mortality statistics, every death is attributed to one underlying condition, based on information

> reported on the death certificate and using the international rules for selecting the underlying cause of death from the conditions stated on the certificate. The underlying cause is defined by the World Health Organization (WHO) as "the disease or injury that initiated the train of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury." Generally, more medical information is reported on death certificates than is directly reflected in the underlying cause of death. Conditions that are not selected as underlying causes of death constitute the nonunderlying causes of death, also known as multiple cause of death. . . . Selected causes of death of public health and medical importance are compiled into tabulation lists and are ranked according to the number of deaths assigned to these causes. The top-ranking causes determine the leading causes of death. (National Center for Health Statistics [NCHS], 2010b, p. 502)

The United States is a good example of how the causes of death have changed since the era of infectious diseases. The leading causes of death are considerably different now than in 1900. The leading causes of death in 1900 in the United States (see Table 2.1) reflect the significance of infectious diseases. Deaths from infectious diseases were continuing to decline in 1900, but were still major health threats. At the turn of the century, the first three causes of death were infectious diseases—pneumonia and influenza; tuberculosis; diarrhea and enteritis; and ulceration of the intestines. These, along with diphtheria, accounted for 34% of all deaths at that time.

TABLE 2.1 LEADING CAUSES OF DEATH: UNITED STATES, 1900

CAUSE OF DEATH	NUMBER OF DEATHS	% OF ALL DEATHS
All causes	343,217	100
Pneumonia (all forms) and influenza	40,362	11.76
Tuberculosis (all forms)	38,820	11.31
Diarrhea, enteritis, and ulceration of the intestines	28,491	8.30
Diseases of the heart	27,427	7.99
Intracranial lesions of vascular origin (stroke)	21,353	6.22
Nephritis (all forms)	17,699	5.16
All accidents	14,429	4.20
Cancer and other malignant tumors	12,769	3.72
Senility	10,015	2.92
Diphtheria	8,056	2.35

Source: National Center for Health Statistics (2010a).

TABLE 2.2 LEADING CAUSES OF DEATH: UNITED STATES, 2006

CAUSE OF DEATH	NUMBER OF DEATHS	% OF ALL DEATHS
All causes	2,426,264	100
Diseases of the heart	631,636	26.03
Malignant neoplasm	559,888	23.08
Cerebrovascular diseases	137,119	5.65
Chronic lower respiratory diseases	124,583	5.13
Unintentional injury	121,599	5.01
Diabetes mellitus	72,449	2.99
Alzheimer's disease	72,432	2.99
Influenza and pneumonia	56,326	2.32
Nephritis, nephritic syndrome, and nephrosis	45,344	1.87
Septicemia	34,234	1.41

Source: National Center for Health Statistics (2010b).

Now, infectious diseases are far less prevalent causes of death than noninfectious diseases, including heart, cerebrovascular, and respiratory diseases, cancer, and diabetes (see Table 2.2). The only infectious diseases among the 10 leading causes of death—influenza and pneumonia, and septicemia—account for only 4% of all deaths. Further, most pneumonia and septicemia deaths now occur during hospitalizations at the end of life, not among the young.

However, it should be noted that infectious diseases remain a problem, even though noninfectious diseases predominate now. New infectious diseases have emerged, for example, HIV, which has had an effect on mortality among young people. Old infectious diseases have become resistant to standard treatments. For example, methicillin-resistant *Staphylococcus aureus* (MRSA), both community- and hospital-acquired, is a great concern. As the CDC reports: "MRSA can be fatal. In 1974, MRSA infections accounted for 2% of the total number of staph infections; in 1995 it was 22%; in 2004 it was 63%. CDC estimated that 94,360 invasive MRSA infections occurred in the United States in 2005; 18,650 of these were associated with death" (CDC, 2010).

> Life expectancy also reflects success in controlling infectious disease. "Life expectancy is a measure often used to gauge the overall health of a population. As a summary measure of mortality, life expectancy represents the average number of years of life that could be expected if current death rates were to remain constant. Shifts in life expectancy are often used to describe trends in mortality. Life expectancy at birth is strongly influenced by infant and

> child mortality. Life expectancy later in life reflects death rates at or above a given age and is independent of the effect of mortality at younger ages. (NCHS, 2010b, p. 44)

The control of infectious diseases, which began with the sanitary and housing improvements in the 1800s and ended with microbial treatments and vaccines in the late 19th and 20th centuries, was a major cause of increased life expectancy in the first half of the 20th century. This is particularly true for young people who were most at risk for death from diseases such as cholera, typhoid, diphtheria, and other infections. As an example, Table 2.3 contains the life expectancies for all people from 1900 through 2006 in the United States (Arias, 2010).[2] Between 1900 and 2006, children at birth and at the age of 1 year experienced a 58% and 40% increase in life expectancy, respectively, largely in the first half of the century. About 65% and 62%, respectively, of the overall increase for these ages came prior to 1951.

In contrast, life expectancy for adults 60 years and older increased further after 1951. People 60, 70, and 80 years old experienced an increase in life expectancy between 1900 and 2006 of 52%, 60%, and 64%, respectively. However, only about 28% of this increase for each age group occurred prior to 1951. In

TABLE 2.3 LIFE EXPECTANCY BY AGE: DEATH REGISTRATION STATES, 1900–1902 TO 1909–1911, AND UNITED STATES, 1929–1931 TO 2006

	AVERAGE NUMBER OF YEARS OF LIFE REMAINING						
Age and Race	1900–1902	1909–1911	1929–1931	1949–1951	1969–1971	1989–1991	2006
All races							
0	49.24	51.49	59.20	68.07	70.75	75.37	77.7
1	55.20	57.11	61.94	69.16	71.19	75.08	77.2
5	54.98	56.21	59.29	65.54	67.43	71.22	73.3
10	51.14	52.15	54.84	60.74	62.57	66.29	68.4
20	42.79	43.53	45.94	51.20	53.00	56.63	58.6
30	35.51	35.70	37.75	41.91	43.71	47.23	49.2
40	28.34	28.20	29.67	32.81	34.52	37.98	39.7
50	21.26	20.98	22.06	24.40	25.93	29.03	30.7
60	14.76	14.42	15.24	17.04	18.34	20.90	22.4
70	9.30	9.11	9.58	10.92	12.00	13.96	14.9
80	5.30	5.25	5.50	6.34	7.10	8.40	8.7

Source: Arias (2010).

the age of the great infectious disease epidemics, the control measures had only small effects on those who survived childhood.

Ten Great Achievements of Public Health Since 1900

Public health has had many accomplishments since its successes in infectious disease control in the 19th and early 20th centuries. The CDC (1999) has developed a list of the 10 greatest public health achievements in the United States since 1900. The average life span has increased by more than 30 years in the United States, and the CDC attributes 25 years of this gain to public health measures. The 10 achievements selected by the CDC were "based on the opportunity for prevention and the impact on death, illness, and disability" (p. 241). They are listed as follows:

Ten Great Public Health Achievements—United States, 1900 to 1999

1. *Vaccination.* Vaccination has resulted in eradication of smallpox; elimination of poliomyelitis in the Americas; and control of measles, rubella, tetanus, diphtheria, *Haemophilus influenza* type b, and other infectious diseases in the United States and other parts of the world.
2. *Motor vehicle safety.* Improvements in motor vehicle safety have resulted from engineering efforts to make both vehicles and highways safer, and from successful efforts to change personal behavior (e.g., increased use of safety belts, child safety seats, and motorcycle helmets, and decreased drinking and driving). These efforts have contributed to large reductions in motor vehicle-related deaths.
3. *Safer workplaces.* Work-related health problems such as coal workers' pneumoconiosis (black lung) and silicosis—common at the beginning of the century—have come under better control. Severe injuries and deaths related to mining, manufacturing, construction, and transportation have also decreased; since 1980, safer workplaces have resulted in a reduction of approximately 40% in the rate of fatal occupational injuries.
4. *Control of infectious diseases.* Control of infectious diseases has resulted from clean water and improved sanitation. Infections such as typhoid and cholera transmitted by contaminated water, a major cause of illness and death early in the 20th century, have been reduced dramatically by improved sanitation. In addition, the discovery of antimicrobial therapy has been critical to successful public health efforts to control infections such as tuberculosis and sexually transmitted diseases (STDs).

5. *Decline in deaths from coronary heart disease and stroke.* Decline in deaths from coronary heart disease and stroke have resulted from risk-factor modification such as smoking cessation and blood pressure control, coupled with improved access to early detection and better treatment. Since 1972, death rates for coronary heart disease have decreased 51%.
6. *Safer and healthier foods.* Since 1900, safer and healthier foods have resulted from decreases in microbial contamination and increases in nutritional content. Identifying essential micronutrients and establishing food-fortification programs have almost eliminated major nutritional deficiency diseases such as rickets, goiter, and pellagra in the United States.
7. *Healthier mothers and babies.* Healthier mothers and babies have resulted from better hygiene and nutrition, availability of antibiotics, greater access to health care, and technologic advances in maternal and neonatal medicine. Since 1900, infant mortality has decreased 90%, and maternal mortality has decreased 99%.
8. *Family planning.* Access to family planning and contraceptive services has altered social and economic roles of women. Family planning has provided health benefits such as smaller family size and longer intervals between the birth of children; increased opportunities for preconceptional counseling and screening; fewer infant, child, and maternal deaths; and the use of barrier contraceptives to prevent pregnancy and transmission of HIV and other STDs.
9. *Fluoridation of drinking water.* Fluoridation of drinking water began in 1945, and in 1999 reached an estimated 144 million persons in the United States. Fluoridation safely and inexpensively benefits both children and adults by effectively preventing tooth decay, regardless of socioeconomic status or access to care. Fluoridation has played an important role in the reductions in tooth decay (40%–70% in children) and of tooth loss in adults (40%–60%).
10. *Recognition of tobacco use as a health hazard.* Recognition of tobacco use as a health hazard and subsequent public health antismoking campaigns have resulted in changes in social norms to prevent initiation of tobacco use, promote cessation of use, and reduce exposure to environmental tobacco smoke. Since the 1964 Surgeon General's report on the health risks of smoking, the prevalence of smoking among adults has decreased, and millions of smoking-related deaths have been prevented. (CDC, 1999, pp. 242–243)

Through the 19th century and into the 20th century, public health in the United States organized principally as a government effort and expanded its impact on the important health issues of the time. Public health practice

continued to be influenced by the health and safety problems—infectious diseases and injuries—that predominated in the industrializing cities of Britain, the United States, and elsewhere during the Industrial Revolution, and the prevention measures that had been successful then. These included provisions of clean water, sanitary removal of sewage and garbage, safe housing, clean food supply, and safe workplaces. Development and provision of vaccines to prevent infectious diseases became an essential component of the public health toolkit. Public health also added initiatives in response to changing health needs, particularly the increase in noninfectious diseases such as heart, vascular, and respiratory diseases; diabetes; and cancer. Reducing health behaviors related to noninfectious disease risk including smoking, poor diet, and sedentary lifestyle became an integral part of public health practice. As medical care became more effective, ensuring availability of hospital and physician services for those whose access was limited by poverty, geography, and health status became an important focus of public health efforts. The development of automobiles and the influence of motor vehicle-related accidents on morbidity and mortality put this issue on the public health agenda as well. Emerging infectious diseases, particularly HIV and the antibiotic-resistant strains of old infectious diseases have become important to public health. Threaded throughout the expanded public health agenda remains the drive to ensure that persons with the least power, influence, and resources have the opportunity to lead safe and healthy lives, just as the plight of child factory workers in the early 1800s moved British reformers to action on their behalf. The emphasis today on ending health disparities is testament to this enduring public health goal and the "public health sensibility" motivating it. This is not to say that public health has been entirely effective. Much has been done, but much remains to be done, as we discuss in the final chapter.

STUDY QUESTIONS

Q: How do the 10 greatest achievements of public health relate to the Health Impact Pyramid?

Q: How do the 10 greatest achievements of public health relate to the PRECEDE-PROCEED model?

Q: Who were the champions of reform during the Industrial Revolution?

Q: How were public health reforms achieved?

Q: What is the relationship of child labor to public health achievements during the Industrial Revolution?

NOTES

1 Byssinosis is a lung disease caused by breathing cotton dust or dusts from other fibers such as flax, hemp, or sisal.
2 Alaska and Hawaii included beginning in 1959. For decennial periods prior to 1929–1931, data are for groups of registration states as follows: 1900–1902 and 1909–1911, 10 states and the District of Columbia (D.C.); 1919–1921, 34 states and D.C. Beginning 1970, excludes deaths of nonresidents of the United States.

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THREE

ORGANIZATION AND FINANCING OF PUBLIC HEALTH

OBJECTIVES

READERS WILL UNDERSTAND . . .

1. The legal basis for public health practice at the federal, state, and local levels.
2. The organization of public health services at the federal, state, and local levels.
3. The three core functions and the 10 essential services and who performs them.
4. The major public health agencies at the federal level and their roles.
5. The major professional organizations and their roles in public health practice.
6. The source and amount of public health funding.

The 2003 Institute of Medicine (IOM) report, *The Future of the Public's Health in the 21st Century*, emphasizes that public health extends beyond government and encompasses, "the efforts, science, art, and approaches used by all sectors of society (public, private, and civil society) to assure, maintain, protect, promote, and improve the health of the people" (Committee on Assuring the Health of the Public in the 21st Century, 2002, p. 20). The report defines six critical "actors" who are in a position to greatly affect health: communities, the health care delivery system, employers and business, the media, academia, and government.

> Public health systems are commonly defined as "all public, private, and voluntary entities that contribute to the delivery of essential public health services within a jurisdiction." These systems are a network of entities with differing roles, relationships, and interactions. All of the entities within a public health system contribute to the health and well-being of the community or state. (Centers for Disease Control and Prevention [CDC], 2007, p. 6)

Other definitions of public health also emphasize the collaboration between the public and private sectors in the organization and activities of public health. Van Wave, Scutchfield, and Honoré (2010) assert that:

> The public health system is defined as the collective resources, infrastructure, and effort of all public, private, and voluntary entities and their respective roles, relationships, and interactions that contribute to the delivery of essential public health services to the population within a jurisdiction. (p. 284)

The CDC states: "The governmental public health agency—both at the state and local levels—is a major contributor and leader in the public health system, but these governmental agencies cannot provide the full spectrum of Essential Services alone" (CDC, 2007, p. 6). The IOM (1988, p. 41) defines the public health system as the "activities undertaken within the formal structure of government and the associated efforts of private and voluntary organizations and individuals." Further, the IOM (2003) finds that a public health system is a complex network of individuals and organizations that have the potential to play critical roles in creating the conditions of health. They can act for health individually, but when they work together toward a health goal, they act as a system—a public health system (p. 28).

Although there is much to recommend this broader understanding of the public health system, it is also too extensive for an introduction. In this chapter, we will focus on the governmental public health system, with some attention to the private actors who frequently collaborate with it (e.g., academia, nonprofit health organizations, and professional associations). The decision to focus on government is, in part, practical: taking an especially broad view of the public health "system," which encompasses a multitude of actors in all areas of society—largely without any formalized organization, relationships, or roles—renders it largely resistant to generalization, and as we will see, the governmental system is itself sufficiently complex all on its own. The decision is also, however, substantive:

> Governmental public health agencies constitute the backbone of the public health system and bear primary, legally mandated responsibility for assuring the delivery of essential public health services. Therefore, the role of government in assuring the nation's health is one that must be continued and sustained. (IOM, 2003, p. 27)

Government has a unique and special responsibility to promote public health. Governments also have the resources and legal authority to implement public health policies and focus public health missions that private actors generally lack. Accordingly, the focus of the discussion of the U.S. public health system will be on the government agencies; we should not lose sight of the fact that government frequently partners with other actors—academia, nongovernmental organizations (NGOs), professional associations, philanthropic organizations, the private health care delivery system, as well as business and media—in developing and delivering public health services.

> The integrating force for the public health system—the "glue"—is the official public health agency infrastructure. Only government has jurisdiction, the power to create and enforce laws, and the mandate to secure our fundamental rights. In the United States, such duties rest within the governments of the fifty states and five territories, each of which has an organized public health unit that oversees the conduct of the government's public health programs and fulfills the roles that "cannot be properly delegated." (Tilson & Berkowitz, 2006, p. 904)

Government is also key because "public health" functions, at least in large part, are to provide for people who are not suitably or effectively provided for by the private sector.

Organization of the Public Health System

The governmental public health system in the United States is comprised of several departments and agencies within the federal government, at least one state-level agency for every state and territory in the country, and approximately 2,800 local health agencies. Hundreds of thousands of public health workers staff these agencies (Association of State and Territorial Health Officials [ASTHO], 2009; National Association of County and City Health Officials [NACCHO], 2011; U.S. Department of Health & Human Services [DHHS], 2013b). Given our cognitive preference to find order in systems and our predispositions about the structure of organizations, it may be tempting to imagine from this rudimentary description that the U.S. public health system is a centralized, cohesive, hierarchically arranged organization in which the federal government sets policy and marshals resources, which it then distributes to the states, which in turn establish the infrastructure for implementation of those polices and provision of public health services to the population through local health departments, which then deliver them.

In truth, however, the governmental public health system in the United States is highly decentralized. The federal government has little direct control over state public health matters. States are generally responsible for their own public health systems, and in most circumstances, states delegate at least

some of that authority to local political units—cities, towns, counties, and so forth—that set and implement their own public health policies. Rather than exercising *authority* over health matters in the United States, the federal government's role is primarily one of *influence*. This influence is broadly either of the "persuasive" variety, whereby research and recommendations conducted at the federal level inform the decisions of more local public health policymakers and actors, or of the "financial" variety, whereby the federal government provides financial support to state and local public health agencies, frequently on the condition that the funds be used in a particular manner. The limited authority the federal government does have is generally restricted to those issues that have been recognized as affecting commercial or business conditions across state lines. Thus, the U.S. government public health system is a highly complex system of discrete, often independent, decentralized, and varied agencies.

The decentralized and largely local character of the public health system is, in substantial part, a consequence of the legal, political, and historical context in which the public health system developed and operates. Largely, the organization of the public health system and the delivery of public health services can be traced to the principles of federalism governing the broader political and governmental organization of the United States (Turnock & Atchison, 2002). Under the U.S. federal system, sovereign power is shared between the federal government and the states, with certain powers delegated to the federal government exclusively, certain powers retained by the states exclusively, and some powers held by both the federal and state governments (subject to the limitations of federal supremacy). The 10th Amendment provides that any power not specifically delegated to the federal government in the Constitution be retained by the states. Among the powers the Constitution provides to the federal government is the power to tax and spend and to regulate interstate commerce. As will be discussed further, the activities of the federal government in support of public health generally derive from these powers. One power not specified in the Constitution, however, is the "police power"—the power to regulate and coerce persons for the benefit and welfare of society. Because it is not specified, it is among the plenary powers remaining with the states. It has long been recognized that the authority to regulate in the interest of public health derives from the police power ("The states of this Union may, in the exercise of their police powers, pass quarantine and health laws." *Passenger Cases*, [1849] Wayne, J., concurring). States, therefore, have primary authority for public health in the United States.

Consistent with federalism's placement of value on local self-determination, states often further pass on the police power, at least to some extent, to smaller and more local units of government (counties, cities, towns, etc.). This is true in the area of public health. Many states have delegated public health responsibilities to local governments or boards of health. Further, "home rule" statutes in 48 states authorize local governments, depending on factors including their size and class, to address public health issues directly through local laws (McCarty, Nelson, Hodge, & Gebbie, 2009). That public health concerns are considered under the federal system to be principally matters of local focus

is consistent with the historic emergence of public health practice and regulation in the United States. "Public health in the United States did not begin as a systematic, rational, centrally directed activity following a coherent plan but rather as a fitful, episodic, and necessity-driven response to immediate local threats" (Fee & Brown, 2002). Public health concerns—and health matters in general, for that matter—did not historically emerge as national issues, but as local ones, and the allocation of government responsibility—with state and the local government having primary responsibility for implementing public health regulations and delivery of public health services—reflects this.

That governmental public health authority and delivery in the United States is decentralized is not necessarily problematic. Consistent with principles of federalism, theories of political economy suggest that superior public services may flow from decentralized governmental authority, because the more local the government, the closer it is to the population it serves, making it more informed of and responsive to the needs of its population (Mays et al., 2006; Mays, Beitsch, Corso, Chang, & Brewer, 2007). However, in the last quarter century, the ability of the U.S. public health system to deliver the services required of it has come under scrutiny. The Institute of Medicine's [IOM] 1988 landmark report, *The Future of Public Health*, which is a frequent reference point for analysis and evaluation of the U.S. public health system, stimulated interest in assessment and improvement of the public health enterprise (Tilson & Berkowitz, 2006; Turnock & Atchison, 2002). The report noted that "[i]n recent years, there has been a growing sense that public health, as a profession, as a governmental activity, and as a commitment of society is neither clearly defined, adequately supported, nor fully understood" (IOM, 1988, p. v). It concluded that the nation "has lost sight of its public health goals and has allowed the system of public health activities to fall into disarray," and that the public health system was incapable of meeting its responsibilities (IOM, 1988).

The legal and constitutional framework in which public health activities are conducted contributes to the "disarray" and fractured system of public health identified by the IOM. A consequence of limited scope of federal government's authority in regulating health is that there is no central public health authority with nationwide reach; no entity or agency has comprehensive authority for the operation of the public health system. Instead, as the IOM observed, because public health regulations and services are implemented primarily at the state and local level, public health goals emerge within different political units and communities, each with their own health problems and concerns, political systems, resource availability, organizations, and values (IOM, 1988). Therefore, public health systems vary widely from community to community, with each prioritizing different problems and offering different responses and solutions to public health issues. While this characteristic may enhance local control, appropriateness, and flexibility of local agencies to meet the needs of a particular population, it also leads to fragmentation and uneven distribution in the type and quality of services provided (Baker et al., 2005). Further, with responsibility for health dispersed across federal, state, and local agencies and governments, coordination in response to health problems or in pursuit of health goals is often frustrated by fragmented system organization.

The division of authority has led to inconsistency, poor resource allocation, and lack of clarity about the agencies' respective responsibilities (Baker & Koplan, 2002). In light of this, the IOM concluded that "viewed from a national perspective, the national public health system is a scene of tremendous variety and disarray as different communities work out different solutions to public health problems" (IOM, 1988, p. 74).

The IOM did not conclude that the structure of the U.S. public health system was inherently flawed. Rather, it acknowledged that states have primary authority over public health matters, that local health departments provide the "front" line in the delivery of public health services, and that the federal government has the resources to facilitate improvement of the public health infrastructure. It emphasized that no community should be without the protections of a public health system, and concluded that this was possible only through the local components of an organized nationwide system of state-level agencies (IOM, 1988; Tilson & Berkowitz, 2006). Rather than propose a reorganization of the public health system, the IOM concentrated on the enterprise of public health, and identified three core functions that should be conducted by public health agencies at all levels of government: (a) assessment—activities concerning community diagnosis such as surveillance and epidemiology; (b) policy development—determination and prioritization of problems, goals, solutions, and resource allocation; and (c) assurance—guaranteeing that necessary public health services are provided. The IOM acknowledges that implementation of the core functions would vary from place to place. "The specific actions appropriate to strengthen public health will vary from area to area and must blend professional knowledge with community values" (IOM, 1988, p. 18).

Ten Essential Services

In 1994, the DHHS convened a committee with representatives from all major public health constituencies, including the American Public Health Association (APHA), the Association of Schools of Public Health (ASPH), the ASTHO, the Environmental Council of the States (ECS), the NACCHO, the National Association of State Alcohol and Drug Abuse Directors, the National Association of State Mental Health Program Directors, the Public Health Foundation (PHF), and the divisions of DHHS constituting the U.S. Public Health Service. The Public Health Functions Steering Committee released a consensus statement titled, *Public Health in America*, which stated the vision, mission, purposes, and essential functions of public health in the United States (Public Health Functions Steering Committee, Office of Disease Prevention and Health Promotion, Office of Public Health and Science, U.S. Department of Health & Human Services [DHHS], 1994). According to the statement, public health:

- Prevents epidemics and the spread of disease
- Protects against environmental hazards
- Prevents injuries
- Promotes and encourages healthy behaviors

- Responds to disasters and assists communities in recovery
- Assures the quality and accessibility of health services

The committee also identified 10 essential services of public health, which have come to guide the practice of public health:

- Monitor health status to identify community health problems.
- Diagnose and investigate health problems and health hazards in the community.
- Inform, educate, and empower people about health issues.
- Mobilize community partnerships to identify and solve health problems.
- Develop policies and plans that support individual and community health efforts.
- Enforce laws and regulations that protect health and ensure safety.
- Link people to needed personal health services and ensure the provision of health care when otherwise unavailable.
- Ensure a competent public health and personal health care workforce.
- Evaluate effectiveness, accessibility, and quality of personal and population-based health services.
- Research for new insights and innovative solutions to health problems.

The list of 10 essential services translates the three core functions identified by the IOM into a more specific set of activities. "These embody the protections and services that every citizen has the right to expect and every government has the obligation to assure. No matter what the unique features of any single community, the concept of the 10 essential services recognizes that every community needs a robust and reliable agency infrastructure" (Tilson & Berkowitz, 2006, p. 905). The 10 essential services now provide the foundation for the nation's public health strategy, including the *Healthy People 2010* objectives, which are discussed in Chapter 6, and the development of the National Public Health Performance Standards (CDC, 2007; DHHS, 2000).

FEDERAL PUBLIC HEALTH

Despite the constitutional restrictions on the federal government's role in regulating public health, it nevertheless plays a very large role in the U.S. public health system. The two powers constitutionally delegated to the federal government mentioned before—the power to tax and spend for the general welfare and the power to regulate interstate commerce—provide the basis for most federal activity in the public health arena. The federal government's key activities can generally be categorized as falling under at least one of four groups: (a) allocation and distribution of resources to public health actors; (b) information generation and distribution; (c) health care access assurance; and (d) regulation and enforcement. In many cases, an activity may be characterized as falling under more than one category.

The power to tax and spend is exactly what it sounds like: The federal government is authorized to collect and distribute funds to promote the welfare

of the nation. "Spending" may be either the funding of projects and programs carried out by the government itself, financing contracts with external parties, or making direct contributions of funds (e.g., through grants). Most of the federal government's public health activities are based on its power to tax and spend. For example, pursuant to this power, the federal government conducts extensive health monitoring, surveillance, and epidemiological studies; it conducts and funds health and biomedical research; it surveys the nation's health status and health needs; it develops policies, guidelines, and standards for public health practice; it provides direct and indirect funding to state and local public health agencies, as well as private organizations such as community health centers; it supports public information and education campaigns on health-related matters; it conducts and funds public health education and research; it provides education and training to the public health workforce; and it funds or provides access to personal health services through such programs as community health centers, Medicaid, Medicare, State Children's Health Insurance Program (SCHIP), and health care for veterans. The taxing power is also used to encourage or discourage certain behaviors. For example, the federal government may encourage private business to provide health insurance to employees through tax credits, and it may discourage the consumption of tobacco products or alcohol through the imposition of excise or "sin" taxes.

The federal government's health-related regulatory authority is generally derived from the Commerce Clause—the constitutional provision permitting the federal government to regulate interstate commerce. Although generally more limited in scope than its activities financing public health research and services or providing access to health care, the federal government does impose and enforce regulations and laws in several public health areas affecting the country generally. For example, federal agencies enforce regulations concerning drug, food, and occupational safety, as well as environmental protection. The federal government's regulatory activities in each of these arenas are based in its authority under the Commerce Clause. If there were political will, this could be overcome and federal control imposed. See the Clean Air Act case; the same reasoning could be applied to communicable disease monitoring—disease affects business and does not respect political boundaries.

Department of Health & Human Services

The central, though not only, federal agency responsible for health and health care in the United States is the Department of Health & Human Services (DHHS). Its mission is to act as "the United States government's principal agency for protecting the health of all Americans and [to] provid[e] essential human services, especially for those who are least able to help themselves" (DHHS, 2013a, para. 2). Through 11 operating divisions, the DHHS administers more than 115 health-related programs in a wide range of areas, including health and biomedical research, epidemiology and surveillance, disease prevention

and immunization, food and drug safety, providing access to primary health care for certain populations, and bioterrorism response preparedness (DHHS, 2013b). The DHHS directly employs the fulltime equivalent of approximately 77,500 people and in 2014 has a budget of $967.3 billion (DHHS, 2013c).

Out of the 11 operating divisions within the DHHS, eight are components of the U.S. Public Health Service. There are three staff offices within the Office of the Secretary, which are also designated components of the U.S. Public Health Service and which operate to coordinate the agency's public health activities. These operating divisions and staff offices themselves each contain many subagencies and offices, administering hundreds of programs within the DHHS. Table 3.1 lists the operating divisions and staff offices of the U.S. Public Health Service and their respective missions.

As Table 3.1 indicates, the scope of activities and services undertaken by the DHHS is vast, and indeed, many of the identified subagencies and offices have their own branches and divisions, each with its own mission and program responsibilities. A comprehensive discussion of the activities and programs of the DHHS agencies is far beyond what can be accomplished

TABLE 3.1 DEPARTMENT OF HEALTH & HUMAN SERVICES OPERATING DIVISIONS, INCLUDING THOSE CONSTITUTING THE U.S. PUBLIC HEALTH SERVICE

OPERATING DIVISION	MISSION
Agency for Healthcare Research and Quality (AHRQ)	*Mission:* to improve the quality, safety, efficiency, and effectiveness of health care for all Americans
Agency for Toxic Substances and Disease Registry (ATSDR)	*Mission:* to serve the public through responsive public health actions to promote healthy and safe environments and prevent harmful exposures
Centers for Disease Control and Prevention (CDC)	*Mission:* collaborating to create the expertise, information, and tools that people and communities need to protect their health, through health promotion; prevention of disease, injury, and disability; and preparedness for new health threats
Food and Drug Administration (FDA)	*Mission:* (a) to protect the public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation; (b) to advance the public health by helping to speed innovations that make medicines and foods more effective, safer, and more affordable; and helping the public get the accurate, science-based information they need to use medicines and foods to improve their health
Health Resources and Services Administration (HRSA)	*Mission:* to improve health and achieve health equity through access to quality services, a skilled health workforce, and innovative programs

(*continued*)

TABLE 3.1 DEPARTMENT OF HEALTH & HUMAN SERVICES OPERATING DIVISIONS, INCLUDING THOSE CONSTITUTING THE U.S. PUBLIC HEALTH SERVICE *(continued)*

OPERATING DIVISION	MISSION
Indian Health Services (IHS)	*Mission:* to raise the physical, mental, social, and spiritual health of American Indians and Alaska Natives to the highest level
National Institutes of Health (NIH)	*Mission:* to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce the burdens of illness and disability
Substance Abuse and Mental Health Services Administration (SAMHSA)	*Mission:* to reduce the impact of substance abuse and mental illness on America's communities
Centers for Medicare & Medicaid Services (CMS)	*Mission:* to ensure availability of effective, up-to-date health care coverage and promote quality care for beneficiaries
Administration for Children and Families (ACF)	*Mission:* to promote the economic and social well-being of children, youth, families, and communities, focusing particular attention on vulnerable populations such as children in low-income families, refugees, and Native Americans
Administration for Community Living (ACL)	*Mission:* to maximize the independence, well-being, and health of older adults; people with disabilities across the life span; and their families and caregivers

Source: DHHS (2013a, 2013b).

here. What follows should not, by any means, be considered an exhaustive description of the agencies discussed, but is rather intended to give an idea of some of the key programs and activities of the DHHS agencies, and how the federal government supports the 11 essential public health services.

Centers for Disease Control and Prevention[1]

Established in 1946 as the Communicable Disease Center, the CDC is the preeminent epidemiological, surveillance, and disease prevention agency in the federal government. Among its key functions is to monitor and report on the nation's health, detect health problems and disease outbreaks, research and implement disease prevention strategies, develop and advocate sound public health policies, promote healthy behaviors, and provide public health leadership and training. The CDC is the nation's go-to agency for public health.

It is the voice of public health for the nation. The CDC houses some of the best epidemiologists; biomedical, behavioral, and social scientists; prevention researchers; health policy analysts; and health economists in the world. Many know the CDC for its outstanding work related to infectious diseases. Its staff travels to sites worldwide when infectious disease outbreaks occur. The CDC publishes the essential *Morbidity and Mortality Weekly Report* (MMWR), which contains the latest information on reportable diseases, new hazards, and other emerging health conditions. The CDC has also been a leader in bioterrorism threats research and practice. The CDC has become actively involved in noninfectious disease prevention, as well as the area of chronic diseases and injury control. Employing the equivalent of nearly 11,000 full-time employees (DHHS, 2013c), the CDC has been called "the nation's premier and largest public health organization" (Hartsaw, 2009, p. 141). At the time of writing, many divisions of the CDC were undergoing reorganization. Where possible, we discuss the roles and activities of the new centers, even if integration of the divisions was not yet complete. The scope of its activities is too great to be presented here, but a few examples follow.

Infectious Diseases

At present, the CDC has three centers to prevent, control, and detect communicable diseases: the National Center for Immunization and Respiratory Diseases; National Center for Emerging and Zoonotic Infectious Diseases (NCEZD); and National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention.[2]

The *National Center for Immunization and Respiratory Diseases* has two components: the mandatory Vaccines for Children (VFC) program and the discretionary Section 317 program. These two programs combined provide approximately 50 percent of the pediatric vaccines and 30 percent of the adolescent vaccines distributed in the United States each year. The Section 317 program provides funds to support state immunization infrastructure and operational costs and supplies many of the vaccines public health departments provide to individuals not eligible for VFC, including adults. Together, these programs constitute a nearly $4.9 billion immunization program (DHHS, 2013c). With increasing health coverage provided by the Affordable Care Act, the CDC will focus on targeting the immunization program and resources to the uninsured, continuing to support the systems that make vaccines available nationwide, and protecting public health's ability to respond to outbreaks (DHHS, 2013c).

The *NCEZD* works to detect, prevent, and control the spread of infectious diseases, focusing on zoonotic diseases, diseases found in connection with refugee health, foodborne diseases, waterborne diseases, nosocomial (health care-associated) infections, and vectorborne diseases. Within the several divisions comprising the office, the CDC conducts extensive disease epidemiology, laboratory programs, and basic and applied research relating to infectious disease; and plans for and coordinates prevention and outbreak response. With a $70 million increase in the FY 2014 budget, investments are being made to modernize the CDC's technology and methods to better detect and track infectious diseases. The Advanced Molecular Detection and

Response to Infectious Disease Outbreaks initiative represents a fundamental change and modernization in the CDC's current public health microbiology and bioinformatics capabilities. The request will support investments in bioinformatics, database development, data warehousing, and analytics to make use of recent technologic advances and allow the CDC to derive information from increasingly complex data sets. These improvements are critical to allowing the CDC to continue to act as the nation's premier public health agency (DHHS, 2013c).

The *National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention* is responsible for public health surveillance, prevention research, and programs to prevent and control human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS), sexually transmitted diseases (STDs), viral hepatitis, and tuberculosis (TB). The center works in collaboration with governmental and nongovernmental partners at community, state, and national levels on research, surveillance, technical assistance, evaluation, and development of prevention programs. In 2014, the department budget is $1.2 billion, an increase of $14 million over the financial year 2012 budget. Forty million dollars will go to the Community High-Impact Prevention Initiative, which will focus on implementing sustainable, high-impact HIV-testing and screening programs; delivering comprehensive prevention for HIV-positive individuals, including linkage to and engagement in care and prevention services; using data to improve viral load suppression rates and other services; supporting scalable and effective behavioral interventions; and implementing public health strategies for at-risk populations. Additionally, the fiscal year 2014 budget includes $10 million to enable public health agencies to seek reimbursement from insurance companies for infectious disease testing covered because of the Affordable Care Act (DHHS, 2013c).

Noninfectious Diseases and Injuries

Many units within the CDC focus on noninfectious diseases and injuries: National Center for Chronic Disease Prevention and Health Promotion; National Center for Environmental Health; National Center for Injury Prevention and Control; National Institute for Occupational Safety and Health (NIOSH); and National Center on Birth Defects, Developmental Disabilities, Disability, and Health.

The *National Center for Chronic Disease Prevention and Health Promotion* works to prevent and control chronic diseases. Focusing on many of the leading causes of morbidity and mortality such as cancer, diabetes, heart disease and stroke, nutrition/obesity, and tobacco use, the center provides funding and assistance to help state, tribal, and territorial health agencies to support data collection on disease risk factors, incidence, and death; to conduct research on disease risk and prevention strategies; to implement disease prevention programs; and to provide educational materials for health

professionals, policymakers, and the public on issues pertaining to chronic disease prevention and control.

Among the programs administered by the National Center for Chronic Disease Prevention and Health Promotion is the Preventive Health and Health Services Block Grant program, which provides funds to state-level agencies to support both public health agency capacity development and chronic disease prevention programs. Grants made under the $80 million annual program are designed to be flexible, providing states funding to fill gaps in programs that address the leading causes of death and disability in a manner determined by the grantees based on the particular needs of the population served. The funds are frequently used to support clinical services, preventive screening, public education, workforce development, surveillance, and chronic disease prevention programs.

The *National Center for Environmental Health* works to prevent illness, disability, and death resulting from human interaction with environmental toxins. The center conducts surveillance and applied research, supports educational campaigns, develops standards and guidelines, and offers training to state and local health agencies in environmental health prevention and response. It works in conjunction with the *ATSDR*, a congressionally mandated agency charged with conducting public health assessments of waste sites, conducting health surveillance and registries related to toxic substances, and providing information, education, and training concerning hazardous substances.

The *National Center for Injury Prevention and Control* works to prevent injuries and violence, and reduce their consequences. The center conducts injury and violent death surveillance, and supports research and injury prevention programs in such areas as domestic violence and firearm violence. The center also funds extramural research on injury prevention, care, and rehabilitation, and supports Injury Control Research Centers at several academic institutions across the country.

The *NIOSH* was created in conjunction with the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA). Whereas OSHA has the responsibility of developing and enforcing workplace safety and health regulations, NIOSH was formed to provide the research in the field of occupational safety and health necessary to do so effectively. NIOSH conducts research, develops guidance and recommendations on workplace safety, disseminates information, and, upon request, conducts workplace health hazard evaluations. In addition to its own research, NIOSH sponsors research and training through extramural programs and enters cooperative agreements with state health departments, academia, unions, and NGOs to participate in collaborative surveillance and research projects.

The *National Center on Birth Defects, Developmental Disabilities, Disability, and Health* conducts research and supports extramural research designed to identify the causes of birth defects, developmental disabilities, and blood disorders and to promote the well-being of persons with disabilities. The center also funds prevention and education programs.

National Center for Health Statistics

The National Center for Health Statistics (NCHS) is the premier organization for the collection, processing, analysis, and dissemination of health data for the nation. The NCHS collects "data from birth and death records, medical records, interview surveys, and through direct physical exams and laboratory testing" (NCHS, 2014a, para. 3). Major regular surveys and data collection systems of the NCHS, from which information is drawn about the nation's health and the determinants of health, include the following (NCHS, 2014b):

- National Health and Nutrition Examination Survey (NHANES)
  - Continuous NHANES
  - NHANES III
  - NHANES II
  - NHANES I
  - NHANES Epidemiologic Follow-Up Study (NHEFS)
  - Hispanic HANES
  - National Health Examination Survey (NHES)
- National Health Care Surveys (NHCS)
  - National Ambulatory Medical Care Survey (NAMCS)
  - National Hospital Ambulatory Medical Care Survey (NHAMCS)
  - National Hospital Discharge Survey (NHDS)
  - National Survey of Ambulatory Surgery (NSAS)
  - National Home and Hospice Care Survey (NHHCS)
  - National Home Health Aide Survey (NHHAS)
  - National Nursing Home Survey (NNHS)
  - National Nursing Assistant Survey (NNAS)
  - National Survey of Residential Care Facilities (NSRCF)
- National Health Interview Survey (NHIS)
  - National Health Interview Survey on Disability (NHIS-D)
  - Joint Canada/United States Survey of Health (JCUSH)
- National Immunization Survey (NIS)
- National Survey of Family Growth (NSFG)
- National Vital Statistics System (NVSS)
  - Birth Data
  - Mortality Data
  - Fetal Death Data
  - Linked Births/Infant Deaths
  - National Mortality Followback Survey
  - National Maternal and Infant Health Survey
- The Longitudinal Studies of Aging (LSOA)
- State and Local Area Integrated Telephone Survey (SLAITS)

Data from the NCHS surveys and systems are available to the public through the NCHS website (www.cdc.gov/nchs/) as public use files. The NCHS also produces innumerable standardized reports based on these data.

The NCHS data are essential for developing, implementing, and evaluating public health policy in the United States. They allow:

- Documentation of population and subpopulation health status
- Identification of health and health care disparities by race or ethnicity, socioeconomic status, region, and other population characteristics
- Description of health care system experiences
- Monitoring health status and health care delivery trends
- Identification of health problems
- Support of biomedical and health services research
- Provision of information for policy
- Evaluation of health policies and programs impact (NCHS, 2014a)

Other CDC Offices and Centers

Other offices and centers include the Office of Surveillance, Epidemiology, and Laboratory Services; Office of Public Health Preparedness and Response; Office for State, Tribal, Local and Territorial Support; Center for Global Health; Office of Women's Health; and Office of Minority Health and Health equity.

The CDC's *Office for State, Tribal, Local and Territorial Support* aims to improve the capacity and performance of the public health system at all levels of organization by providing guidance on activities related to state, tribal and local, and public health agencies. The office provides technical assistance and direct funding to state and local agencies to support the delivery of public health services and programs in accordance with CDC guidelines and standards in areas such as health promotion and disease prevention, public health policy, technology and communications infrastructure, and workforce development.

Through its *Center for Global Health*, the CDC works with international partners to prevent and control infectious and chronic diseases and to build sustainable global public health capacity through the development of epidemiological and laboratory resources and the international public health workforce. Activities of the *Center for Global Health* include programs in global disease detection through which the CDC works with international public health actors such as ministries of health and the World Health Organization (WHO) to develop capacity for the rapid detection, identification, and containment of infectious diseases and bioterrorist threats internationally.

The Center for Global Health also supports programs in AIDS prevention and treatment, and the prevention and control or eradication of polio, measles, influenza, and malaria. CDC staff work in more than 60 countries in support of the global health mission.

Agency for Healthcare Research and Quality

The Agency for Healthcare Research and Quality (AHRQ) is the lead federal agency charged with improving the quality, safety, efficiency, and effectiveness of health care for all Americans. It does not make policy, but rather,

with a budget of approximately $434 million and a staff of 300, AHRQ "conducts and supports a broad range of health services research within research institutions, hospitals, and health care systems that informs and enhances decision-making, and improves health care services, organization, and financing" (DHHS, 2013c). AHRQ's research, which is both conducted internally and through grants and contracts to universities, health care systems, hospitals, and physician practices, focuses on a set of broad issues relating to both clinical services and the system in which those services are provided, including comparative effectiveness, patient safety, health information technology, prevention and care management for chronic conditions, and value research.

Among the programs supported by AHRQ are 11 Evidence-Based Practice Centers, established to review and synthesize available evidence on various health care topics and to assess and describe the quality of the evidence. AHRQ also supports six Centers for Education and Research on Therapeutics charged with developing and disseminating information concerning products that may be used to prevent or treat disease. The purpose of the centers is to enable appropriate use of available drugs and products to facilitate safe and effective use and treatment while reducing cost. AHRQ also administers the Health Care Cost and Utilization Project, through which it collects and distributes statistical data related to hospital inpatient care from across the nation.

Health Resources and Services Administration

The activities of the Health Resources and Services Administration (HRSA) are principally to further the essential services related to workforce development and ensure access to health care services. Comprising six bureaus and 10 offices and with a staff of more than 1,800, HRSA is the primary federal agency for improving access to health care services for people who are uninsured, isolated, or particularly vulnerable. HRSA provides leadership and financial support to health care providers in every state and U.S. territory. Primarily a grant-giving and oversight agency, HRSA distributes the overwhelming majority of its budget to community-based organizations, colleges and universities, hospitals, local and state governments, associations, and foundations.

HRSA's Bureau of Clinician Recruitment and Service provides scholarship and educational loan repayment opportunities in exchange for clinicians' agreement to serve in communities with critical shortages of health care providers. The Bureau of Health Professions similarly supports workforce development by making grants to health professions' training programs and funding scholarships and loan repayment programs for health professionals.

HRSA's HIV/AIDS Bureau administers the Ryan White HIV/AIDS Program, which provides funding to grantees for HIV/AIDS outreach and AIDS Drug Assistance Programs (ADAPs). The program is designed to help those who do not have sufficient health care coverage or financial resources to cope

with HIV and AIDS. The Maternal and Child Health Bureau administers the Maternal and Child Health Block Grant to states. The grants are designed to expand access to comprehensive prenatal and postnatal care for women, support health assessments, diagnostics, and treatment for children, and expand access to immunization and other preventive care for children.

HRSA's Bureau of Primary Health Care provides funding for nonprofit, community-run health centers delivering comprehensive primary and preventive health care for people who otherwise lack access to health care. Populations served by these centers include people with low incomes, the uninsured, those with limited English proficiency, migrant and seasonal farm workers, individuals and families who are homeless, and those living in public housing. Health centers provide care on a sliding fee scale and see patients without regard for their ability to pay. There are approximately 1,200 community health organizations, delivering health care services at 9,000 sites. The centers serve approximately 20 million people, including nearly 1 million migrant farm workers and 1 million homeless persons. There were approximately 84 million patient visits to federally funded health centers in 2012 (HRSA, 2014).[5]

Food and Drug Administration

The Food and Drug Administration (FDA), with approximately 15,500 employees, is the agency charged with regulating drugs and most food products in the United States. Over-the-counter and prescription drugs, including generic drugs, are regulated by the FDA's Center for Drug Evaluation and Research. The FDA evaluates drug safety and efficacy and ensures that the labeling and marketing of approved drugs are accurate. Vaccines, blood, and biologics are regulated by the FDA's Center for Biologics Evaluation and Research. The Center for Food Safety and Applied Nutrition works to ensure that the food supply is safe, sanitary, and honestly labeled. The Center for Tobacco Products was established to oversee the regulation of the marketing and promotion of tobacco products and set performance standards for tobacco products to protect the public health. The FDA also operates the National Center for Toxicological Research, which conducts research aimed at the evaluation of biological effects of potentially toxic chemicals or microorganisms and to understand toxicological processes so as to inform the FDA's regulatory decisions.

National Institutes of Health

The National Institutes of Health (NIH) is the primary federal agency conducting and supporting biomedical research. Composed of 27 institutes and centers, the NIH conducts and funds research into the causes, treatment, cure, and prevention of a broad range of disease. The vast majority of the NIH's budget goes to support extramural research at universities and other research institutions. Included in its portfolio is a substantial body of disease prevention

research. Research on disease prevention is an important part of the NIH mission. The institutes and centers have a broad portfolio of prevention research and training, as well as programs to disseminate the findings to scientists, health professionals, and the public. Ultimately, knowledge gained from NIH-supported prevention research enables the application of sound science in clinical practice, health policy, and community health programs, thereby improving the health of the public.

Indian Health Service

The Indian Health Service (IHS) is responsible for providing federal health services to American Indians and Alaska Natives. The IHS provides a comprehensive health service delivery system for approximately 2 million American Indians and Alaskan Natives who belong to 566 federally recognized tribes in 35 states. It is the principal federal health care provider and health advocate for native people. The IHS operates or finances over 620 hospitals, clinics, and health stations on or near Indian reservations.

In addition to providing direct health care services, the IHS also undertakes broader health promotion activities. For example, the Office of Environmental Health and Engineering promotes the development of safe water and waste treatment programs. The IHS has also launched a Health Promotion and Disease Prevention (HP/DP) Initiative that aims to develop and implement effective health promotion and chronic disease prevention programs, particularly in areas of concern for the native population, including increasing incidence of chronic diseases related to lifestyle issues such as obesity, physical inactivity, poor diet, substance abuse, and injuries.

Substance Abuse and Mental Health Services Administration

The Substance Abuse and Mental Health Services Administration (SAMHSA) works to improve the quality and availability of substance abuse prevention, addiction treatment, and mental health services. SAMHSA provides funding through block grants to state and local governments to support substance abuse and mental health services, including treatment for serious substance abuse problems or mental health problems; supports education programs for the general public and health care providers; improves substance abuse prevention and treatment services through the identification and dissemination of best practices; and conducts surveillance and monitoring of the prevalence and incidence of substance abuse.

Centers for Medicare & Medicaid Services

The Centers for Medicare & Medicaid Services (CMS) administer the largest insurance programs in the country, with a 2014 budget of approximately

$850 billion. Medicare provides publicly financed health insurance for more than 54 million elderly and disabled Americans, and Medicaid, a program administered jointly by the federal government and the states, provides publicly financed health coverage for approximately 57.4 million low-income earner persons and nursing home coverage for low-income earner elderly adults. CMS also administers CHIP, which covers more than 8 million children. Although primarily considered a health care insurance program for low-income people, Medicaid-reimbursed services may also include such public health activities as Early and Periodic Screening, Diagnostic and Treatment (EPSDT) services for children, family planning services, cancer screening, school health services, and adult immunizations. Further, Medicaid payments also support public health providers such as health centers, public hospitals, community mental health providers, and STD clinics, which are dependent on Medicaid revenues to sustain their operations (Perlino, 2006).

Administration for Community Living

With approximately 200 full-time employees, the Administration for Community Living (ACL) is focused on ensuring that older adults and people with disabilities are able to have the option to live at home and fully participate in their communities. Created in April 2012, ACL brought together three previously separate entities within the DHHS: the Administration on Aging, the Office on Disability, and the Administration on Intellectual and Developmental Disabilities (AIDD).

Administration for Children and Families

The Administration for Children and Families (ACF) works in partnership with states and communities to provide critical assistance to vulnerable families while helping families and children achieve a path to success. AFC programs work to find safe and supportive homes for abused children, counsel newly arrived refugees as they begin their new lives in America, and work to remove and provide opportunities to troubled teens living on the streets. Examples of programs and the percentage of the 2014 budget allotted to each program under the AFC include Temporary Assistance for Needy Families (TANF; 33%), Head Start (16%), Foster Care and Permanency (14%), Child Care and Development (11%), Child Support (8%), LIHEAP (6%), Social Services Block Grant (SSBG; 3%), and Early Learning Initiative (3%). The ACF has approximately 1,500 employees.

Other Federal Agencies

Federal agencies other than those in the DHHS have important public health roles. These include the U.S. Department of Agriculture (USDA), Environmental

Protection Agency (EPA), U.S. Department of Labor (DOL), and the Department of Veterans Affairs (VA), and the Department of Defense (DOD).

U.S. Department of Agriculture

The USDA plays a vital regulatory role in the public health system through its Food Safety and Inspection Service, the public health agency responsible for the safety and labeling of the commercial supply of meat, poultry, and egg products. The USDA also plays a role in directly ensuring health through its Food and Nutrition Service, which oversees funding of food assistance programs such as the Supplemental Nutrition Assistance Program (formerly the Food Stamp Program), which subsidizes food purchases for 28 million people each month; the National School Lunch Program, which provides subsidies to schools for meals in exchange for serving lunches that meet federal nutritional requirements to students, and offers free or reduced price lunches to eligible children; and the Women Infants and Children Program (WIC), which provides federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant, breastfeeding, and nonbreastfeeding postpartum women and to infants and children up to age 5 who are found to be at nutritional risk.

Environmental Protection Agency

The EPA regulates the release of pollutants in the air, land, and water and conducts or provides grants for environmental remediation where necessary. Among the laws administered by the EPA are the Clean Air Act, the Clean Water Act, the Comprehensive Environmental Response, Compensation and Liability Act, and the Toxic Substances Control Act. Nearly half of the EPA's budget is expended through grants to states, nonprofits, educational institutions, and others for various projects, from scientific studies to site cleanups.

U.S. Department of Labor

The DOL, through the OSHA, regulates the health and safety of workplaces, either directly or through approval of state occupational safety programs that exceed federal requirements. OSHA regulations are based on NIOSH research and regulate matters ranging from the permissible exposures limits for hazardous substances in the workplace to the use of portable power tools.

Department of Veterans Affairs and Department of Defense

The VA and DOD provide access to health care services to veterans and active military personnel. The VA operates the nation's largest integrated health care system, with a network of 152 medical centers, more than 800

community-based outpatient clinics, 135 nursing homes, 48 residential rehabilitation treatment programs, and 278 readjustment counseling centers (VA, 2013).

STATE PUBLIC HEALTH

As described earlier, the primary legal authority for public health in the United States rests with the states. Although the federal government undertakes extensive public health activities, as we have seen, those programs are generally categorized under resource allocation and distribution, information generation and distribution, health care access assurance, and, to a more limited extent, regulation and enforcement in matters affecting the country broadly (e.g., drug and food safety). The states generally have responsibility, at least at first, for implementing public health programs and delivering public health services. So while the federal government has, for example, established the National Electronic Disease Surveillance System whereby state and local health agencies may report incidences of reportable diseases, the decision whether or to what degree to participate in the system is left to the individual states. The ASTHO—citing considerable variation among agencies—finds the public health system "comprehensive, yet inconsistent" (ASTHO, 2009, p. 8).

Organization and Governance

There is at least one state-level government authority with primary responsibility for public health in every state, and in state governments alone, there are more than 100,000 workers in the area of public health (ASTHO, 2011). State health departments are structured and organized in a multitude of ways, are located in different parts of state government, and differ in the extent and nature of the authority granted to them. In general, state public health departments are organized in one of three ways. Stand-alone agencies are independent from other agencies. They are mixed-function agencies (sometimes referred to as "super agencies") that are independent but also carry out activities other than core public health activities, such as health insurance regulation or Medicaid administration. Most state health departments (55%) are freestanding, independent agencies of these sorts.

Other state health departments are part of a larger "umbrella" agency of state government, such as a state department of health & human services, which oversees several departments. In states where the health department falls within an umbrella agency, other health services are often provided by other departments of the agency, including administration of the state Medicaid program, provision of long-term care services, substance abuse treatment and prevention or other behavioral health services, and environmental protection (ASTHO, 2011). The California Department of

Public Health is one example of a public health department located within an umbrella agency: the California Health and Human Services Agency (CHHSA). CHHSA oversees 12 departments other than Public Health, including the departments of Aging, Child Support Services, Health Care Services (Medicaid and other public insurance administration), Community Services and Development, Developmental Services, Emergency Medical Services Authority, Managed Health Care, Managed Risk Medical Insurance Board, State Hospitals, Statewide Health Planning and Development, and Social Services.

State public health agencies also vary in the authorities granted to them. Most state health departments (70%) are authorized to declare health emergencies and to collect key health data. Less than one half of state health departments, however, have the authority to adopt public health laws and regulations. Health departments have even less authority over budgetary and leadership issues. Overall funding and administrative decisions generally rest with the legislature or executive branch of state government. For example, less than 30% of state health agencies have budget authority, and almost none may select the agency head, establish taxes in support of public health, or place tax and levy measures on the ballot; those powers being reserved for the governor or legislature (ASTHO, 2011).

Twenty-six states have boards or councils of health, which variously promulgate rules and advise elected officials on policy. A minority of state boards of health formulate public health policies, legislative agendas, or public health budgets for the state (Beitsch, Brooks, Grigg, & Menachemi, 2006). Boards of health, typically comprised of citizens, consumers, members of the business community, and public health professionals, play a decreasingly important role in state public health activities (Beitsch et al., 2006).

The relationship between state health departments and local departments also exhibits considerable variation. Thirty percent of states are best characterized as having state health department control over local health departments; roughly 50% of states have decentralized, operating independently (though often in collaboration with) state health agencies; and 10% of states have a mix, with some local health agencies acting independently and some under the direction of the state agency (ASTHO, 2011; NACCHO, 2011).

The overwhelming majority of state health agencies report partnering with NGOs on various programs and activities. Most frequently, state agencies partner with universities and schools, community organizations, hospitals and other health care providers, insurers, and community health centers. More than half of state agencies also report partnering with businesses, the media, and environmental and conservation organizations.

Services and Activities

State public health departments engage in a wide range of public health activities. The top three activities reported by state health agencies were wellness

and disease prevention programs, emergency preparedness, and epidemiology/surveillance/monitoring. Notably, however, there is wide variety. No more than 40% identified disease prevention as a top three priority, and fewer than 30% identified emergency preparedness or epidemiology/surveillance as being one of their top three activities. Other "top three activities" included wellness, health promotion, health communication, improving performance, and specific prevention programs (cancer control, immunizations, family and newborn screening, infant mortality reduction, as well as prevention programs for tobacco use, injury, and chronic diseases, most notably obesity and type 2 diabetes). Regulation, health insurance and health care, planning and policy, addressing health disparities, leadership development, adoption of National Public Health Performance Standards, implementation of the Public Health Improvement Project, workforce development, coordination with partners in the public health system, support for local public health agencies, and data-driven management were also listed. The following is information about some of the major groupings of public health services and activities performed by states: surveillance and epidemiology; environmental health; maternal and child health; emergency preparedness; immunization services; regulation, inspection, and licensing; and personal health care.

Surveillance and Epidemiology

Every state public health department conducts some level of public health surveillance, monitoring, and epidemiological activities. Almost all state public health departments collect data related to risk factors and disease incidence, including chronic and infectious diseases, exposures, and access to care. The most common data collection activities, with 96% of departments engaging in data collection, include behavioral risk factors, communicable and infectious disease, reportable diseases, and vital statistics. Activities are not based on size of the population served, governance classification, or geographic region.

Environmental Health

The overwhelming majority of state health agencies (approximately 90%) oversee environmental health epidemiology and food safety education. Less frequently, but in most instances, the state health agency is involved in toxicology, as well as radiation, radon, poison, vector control, indoor air quality, and water supply safety.

Maternal and Child Health

Almost 80% of states offer services to children with special health care needs, and 57% states also administer the Women, Infants, and Children (WIC) nutrition program and provide family planning and prenatal care services. About half of all state health departments are involved in early intervention services for children, maternal and child health home visits, and family planning services.

Emergency Preparedness

All state health agencies have some responsibility to prepare for disaster response and emergencies. All state health departments have responsibility for responding to communicable disease outbreaks, nearly all have responsibilities for responding to bioterrorism events, and almost 90% have responsibility for responding to chemical, nuclear, and natural disasters.

Immunization Services

Over 90% of state health agencies are responsible for vaccine order management, and inventory distribution of childhood and adult immunizations. Approximately 46% administer childhood immunization and about 42% administer adult immunizations. The number of individuals immunized by state health agencies is dependent on the agency's geographic location. Eighty-five percent of agencies in centralized states provide childhood and adult vaccine administration in comparison to those in decentralized states, which administer about 22% of childhood and adult vaccines. In decentralized states, vaccination services are often provided by primary health care providers or local health departments.

Regulation, Inspection, and Licensing

Most state health agencies have some involvement (along with other agencies at the federal, state, and/or local level) in the regulation and enforcement of laws that protect health and ensure safety. Activities include inspection or licensing of a variety of public health system partners such as entities that provide direct care, including hospitals (42 states), clinics (23 states), and hospice facilities (36 states). Other activities include regulation, inspection, and licensing of entities that process and serve food; recreational sites such as beaches, campgrounds, and public swimming pools; water sources; waste disposal sites and entities; and tobacco retailers. Most state public health departments, however, do not license health professionals. This is typically a function of another agency or department of state government. Fewer than 25% of state health agencies directly license nurses, physicians, physician assistants or dentists. Vital and health statistics may start at the state or local government level. Marriage, births, and deaths are state or local functions. Notification of reportable diseases starts at the local level and is sent to the state.

Personal Health Care

With the exception of HIV/AIDS and STDs, state health agencies generally do not provide treatment for communicable and chronic diseases. Approximately 60% screen for tuberculosis and STDs, including HIV/AIDS. Over 70% of agencies provide newborn screening services. The frequency of screenings for breast, cervical, colon, and rectal cancers are dependent on the size of the population served. Agencies in centralized states provide these services more

often than those in decentralized states. Most state health agencies provide or regulate at least some clinical services in oral health, emergency medical services, minority health, and rural health. A minority provide services for victims of sexual assault and violence, substance abuse prevention, or pharmacy services.

Priorities

State health agency officials listed in their top five priorities: (a) improving public health and public health infrastructure; (b) assurance of access to health care systems and services; (c) increasing the availability and use of data and evidence; (d) quality improvement, performance management, and accreditation-related services; and (e) implementation of effective health policies.

State governments have the authority and responsibility to protect the welfare of the population within their borders. As stated earlier, some states carry out the essential functions, whereas others delegate these services and duties. States take responsibilities for high-level laboratories, data collection, assessments, and policies. Many states issue certification and licensing for personnel and facilities and are responsible for enforcing disciplinary actions because of wrongful actions by health providers. Since Medicaid is a state–federal program, usually the state department plays an important role in setting policies as well as, in many cases, providing assurance and assessment; sometimes a small percentage may be delegated to the county level. The state may have counties carry out the eligibility determination.

Other issues related to the organization of public health services at the state level concern the locus of responsibility. Is there a separate agency for environment and environmental health? Is public health responsible for mental health and substance abuse, or is there a separate agency? This would also be the case for aging and child health. If there are separate agencies, do they work and coordinate efforts in a positive way? These issues are answered differently in different states and have consequences for the coordination and provision of public health services.

Relationship to Ten Essential Health Services

Surveys of state public health agencies indicate that, in general, most states perform public health activities falling within each of the 10 essential services, although it is difficult to evaluate this assessment because public health services and activities are not organized by the essential services.

Most services are specific to a health problem, population, and/or behavior. HIV/AIDS, STDs, foodborne diseases, waterborne diseases, maternal and child health, emergency preparedness, injuries, childhood immunizations, smoking, obesity, and nutrition are common organizational groupings of public health services and activities. In each case, the 10 essential services may (or may not) be relevant or provided.

For example, it is not clear whether HIV/AIDS programs are assessed (or should be assessed) on whether they offer all 10 essential services for the population they serve: monitor, diagnose, and investigate health problems related to HIV/AIDS in the community; inform, educate, and empower people with HIV/AIDS; mobilize community partnerships to solve their problems; develop policies and plans to support HIV/AIDS patients' health efforts; enforce laws and regulations to protect people with HIV/AIDS; link people with HIV/AIDS to needed personal health services if otherwise unavailable; ensure a competent workforce to meet HIV/AIDS patients' needs; evaluate services for people with HIV/AIDS; and research innovative solutions to their health problems. Further, it would be difficult to determine if all essential services were provided to people with HIV/AIDS because some essential services might be within the scope of the HIV/AIDS program and others might be within the responsibility of a crosscutting unit such as communications or epidemiology.

Also, it is difficult to compare across states on the essential services, because even though two states may conduct performance evaluations, the scope and depth of the evaluations undertaken may vary significantly, and the states may prioritize performance evaluation very differently. Further, there are few data showing whether the form of essential service provided was tailored to the particular needs of the population, or whether, for example, it was performed in response to a federal categorical grant without a particular need in the community.

LOCAL PUBLIC HEALTH

The implementation and delivery of many, if not most, public health services occur at the local level—usually city, county, or region. Local health departments are on the front line of control of communicable diseases and noncommunicable hazardous exposures, as well as informing and educating communities about public health issues. However, local public health organizations collaborate with state and federal public health agencies and depend on their resources—data, skilled personnel, funds, and so forth—a great deal. In most states, the state and local public health agencies form a very connected system. The state may not provide direct services but offers a higher level of technical expertise at the research and policy level, which the local health department carries out.

There are enormous variations between local health departments, as we will discuss. It is almost true that if you have seen one local health department, you have seen one local health department. They differ between states and, within states, on organization, governance, services offered, and implementation strategies. Not surprisingly, a major factor driving variation is the size of the population served. There are approximately 2,800 total local health departments in the United States (NACCHO, 2014). The majority (61%) of local health departments serve jurisdictions with 50,000 or fewer people, and 41%

of local health departments serve jurisdictions with fewer than 25,000 people. Although constituting a sizable majority of departments, the persons served in these jurisdictions constitute only 10% of the national population (NACCHO, 2014). Jurisdictions of 50,000 to 499,999 persons are served by 34% of local health departments and comprise 41% of the population. Local health departments serving large urban centers—departments in jurisdictions with 500,000 or more people—constitute only 5% of nationwide local health departments, yet serve 49% of the United States population (NACCHO, 2014).

Organization and Governance

Nearly every state's population is served by local health departments (regional, county, municipal). The only exceptions are Hawaii and Rhode Island, which do not have any local or regional health agencies. In those states, the state health departments operate on behalf of local public health, and there are no administrative or service units with responsibility for the health of a substate jurisdiction (NACCHO, 2014).

The political units served and jurisdictional boundaries of local health departments vary throughout the country. Sixty-eight percent of local health departments operate at the county level; 20% operate at the city, town, or township level, and 4% serve multiple cities or towns. The jurisdictions of 8% of local departments do not conform to discrete substate political units but are organized to serve a multicounty, regional, or other local district area (NACCHO, 2014). In some instances, it may be that city or township health departments operate within counties that are also served by county health departments (IOM, 2003).

Local health departments also vary in their governance. In 27 states, the local health departments are primarily governed by local authorities—local boards of health or officials of a county or city. The local departments in four states—Arkansas, Mississippi, South Carolina, and Vermont—are governed by state-level authorities. In 14 states, some local health departments are governed primarily at the local level, whereas others are governed by state authorities (NACCHO, 2014).

The majority (70%) of local health departments have associated local boards of health. Local boards of health are associated with a local health department less frequently where a department serves a large population; whereas 79% of local health departments which serve populations of less than 10,000 have an associated local board of health, only 33% of departments serving more than 1 million persons have local boards (NACCHO, 2014).

In nine states, all local health departments have an associated local board of health. In 22 states, more than half of all local health departments are associated with a local board of health, and in 13 states, fewer than half of the departments have an associated board. In four states—Delaware, Alaska, Vermont, and South Carolina—and the District of Columbia there are no local boards of health. Most local boards of health have the authority to adopt public health

regulations (76%), set and impose fees for services (71%), approve the budget for the local health department (75%), and hire or fire the department head (65%). Some local boards also request public health levies (37%) and have the authority to impose taxes to support public health activities (19%; NACCHO, 2014).

Workforce

The estimated number of local health department workers nationwide was 162,000 in 2013. Since 2008, the overall local health department workforce in full-time employees decreased by approximately 12%, from 166,000 to 146,000. The median number of full-time employees in a U.S. local health department is 17, ranging from a median of four for departments serving a population of fewer than 10,000 people, to a median of 453 full-time employees for departments serving more than a million people. The median number of local public health department workers per 100,000 persons in the population served is 64 (NACCHO, 2013, 2014).

Most local health department heads are full-time employees (91%). The highest educational level for heads of local public health departments was master's degree (45%), followed by bachelor's degree (32%), doctoral degree (15%), and associate's degree (8%; NACCHO, 2013, 2014). The composition of the public health workforce, overall, is seen in Table 3.2. The largest portion of the workforce is administrative or clerical personnel (24%), the second-largest portion is nursing staff (19%), followed by other profile occupation categories (15%).

TABLE 3.2 LOCAL HEALTH DEPARTMENT WORKFORCE COMPOSITION (BY SELECT OCCUPATION)

OCCUPATION	PERCENTAGE OF TOTAL FULL-TIME EMPLOYEES
Administrative or Clerical Personnel	24%
Registered Nurse	19%
Other Profile Occupation Categories*	15%
Not Categorized	10%
Environmental Health Worker	9%
Public Health Manager	7%
Community Health Worker	5%
Nursing Aide and Home Health Aide	4%
Health Educator	3%
Nutritionist	3%

Note: Due to rounding, percentages do not add to 100 percent.
**Ten occupations each with less than three percent of LHD workforce.*

From 2008 to 2010, the number of nutritionists employed in local health departments increased 19% and health educators employed in local health departments increased by 15%. The number of epidemiologists increased by 38%, the number of registered nurses decreased 16%, and the number of environmental health workers decreased 13% (NACCHO, 2014).

The composition of each local health department's workforce varies by size of the population served (see Table 3.3). The smallest departments often consist only of a public health manager, secretary, environmental health worker, and nurse. Next to be added are typically emergency preparedness staff, a health educator, and a nutritionist. Nearly all of the largest departments have physicians, behavioral and environmental health scientists, epidemiologists, and information specialists, whereas these positions are rare in departments serving fewer than 100,000 people (NACCHO, 2014).

Services and Activities

As with the other characteristics examined, there is wide variation in the activities and services offered by local health departments. The activities and services most frequently offered directly by local health departments are the provision of adult immunizations (90% of departments), communicable and infectious disease surveillance (91% of departments), provision of child immunizations (90% of departments), TB screening (83% of departments), inspection of food service establishments (78% of departments), environmental health surveillance (78% of departments), food safety education (72% of departments), TB treatment (76% of departments), school and daycare inspection (69% of departments), and population-based nutrition services (69% of departments). The availability of the services varies with the size of the population served. For example, 85% of departments serving populations smaller than 25,000 people offer child immunization services, while 95% of departments serving more than 500,000 people do so. To state that the local health department does not provide a service either directly or through contract does not necessarily indicate that those services are not publicly available within a jurisdiction. In some cases, another local government agency, a state agency, or an NGO may provide the service. Following is a brief description of some of the common public health services and programs at the local level (NACCHO, 2014).

Surveillance and Epidemiology

Of all the local health departments studied, 91% perform surveillance and epidemiology with respect to communicable and infectious diseases, 78% perform surveillance in environmental health, and 61% do so in maternal and child health. A minority of departments conduct syndromic surveillance (47%), chronic disease surveillance (44%), surveillance of behavioral risk factors (36%), and injury surveillance (27%). Departments serving large populations are substantially more likely to perform epidemiology and surveillance.

TABLE 3.3 MEDIAN NUMBER OF LOCAL HEALTH DEPARTMENT FULL-TIME EMPLOYEES IN SELECT OCCUPATIONS (BY POPULATION SERVED)

		SIZE OF POPULATION SERVED							
	ALL LHDS	<10,000	10,000–24,999	25,000–49,999	50,000–99,999	100,000–249,999	250,000–499,999	500,000–999,999	1,000,000+
Median Number of Full-Time Employees in All Staff Positions	17	4	9	15	28	64	130	251	453
Median FTEs in Select Occupations									
Administrative or Clerical Personnel	4	1	2.5	4	6.79	14	28.25	48.5	101.5
Registered Nurse	4	1	2.75	4	6	12	19	34.5	44.45
Environmental Health Worker	2	0.1	1	1.8	3	7	14	25	34
Public Health Manager	1	0.7	1	1	2	2	4	14	17
Emergency Preparedness Staff	0.74	0	0.2	0.5	1	1	2	4	5
Health Educator	0.9	0	0	0.55	1	1.71	3	5	9.9
Nutritionist	0.5	0	0	0.6	1	3	5	8.5	20.9
Public Health Physician	0	0	0	0	0	0.25	1	1.7	3
Community Health Worker	0	0	0	0	0	0.5	2	6	20
Epidemiologist	0	0	0	0	0	0	1	2	6
Information Systems Specialist	0	0	0	0	0	0	1	2	4.5
Laboratory Worker	0	0	0	0	0	0	0	2	10
Licensed Practical or Vocational Nurse (LPN/LVN)	0	0	0	0	0	0	0	2	3
Public Information Specialist	0	0	0	0	0	0	0	1	1
Behavioral Health Professional	0	0	0	0	0	0	0	1	0
Oral Health Care Professional	0	0	0	0	0	0	0	0	1

Of all the local health departments studied, 83% provide screening for TB, and 57% do so for high blood pressure, 61% for blood lead, 64% for sexually transmitted diseases, 61% for HIV and AIDS, 36% for diabetes, 36% for cancer, and 27% for cardiovascular disease. For all of these conditions, with the exception of high blood pressure, the larger the population served by the local health department, the more likely the department is to offer screening. For example, TB screening is available from the local health department in 83% of jurisdictions with fewer than 25,000 people, but available in more than 90% of jurisdictions with populations of 100,000 or more.

Primary Prevention

Of all the local health departments studied, 68% engaged in primary prevention services concerning tobacco use, and 69% provided nutrition services. Approximately half of all departments offer prevention programs in the areas of chronic disease, exercise and physical activity, and unintended pregnancy. Other prevention services are less common, with injury prevention services available through 38% of departments, substance abuse prevention in 24%, violence prevention in 21%, and mental illness prevention services available in just 12%. Departments serving large populations are significantly more likely to offer prevention services than departments serving small populations. Notably, the four preventive services that most departments do not offer are still reported to be available in a sizable majority of jurisdictions but are frequently provided by other government agencies or NGOs.

Maternal and Child Health

Of all the departments studied, 60% provide maternal and child health home visits, 65% provide WIC services, 54% provide family planning services, 36% provide services in connection with the Early Periodic Screening, Detection, and Treatment program (the child health component of Medicaid), 32% provide a Well-Child Clinic, 27% offer prenatal care, and 8% offer obstetrical care. Large public health departments are significantly more likely to offer these services than departments serving small populations.

Emergency Preparedness

Emergency preparedness has become a significant local health department effort as a result of 9/11 and the subsequent shift in funds and priority to this area at the federal level. Of all local health departments studied, 87% have developed or updated a written emergency plan, provided emergency preparedness training to staff (84%), participated in tabletop exercises or drills (76%), assessed emergency preparedness competencies of staff and participated in functional exercises or drills (66%), reviewed relevant legal authorities (47%), and participated in full-scale exercises or drills (38%). Departments that serve larger populations are more likely to participate in emergency preparedness activities, with only 30% participation from departments serving 50,000

or fewer, compared to 68% participation from departments serving 500,000 or more. Additionally, local health departments with a shared governance structure are more likely to participate in emergency preparedness activities (53%) than those governed exclusively by state or local authorities (37%).

Personal Health Care

Local health departments are substantially less likely to provide personal health care services. Of all the departments studied, 24% offer oral health services, 21% offer home health care, 11% offer comprehensive primary care, 10% offer behavioral and mental health services, and 7% offer substance abuse treatment services. Departments serving more than 500,000 people are more than twice as likely to offer oral health services, comprehensive primary care, behavior and mental health services, and substance abuse services than are departments serving fewer than 50,000 people. The reverse is true of home health care services, however. Departments serving populations smaller than 100,000 are more likely to offer home health care than are departments serving more than 500,000.

Most local health departments provide some treatments for communicable diseases. Of all the departments studied, 76% provide treatment for TB and 60% for STDs. Treatment for HIV/AIDS was offered by 21% of departments. Again, the likelihood that a department provides treatment services generally increases with the population size of the jurisdiction. Although only 19% of departments serving small populations offer treatment for HIV/AIDS, nearly 40% of large departments do.

FUNDING PUBLIC HEALTH

Funding for the public health system comes mainly from public sources: taxes and other monies, such as fees, collected by the government at the federal, state, and local levels. The total expenditure for the public health system in 2012 was estimated by the CMS as $74.9 billion, of which $10.8 billion came from the federal government and $64 billion from state and local government (CMS, 2011). These figures do not include some important public health services:

> Government spending for public works, environmental functions (air and water pollution abatement, sanitation and sewage treatment, water supplies, and so on), emergency planning and other such functions are not included. Most Federal government public health activity emanates from the Department of Health & Human Services. The Food and Drug Administration and the Centers for Disease Control account for the great majority of Federal spending in the area. Since the 9/11 catastrophe, substantial public health funding has come from two other sources: The Public Health and Social Services Emergency Fund, a part of the HHS Departmental

> Management Budget, and the Department of Homeland Security. State and local government public health activity expenditures are primarily for the operation of State and local health departments. Federal payments to State and local governments are deducted to avoid double counting, as are expenditures made through the Maternal and Child Health Program and the Crippled Children's Program. Disbursements made by State and local government departments for environmental functions (water and sewer authorities, for example) are not included. (CMS, 2011, p. 27)

There are many challenges to measuring public health expenditures in the United States (Sensenig, 2007). Chief among them is the difficulty of defining what government activities constitute public health services. "There is no clear-cut, universally accepted definition of government public health care services" (Sensenig, p. 103). Also, the distinction between health and public health services is not clear in the classification of budget categories. Finally, the government must collect expenditure data according to the Classification of the Functions of Government (COFOG), which is an international system developed by the United Nations.

Federal

The 2013 estimated federal outlay for public health activities, in large categories, is contained in Table 3.4 (CMS, 2013).

The federal public health budget is used for two purposes: (a) to fund federal activities and (b) to fund state and local activities by returning federal money to states. "Most of the CDC's funding to the states is distributed through 'categorical grants' that are program-focused, restricted to specific program use, and do not go to support broader or core public health responsibilities. The basis for the distribution of categorical funds varies from program to program; some funds are awarded on a population basis, some on

TABLE 3.4 PUBLIC HEALTH OUTLAY CATEGORIES BY THE FEDERAL GOVERNMENT, 2013 (ESTIMATES)

CATEGORY	DOLLARS (IN MILLIONS)
Disease control, research, and training	$6,453
Public health and social services emergency fund	$812
Departmental management	$658
Food safety and inspection	$1,136
Food and drug administration	$2,029
Total	$11,088

a demonstration of need, and others on a competitive basis. When taken together, funding is not necessarily determined by population or by disease burden" (Levi, Juliano, & Richardson, 2007).

Federal categorical and block grants may be criticized because they require states to engage in activities mandated by particular grant program requirements rather than in accordance with the needs of the particular population being served. That is, because federal funding is available for one kind of program, a state may dedicate resources to that program area to obtain funds, even if the program does not align with the priorities dictated by the health needs of the state. Although this is not true of every federal grant program—the Preventive Health and Health Services Block Grant mentioned earlier, for example, allows for considerable flexibility in how the funds are used—the large proportion of state health department resources that come from the federal government should be kept in mind when considering state health department budgets. In effect, not all dollars available to the state health department are created equal—they are not all part of a general pool that can be simply allocated in accordance with the state's health needs and priorities. The availability of state sources of funding may therefore be critical in financing essential services in a manner that is consistent with the state's needs and priorities.

There is wide variation in the amount of state resources expended by state public health departments.

State

As discussed previously, public health financing in the United States derives from a complex web of intergovernmental relationships at the federal, state, and local levels. Other than sharing common legal frameworks and federal funding opportunities, each state government is organized very differently, with its own priorities and organizational structure, when it comes to public health. As such, a comprehensive, up-to-date, and accurate summary of public health financing is difficult (Sensenig, 2007; Turnock & Atchison, 2002).

For example, while California had approximately 50% more people than Texas in 2003, its government was nearly three times as large in terms of expenditures. However, Texas spent four times more on public health than California, mostly because of the greater amount of federal funding received by Texas. Subtracting the entry of federal funds, Texas's appropriated funds were still 45% more than California, and as a proportion of total state expenditures, much larger. Overall, California spent $14.70 per person on population health in 2003, and Texas spent $99.30 per person. Most of Texas's public health spending went for chronic disease control and support for health behavior change, using federal funds (Milbank Memorial Fund, 2005).

When trying to understand the financing of public health departments and public health activities in particular, one should not assume that the numbers across states are comparable. Whereas Rhode Island and Hawaii

have no local health departments, other states are organized with all local health departments independent from the state health departments. These differences mean per capita spending is not comparable, because funding may be at the local rather than the state level or vice versa. In addition, states may differ in the amount they appropriate for public health through taxation and fees, but they may also vary in the amount of "pass-through" funding that they obtain from the federal government. On average, state population health expenditures represented 1.7% of state budgets and ranged from a low of 0.3% in California to a high of 4.4% in Montana in 2003 (Milbank Memorial Fund, 2005).

Local

Sources of Local Public Health Funding

Local health departments obtain funding from a combination of sources that includes local funds, state-direct funds, clinical sources such as from categorical grants, federal-direct funds, Medicaid and Medicare funds, and fees. Figures 3.1 and 3.2 show the median annual per capita revenues from local and clinical sources. The source of funding and the amount given depends on the governance structure of the local health department. For example, on average, state-governed health departments receive only $2 per person from local sources, whereas locally governed departments receive $10 per person, and those with a shared governance structure receive $11 per person. Nationwide, local government sources provide $8 per person to local health departments,

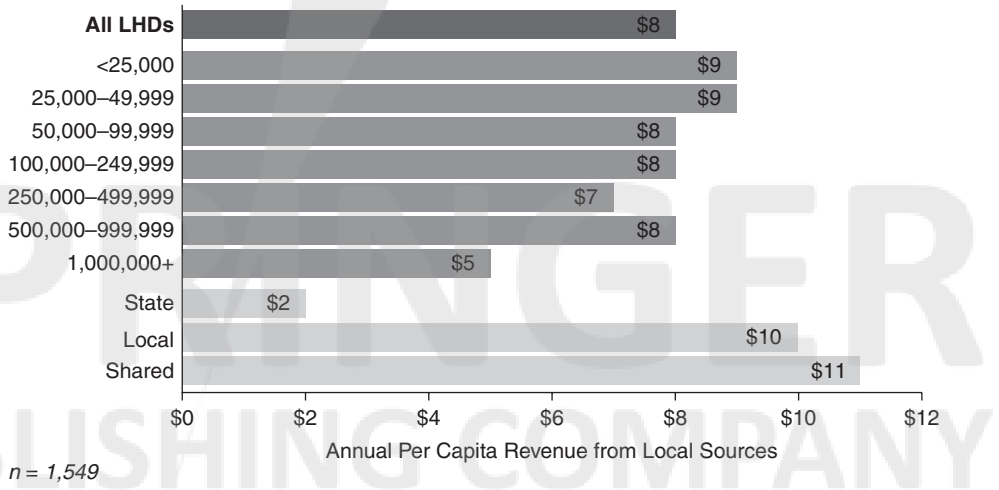

FIGURE 3.1 Median annual per capita revenues for local health departments (LHDs) from local sources (by population served and governance).

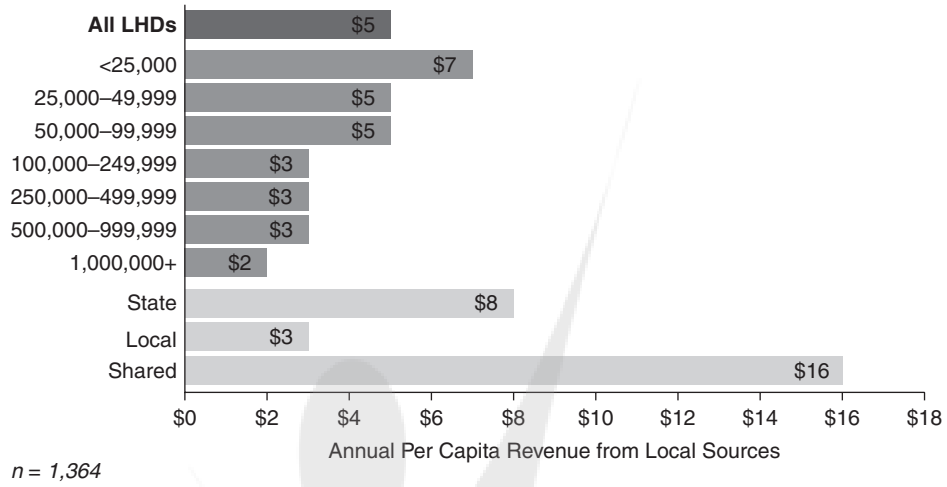

FIGURE 3.2 Median annual per capita revenues for local health departments (LHDs) from all clinical sources (by population served and governance).

with a range of $7 to $9 per person with populations fewer than 1 million people. Local health departments serving populations of greater than 1 million people received a median of $5 per person from local sources. Funding also varies by state, with Nebraska, Alabama, and Arkansas receiving less than $2 per person from local sources, in comparison to that of North Carolina, with local government funding of $20 per person.

Clinical funding sources include Medicare, Medicaid, private insurance, and patient personal fees. Local health departments serving smaller populations receive more per person, on average, than those serving larger populations. The amount of median revenues from clinical sources varies based on the type of governance structure, with local health departments having a shared government structure receiving $16 per person, state-governed departments receiving $8 per person, and locally governed departments receiving $3 per person. Variation in funding by state is also evident, with medians less than $5 per person in 20 states, and four states—Kentucky, North Carolina, Alabama, and Florida—receiving $15 per person.

Reserve funds help protect agencies from fluctuations in revenues and provide local health departments a measure of resilience to economic stress. Reserve funds may or may not be controlled by the local health department. Nearly half of all local health departments have a reserve fund that is controlled by the department, whereas only 6% have a reserve fund not controlled by the department. The type of governance structure affects whether a local health department will have a reserve fund, with 45% of all local health departments not having one available. Departments with a shared governance structure are more likely to have a reserve fund controlled by the department (70%), with locally governed departments (49%) and state-governed

departments (31%) less likely to control the reserve account. There are two basic types of local health departments: (a) those that are units of local government; and (b) those that are units of the state health agency. Health departments that are locally controlled obtain far less money from the state and from Medicaid and Medicare funds than departments that are units of the state. As a result, they depend more heavily on local funds and fees.

Even though control of a local health department—local or state—influences its funding sources, other factors play a role as well, because there is great heterogeneity in the funding mix for local health departments that is not explained by control. For example, although both are states where local health departments are primarily governed locally, departments in New York receive, on average, 5% of their funding from local sources, whereas Wisconsin departments receive 47% of their funds from local sources. Similarly, in both California and Missouri, departments are units of local government, but Missouri departments receive 6% of their funds directly from the state, whereas California departments get 32% of their funds from the state. South Carolina departments receive 44% of their revenue in federal pass-through funds, whereas Alaska departments receive 10% from the same source. Twenty percent of funding for Texas departments comes directly from the federal government, whereas North Carolina departments report that 1% of their revenue is in the form of direct federal funds. Alabama departments receive 55% of their funds through Medicare and Medicaid, whereas Arizona departments receive 1% of their revenue from those sources (NACCHO, 2011). This observation is consistent with the findings of Levi et al. (2007) and the Trust for America's Future (2010), which found that the organization structure for a state health department—be it an independent agency, mixed-function agency, or part of an umbrella agency—plays little role in the amount of state funding the agency receives.

Amount Expended on Local Public Health

Another issue concerning funding of local health departments is the amount spent on public health. The diversity among LHDs is clearly evident when annual budgets are examined. These ranged from less than $10,000 to more than $1 billion. Of all the local health departments studied, 25% had annual expenditures of under $500,000, and 11% had annual expenditures of more than $5 million. To take into account the large variation in the populations served by local health departments, we examine per capita spending. Per capita expenditures, again, are highly variable. The typical expenditure is about $40 per capita, but the range is from less than $32 to more than $60 per capita. On average, local health departments serving smaller populations have higher per capita expenditures than departments serving larger populations. For example, departments serving fewer than 25,000 people spend 34% more than departments serving more than 1 million people (see Table 3.5; NACCHO, 2014).

TABLE 3.5 MEDIAN AND MEAN ANNUAL PER CAPITA LOCAL HEALTH DEPARTMENT (LHD) EXPENDITURES AND REVENUES (BY POPULATION SERVED AND GOVERNANCE)

	EXPENDITURES[a]		REVENUES[b]	
LHD CHARACTERISTICS	MEDIAN	MEAN	MEDIAN	MEAN
All LHDs	**$39**	**$57**	**$39**	**$58**
Size of Population Served				
<25,000	$43	$67	$46	$69
25,000–49,999	$33	$50	$37	$52
50,000–99,999	$37	$48	$38	$47
100,000–249,999	$36	$45	$38	$45
250,000–499,999	$32	$43	$31	$39
500,000–999,999	$40	$78	$40	$82
1,000,000+	$32	$48	$32	$48
Type of Governance				
State	$35	$44	$36	$48
Local	$37	$54	$37	$55
Shared	$67	$89	$67	$89

[a]*(Expenditures) = 1,516*
[b]*(Revenues) = 1,346*

There is no apparent regional pattern that explains the variation. For example, states with the highest per capita expenditures include Maryland and New York. States with the lowest per capita expenditures include Indiana, New Jersey, Massachusetts, and Connecticut. Figure 3.3 shows the median annual per capita expenditure by local health departments by state.

Other Funding Considerations

Federal, state, and local expenditures do not tell the entire story of public health spending in local areas.

> Measuring investments in public health, particularly in Essential Services, in a given jurisdiction must go well beyond measuring only local health department expenditures. The health status and well-being of a community is a function of the collective efforts of many "community partners," including the health department, other social and human service agencies, primary care providers, hospitals, businesses, community groups, schools, churches, volunteer organizations, and the citizenry itself. The relative

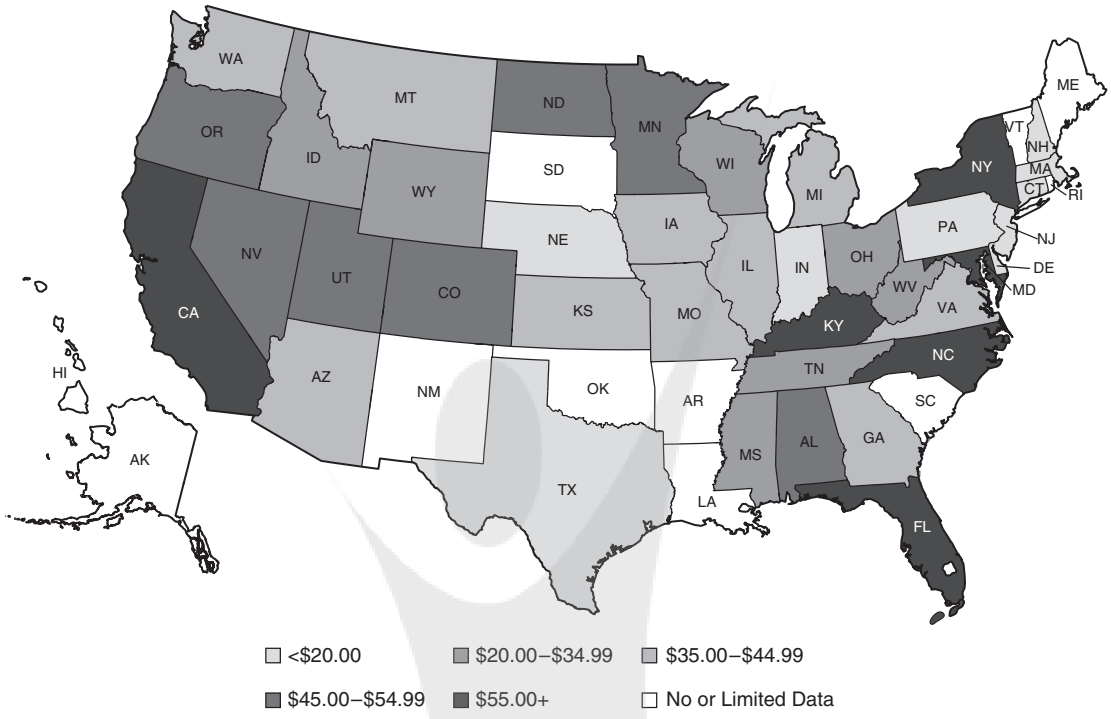

FIGURE 3.3 Median annual per capita local health department expenditures (by state).

contributions of these entities varies considerably from community to community, depending on a host of factors, including geography, political imperatives, the local economy, market forces, and public health infrastructure. (Barry, Centra, Pratt, Carol, & Giordano, 1998, p. 31)

STUDY QUESTIONS

Q: What is the lead public health agency at the federal level, and what are its major activities and responsibilities?

Q: How does this federal public health agency interact with the state departments of health?

Q: What agency is responsible for the Medicare program? Medicaid program? SCHIP?

Q: What are the sources of funding for state departments of health?

Q: Discuss the degree of and why there is variation in public health services from state to state.

NOTE

1 Alaska and Hawaii were included beginning in 1959. For decennial periods prior to 1929–1931, data are for groups of registration states as follows: 1900–1902 and 1909–1911, 10 states and the District of Columbia (D.C.); 1919–1921, 34 states and D.C. Beginning 1970, excludes deaths of nonresidents of the United States.

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FOUR

INFECTIOUS DISEASE CONTROL

OBJECTIVES

Readers will learn . . .

1. The basic approach of the federal public health system toward infectious disease control.
2. How the public health system monitors infectious disease outbreaks and trends.
3. How the public health infrastructure responds to infectious disease outbreaks and new infectious diseases.
4. The public health role in developing vaccines and the success of immunizations in controlling infectious diseases.
5. The public health infrastructure for responding to foodborne illnesses and its record of success.

Infectious disease control continues to be an essential part of public health in the United States and throughout the world. In the mid-20th century, some believed that infectious diseases were a health problem of the past. We now know that this is not true. As Moore (2007) expressively puts it:

> The word "plague" would have sent a ripple of fear down the spines of the people in (Shakespeare's) audiences, and the fact that they had no knowledge of the agent that swept invisibly across continents, devastating populations and leaving families shattered and entire economies in tatters, only served to heighten the anxiety.
>
> We have come a long way since Shakespeare's sixteenth century. We know about bacteria, viruses, and microscopic

> protozoa. We can watch the way that these tiny agents move into our bodies and damage our organs. We have a growing understanding of how our body mounts defensive strategies that fight off these invaders, and have built some clever chemical that can help mount an assault on these bio-villains. In the middle of the twentieth century, as science was creating a new optimism, some serious commentators believed that the total eradication of nasty bacteria and viruses could be just a decade or so away. But it wasn't. Far from it. (p. 6)

Today, both primary and secondary prevention are important public health practices related to infectious disease control. As will be evident, the methods used for primary prevention include the classic surveillance, sanitation, vaccination, and quarantine. Treatment relies on providing antimicrobial drug therapy and developing new therapies in response to new strains as well as antimicrobial resistance among existing strains. Although the methods for preventing and treating infectious diseases are, in general, the same as in the past, great improvements in these methods have resulted because of advances in microbiology, information and communication systems, and laboratory techniques. Following are descriptions of public health practice related to two major classes of infectious diseases addressed by public health: notifiable infectious diseases and foodborne diseases.

NOTIFIABLE INFECTIOUS DISEASES

A major component of the public health effort to prevent infectious disease outbreaks is the Centers for Disease Control and Prevention's (CDC) National Notifiable Diseases Surveillance System (NNDSS). The history of this program begins in the 19th century:

> In 1878, Congress authorized the U.S. Marine Hospital Service (i.e., the forerunner of the Public Health Service [PHS]) to collect morbidity reports regarding cholera, smallpox, plague, and yellow fever from U.S. consuls overseas; this information was to be used for instituting quarantine measures to prevent the introduction and spread of these diseases into the United States. In 1879, a specific Congressional appropriation was made for the collection and publication of reports of these notifiable diseases. The authority for weekly reporting and publication of these reports was expanded by Congress in 1893 to include data from states and municipal authorities. To increase the uniformity of the data, Congress enacted a law in 1902 directing the Surgeon General to provide forms for the collection and compilation of data and for the publication of reports at the national level. In 1912, state and territorial health authorities—in conjunction with PHS—recommended immediate telegraphic reporting of five infectious

> diseases and the monthly reporting, by letter, of 10 additional diseases. The first annual summary of The Notifiable Diseases in 1912 included reports of 10 diseases from 19 states, the District of Columbia, and Hawaii. By 1928, all states, the District of Columbia, Hawaii, and Puerto Rico were participating in national reporting of 29 specified diseases. At their annual meeting in 1950, the State and Territorial Health Officers authorized a conference of state and territorial epidemiologists whose purpose was to determine which diseases should be reported to PHS. In 1961, CDC assumed responsibility for the collection and publication of data concerning nationally notifiable diseases. (CDC, 2013a)

The NNDSS collects data from state and local authorities about selected notifiable infectious diseases. The states report cases to the CDC voluntarily. Currently, reporting is mandated only at the state level through state legislation or regulation. In general, all states report the internationally quarantinable diseases, which include cholera, plague, and yellow fever, to comply with the World Health Organization's (WHO) International Health Regulations. The CDC, in collaboration with the Council of State and Territorial Epidemiologists (CSTE), updates the list of reportable diseases annually. The CDC published Case Definitions for Public Health Surveillance in 1990, providing uniform criteria for reporting cases for the first time and including infectious and noninfectious diseases. The results of the NNDSS are published weekly in the *Morbidity and Mortality Weekly Report* (*MMWR*) and annually in a year-end summary. See the 2010 list of notifiable infectious and noninfectious diseases in Table 4.1 (CDC, 2013b).

TABLE 4.1 NATIONALLY NOTIFIABLE DISEASES, 2013

INFECTIOUS DISEASES	
Anthrax	Gonorrhea
Arboviral diseases, neuroinvasive and nonneuroinvasive	*Haemophilus influenzae*, invasive disease
Babesiosis	Hansen's disease
Botulism	Hantavirus pulmonary syndrome
Brucellosis	Hemolytic uremic syndrome, postdiarrheal
Chancroid	Hepatitis A, acute
Chlamydia trachomatis infection	Hepatitis B, acute
Cholera	Hepatitis B, chronic
Coccidioidomycosis	Hepatitis B, perinatal infection
Congenital syphilis	Hepatitis C, acute
Cryptosporidiosis	Hepatitis C, past or present
Cyclosporiasis	HIV Infection (AIDS has been reclassified as HIV Stage III)
Dengue virus infections	Influenza-associated pediatric mortality
Diphtheria	Invasive pneumococcal disease
Ehrlichiosis and anaplasmosis	Legionellosis
Giardiasis	Listeriosis

(*continued*)

TABLE 4.1 NATIONALLY NOTIFIABLE DISEASES, 2013 *(continued)*

INFECTIOUS DISEASES	
Lyme disease	Syphilis
Malaria	Tetanus
Measles	Toxic shock syndrome (other than streptococcal)
Meningococcal disease	Trichinellosis
Mumps	Tuberculosis
Novel influenza A virus infections	Tularemia
Pertussis	Typhoid fever
Plague	Vancomycin-intermediate *Staphylococcus aureus* and vancomycin-resistant *S. aureus*
Poliomyelitis, paralytic	Varicella
Poliovirus infection, nonparalytic	Varicella deaths
Psittacosis	Vibriosis
Q fever	Viral hemorrhagic fever
Rabies, animal	Yellow fever
Rabies, human	
Rubella	**NONINFECTIOUS DISEASES**
Rubella, congenital syndrome	
Salmonellosis	Cancer
Severe acute respiratory syndrome-associated coronavirus disease	Elevated blood lead levels
Shiga toxin-producing *Escherichia coli*	Foodborne disease outbreak
Shigellosis	Pesticide-related illness, acute
Smallpox	Silicosis
Spotted fever rickettsiosis	Waterborne disease outbreak
Streptococcal toxic-shock syndrome	

Source: National Notifiable Diseases Surveillance System, Centers for Disease Control and Prevention (2013b).

The following case studies illustrate public health practice related to control of notifiable infectious diseases.

Case Study: Pandemic Influenza and Avian Influenza

Pandemic Influenza

Pandemic influenza, by definition, is a *global public health emergency*. There is no human disease that causes more illness and death in a matter of months than an outbreak of pandemic flu. An influenza pandemic is a rare but recurring event and is significantly different from avian influenza and seasonal influenza. Avian influenza refers to many different types of influenza viruses that primarily affect birds and, on rare occasions, these avian viruses may affect other species, including humans. The rapid expansion of avian H5N1 influenza from Asia to Europe, and now Africa may or may not adapt into a strain that is readily contagious among humans. If this rare adaptation occurs and it crosses species from birds to humans, it will then become a human influenza disease (Taubenberger et al., 2005; Tumpey et al., 2005). Seasonal influenza occurs each and every year with some variation and causes approximately

36,000 deaths annually in the United States alone. There is a vaccine available each year, which may prevent or ameliorate illness in the majority of people infected. Whether there are large numbers of deaths from pandemic influenza is determined primarily by four factors:

- Number of people infected
- Virulence of the virus
- Vulnerability of the affected populations
- Effectiveness of preventive measures, such as isolation, quarantine, antiviral medications, and vaccines if available

The social and economic disruption in all countries affected can be tremendous. High rates of absenteeism in the workplace and in schools can be expected, as well as significant disruption in essential services and supplies of food, transportation, education, communications, and energy.

Global influenza pandemics are rare but have occurred on three occasions in the past century. In 1918, the Spanish influenza pandemic killed an estimated 50 million people worldwide (see Figure 4.1). It is believed by many to have caused more illness and death than any other disease in human history.

FIGURE 4.1 In 1918, influenza victims crowded into an emergency hospital at Fort Riley in Kansas.

Source: The National Museum of Health and Medicine, Armed Forces Institute of Pathology.

A second influenza pandemic, known as the Asian influenza (H2N2), occurred in 1957. It resulted in an estimated 2 million deaths worldwide. A third pandemic in 1968, known as the Hong Kong influenza (H3N2), killed more than 1 million people. Influenza pandemics are *rare* but *recurrent* events that meet three criteria:

- Result from a new influenza virus that emerges in a population that has little or *no* immunity
- Cause *serious* illness and death in humans
- Require *sustained* human-to-human transmission by respiratory droplet (i.e., by coughing and sneezing)

Avian Influenza

As highly pathogenic avian influenza A/H5N1 races across the continents from Asia to Europe, and now to Africa and the Middle East, the H5N1 pathogen has resulted in the death of more than 150 million birds—the largest and most severe case on record. The risk of human infection from the H5N1 avian virus persists as long as opportunities for direct contact exist between humans and infected birds. The risk from direct infection from H5N1 in birds occurs when the virus passes directly from infected poultry via feces to humans and may result in serious illness or death (CDC, 2006a). The number of confirmed human cases of avian influenza A/H5N1 in the world is over 645, with 384 resulting in death (WHO, 2013a). As the contact between infected birds and humans continues, the potential for the admixing of avian and human viral components increases. A pandemic influenza in humans *may* or *may not* occur as the result of the avian influenza outbreak over the last 9 years. Nevertheless, the danger of it happening exists.

The avian influenza virus can improve its transmissibility among humans through two primary mechanisms (Belshe, 2005):

- An explosive outbreak and surge of cases can occur in humans when there is a *reassortment of genetic material* between avian and human viruses in humans or in another species such as swine. This could result in a rapidly transmissible pandemic outbreak of influenza in humans.
- A second mechanism is the more gradual process of *adaptive*, *mutational change* of the avian virus that may bind to human cells and increase human infections. This may result in subsequent and more gradual outbreaks of human-to-human transmission of influenza.

There is the risk that the H5N1 avian virus, which is circulating widely among birds in many continents today, may develop the characteristics needed to begin another influenza pandemic. To date, it has met all the prerequisites

for the beginning of a pandemic except the ability to spread in a sustained manner from person-to-person. Therefore, although there is the possibility that a pandemic influenza in humans may not occur, the probability increases as the spread of avian influenza virus continues.

The most recently confirmed cases of avian influenza A/H5N1 have identified direct contact with infected birds as the most likely source of exposure. To date, the WHO has reported human cases in 15 countries (WHO, 2013a). All human cases have occurred in countries where highly pathogenic avian influenza has been found in poultry. There is one reported case of probable human-to-human transmission in Thailand in September 2004. No evidence of sustained human-to-human transmission of H5N1 has been detected, although rare instances of probable human-to-human transmission have occurred (Ungchusak et al., 2005).

Because there is no evidence of sustained human-to-human transmission of the virus occurring in any country, simply traveling to an outbreak country does not place an individual at risk of infection, provided the person does not have very close or direct contact with diseased birds in these countries. A history of poultry consumption in an affected country is not a risk factor if the food is thoroughly cooked and the person was not involved in any food preparation. In areas with avian influenza and confirmed human cases, poultry can be safely consumed if properly cooked and handled during preparation. The H5N1 virus is sensitive to heat, and normal cooking temperatures will kill the virus. However, cross-contamination from juices of raw poultry products during food preparation can transmit the virus, and there should be no mixing of any items or eating of any raw poultry products. Avian influenza virus is *not* transmitted through cooked food and clinical investigations to date have shown no evidence that anyone has become infected following the consumption of properly cooked poultry or egg products.

Prevention Policies and Practices

Formerly known as Global Influenza Surveillance Network (GISN), the WHO's Global Influenza Surveillance and Response System (GISRS) is a critical component of preparedness throughout the world for pandemic influenza. The GISRS:

> . . . enables WHO to recommend twice annually the content of the influenza vaccine for the subsequent influenza season. More than 250 million doses of influenza vaccine are produced annually which contain the WHO recommended influenza strains.
>
> Frequent updating of the influenza vaccine content is necessary as influenza viruses are permanently evolving. Only a vaccine whose virus strains match the circulating influenza viruses will protect recipients efficiently from influenza disease and death.

> The WHO Influenza Surveillance Network serves also as a global alert mechanism for the emergence of influenza viruses with pandemic potential. Its activities have contributed greatly to the understanding of influenza epidemiology. The network was established in 1952, after a WHO Expert Committee recommended that through an international network of laboratories, WHO would be able to advise WHO Member States as to "what influenza control measures are useful, useless or harmful." . . . The main components of the WHO Global Influenza Surveillance Network are National Influenza Centres (NICs) which sample patients with influenza-like-illness and submit representative isolates to WHO Collaborating Centres (WHO CCs) for antigenic and genetic analyses. NICs, WHO CCs and WHO form the WHO Global Influenza Surveillance Network, with collaboration based on agreed terms of reference.
>
> Currently, 134 institutions from 104 countries are recognized by WHO as National Influenza Centres. In addition, various other laboratories have regularly submitted influenza viruses to the Programme in the past years. (WHO, 2014a)

The United States has four WHO National Influenza Centers: the Viral and Rickettsial Disease Laboratory in California; the School of Public Health, Department of Epidemiology in Ann Arbor, Michigan; the CDC in Georgia; and the Virology Diagnostic Services Laboratory of Zoonotic Diseases at the Wadsworth Center in New York.

As the countries of the world, including the United States, plan for pandemic influenza, preparedness efforts revolve around the following:

- Enhanced surveillance and early identification of cases in humans with isolation and contact tracing, and quarantine for exposed individuals to decrease transmission to others
- Communication and education of health care professionals and the public about the seriousness of the situation
- Implementation of infection-control measures and the provision of quality medical and supportive care
- Maintenance of emergency and essential community services
- Outbreak control via the use of antiviral treatments, prophylaxis, and vaccination, if available

Local health departments have been planning for a pandemic flu for several years. In recent years, there has also been greater collaboration between local health departments and other local governmental departments as part of overall disaster preparedness. This has allowed the departments of health to work more closely with the police, fire, rescue, and emergency services, local hospitals and physicians, and various other public safety units.

It is believed that any major effort to respond to this threat will require a strong local response.

To respond to a pandemic influenza, vaccine manufacturers need the capability to develop and produce large quantities of new vaccines within months and not the 8 to 10 years that is needed today. This will entail making huge investments in new technologies to produce vaccines rapidly. Developing a cell-culture–derived vaccine instead of depending on chicken egg embryos; creating a library of clinical grade vaccine strains that are now appearing; new microdiagnostic laboratory assays, refining production methods to reduce the time and cost of making vaccines; and boosting an immune response after a single dose of a nasal spray vaccine would all be major contributions to an effective response to a pandemic influenza. Traditional public health methods to control an outbreak may include isolation and quarantine of infected persons, which may be ineffective after a short period.

Recent literature raised important questions regarding the implication of resistance to antiviral agents for the management of influenza and for planning a response to a possible pandemic (Hayden, 2006). Because of the high levels of resistance to amantadine and rimantadine detected among influenza A viruses, the CDC recommended in 2006 that neither drug be used for the treatment or chemoprophylaxis of influenza A infections (CDC, 2006b). Given that the two most important medical interventions—vaccines and antiviral medications—may likely be in short supply, federal, state, and local efforts need a strong community education program on methods of infection control. It is recommended that all communities be targeted for infection control education, including minority, low-income, and immigrant populations.

Public health officials believe that it is of paramount importance that federal and state-level governments invest in the local infrastructure. Appropriate activities include enhanced funding for local medical research institutions, local hospitals, physicians, nurses, educators and other professionals, and devoting substantial resources to local emergency and public health systems. Pandemic influenza is rare, but the probability of it recurring is increasing. When pandemic influenza does occur, it will probably cause more illness and death in a shorter time frame than any other public health threat currently being faced.

Case Study: Perinatal Hepatitis B

One of the notifiable infectious diseases monitored by the NNDSS is hepatitis B. The hepatitis B virus (HBV) infection is an established cause of acute and chronic hepatitis and cirrhosis. It is the cause of up to 80% of hepatocellular carcinoma and is second only to tobacco among known human carcinogens. More than 350 million persons are chronically infected worldwide, and there were over 1,000,000 deaths in 2013 from hepatitis B infection

(WHO, 2014b). The virus is transmitted through blood or other bodily fluids, and it is 50 to 100 times more infectious than HIV. Approximately 10% of all acute HBV infections progress to chronic infection with the risk of chronic HBV infection decreasing with age. As many as 90% of infants who acquire HBV infection from their mothers at birth become chronically infected, or carriers. Of children who become infected with HBV between 1 and 5 years of age, 30% to 50% become carriers. Persons with chronic HBV infection are often asymptomatic and may not be aware that they are infected, yet are capable of infecting others. About 25% of adults who become carriers as children die from liver cancer or cirrhosis caused by the infection. Chronic infection is responsible for most HBV-related morbidity and mortality, including chronic hepatitis, cirrhosis, liver failure, and hepatocellular carcinoma. Persons with chronic HBV infection are at 12 to 300 times higher risk of hepatocellular carcinoma than noncarriers (CDC, 2009; WHO, 2014a).

The hepatitis B vaccine is safe and effective according to the WHO, and has been available in the United States since 1982 (WHO, 2013b). Since then, the control of perinatal infection has been a crucial part of the evolving vaccination strategy of the Advisory Committee on Immunization Practices (ACIP). The CDC, American Academy of Pediatrics (AAP), and the ACIP recommend maternal identification through screening and newborn prophylaxis, which can significantly reduce neonatal infection and potential sequelae.

> Preventing perinatal HBV transmission is an integral part of the national strategy to eliminate Hepatitis B in the United States. National guidelines call for the following:
>
> - Universal screening of pregnant women for HBsAg during each pregnancy,
> - Case management of HBsAg-positive mothers and their infants,
> - Provision of immunoprophylaxis for infants born to infected mothers, including Hepatitis B vaccine and Hepatitis B immune globulin [sic],
> - Routine vaccination of all infants with the Hepatitis B vaccine series, with the first dose administered at birth. (CDC, 2012a)

To accomplish the goal of eliminating perinatal hepatitis B transmission, many local health departments administer the Perinatal Hepatitis B Prevention Program in coordination with the CDC (CDC, 2013c).

Infectious Disease Management: Hepatitis B in New York State

New York State Public Health Law requires the completion of the following steps if a pregnant woman is hepatitis B surface antigen (HBsAg)-positive:

Reporting of the Case

- Physicians report to the County Department of Health's Perinatal Hepatitis B Prevention Program.
- Diagnostic laboratories report to the County Department of Health's Perinatal Hepatitis B Prevention Program.
- Labor and delivery hospitals report to the County Department of Health's Perinatal Hepatitis B Prevention Program.
- County Department of Health reports to New York State Department of Health (NYSDOH).

Management of the Case

- *Isolation.* Blood, body fluid, and tissue precautions are indicated for a pregnant woman who is HBsAg-positive and for her infant.
- *Investigation.* Case investigations are performed to determine the source of infection and exposure to the infant–sexual, needle sharing, and household contacts.
- *Laboratory Work and Follow-Up.* Follow-up is needed regarding HBsAg status of the mother and her infant, including follow-up laboratory work to determine the success of treatment for infants who complete the hepatitis B vaccine series.
- *Counseling.* HBsAg-positive individuals shall be counseled in measures to prevent the spread of hepatitis B transmission to household, sexual, and needle-sharing contacts.
- *Referral.* Individuals diagnosed as hepatitis B carriers should be referred to their private physicians for disease management.

Management of the Contacts

- *Investigation.* Case investigation is performed to determine the exposure to household, sexual, and needle-sharing contacts.
- *Laboratory Testing and Follow-Up.* Identified household, sexual, and needle-sharing contacts should be tested for the presence of HBV, and vaccine offered if indicated by their physicians.
- *Infants.* The purpose of maternal screening and intervention is to prevent the development of hepatitis B infection among infants born to mothers who are HBsAg-positive.

Case Study: Tuberculosis

In 2012, an outbreak of 27 cases of tuberculosis was identified in a primarily homeless population in Grand Forks and Fargo, North Dakota (Dwelle, 2014). Of those infected, 22 were identified as being Native American. Fifteen cases

were diagnosed by culture and 12 diagnosed clinically. Several of these individuals were also abusing drugs like methamphetamine. Over 1,700 contacts were screened for tuberculosis during the investigation, identifying 79 cases of latent tuberculosis infection with 53.7% of all named contacts having latent tuberculosis infection.

Investigative tools used by public health included epidemiologic case interviews, review of electronic medical records, name and photo press releases, Facebook and other social networks, and pictures of transmission locations to aid in contact tracing and genotyping. All genotype results from the outbreak were a match to GENtype GOOO11 via Whole Genome Sequencing, performed by the CDC, confirming that these cases were linked.

Resistance to Isoniazid (INH) at 0.2 mcg/mL was noted for all cases with sensitivities completed. This resistance to INH meant that all latent tuberculosis cases would need to be treated with Rifampin versus INH, and the treatment course for active cases extended to 9 months from the usual course of 6 months. Initial contacts and latent cases initially treated with INH were retreated with Rifampin once the INH resistance was reported.

The emergency preparedness and response section of the North Dakota Department of Health was activated to provide incident command services to manage the response to this epidemic. Housing, food, and utilities support were among the services provided, since most of these individuals were homeless. Additional staff were requested and assigned to support this effort for several months, providing personnel to complete Directly Observed Therapy (DOT) 7 days a week for the infected and for high-risk patients with latent tuberculosis infection. Financial and other incentives were used to encourage compliance. The incident command system coordinated the response with several other agencies and partners including the Indian Health Service, border states and Canadian provinces, jails, and child welfare and foster care services.

As of January 2014, public health and its partners have been engaged in this process for over 16 months, with 11 cases still under treatment. Public health is often looked to to coordinate the response to epidemics like tuberculosis. This can be a long, intensive, complicated process.

Case Study: Unvaccinated Children

Childhood vaccinations are an essential public health strategy to maintaining a healthy population of children, adolescents, and adults free of infectious diseases. The CDC's ACIP provides a list of childhood vaccinations recommended for all children. By age 18, a child immunized according to schedule will have been vaccinated against (CDC, 2010):

- Hepatitis B
- Rotavirus

- Diphtheria and tetanus toxoids and acellular pertussis
- *Haemophilus influenzae* type b
- Pneumococcus
- Poliovirus
- Influenza (seasonal)
- Measles, mumps, rubella
- Varicella
- Hepatitis A
- Meningococcus
- Human papillomavirus

The National Immunization Survey (NIS), sponsored by the National Center for Immunizations and Respiratory Diseases (NCIRD), monitors immunization coverage among children in the United States (CDC, 2013d). The results from the 2008 survey show that, overall, about 90% of children aged 19 to 35 months of all races and ethnicities are fully or partially immunized against the major childhood diseases: hepatitis B, diphtheria, and tetanus toxoids and acellular pertussis, *H. influenzae* type b, pneumococcus, poliovirus, measles, mumps, rubella, and varicella. Not only can children be protected from diseases through vaccinations, but vaccinations can also result in cost savings. Table 4.2 shows the cost savings and death rates associated with vaccination programs compared to nonvaccination programs (Zhou et al., 2005).

The percentage of children vaccinated, however, has been declining. In 1991, less than 1% of children were exempted from childhood vaccinations by states and localities. By 2004, nearly 2.5% of children were exempted. There are medical and religious exemptions in nearly all states. Personal exemptions, on the other hand, exist in 21 states, including California, Texas, Ohio, and Minnesota. They are not permitted in the states of New York, New Jersey, Florida, and Connecticut. This situation has led to more clusters of childhood diseases that were previously rare and is becoming an increasingly serious public health risk to many unvaccinated children and immunocompromised individuals of all ages. Unvaccinated children are susceptible to serious illnesses, such as measles. In addition, they present a danger to others who may not be fully protected. Herd immunity is the concept that if enough people are vaccinated against a disease, there is little opportunity for an outbreak. In this way, even people who are not able to be vaccinated are still protected. Herd immunity fails when too many people in a population opt out of being vaccinated. Figure 4.2 illustrates the concept of herd immunity and what happens as people claim exemptions from vaccinations. Personal or philosophical exemptions are considered potentially dangerous and bad public health policy (Omer et al., 2006). Following is a commentary written by Paul Offit and published in the *Wall Street Journal* in 2007, discussing the problem of unvaccinated children.

TABLE 4.2 HEALTH AND ECONOMIC OUTCOMES FOR SELECTED VACCINE-PREVENTABLE DISEASES WITH AND WITHOUT A VACCINATION PROGRAM*

	WITHOUT VACCINATION PROGRAM				PREVENTED OR SAVED BY VACCINATION PROGRAM			
	Cases (No.)	Deaths (No.)	Direct Costs (Million $)	Total Costs (Million $)	Cases (No.)	Deaths, No.	Direct Costs (Million $)	Total Costs (Million $)
Diphtheria	247,214	24,721	2,358	24,930	247,212	24,721	2,358	24,930
Tetanus	153	23	8	29	146	22	8	28
Pertussis	2,662,307	1,049	2,265	3,668	2,614,874	1,008	2,193	3,545
Haemophilus influenzae type b	17,530	663	1,434	2,696	17,469	661	1,430	2,689
Poliomyelitis	60,974	723	2,084	4,890	60,974	723	2,084	4,890
Measles	3,493,722	2,795	2,646	5,875	3,433,036	2,794	2,645	5,874
Mumps	2,100,718	11	936	1,459	2,095,917	11	934	1,456
Rubella	1,786,334	14	88	381	1,784,030	14	88	380
Congenital rubella syndrome	616	68	115	173	602	66	112	169
Hepatitis B	232,001	3,427	168	1,272	207,353	3,024	149	1,121
Varicella	3,788,807	70	205	1,184	3,160,391	57	173	993
Total	14,330,376	33,564	12,307	46,557	13,622,004	33,101	12,174	45,075

*Costs are rounded and given in US dollars
Source: Zhou et al. (2005).

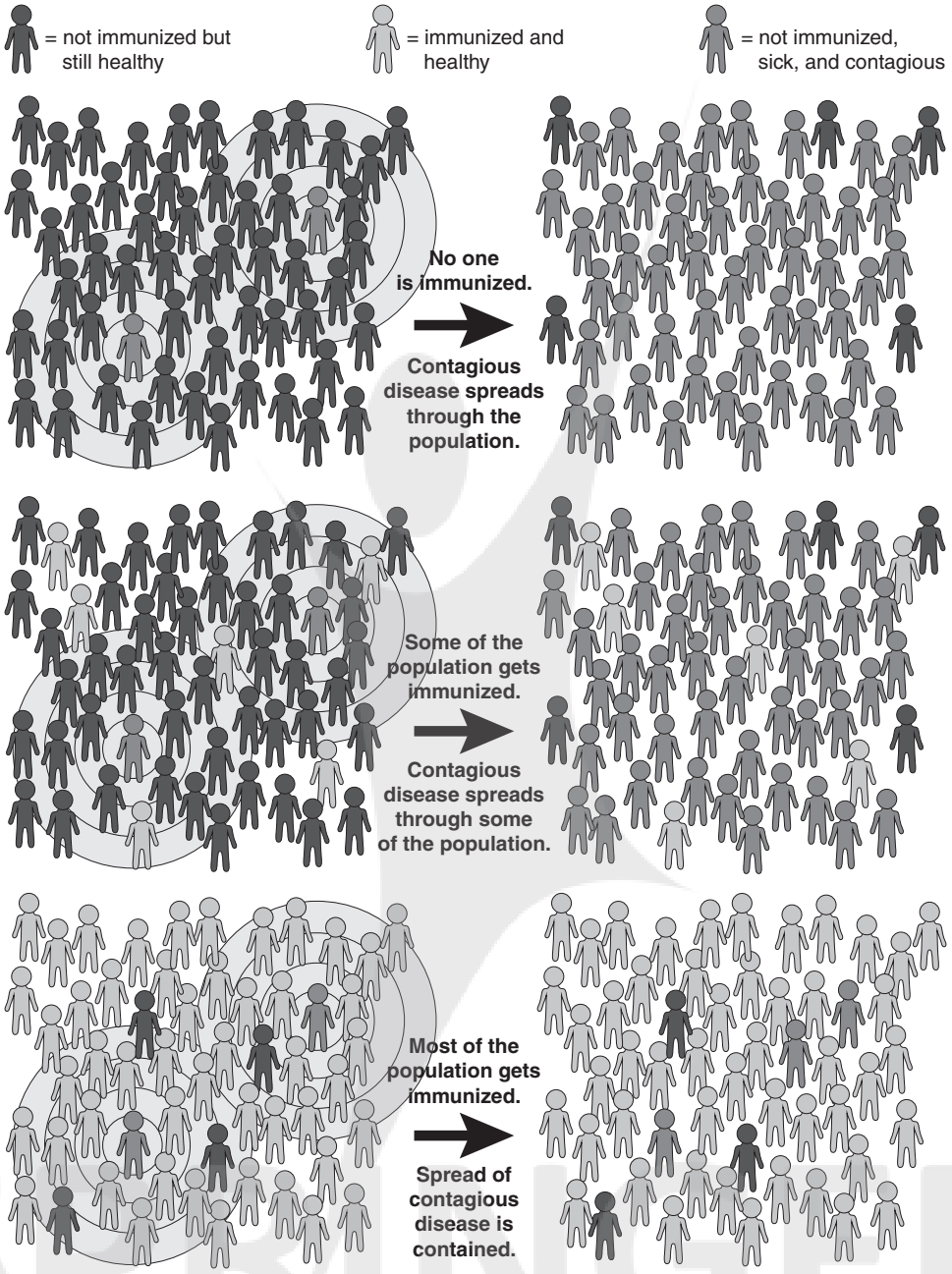

FIGURE 4.2 The effect of population immunization on herd immunity.
Source: National Institutes of Allergy and Infectious Diseases (2010).

Fatal Exemption: Relationship Between Vaccine Exemptions and Rates of Disease. Commentary by Paul Offit, MD, Chief of Division of Infectious Diseases, Children's Hospital of Philadelphia. Published in the *Wall Street Journal*, January 20, 2007.

Last month [October 2006] the *Journal of the American Medical Association* (*JAMA*) published a study that received little attention from the press and, as a consequence, the public. The study examined the incidence of whooping cough (pertussis) in children whose parents had chosen not to vaccinate them; the results were concerning.

Vaccines are recommended by the Centers for Disease Control and Prevention (CDC) and professional societies, such as the American Academy of Pediatrics. But these organizations can't enforce their recommendations; only states can do that—usually when children enter day care centers and elementary schools—in the form of mandates. State vaccine mandates have been on the books since the early 1900s; but aggressive enforcement of them didn't occur until much later, born from tragedy.

In 1963 the first measles vaccine was introduced in the United States. Measles is a highly contagious disease that can infect the lungs causing fatal pneumonia, or the brain causing encephalitis. Before the measles vaccine, measles caused 100,000 American children to be hospitalized and 3,000 to die every year. In the early 1970s, public health officials found that states with vaccine mandates had rates of measles that were 50 percent lower than states without mandates. As a consequence, all states worked toward requiring children to get vaccines. Now every state has some form of vaccine mandates.

But not all children are subject to these mandates. All fifty states have medical exemptions to vaccines, such as a serious allergy to a vaccine component. Forty-eight states also have religious exemptions; Amish groups, for example, traditionally reject vaccines, believing that clean living and a healthy diet are all that are needed to avoid vaccine preventable diseases. And twenty states have philosophical exemptions; in some states these exemptions are easy to obtain, by simply signing your name at the bottom of a form; and in others they're much harder, requiring notarization, annual renewal, a signature from a local health official, or a personally written letter from a parent.

The *JAMA* study examined the relationship between vaccine exemptions and rates of disease. The authors found that between 1991 and 2004 the percentage of children whose parents had chosen to exempt them from vaccines increased by 6 percent per year, resulting in a 2.5-fold increase. This increase occurred almost solely in states where philosophical exemptions were easy to obtain. Worse, states with easy-to-obtain philosophical exemptions had twice as many children suffering from pertussis—a disease that causes inflammation of the windpipe and breathing tubes, pneumonia and, in about twenty infants every year, death—than states with hard-to-obtain philosophical exemptions.

The finding that lower immunization rates caused higher rates of disease shouldn't be surprising. In 1991 a massive epidemic of measles in Philadelphia centered on a group that chose not to immunize its children; as a consequence nine children died from measles. In the late 1990s, severe outbreaks of pertussis occurred in Colorado and Washington among children whose parents feared pertussis vaccine. And in 2005 a 17-year-old unvaccinated girl, unknowingly having brought measles back with her from Romania, attended a church gathering of 500 people in Indiana and caused the largest outbreak of measles in the United States in ten years; an outbreak that was limited to children whose parents had chosen not to vaccinate them. These events showed that for contagious diseases like measles and pertussis it's hard for unvaccinated children to successfully hide among herds of vaccinated children.

Some would argue that philosophical exemptions are a necessary pop-off valve for a society that requires children to be injected with biological agents for the common good. But as anti-vaccine activists continue to push more states to allow for easy philosophical exemptions one thing is clear, more and more children will suffer and occasionally die from vaccine preventable diseases.

When it comes to issues of public health and safety we invariably have laws. Many of these laws are strictly enforced and immutable. For example, we don't allow philosophical exemptions to restraining young children in car seats or smoking in restaurants or stopping at stop signs. And the notion of requiring vaccines for school entry, while it seems to tear at the very heart of a country founded on the basis of individual rights and freedoms, saves lives. Given the increasing number of states allowing philosophical exemptions to vaccines, at some point we are going to be forced to decide whether it is our inalienable right to catch and transmit potentially fatal infections.

Case Study: Measles

Measles is still a worldwide health problem, and a global effort by the WHO and the United Nations Children's Emergency Fund (UNICEF) to control measles is underway, with some reduction in cases:

> Because of limited disease surveillance and death registration in many countries with weak infrastructure and high measles burden, current routine reporting systems are inadequate for monitoring global measles mortality. Different modeling approaches have been used to estimate the global number of measles deaths. Published estimates from these approaches vary both in level and precision and have wide uncertainty bounds that overlap. A panel of six experts was convened in January 2005 to advise WHO on how best to monitor progress toward the 2005 measles mortality

> reduction goal. The panel noted strengths and weaknesses in various approaches to estimating measles mortality but endorsed the use of surveillance data (where they are reliable) and a natural history model (where surveillance data are unreliable) because the latter accounts for recent changes in vaccination coverage and is therefore better suited for monitoring trends. However, the panel recommended that uncertainty bounds around the point estimates be calculated to indicate the lack of precision.
>
> Due to increased vaccination efforts for measles, overall global measles mortality decreased 74% from 535,300 deaths in 2000 to 139,300 (bounds: 383,000—731,000 deaths) in 2010. The largest reduction was in Sub-Saharan Africa, where estimated measles mortality decreased by 85% between 2000 and 2010. (WHO, 2012)

As of 2000, measles is no longer considered endemic in the United States, and all cases of measles reported are believed to be related directly or secondarily to international importation (CDC, 2005). Because measles continues to be endemic throughout the world, the CDC recommends full measles immunity for any individual traveling outside the country. Recent large outbreaks have been reported in Great Britain, Switzerland, Austria, Italy, and Israel. Cases have been identified throughout Europe and also in Central Asia and Japan.

Immunization Successes

The long-term benefits of wide-scale immunizations of children are clear, as noted in the following table from the National Institute of Allergy and Infectious Diseases (2009), which displays the number of pre-vaccine annual cases for many infectious diseases compared to 2009. (see Table 4.3):

FOODBORNE DISEASE

Foodborne disease remains a serious public health problem in the United States and worldwide.

> The CDC estimates that each year roughly 1 in 6 Americans (or 48 million people) gets sick, 128,000 are hospitalized, and 2,000 die of foodborne diseases. The 2011 estimates provide the most accurate picture yet of which foodborne bacteria, viruses, microbes ("pathogens") are causing the most illnesses in the United States. According to the 2011 estimates, the most common foodborne

TABLE 4.3 THE IMPACT OF VACCINES IN THE UNITED STATES

DISEASE	BASELINE 20TH CENTURY PRE-VACCINE ANNUAL CASES	2009 CASES	PERCENT DECREASE
Measles	503,282	71	99.9%
Diphtheria	175,885	0	100%
Mumps	152,209	1,991	98.7%
Pertussis	147,271	13,214	91.0%
Smallpox	48,164	0	100%
Rubella	47,745	3	99.9%
Haemophilus influenzae type b, invasive	20,000	35	99.8%
Polio	16,316	0*	100%
Tetanus	1,314	18	98.6%

Source: National Institute of Allergy and Infectious Diseases (2009).

illnesses are caused by norovirus and by the bacteria *Salmonella, Clostridium perfringens,* and *Campylobacter.*

Additional important safety concerns are associated with the greater susceptibility to foodborne infections of several population groups. These include persons with lowered immunity due to HIV/AIDS, those on medications for cancer treatment or for organ transplantation, as well as pregnant women (and their fetuses), young children, and elderly persons. Patients taking antibiotics, or antacids, are also at greater risk of infection from some pathogens. Other groups who may be disproportionately affected include persons living in institutional settings, such as hospitals and nursing homes, and those with inadequate access to health care, such as homeless persons, migrant farm workers, and others of low socioeconomic status. (CDC, 2012b; Occupational Safety and Health Administration [OSHA], 2010)

Among outbreaks for which etiology was determined in recent years, bacterial pathogens caused 75% of the outbreaks and of these, *Salmonella enteritides* was responsible for 86% of them. Chemical agents caused 17% of the outbreaks and 1% of cases; viruses, 6% of outbreaks and 8% of cases; and parasites, 2% of outbreaks and 5% of cases. These illnesses primarily affect elderly, very young, and immunocompromised individuals. Increased travel and global trade may increase the risk of contracting and spreading foodborne illnesses.

A foodborne disease outbreak is the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food. Food poisoning ranks second only to the common cold as the most frequent cause of short-term illness. Infections transmitted through the consumption of food may cause acute gastroenteritis food poisoning or various syndromes with systemic manifestations. Food poisoning is defined as the occurrence of nausea, vomiting, diarrhea, and acute gastroenteritis of short duration due to the ingestion of food contaminated by microorganism or their products, chemical toxins, or toxic substances present naturally in certain foods. This definition includes both food intoxication and food infection. Sometimes the term *food poisoning* is limited to food intoxication.

Food may be infected at its source during manufacture, preparation, storage, and distribution. Diseases that occur at the source include trichinosis, brucellosis, and salmonellosis.

In 2006, there was a nationwide outbreak of Shiga toxin-producing *Escherichia coli* O157:H7 enteritis linked to the consumption of contaminated leafy green vegetables (specifically spinach) from one California supplier. This was the 26th reported outbreak of *E. coli* infection in the United States that had been traced to contaminated leafy green vegetables since 1993. Each year, approximately 110,000 people acquire toxigenic *E. coli* infection, and about 50 of them die (Maki, 2006).

Foodborne illnesses can be caused by many microorganisms including bacteria, fungi, and viruses and their related toxins, parasites, and chemical contaminants. During the last 20 years, some foods that have been linked to outbreaks include milk (*Campylobacter*); unpasteurized apple cider (*E. coli* O157:H7); raw and undercooked eggs (*Salmonella*); shellfish (*noroviruses*); fish (ciguatera poisoning); raspberries (*Cyclospora*); strawberries (hepatitis A virus); and ready-to-eat meats (*Listeria*). Only a small percentage of the people who have foodborne illnesses actually seek medical care. The bacterial agents most often identified in patients with foodborne illness in the United States are *Campylobacter*, *Salmonella*, and *Shigella*. Testing for viruses that may cause diarrheal disease is rarely done in clinical practice, even though they are considered the most common cause of foodborne illness.

Signs and Symptoms of Foodborne Illness

Foodborne illnesses typically present with gastrointestinal symptoms such as vomiting, diarrhea, and abdominal pain. However, nonspecific and neurological symptoms may also occur. A high degree of suspicion by the physician and asking the appropriate questions may be the only opportunity to make an early clinical diagnosis of a foodborne illness. Important clues to determining the etiology of a foodborne disease are:

- Incubation period
- Duration of illness
- Predominant clinical symptoms
- Population involved

When considering foodborne illness in the differential diagnosis, patients are asked if they have consumed raw or poorly cooked foods (e.g., eggs, meats, shellfish, fish, unpasteurized milk or juices, home-canned goods, fresh produce, or soft cheeses). They are also asked if any of their family members or close friends have similar symptoms. Questions to the patient address occupation, food preparation habits, foreign travel, contact with a farm or pet, camping, untreated water consumption, and picnic attendance. If foodborne illness is suspected, specimens are submitted for laboratory testing and the local health department is contacted. Because infectious diarrhea can be very contagious and is easily spread, rapid identification of an etiologic agent may help control disease outbreak and prevent further exposures. Deliberate contamination is a rare event, but it has been documented in the past. Intentional contamination of a food product may be suggested by the presence of an unusual pathogen in a common food, or a common agent affecting an unusually large number of people, or a common agent that is not usually seen in clinical practice, as might occur with chemical poisonings.

The following signs or symptoms may suggest the presence of a foodborne illness and laboratory testing may provide important diagnostic clues, especially in the very young, the elderly, and the immunocompromised: bloody diarrhea, weight loss, diarrhea and dehydration, fever, prolonged diarrhea over several days, neurological involvement such as paresthesias, motor weakness, cranial nerve palsies, sudden onset of nausea, vomiting, or diarrhea, and severe abdominal pain. In addition to foodborne causes, a differential diagnosis should include underlying medical conditions such as inflammatory bowel diseases, malignancies, medication use, recent surgery or radiation, malabsorption syndromes, immune deficiencies, and other morbidities.

Stool cultures are indicated if the patient is febrile, has bloody diarrhea, has severe abdominal pain, or if the illness is severe or persistent in a vulnerable person. Stool cultures are also recommended if many fecal leukocytes are present. This may indicate diffuse colonic inflammation and is suggestive of invasive bacteria such as *Shigella*, *Salmonella*, *Campylobacter,* and invasive *E. coli*.

Acute gastroenteritis may be self-limiting and may only require hydration and supportive care. Routine use of antidiarrheal agents is not recommended because many of these agents have potentially serious adverse effects in infants and young children. Choice of antimicrobial therapy should be based on clinical signs and symptoms, organisms present, susceptibility tests, and appropriateness of treating with an antibiotic. Table 4.4 summarizes selected common bacterial foodborne illnesses by etiology, incubation period, signs and symptoms, duration of illness, associated foods, laboratory testing, and treatment (CDC, 2004).

Prevention Policies and Practices

The huge burden of disease from foodborne diseases—affecting thousands of people and causing many deaths—occurs despite intensive prevention efforts by the federal food safety agencies: the United States Department of

TABLE 4.4 COMMON FOODBORNE DISEASE AGENTS

AGENT	INCUBATION PERIOD	SYMPTOMS	DURATION	SOURCE	DIAGNOSIS AND TREATMENT
Bacillus cereus (preformed enterotoxin)	1–6 hours	Sudden onset of severe nausea and vomiting	24 hours	Improperly refrigerated cooked or fried rice, meats.	—Normally a clinical diagnosis; Send stool and food specimens to reference laboratory for culture and toxin. —Supportive care.
B. cereus (diarrheal toxin)	10–16 hours	Abdominal cramps, watery diarrhea, nausea.	24–48 hours	Meats, stews, gravies, vanilla sauce.	—Testing not necessary unless outbreak. —Supportive care.
Campylobacter jejuni	2–5 days	Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody.	2–10 days	Raw and undercooked poultry, unpasteurized milk, contaminated water.	—Routine stool culture; requires special media. —Supportive care. For severe cases: erythromycin and quinolones.
Enterohemorrhagic *Escherichia coli* (EHEC) Including *E. coli* **O157:H7**	1–8 days	Severe diarrhea—often bloody, abdominal pain, vomiting. Rarely fever, more common in younger than 4 years of age.	5–10 days	Undercooked beef especially hamburger, unpasteurized milk and juice, raw fruits and vegetables (e.g., sprouts), salami (rarely), and contaminated water.	—Stool culture; *E. coli* O157:H7 requires special media to grow. —Supportive care, monitor renal function, hemoglobin, and platelets. *E. coli* O157:H7 associated with hemolytic uremic syndrome (HUS). Antibiotics may promote HUS.
Enterotoxigenic *E. coli* (ETEC)	1–3 days	Watery diarrhea, abdominal cramps, some vomiting.	3–7 days	Water or food contaminated with human feces.	—Stool culture, ETEC requires special laboratory techniques. —Supportive care. Antibiotics (TMP-SMX and quinolones) are rarely needed except in severe cases.

(*continued*)

Salmonella	6–72 hours	Diarrhea, fever, abdominal cramps, vomiting.	4–7 days	Contaminated eggs, poultry, unpasteurized milk or juice, cheese, contaminated raw fruits and vegetables (alfalfa sprouts, melons).	—Routine stool cultures. —Supportive care. Other than for *Salmonella* typhi, antibiotics are not indicated unless extra-intestinal spread. Consider ampicillin, gentamicin, TMP-SMX, or quinolones.
Shigella	24–48 hours	Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus.	4–7 days	Food or water contaminated with human fecal material. Usually person-to-person spread, fecal–oral transmission, raw vegetables, salads sandwiches.	—Routine stool cultures. —Supportive care. TMP-SMX recommended if susceptible; nalidixic acid or other quinolones if resistant.
Staphylococcus aureus (preformed enterotoxin)	1–6 hours	Sudden onset of severe nausea and vomiting. Possible diarrhea and fever. Abdominal cramps.	24–48 hours	Unrefrigerated or improperly refrigerated meats, potato and egg salads, and cream pastries.	—Normally a clinical diagnosis. Stool, vomitus, and food can be tested for toxin and cultured if indicated. —Supportive care.

Agriculture (USDA), the United States Food and Drug Administration (FDA), and the CDC. Physicians and other health care professionals play a critical role in the prevention and control of food-related disease outbreaks because of the opportunity to identify suspicious symptoms, disease clusters, and etiological agents and report their findings to public health authorities, where they will become part of the larger network of information that monitors foodborne diseases. Specifically, physicians should recognize the potential for foodborne etiology in a patient's illness, and realize that many but not all cases of foodborne illness have gastrointestinal symptoms. They should obtain stool cultures in appropriate settings and recognize that some specific pathogens (e.g., *E. coli* O157:H7) must be requested. Physicians should talk with their patients about ways to prevent food-related diseases. They should also appreciate that any patient with a foodborne illness may represent the sentinel case of a more extensive outbreak, and therefore, it is important to understand the cause of the outbreak and to prevent its spread.

Today in the United States virtually all food consumed is grown and processed on vast farming and industrial scales or is increasingly imported from other countries, including milk and other dairy products, eggs and egg products, fresh vegetables and fruits, and processed snacks and other food stuffs. These aspects of food delivery make prevention of foodborne diseases more difficult. Relatively little of our fresh food is now grown locally. The risk of foodborne disease is considerably higher with more food prepared outside of the home than meals made at home. The risk of diseases such as *Salmonella*, pathogenic *E. coli*, *Campylobacter*, and *Listeria* increases with centralized production and distribution of commercially produced foods, and the failure to remove bacterial contaminants in a single production step can result in a shipment of contaminated food to millions of consumers.

Efforts to reduce foodborne disease occur at the federal, state, and local levels. At the federal level, the USDA's Food Safety and Inspection Service (FSIS) is central. Notably, the USDA introduced the Pathogen Reduction and Hazard Analysis and Critical Control Point (HACCP) program in 1996, which provides more intensive surveillance of foodborne infections in 10 states to ensure the safety of the meat, poultry, and egg products supply. "The HACCP-Based Inspection Models Project was developed by the FSIS to produce a flexible, more efficient, fully integrated meat and poultry inspection system" (USDA, 2014).

PulseNet is another federal initiative to ensure safe food, a collaborative of the USDA/FSIS, FDA, and CDC. The objectives of the program are to detect foodborne disease case clusters by pulsed-field gel electrophoresis (PFGE) and facilitate early detection of outbreak sources.

> PulseNet is a national network of public health and food regulatory agency laboratories coordinated by the Centers for Disease Control and Prevention (CDC). The network consists of: state health departments, local health departments, and federal agencies (CDC, USDA/FSIS, FDA).
>
> PulseNet participants perform standardized molecular subtyping (or "fingerprinting") of foodborne disease-causing bacteria by pulsed-field gel electrophoresis (PFGE). PFGE can be

> used to distinguish strains of organisms such as *Escherichia coli* O157:H7, *Salmonella*, *Shigella*, *Listeria*, or *Campylobacter* at the DNA level. DNA "fingerprints," or patterns, are submitted electronically to a dynamic database at the CDC. These databases are available on-demand to participants—this allows for rapid comparison of the patterns. (CDC, 2013e)

FoodNet is another federal program aimed at decreasing foodborne illness:

> The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne disease component of CDC's Emerging Infections Program (EIP). FoodNet is a collaborative project of the CDC, ten EIP sites, the U.S. Department of Agriculture (USDA), and the Food and Drug Administration (FDA).
>
> The project consists of active surveillance for foodborne diseases and related epidemiologic studies designed to help public health officials better understand the epidemiology of foodborne diseases in the United States.
>
> The objectives are:
>
> - Determine the burden of foodborne illness in the United States
> - Monitor trends in the burden of specific foodborne illness over time
> - Attribute the burden of foodborne illness to specific foods and settings
> - Disseminate information that can lead to improvements in public health practice and the development of interventions to reduce the burden of foodborne illness. (CDC 2013f)

The National Outbreak Reporting System (NORS) is the mechanism by which states can report outbreaks. It was started in 2009 by the CDC so that state and local agencies can report outbreak data quickly and easily online. NORS collects data on foodborne illness outbreaks, waterborne disease outbreaks, animal contact disease outbreaks, environmental contamination outbreaks, and other enteric illness outbreaks. The data collected help the CDC to provide information about outbreaks in order to learn from them and prevent future outbreaks (CDC, 2013g).

Most areas of the country have restaurant and food preparation inspection systems provided by state or local health departments. Because the most common factors responsible for foodborne disease outbreaks are improper holding temperature, poor hygiene of food handlers, contaminated equipment, and inadequate cooking, these efforts to inspect and maintain safe food preparation in local areas are vital.

Nationwide expansion and improvement of each of these programs would significantly improve the surveillance of documented foodborne diseases and reduce report and investigation time for each of these infections. Most individual cases of foodborne disease require approximately 2 weeks of time to investigate effectively, but with intensive active surveillance, that time can be

reduced to 5 to 7 days. In addition, food irradiation has been endorsed by the WHO, CDC, FDA, USDA, and the American Medical Association. Currently, the European Commission's Food and Feed Safety section has approved food irradiation for certain purposes. Since 1997, the United States has irradiated fresh meat, and, in August of 2008, the FDA approved the irradiation of iceberg lettuce and spinach. In 2001, the CDC estimated that irradiation of these high-risk foods could prevent nearly 1 million cases of bacterial foodborne disease each year, 8,500 hospitalizations, more than 6,000 catastrophic illnesses, and 350 deaths in the United States (Tauxe, 2001).

New initiatives would improve food safety as well. These include more rapid and sensitive laboratory methods for detecting enteropathogens in food during processing and in random sampling of final products. In addition, commercial foods could be required to bar code, which would permit immediate tracing of a food item from a specific farm, plant, or distribution center. This would greatly accelerate the resolutions of foodborne outbreaks such as the *Salmonella* outbreaks traced to Mexican peppers. In addition, we could pursue new approaches to the feeding of poultry, swine, and cattle that can reduce the colonization by bacteria such as *E. coli*, *Salmonella*, and *Campylobacter* (CDC, 2012c).

Case Study: Contaminated Rice

In October 2013, a daycare center in North Dakota reported 3 illnesses/reactions of children that experienced a rash that lasted for about one-half hour and covered their bodies roughly 45 minutes after eating lunch (Dwelle, 2014). No other symptoms were reported. The week before, the same thing happened to a student at the local college. The food item that was common to the student and the children in the daycare center was Spanish rice. It was mentioned that the remaining bag of rice looked discolored/different than other bags of the same kind of rice that they have. The brand was Uncle Ben's Infused Rice Mexican flavor. The North Dakota Department of Health advised the daycare center and school to discontinue the use of that rice. No additional complaints have been reported.

On December 3, 2013, a school in Illinois reported 25 children, of 226 served, developed a red burning/itching rash, not raised, no wheals, on the ears, neck, arms, some on the face and trunk within 30 minutes of consuming lunch at school. Both male and female students were affected (14 males and 11 females). Additional symptoms included headache and nausea. No respiratory symptoms were noted. Students recovered within 90 to 120 minutes. No fish was served. The food most likely to have contributed to the problem is Mexican rice from 5 lb bags. Two staff who handled or were near the bags later also developed burning and rash, even on parts of the body not in direct contact with the bags.

The FDA worked with state agricultural and public health departments to collect leftover rice from the Illinois school, rice from a distribution center, and rice from the production center. Testing conducted by the FDA found

inconsistent levels of the chemical niacin in the Uncle Ben's Infused Rice Mexican Style. The FDA and NOL-DO worked with the company of interest to resolve the issue. A market withdrawal was performed by the company. No additional illnesses were reported to the CDC. The investigation was closed.

INVESTIGATION OF A DISEASE OUTBREAK OR EPIDEMIC

There are several fundamental steps necessary to conduct an investigation of an infectious disease outbreak. They are:

- Verify the diagnosis of the disease that is suspected or under investigation
- Establish the existence of an outbreak of disease or an epidemic
- Characterize the distribution of disease cases by the variables of person, place, and time
- Develop a hypothesis that can explain the observed distribution of cases
- Institute control measures as early as possible

Verify Diagnosis

To verify the diagnosis of an outbreak of disease, the epidemiologist considers several factors.

- Laboratory tests may be used in a diagnosis of the disease. The investigator must make certain that the results are reliable by having the test confirmed by a trustworthy laboratory or repeated by another laboratory to confirm the original diagnosis. In each state, there is a diagnostic laboratory that is approved for this purpose.
- Use clinical criteria when the laboratory results are not entirely reliable or may not be available in a timely fashion. Some illnesses may be very mild or not apparent in laboratory tests. Similarly, there may be other unrelated illnesses that may be part of the initial count of cases in the outbreak investigation.
- Epidemiologic criteria may be added to the laboratory information and to the clinical criteria to further restrict the number of cases that are under investigation. For example, during the 1976 investigation of Legionnaires' disease in Philadelphia, there was no laboratory test available to confirm the clinical suspicion of the illness. Consequently, a clinical diagnosis of a respiratory illness with a fever was created. Because the clinical definition of a febrile respiratory illness was so broad as to include a very large number of unrelated cases, an additional component in the epidemiologic investigation was added to the case definition: An individual needed to have specific clinical findings and also to have attended the American Legion Convention in Philadelphia or entered one of the hotels where the convention itself was held during a specific period. This additional information helped restrict the suspect cases to determine and make a more accurate count of cases.

Establish Existence of Outbreak

If an outbreak or an epidemic is considered an unusual occurrence of the disease in a defined population during a specific period, it must be documented. It could be a common disease in an unusual segment of the population (e.g., pneumonia in persons who attended the 1976 American Legion Convention in Philadelphia) or an unusual disease in a common segment of the population (e.g., the occurrence of a specific form of pneumonia caused by *Pneumocystis carinii* in young homosexual men), which was seen as a common factor in HIV-infected individuals in the early days of the AIDS epidemic in the 1980s. When trying to establish the existence of an outbreak of disease or an epidemic, epidemiologists do the following:

- Identify unreported or unrecognized cases that may be part of the specific outbreak of disease. These additional cases may be found by surveying hospitals, laboratories, physicians, and family and friends of the known cases.
- Determine the population at risk for developing the disease in question. This may be a specific classroom of children, or the entire school, or a much larger community of people.
- Compare the incidence of new cases of the disease in the population now, with the previous period, using the case count as a numerator and the population at risk as the denominator. Take into consideration seasonal variations, while comparing the incidence of new cases with the same period in previous years.

Characterize Distribution of Cases by Person, Place, and Time

Understanding the cause of an outbreak results from the proper analysis of the distribution of cases by time, place, and person.

Time

The variable time is used to begin the construction of an epidemic curve, which is a graph showing the distribution of cases (on the *y-axis*) by the date of onset of the illness in hours, days, weeks, or months (on the *x*-axis). The shape of this curve may suggest either a common source outbreak or person-to-person transmission. A point source of exposure is suggested if all cases occur within one incubation period of the disease (i.e., the time in which the disease was incubating before signs and symptoms of disease occurred). Common source outbreaks of disease result from the exposure of individuals to the same causal factor or pathogen(s) including contaminated water, milk, food, or in other ingested, consumed, inhaled, or absorbed substances. Exposure to a contaminated source may be temporary or continuous. In the case of instantaneous or temporary contamination, transmission occurs in the following fashion (see Figure 4.3).

One characteristic feature of a temporary or instantaneous common source epidemic (sometimes called *point source*) is that all cases occur during

a period that covers the range of one incubation period (see Figure 4.4). This pattern can be observed only if secondary cases do not result from the primary case.

Common source outbreaks differ from contact, or progressive, outbreaks whereby infection is transmitted from a patient or a carrier to one or more susceptibles, characterized by the epidemic diagram in Figure 4.5.

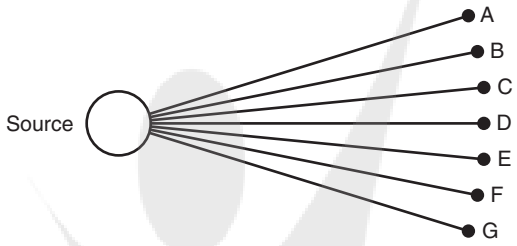

FIGURE 4.3 Common source epidemic.

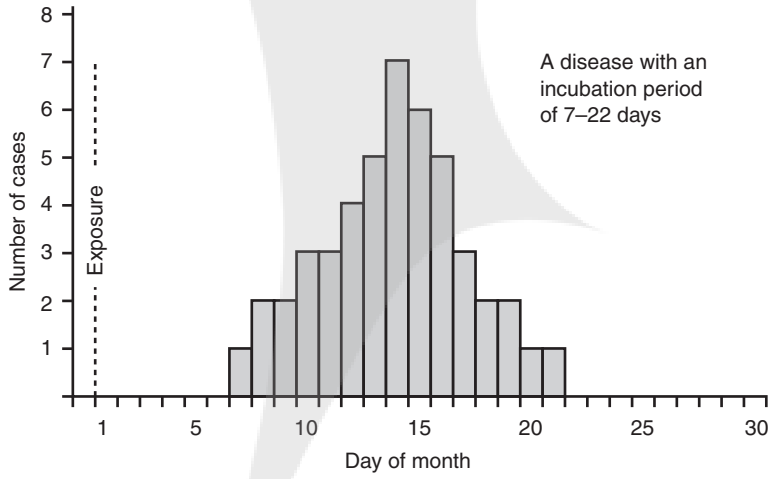

FIGURE 4.4 Example of common source incubation period.

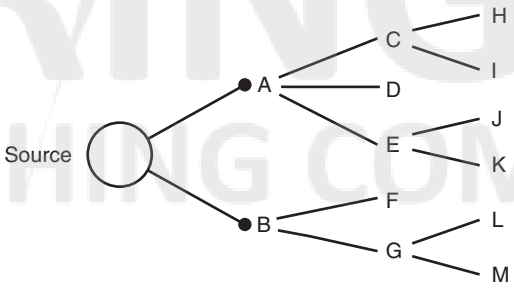

FIGURE 4.5 Contact, or progressive, epidemic.

The shape of the epidemic curve in contact or progressive outbreak depends on the infectivity of the pathogen, its ability to survive outside of the human host, the proportion of susceptibles in the community, and the length of the carrier state.

Cases that occur over several different incubation periods suggest either person-to-person transmission or a continuing common source of exposure and outbreak. If the incubation period of the disease is known, the curve indicates the probable time and possible source of the infection. If the time of exposure can be determined, the incubation period of the disease can be identified.

If the time of exposure is known, the incubation period can be used to establish a diagnosis in a foodborne disease outbreak. For example, if there is a chemical food poisoning due to the ingestion of copper, the incubation period can be measured in minutes. Staphylococcal food poisoning has an onset in 1–6 hours. Other foodborne bacteria that cause disease outbreaks are *Bacillus cereus*, with an incubation period of 10 to 16 hours; *Salmonella*, with an incubation period of 6 to 72 hours; and *Shigella*, with an incubation period of 24 to 48 hours.

Place

The variable place can be used to detect a source of infection by identification of spatial clustering of cases. Cases can be plotted by the place where the individuals reside, work, or attend school, or by any other geographic location. Because clustering of cases may only reflect population density, maps should be drawn comparing the rates of outbreak in different geographic areas.

Person

The variable person can be used to compare the characteristics of the population contracting the disease to the characteristics of the population without the disease.

Develop and Test the Hypothesis

In developing a hypothesis, the unusual or odd case may be extremely helpful. The exceptions frequently provide important information and may help explain the source of an infection, the mode of disease transmission, or the normal background of the disease. The following procedure is standard:

- Demonstrate the differences in the attack rates of people who were exposed and not exposed to the source of infection. The cases must be shown to be exposed more often to the risk factor than the group of individuals, known as the *controls*, who are not ill.
- Apply statistical tests to the data to indicate statistical differences between cases and controls.

- Collect clinical and environmental specimens if they are available for processing in an appropriate laboratory.
- If the laboratory data do not support the epidemiologic data, ignore the laboratory data.
- Formulate a conclusion based on all pertinent evidence and the results of the hypothesis testing.
- A final report describing all aspects of the investigation should be prepared.

Institute Control Measures

Institute control measures as early as possible in the outbreak investigation to prevent further occurrence of illness. Control or intervention measures are directed at one of the conditions or events in the infectious disease process. The control measures selected depend on the disease under consideration. For example, if a contaminated food is a suspected source of the infection, remove that food and submit to testing.

Case Studies: Two Investigations of *Salmonella* Outbreaks

In 2008, two nationwide outbreaks of *Salmonella* infection occurred. Between April and August 2008, *Salmonella* Saintpaul enteritis was diagnosed in more than 1,400 people in 43 states, the District of Columbia, and Canada. Ultimately, 282 people were hospitalized and two elderly patients died from the *Salmonella* infection. In the initial investigation by the state health departments and the CDC (Maki, 2009), the source of contamination was thought to be tomatoes grown in the southwestern United States, although this was never proved by laboratory findings. Because of those initial investigations and adverse publicity, tomato consumption in the United States dropped dramatically and the industry lost hundreds of millions of dollars. After several months of further investigation, the outbreak of *Salmonella* was isolated from jalapeño and serrano peppers that had been grown on one Mexican farm. The CDC concluded that the outbreak of *Salmonella* derived from contaminated peppers that were eaten raw and may have accompanied tomatoes, which could have explained the misleading results from the early investigation (CDC, 2011).

In a second *Salmonella* outbreak, which began in September 2008 and continued into 2009, *Salmonella typhimurium* enteritis was diagnosed in more than 600 people in 44 states and in Canada by February 2009. The CDC traced the outbreak to contamination of one peanut butter producer in Georgia and other manufacturers that used the contaminated peanut butter. More than half the cases were children and hundreds of patients were hospitalized. The outbreak may have contributed to eight deaths. Because of this outbreak, there was a recall of all peanut butter products produced by the company since early 2008, which involved more than 400 food products including cookies, crackers, cereal, candy, ice cream, and pet foods. The investigation revealed that

Salmonella had been isolated from the company's peanut butter or peanut paste during internal quality control efforts on at least a dozen occasions in the previous year, but no action had been taken to end the contamination. The company is now under criminal investigation (CDC, 2012d). It has been estimated that in outbreaks of *Salmonella*, for every case that is identified by clinical laboratory tests and culture, there are approximately 38 additional undetected cases, meaning that each of these two outbreaks may have affected more than 20,000 persons.

STUDY QUESTIONS

Q: What is the disease burden of influenza in the United States and worldwide?

Q: What is the disease burden of foodborne diseases in the United States?

Q: Describe how an infectious disease outbreak would be investigated.

Q: How successful have immunizations been in controlling infectious diseases?

Q: What are some of the factors that increase susceptibility to infectious diseases and how do they relate to the Health Impact Pyramid?

NOTE

We wish to acknowledge Mahfouz H. Zaki, MD, MPH, DrPH, formerly distinguished university professor of Preventive Medicine and Public Health at Downstate Medical Center in Brooklyn and adjunct professor of Preventive Medicine at State University of New York at Stony Brook, for his contributions to this section. Sadly, Dr. Zaki passed away in 2009.

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FIVE

INJURIES AND NONINFECTIOUS DISEASES

OBJECTIVES

Readers will learn . . .

1. The basic approach of the federal public health system toward chronic disease and injury control.
2. How the federal public health system monitors chronic disease and injury incidence, prevalence, and trends.
3. The federal public health role in developing programs to prevent and reduce chronic diseases and the success of these initiatives.
4. Some major federal initiatives to reduce and prevent obesity in communities.
5. Some major federal initiatives to reduce and prevent motor vehicle injuries in communities.

Infectious disease control has historical significance for public health—having provided many, if not most of, public health's early successes—and it remains a major component of public health practice today, as discussed in the previous chapter. However, the scope of public health in the United States has steadily increased since the 19th century in response to changes in the

health problems that have the greatest impact on morbidity and mortality. In 2010, the 10 leading causes of death, overall, in the United States were:

- Heart disease
- Malignant neoplasms
- Chronic lower respiratory diseases
- Cerebrovascular diseases
- Unintentional injuries
- Alzheimer's disease
- Diabetes
- Nephritis
- Influenza and pneumonia
- Suicide

Although the order is different, these are the same 10 leading causes of death for men and women, with the exception that for women, septicemia is one of the leading causes of death and suicide is not. It is interesting to look at the differences in death rates among different racial and ethnic categories. In males, heart disease is the leading cause of death among all racial/ethnic groups, with the exception of Asian or Pacific Islander, in which cancer is the leading cause of death and heart disease is second (Centers for Disease Control and Prevention [CDC], 2013a).

Looking at death rates related to injury by firearms, Black males have death rates more than double that of any other racial or ethnic group, at 33.4 per 100,000 people. American Indian or Alaska Native men have alcohol-induced deaths more than double that of any other group, at 28.5 deaths/100,000 population. Black males are also the only racial/ethnic group to have HIV in the top 10 leading causes of death (CDC, 2013a). Among both sexes and all races/ethnicities, the only leading cause of death that is infectious is influenza/pneumonia. (For women, the two leading causes of death that are infectious are influenza and septicemia.)

The number of problems tackled within the area of injury prevention and noninfectious disease control is tremendous. Following is a partial overview of the CDC agenda, which establishes and reflects the public health agenda for the nation. The list gives an indication of the scope, variety, and number of issues related to injuries and noninfectious diseases that are targeted by public health (CDC, 2014).

- Diseases and conditions:
  ADHD, birth defects, cancer, diabetes, fetal alcohol syndrome . . .
- Emergency preparedness and response:
  bioterrorism, chemical and radiation emergencies, severe weather . . .
- Environmental health:
  air pollution, carbon monoxide, lead, mold, water quality, climate change . . .
- Healthy living:
  bone health, physical activity, genetics, smoking prevention . . .

- Injury, violence, and safety:
  brain injury, child abuse, falls, fires, poisoning, suicide, youth violence . . .
- Workplace safety and health:
  asbestos, chemical safety, construction, mining, office environments, respirators . . .

As a result of the range of issues related to injury prevention and noninfectious disease control, public health's response to each will not be discussed. Instead, we examine several childhood health problems that illustrate public health practice today in the areas of injury prevention and noninfectious disease control: (a) motor vehicle injuries among children; and (b) childhood obesity. Clearly unintentional injuries are a major problem, as they are a leading cause of death for males and females and among persons of the major race/ethnic groups. Obesity is a health behavior that contributes heavily to both cardiovascular disease and diabetes, both of which are on the top 10 causes of death for all groups.

Public health practice can be classified in the following way, and each practice example will be described using these categories:

Surveillance and Research
- Provide information on incidence, prevalence, and risk factors
- Conduct research on causes and consequences of the health problem
- Evaluate effectiveness of interventions aimed at preventing and controlling the health problem
- Develop data systems necessary for surveillance and research

Interventions to Prevent and Control the Health Problem
- Educate population at risk and related persons on how to reduce risk of the health problem
- Provide services for victims of the health problem, including screening, treatment, and supportive services
- Change social and/or physical environments to prevent health problems from occurring, which include advocacy and policy solutions

We focus on the CDC activities because these are usually the most comprehensive, and they often lead the state and local public heath efforts intellectually and through provision of technical and financial resources such as the cooperative agreements and block and categorical grants. However, we discuss state and local interventions, as this is the level where they are implemented.

MOTOR VEHICLE INJURIES

- Unintentional injuries are a leading cause of death in the United States among all age, race, and ethnic groups, and motor vehicle accidents are the foremost cause of unintentional injuries. Motor vehicle accidents are also a leading cause of years of potential life lost before age 75 (NCHS, 2010a, Table 27).

In addition, they are a leading cause of morbidity. Motor vehicle injuries are responsible for a major portion of all disabilities, which affect about 25% of all persons 18 to 64 years old and about 61% of persons 65 and over (NCHS, 2010a, Table 55). They are also expensive, with one study estimating that motor vehicle crashes cost the country over $99 billion a year in medical costs and lost productivity (Naumann, Delinger, Zaloshnia, Lawrence, & Miller, 2010).

The National Center for Injury Prevention and Control (NCIPC), the CDC's lead division for injury prevention, reports the following statistics about the prevalence and cost, monetary and nonmonetary, of motor vehicle accidents:

- In the United States, motor vehicle–related injuries are the leading cause of death among people ages 5 to 34, and more than 2.3 million adult drivers and passengers were treated in emergency departments in 2009.
- The economic impact of motor vehicle–related injuries is significant, with costs in a 1-year period exceeding $99 billion.
- Motor vehicle crashes prevent young people from achieving their full potential. Crashes are the leading cause of death for U.S. teens, accounting for more than one in three deaths in this age group. In 2010, on average, 7 teens ages 16 to 19 died every day from motor vehicle–related injuries.
- In 2011, more than 650 children ages 12 years and younger died as occupants in motor vehicle crashes, and more than 148,000 were injured.
- Every day, almost 30 people in the United States die in motor vehicle crashes that involve alcohol-impaired drivers. This amounts to one death every 48 minutes (CDC, 2012b).

Not surprisingly, then, prevention of motor vehicle injuries and fatalities is a major public activity. The following description of public health practice related to prevention of motor vehicle accidents is taken mainly from the CDC (CDC, 2012a, 2013b), which is the predominant actor in terms of agenda setting, surveillance and research, and source of funding. The emphasis is on childhood motor vehicle accidents.

Surveillance and Research

The NCIPC conducts surveillance for all injuries, including motor vehicle injuries, through its Core Violence and Injury Prevention Program (Core VIPP). The program supports 20 state health departments to strengthen the capacity to collect and use data to achieve a better understanding of local injury issues.

The Core Violence and Injury Prevention Program is made up of five components:

- Base Integration Component (BIC)
  Core VIPP supports all 20 funded state partners to maintain and strengthen their injury and violence prevention programs with a focus on key components: building a solid infrastructure;

collecting and analyzing data; designing, implementing and evaluating programs; providing technical support and training; and affecting behavior and knowledge. The 20 states are: Arizona, Colorado, Florida, Hawaii, Kansas, Kentucky, Maryland, Massachusetts, Minnesota, Nebraska, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Utah, and Washington.

- Regional Network Leader (RNL)
  Five of the 20 funded state partners serve as Regional Network Leaders and provide a structure for cross-state collaboration and assistance to all states within their designated regions. Together they address injury and violence prevention across all 50 states. RNLs develop partnerships with appropriate organizations and research centers, and also work with the CDC and each other to identify common issues and shape effective program infrastructure at the state, regional, and national level.
- Surveillance Quality Improvement (SQI)
  Four of the 20 funded state partners conduct injury data investigations supportive of promoting and advancing uniform injury case definitions, improving data quality, and advancing methodology.
- State Falls Prevention
  Core VIPP funds three of the 20 funded partners to prevent falls among older adults by integrating evidence-based practices and interventions with the community and clinical care practice.
- Motor Vehicle Child Injury Prevention Policy (MVP)
  Four of the 20 Core VIPP funded state partners address the issue of motor vehicle-related injuries among children and teens by: using data to better understand who is at risk and what works to prevent motor vehicle injury; develop programs; and inform decision makers about strategies to help keep drivers, passengers, bicyclists and pedestrians safe on the road each day. (CDC, 2013b)

Fatal injury data are drawn from death certificate data from the *National Vital Statistics System*—deaths, death rates, and years of potential life lost (a measure of premature death) by specific causes of injury mortality and common causes of death. National estimates of injuries treated in U.S. hospital emergency departments are from the National Electronic Injury Surveillance System—All Injury Program (NEISS-AIP)—nonfatal injuries and nonfatal injury rates. Violent death data are from the National Violent Death Reporting System (NVDRS)—violent incidents and deaths, death rates, and causes of injury mortality. These data are provided for 16 states only and are not nationally representative. Data are made available in WISQARS™ (Web-based Injury Statistics Query and Reporting System), an interactive database system that provides customized reports of injury-related data.

Two surveillance and research initiatives aimed at reducing motor vehicle injuries among children are Child Passenger Safety and Teen Drivers. We will discuss the surveillance and research of both initiatives.

Child Passenger Safety

The Child Passenger Safety initiative focuses on increasing the use of car and booster seats and seat belts; reducing impaired driving; and helping groups at risk including child passengers, teen drivers, and older adult drivers. There is also an interest in preventing pedestrian and bicycle injuries. The mission of the initiative is "to provide public health leadership to keep people safe on the road—every day; and to focus our research and programs on preventing injuries and deaths by increasing child safety seat and seat belt use, reducing alcohol-impaired driving, and helping groups at special risk: child passengers, teens, and American Indians/Alaska Natives" (CDC, 2014a). Numerous studies have been conducted by the Child Passenger Safety initiative to understand the factors related to use of child safety restraints in motor vehicles and the risk of not using them (CDC, 2014a). See Table 5.1 for a summary of studies and their findings.

The risk factors for motor vehicle injuries among children have been identified through the surveillance and research functions of the NCIPC. They include the following:

A Drinking Driver

- Seventeen percent of motor vehicle–related deaths among children ages 0–14 years involved a drinking driver.
- More than two thirds of motor vehicle–related deaths are among children riding with a drinking driver.
- In over half of the deaths of the children related to alcohol-impaired motor vehicle crashes, the child was riding with the alcohol-impaired driver (CDC, 2012b).

Improper or No Use of Seat Belt or Booster Seat

- The rate of serious and fatal injuries to children can be reduced by half by using age- and size-appropriate car and booster seats.
- Restraint use among young children often depends on the driver's seat belt use. Almost 40% of children riding with unbelted drivers were themselves unrestrained.
- Child restraint systems are often used incorrectly. One study found that 72% of nearly 3,500 observed car and booster seats were misused in a way that could be expected to increase a child's risk of injury during a crash (CDC 2014a).

Placing Child in the Front Seat of a Motor Vehicle

- Riding in the back seat reduces the risk of serious injury to children under 16 by 40% (2014a).

TABLE 5.1 CDC RESEARCH ACTIVITIES RELATED TO CHILD PASSENGER SAFETY, 2010

Child Counseling Study	Study: Cross-sectional telephone survey of randomly selected children in English- or Spanish-speaking households in all 50 states and the District of Columbia. Main outcome measures: Respondent or his or her child received injury-prevention counseling from child's health care provider in the 12 months preceding the interview. Findings: Pediatric injury-prevention counseling, although not pervasive, was associated with safer behaviors among children, including use of bicycle helmets while biking and use of car seats and seat belts while riding in motor vehicles.
Modes of Travel to School	Study: Cross-sectional, nationally representative telephone survey among English- and Spanish-speaking adults with at least one child between 5 and 14 years old in the household. Main outcome measure: Mode of travel to school. Findings: Most common mode of travel to school was the family car (46.3%), followed by school bus (39.6%), and walking (14%). Among those who did not usually walk to school, distance (70.7%) was the most common barrier, followed by traffic danger (9.2%). Children in the South were less likely to walk to school than children in other regions (Northeast, North Central, and West). Distance to school was more commonly cited as a barrier to walking for older children than younger children. Efforts to promote walking to school may achieve better near-term success if focused on students who already live close to school.
Children's Hospital of Philadelphia Study	Study: Interview with parents of children younger than 16 years involved in a motor vehicle crash. Main outcome measures: Typical use of child restraints, type of restraint in use at the time of the crash, parents' understanding of child restraint laws in their state, and parents' understanding of how the motor vehicle crash had affected the child's daily life. Findings: Children with one or more physical limitation after the crash accounts for 3.3%. Parents were more likely to report physical limitations among older children (7.6%) than younger children (1%). Children whose whiplash injuries were reported to have physical limitations after their injury accounts for 47%. Children who were not restrained optimally were nearly twice as likely as optimally restrained children to have physical limitations.
Alcohol-Impaired Driving and Children in the Household	Study: Second Injury Control and Risk Survey, a nationally representative cross-sectional telephone survey of adults. Main outcome measure: Alcohol-impaired driving by an adult with a child in the household. Findings: An estimated 2.5 million adult drivers with children living in their households reported that they had been a recent alcohol-impaired driver.

Source: Centers for Disease Control and Prevention (2012a).

Teen Drivers

The risk factors for motor vehicle fatalities and injuries by teen drivers have been identified through the surveillance and research functions of the NCIPC (CDC, 2012c). They include the following:

Being 16 to 19 Years Old

The risk of motor vehicle crashes is higher among 16 to 19 year olds than among any other age group. In fact, per mile driven, teen drivers ages 16 to 19 are three times more likely than older drivers to crash.

Male Teen

- In 2010, the motor vehicle death rate for male drivers and passengers ages 15 to 19 was almost two times that of their female counterparts.

Teen Driving With Teen Passengers

- The presence of teen passengers increases the crash risk of unsupervised teen drivers. This risk increases with the number of teen passengers.
- The presence of male teenage passengers increases the likelihood of risky driving behavior.

Newly Licensed Teen

- Crash risk is particularly high during the first year that teenagers are eligible to drive.

Unsafe Driving Patterns

- Teens are more likely than older drivers to underestimate dangerous situations and to be unable to recognize hazardous situations.
- Teens are more likely than older drivers to speed and allow shorter headways (the distance from the front of one vehicle to the front of the next).

Failure to Wear Seat Belts

- Teens have the lowest rate of seat belt use. In 2011, 54% of high school students reported they always wear seat belts when riding with someone else.

Drinking and Driving

- At all levels of blood alcohol concentration (BAC), the risk of involvement in a motor vehicle crash is greater for teens than older drivers.
- In 2010, 22% of drivers ages 15 to 20 who died in motor vehicle crashes had been drinking.
- Drinking makes teens (already the group least likely to wear a seat belt) less likely to wear a seat belt, with 56% of teenage drivers ages 15 to 20 killed in motor vehicle crashes in 2010 that had been drinking were also not wearing seat belts.

- In 2011, 24% of teenagers reported that, within the previous month, they had ridden with a driver who had been drinking alcohol. One in 10 reported having driven after drinking alcohol within the same 1-month period.
- In 2010, half of teen deaths from motor vehicle crashes occurred between 3 p.m. and midnight and 55% occurred on Friday, Saturday, or Sunday.
- Thirty-nine percent of male drivers between 15 and 20 years old who were involved in fatal crashes in 2010 were speeding at the time of the crash and 25% had been drinking.

Prevention Policies and Practices

As with most public health interventions, those for the Child Passenger Safety and Teen Driver initiatives are implemented at the state and local levels as to ensure culturally appropriate communications and in other ways be responsive to local needs, preferences, and conditions. In terms of primary and secondary prevention, interventions can be grouped as follows:

Primary Prevention

- Educating population at risk and related persons on how to reduce risk of the health problem.
- Changing the social and/or physical environment to prevent health problems from occurring, including advocacy and policy solutions.

Secondary and Tertiary Prevention

- Providing services for victims of a health problem, including screening, treatment, and supportive services.

As we will see, both the Child Passenger Safety and Teen Drivers initiatives emphasize primary prevention, particularly education. This does not mean that providing health care services, that is, secondary and tertiary prevention, does not occur at other levels—state and local—for children who have sustained motor vehicle injuries. Much of this care—including screening, diagnosis, and treatment of injury victims—is provided through public and private health insurance plans. Moreover, the provision of medical care for all people is a major goal of public health, and the general public health effort to ensure access to health care for all through support of health care reform will be discussed later in the chapter. The public health effort to ensure health care for all must be viewed as a component of motor vehicle injury interventions that is supported by public health.

Child Passenger Safety

The principal interventions that have been supported by the research of the Child Passenger Safety initiative have concerned educating people about the need to use booster seats or seat belts; providing car seats themselves to people

with children, and advocating for safety seat laws and their enforcement. "There is strong evidence that child safety seat laws, safety seat distribution and education programs, communitywide education and enforcement campaigns, and incentive-plus-education programs are effective in increasing child safety seat use" (CDC, 2014a).

Educating parents to use car seats and seat belts for their children is a pervasive theme in the interventions used to prevent child passenger injuries. The program, Protect the Ones You Love, is an example. The Child Passenger Safety website contains materials that can be used in educational campaigns including information about the risk of injury and tips for parents about how to keep their child safe in a motor vehicle (2014a):

> We all want to keep our children safe and secure and help them live to their full potential. Knowing how to prevent leading causes of child injury, like road traffic injuries, is a step toward this goal. Every hour, 150 children between ages 0 and 19 are treated in emergency departments for injuries sustained in motor vehicle crashes. More children ages 5–19 die from crash-related injuries than from any other type of injury. Thankfully, parents can play a key role in protecting the children they love from road traffic injuries.
>
> Prevention tips: One of the best protective measures you can take is using seat belts, child safety seats, and booster seats that are appropriate for your child's age and weight.

However, education alone has not been found effective. The Task Force on Community Preventive Services (TFCPS, 2005) did not find evidence that education programs that provide information to parents, children, or professional groups about the importance of child safety seats and how to use them properly were effective when used alone. A caveat is that the task force also said that evidence was insufficient because the educational interventions evaluated in their studies varied widely and the small number of available studies produced inconsistent results. The task force did find, however, that incentive and education programs that reward parents for obtaining and correctly using child safety seats or directly reward children for correctly using safety seats are effective, and these programs also include educational components.

The CDC is currently emphasizing research that examines what interventions are the most effective at increasing consistent and correct use of child safety seats and booster seats. The agency is looking to improve distribution and adoption of effective strategies to improve child passenger safety (CDC, 2014b).

There is also a substantial public health effort to change the social and physical environments to prevent child passenger injuries and fatalities: "child safety seat laws, safety seat distribution and education programs, community-wide

education and enforcement campaigns, and incentive-plus-education programs are effective in increasing child safety seat use" (CDC, 2014b).

The TFCPS (2005) identified and rated the evidence on effectiveness for several interventions of this type. Child safety seat laws require children traveling in motor vehicles to be buckled into federally approved infant or child safety seats that are appropriate for the child's age and size. All states currently have child safety seat laws in place. The laws, which vary from state to state, specify the children they cover in terms of age, height, weight, or a combination of these factors. The task force found:

- Child safety seat laws are effective in reducing fatal injuries to children by approximately 35%.
- These laws are also effective in reducing all injuries to children by approximately 17%.
- These laws are also effective in increasing child safety seat use by approximately 13 percentage points. (TFCPS, 2005, p. 334)

Other interventions that public health advocates for change are the social or physical environments to prevent childhood motor vehicle injuries and fatalities:

- Distribution and education programs provide free or low-cost child safety seats to parents, along with education about proper use of the seats. The idea behind such programs is that parents who cannot afford a safety seat or who have a poor understanding of the importance of the seat might be more likely to use it if they receive financial help in acquiring a safety seat and learn about the importance of using it. (TFCPS, 2005, p. 335)
- Communitywide information and enhanced enforcement campaigns provide information about child safety seats and child automobile safety to an entire community (usually defined geographically). These campaigns use several approaches: mass media, publicity, safety seat displays in public places, and special law enforcement strategies, such as checkpoints, dedicated law enforcement officials, or alternative penalties (e.g., warnings instead of tickets). (TFCPS, 2005, p. 337)

Teen Drivers

Similar to the Child Passenger Safety initiative, Teen Drivers also emphasizes education, and in addition, advocates for changes in the environment that will reduce the risk of injury and death among teen drivers. The CDC has named motor vehicle injuries as one of its "Winnable Battles," meaning they believe that with targeted efforts and interventions, there could be a sizable impact on the injuries and deaths related to motor vehicles in the near future.

Common types of educationally oriented interventions to promote safe teen driving include school-based instructional programs, peer organizations, and social norming campaigns (Elder et al., 2005). They generally focus on prevention of driving after drinking (DD) and riding with drinking drivers (RDD). A review of the effectiveness of various kinds of programs summarizes each type of program:

> School-based instructional programs are a commonly used approach to addressing the problems of DD and RDD. These programs vary widely in their focus, with some targeting a variety of consequences of substance use and others more directly focused on problems related to alcohol-impaired driving. . . . Many of the more recent school-based programs to prevent DD and RDD are either explicitly theory based or incorporate theory-based concepts and methods, such as peer intervention social deviance, educational inoculation, and risk skills training. . . .
>
> Social norming programs generally consist of ongoing, multiyear public information programs conducted on college campuses to reduce alcohol use, although they can also be conducted in other settings and for other target behaviors. The premise underlying the social norming approach is that students overestimate the amount and frequency of alcohol use among other students, and that this misperception influences them to drink more than they would otherwise. The key objective is to provide students with more objective normative information regarding student alcohol consumption, thus reducing their misperceptions and ultimately changing their behavior. Often this information is gathered via campus surveys, and then conveyed to students via campus media programs. In addition to such media programs, some social norming programs implement more instructional activities involving peer-to-peer interaction. . . .
>
> School-based peer organizations are groups of students, often with faculty advisors, who encourage other students to refrain from drinking, DD, and RDD. The most widespread peer organization in the United States is Students Against Destructive Decisions (SADD), formerly called Students Against Drunk Driving. SADD activities, including assembly presentations, a curriculum with as many as 15 sessions, various school and community events, and a "Contract for Life" in which a student agrees to call a parent if he or she has been drinking or if the person responsible for driving has been drinking. SADD programs and curricula include activities aimed at providing information, influencing attitudes, and changing social norms. They include both didactic and interactive delivery, usually involving peer-to-peer delivery, but frequently involving outside experts as well. (Elder et al., 2005, pp. 290–294)

Three examples of programs demonstrate the variety of methods used in these types of interventions, but their common focus is on changing individual teens' behavior related to safe driving through educational initiatives:

- A campuswide public awareness program was developed to provide objective information regarding student use of alcohol. The phrase "74% of University of Albany students drink once a week or less" provided the primary message.
- A 1-hour peer theater session, using trained peer "actors" and involving the audience in discussions regarding topical scenarios that were acted out.
- A program using Bandura's social learning theory and concept of self-efficacy, which taught knowledge, attitudes, and judgments related to safe driving. A "reasoned argument" approach that minimized fear appeals was used. There was a focus on building self-efficacy with interactive sessions and role playing (Elder et al., 2005).

Educational programs may also focus on the parents' role in teen driving. For instance, the Checkpoints Program is designed to improve parental management of the process of learning to drive in driver's education classes. "It is the only intervention of its type with proven efficacy in increasing parental restrictions on newly licensed teen drivers. The effectiveness of this intervention will be evaluated by measuring the level of restrictions that parents place on their teens as they move from learner's permit to provisional license to full licensure. The number of violations and crashes among participating teens may also be measured" (CDC, 2012c).

Interventions that target the larger social and physical environments include advocacy for building safer motor vehicles, enforcement of laws related to DD, and changing community attitudes about teen driving.

Regarding laws and law enforcement, lowering blood alcohol concentrations laws for young or inexperienced drivers; instituting sobriety checkpoints; and raising the minimum legal drinking age (MLDA) laws to 21 years of age (or maintain the age at 21 years) have all been found effective in reducing fatalities and injuries among teen drivers and their passengers. For example, "raising the MLDA is effective in reducing fatal injury crashes by approximately 17% and fatal and nonfatal injury crashes combined by approximately 15%. Lowering the MLDA leads to approximately an 8% increase in fatal injury crashes and approximately a 5% increase in fatal and nonfatal injury crashes combined" (TFCPS, 2005, p. 350). These legal interventions are strongly advocated by public health.

A current important public health advocacy issue related to teen driving is graduated driver licensing (GDL), a system of laws and practices that gradually introduce young drivers into the driving population. Full licensing is delayed while the teen gets initial driving experiences under low-risk conditions. GDL is associated with reductions of 38% and 40% in fatal and injury crashes, respectively, among 16-year-old drivers. The CDC now recommends GDLs in every state, and says that if every state had GDLs, hundreds

of thousands of injuries could be prevented. The three-stage GDL that they recommend includes:

- Learner's permit at 16, with at least a 6 month holding period
- Probationary licensing period that limits teen drivers on the time of night they can drive and the number of teens that can be passengers
- Full licensing at a minimum age of 18 (CDC, 2011)

A symposium, the proceedings of which were published in *Injury Prevention* (Simons-Morton & Hartos, 2002), provided evidence about GDL:

Traditional driver education is insufficient for reducing the high risk of teen crashes (Mayhew & Simpson, pp. ii3–ii8).

- Most traditional driver education provides classroom training about the rules of the road and a few hours of behind-the-wheel training. Research suggests that this approach is not effective in reducing the crash risk among newly licensed teen drivers. Driver education programs may be improved by teaching psychomotor, perceptual, and cognitive skills that are critical for safe driving, and by addressing inexperience, risky behaviors, and other age-related factors that increase the crash risk among young drivers. However, more research into these factors is needed before they can be addressed effectively.

Important risk factors highlight the need for graduated driver licensing (Williams & Ferguson, pp. ii9–ii16).

- Young, beginning drivers have an extremely high crash risk. Certain situations contribute to even greater risk, most notably nighttime driving and driving with teen passengers. The GDL approach addresses the high risks faced by young drivers by requiring an apprenticeship of planned and supervised practice, followed by a provisional license that places temporary restrictions on unsupervised driving in some higher risk situations.

Developmental characteristics of young drivers may contribute to their crash risk (Arnett, pp. ii17–ii23).

- Inexperience increases the crash risk for new drivers of all ages. However, younger novice drivers crash at higher rates than older novice drivers. These higher crash rates may be due in part to developmental factors such as peer influence, poor perception of risk, and high emotionality. Research about such developmental characteristics could increase our understanding about why young drivers have higher crash rates and could help to improve driver education programs and licensing policies.

Greater parental involvement is needed (Simons-Morton et al., pp. ii24–31).

- A growing body of research indicates that close parental management of teen drivers can lead to less risky driving behavior, fewer traffic tickets, and fewer crashes. However, many parents tend to be less involved than they could be. Research indicates that parents can be motivated to increase restrictions on their newly licensed teens, at least during the critical first few months of

licensure. A model intervention, the Checkpoint Program, led to increased parental limits on teenage driving at licensure and 3 months after licensure.

GDL works (McKnight & Peck, pp. ii32–ii38).

- GDL has consistently proven effective in reducing new driver crash risk. Although research is still needed to better understand which components of GDL are essential, it remains a promising solution for improving teen driver safety. It may also provide the best context for improving driver education and increasing parental involvement, both of which could also reduce the crash risk for teen drivers (Simon-Morton & Hartos, 2002).

Media campaigns are usually the method of attempting to influence community norms, values, and beliefs about teen driving. These include the seasonal educational campaigns sponsored by the CDC to raise awareness and change community attitudes: National Child Passenger Safety Week, National Teen Driver Safety Week, National Drunk and Drugged Driving Prevention Month, and Native American Road Safety (CDC, 2011). Another example is the CDC-sponsored national Parents are Key campaign. The campaign will "offer parents tools and proven steps for reducing teen driving injuries and deaths" (CDC, 2010a). The CDC conducted a 2-month pilot study in the fall of 2009 for the Parents are Key campaign. Based on the success of the pilot, the CDC has updated the materials and expanded the campaign nationwide.

The TFCPS (2005) found strong evidence of effectiveness of mass media campaigns. They have been found to be effective in decreasing all crashes by approximately 13% and injury crashes by approximately 10%:

> Mass media campaigns are typically carried out in conjunction with other programs and policies to prevent alcohol-impaired driving. Where adequate local resources can support a mass media campaign that is carefully planned, well executed, attains adequate audience exposure, and is supported by other prevention activities, this combination of activities can be effective in reducing alcohol-impaired driving. (TFCPS, 2005, p. 360)

Some interventions combine teen education and communitywide media campaigns, such as the community-based intervention to increase seat belt use among teens in Mississippi, where

> "Meharry Medical College and Jackson State University are evaluating the independent and combined effects of a multifaceted, communitywide campaign to increase seat belt usage among adolescent motorists ages 15–19 in Jackson, Mississippi. The project aims to: (a) evaluate the impact of a targeted, school-based, peer-to-peer, service learning intervention; (b) evaluate the impact of a comprehensive, community-based, educational and media campaign to increase youth awareness and usage of seat belts; and (c) compare study results with other secondary data sets that reflect changes in teen seat belt use rates" (CDC, 2010b).

CHILDHOOD OBESITY

Obesity is a worldwide problem, which more and more frequently begins in childhood. In the United States, the Division of Nutrition, Physical Activity, and Obesity (DNPAO) is the CDC's lead division for obesity prevention and control. The DNPAO is at the forefront in the development of knowledge about obesity—its prevalence, incidence, risk factors, causes, and consequences. This information, then, is being used to develop prevention interventions—primary, secondary, and tertiary. The following description of public health practice related to the prevention and control of obesity is taken mainly from the CDC (CDC, 2012d), which again is the predominant actor in terms of agenda setting, surveillance and research, and source of funding to stimulate prevention strategies. The emphasis is on childhood obesity.

Surveillance and Research

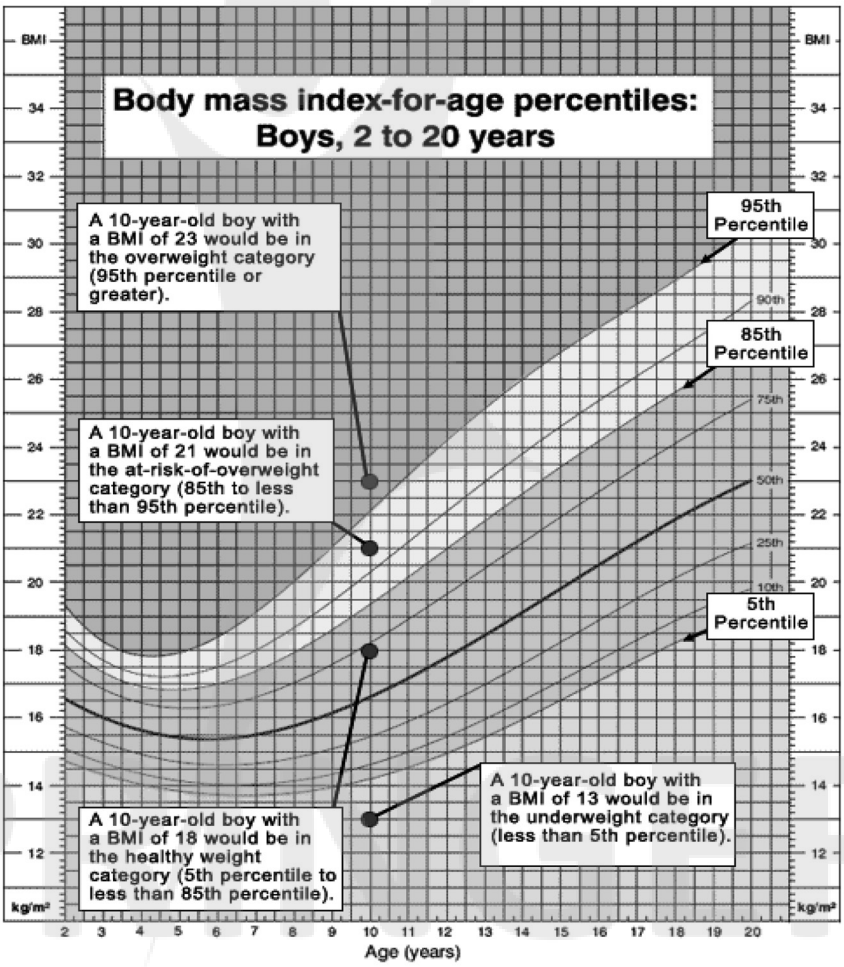
Overweight and obesity are defined by the WHO as "abnormal or excessive fat accumulation that may impair health" (WHO, 2014). There are a number of methods of measuring obesity and overweight. These include skinfold thickness measurements (with calipers), underwater weighing, bioelectrical impedance, dual-energy x-ray absorptiometry (DXA), and isotope dilution. However, these methods are expensive and, in addition, need to be performed with expensive equipment by highly trained personnel. Further, many of them can be difficult to standardize across observers or machines, making comparisons across studies and time periods difficult and unreliable (CDC, 2013c).

As a result, the body mass index (BMI) is commonly used in studies of overweight and obesity in populations and individuals although it is not as accurate as more expensive measures of obesity and overweight. BMI is a simple index of weight-to-height that is calculated as the weight of an individual in kilograms divided by the square of the height in meters (kg/m^2).

> BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered as a rough guide because it may not correspond to the same degree of fatness in different individuals (CDC, 2013c).

The new WHO Child Growth Standards, launched in April 2006, include BMI charts for infants and young children up to age 5. Additionally, WHO has developed the Growth Reference Data for children 5 to 9 years. "It is a reconstruction of the 1977 National Center for Health Statistics (NCHS)/WHO reference and uses the original NCHS data set supplemented with data from the WHO child growth standards sample for children up to age 5" (WHO, 2014).

The BMI is calculated for children and adults in the same way, but the criteria used to interpret the BMI for children and adolescents are different from those for adults. For children, overweight and obesity use age- and sex-specific growth charts. These growth charts are a series of percentile curves that illustrate the distribution of selected body measurements in children and have been used to track the growth of infants, children, and adolescents in the United States since 1977. See Figure 5.1 for an example of a growth chart. The reasons for using age- and sex-specific percentiles from growth charts to determine overweight and obesity in children are that the amount of body fat changes with age; and the amount of body fat differs between girls and boys.



- The Center for Disease Control (CDC) has categorized the BMI measurement within the United States so that a clear and distinct definition of obesity can be ascertained
- This categorization of the BMI measurement's criteria can be adjusted according to age, gender, or race

FIGURE 5.1 Body mass index.

In the United States, the CDC recommends the use of the WHO growth standards to monitor growth for infants and children ages 0 to 2 years of age and the CDC growth charts for children age 2 years and older. Using these growth charts:

- Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile.
- Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex (CDC, 2013c).

As with other public health efforts, data systems are necessary to provide information about the incidence, prevalence, and risk factors for obesity; to conduct research on the causes and consequences of obesity; and to evaluate the effectiveness of interventions aimed at preventing and controlling obesity. Surveillance data for obesity are obtained from the National Health and Nutrition Examination Survey (NHANES).

> The National Health and Nutrition Examination Survey (NHANES) is a program of studies designed to assess the health and nutritional status of adults and children in the United States. The survey is unique in that it combines interviews and physical examinations. NHANES is a major program of the National Center for Health Statistics (NCHS). NCHS is part of the Centers for Disease Control and Prevention (CDC) and has the responsibility for producing vital and health statistics for the Nation.
>
> The NHANES program began in the early 1960s and has been conducted as a series of surveys focusing on different population groups or health topics. In 1999, the survey became a continuous program that has a changing focus on various health and nutrition measurements to meet emerging needs. The survey examines a nationally representative sample of about 5,000 persons each year. These persons are located in counties across the country, 15 of which are visited each year.
>
> The NHANES interview includes demographic, socioeconomic, dietary, and health-related questions. The examination component consists of medical, dental, and physiological measurements, as well as laboratory tests administered by highly trained medical personnel.

Findings from this survey will be used to determine the prevalence of major diseases and risk factors for diseases. Information will be used to assess nutritional status and its association with health promotion and disease prevention. NHANES findings are also the basis for national standards for such measurements as height, weight, and blood pressure. Data from this survey will be used in epidemiological studies and health sciences research, which help develop sound public health policy, direct and design health programs and services, and expand the health knowledge for the Nation. (NCHS, 2010b, para. 1–4)

DNPAO also has two surveillance systems that are program-based: Pediatric Nutrition Surveillance System (PedNSS) and Pregnancy Surveillance System (PNSS). Both are used to monitor the nutritional status of low-income infants, children, and women in federally funded maternal and child health programs. PedNSS provides data on the prevalence and trends of nutrition-related problems. PNSS is used to identify risk factors associated with infant mortality and poor birth outcomes. The data sources for PedNSS and PNSS are existing data from the following public health programs for nutrition surveillance:

- Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
- Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) Program (PedNSS only)
- Title V Maternal and Child Health Program (MCH)

Besides surveillance related to nutrition, physical activity, and obesity, DNPAO supports special studies to evaluate and enhance the effectiveness of physical activity and nutrition programs. For example, current research topics include the following:

- Effectiveness of parent-focused strategies to reduce the time children spend watching television
- Influences of the home environment on sugar-sweetened beverage consumption
- Use of policy interventions to promote physical activity
- Effectiveness of breastfeeding interventions in various settings

Based on the surveillance and research conducted or sponsored by DNPAO and other groups, we know a great deal about the extent of the childhood obesity problem, as we shall discuss now.

The CDC has reported that a third of the children in America are obese. Childhood obesity is becoming an epidemic in other developed nations as well as in the United States. Childhood obesity has affected every demographic population within the United States and the problem is becoming a global concern. The problem is considered pandemic as a result of the global distribution of childhood obesity, but because incident rates continue to increase, it is not thought to be endemic (Kimm & Obarzanek, 2002).

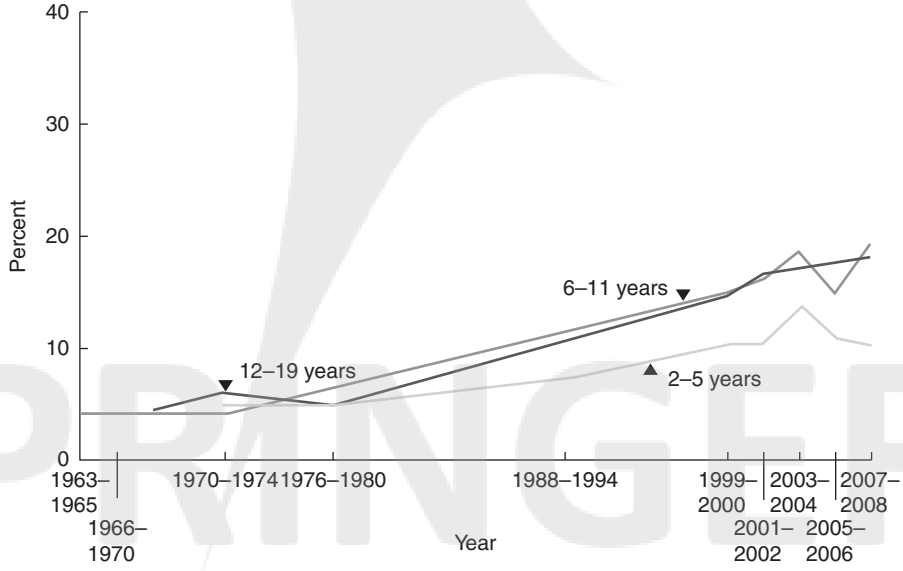
Studies have shown that the average BMI of the American youth has increased 12% since 1963. In chart format, the average BMI in 1963 was 21.3 and the current BMI is 24.1 (LaFontaine, 2008). The NHANES has calculated that the incidence of childhood obesity has tripled since 1980 (LaFontaine). However, recent studies have shown a more promising outlook, with one study showing that among low-income children, the prevalence of obesity has decreased from 2003 to 2010 from 15.21% to 14.94% (CDC, 2012e).

According to the CDC's charts, the incidence of childhood obesity in children 2 to 5 years of age has increased from 5.0% in 1980 to 13.9% in 2004 (Ogden et al., 2006). Children in the 6 to 11 age bracket and the 12 to 19 age bracket

have seen increases of childhood obesity since 1980. The 6 to 11 age group saw an increase in childhood obesity from 5.0% in 1980 to 13.9% in 2004. The 12 to 19 age group had an increase from 6.6% in 1980 to 18.8% in 2004. Adolescents 12 to 19 years of age saw the largest increase, with the incidence of obesity increasing from 5% in 1980 to 17.4% in 2004 (Ogden et al., 2006).

The prevalence of childhood obesity has also been increasing over the past 4 decades. Ogden and Carroll (2010) have calculated childhood obesity using National Health Examination Surveys and National Health and Nutrition Examination Surveys. Steady increases have occurred among all age groups since the late 1970s, and they have been particularly steep among children 6 to 19 years (see Figure 5.2). Further, childhood obesity is not equally distributed among the states. In general, childhood obesity is highest in the south (see Figure 5.3).

In addition to studies of prevalence and incidence, the CDC has been investigating possible causes of the increase in childhood obesity. Multiple studies have shown a strong correlation between childhood obesity and parental obesity. There appears to be a familial link in that children of parents who were obese as kids tend to have high BMIs (Li, Law, Lo Conte, & Power, 2009). Studies have also indicated that obese children maintain and increase their BMI scores in adulthood to become obese adults (Serdula et al., 1993). One study of students 13 to 20 years of age found that only 14.7% reduced their weight



Note: Obesity is defined as body mass index (BMI) greater than or equal to sex- and age-specific 95th percentile from the 2000 CDC Growth Charts.

FIGURE 5.2 Trends in prevalence of childhood obesity, United States, 1963-1965 through 2007-2008.

Source: Ogden and Carroll (2010).

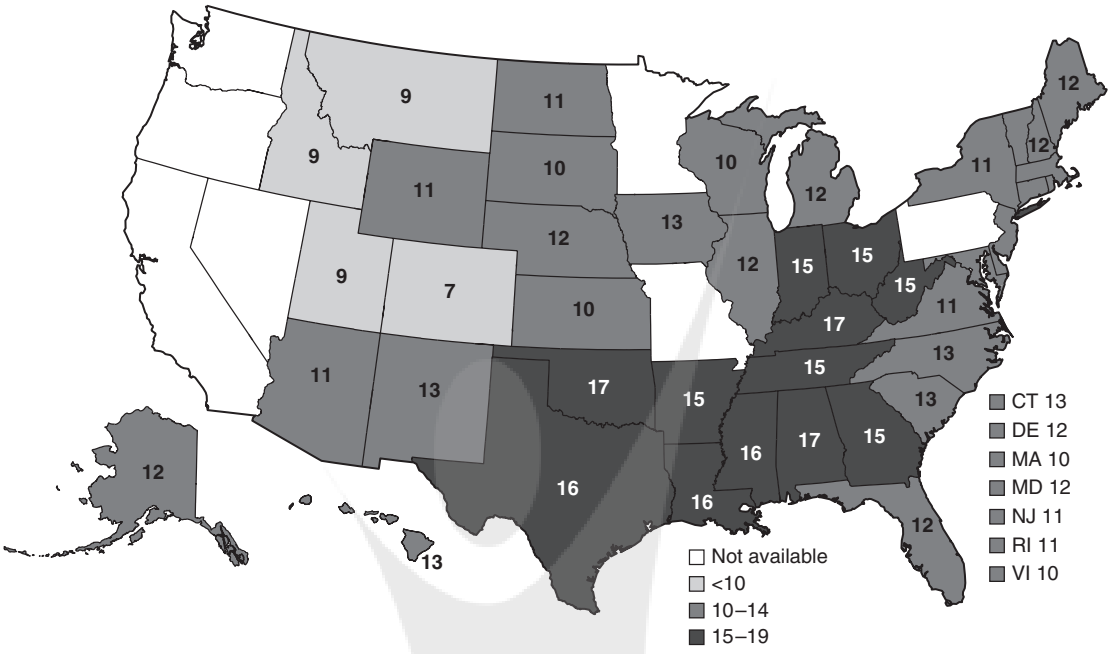


FIGURE 5.3 Childhood obesity in the United States, 2011.
Source: CDC (2011a).

TABLE 5.2 PREVALENCE OF OBESITY AMONG U.S. ADOLESCENTS AGED 12 TO 19, FOR SELECTED YEARS 1988 TO 1994 THROUGH 2007 TO 2008

	1988–94	99–2003	01–02	03–04	05–06	07–08
Boys, All	11.3	14.8	17.6	18.2	18.2	19.3
Boys, Non-Hispanic White	11.6	11.8	16.6	19.1	15.5	16.7
Boys, Non-Hispanic Black	10.7	21.1	16.7	18.4	18.4	19.8
Boys, Mexican American	14.1	27.2	21.8	18.3	25.6	26.8
Girls1, All	9.7	14.8	15.7	16.4	17.3	16.8
Girls1, Non-Hispanic White	8.9	11.0	13.7	15.4	13.5	14.5
Girls1, Non-Hispanic Black	16.3	25.2	22.0	25.4	29.8	29.2
Girls1, Mexican American	13.4	19.3	20.3	14.1	25.4	17.4

Source: Ogden and Carroll (2010).

below the 95th percentile, which represents the obesity level (Gordon-Larsen Adair, Nelson, & Popkin, 2004). Another study found that approximately 80% of overweight children 10 to 15 years of age become obese by age 25 (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997).

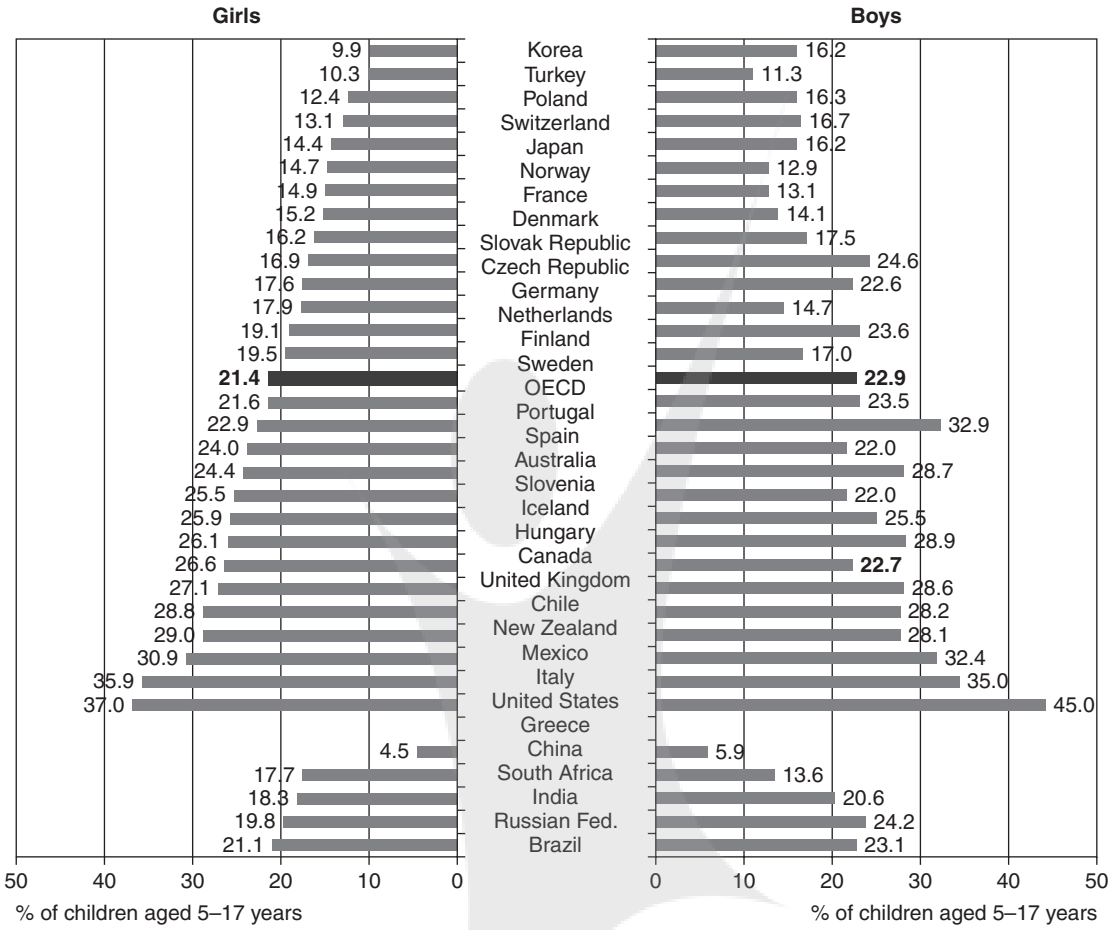


FIGURE 5.4 Prevalence of childhood overweight, including obesity, globally.
Source: OECD (2011).

The prevalence of childhood obesity is rising throughout the world (Organization for Economic Cooperation and Development [OECD], 20110; International Association for the Study of Obesity [IASO], 2011; 2014). The International Association for the Study of Obesity (IASO) has determined the number of children who are overweight, including obese, globally (see Figure 5.4). The IASO estimates that over 200 million children 5 to 17 years of age are obese or overweight. The IASO reports that even while obesity rates vary by country, ranging from 5% in Africa to over 30% in the United States, childhood obesity has been on the rise since the 1960s and is a severe and growing threat to public health.

For example, BMI measurements in England between 2000 and 2004 increased for English boys from 20% to 25% ("Global Trends," 2008). In general, obesity tends to be a larger problem for adults than children. But some countries, such as the United States, China, and Brazil have seen the obesity rates grow more rapidly in children than adults (Harvard School of Public Health, 2014).

However, there has been an increase in childhood obesity in developing nations such as Thailand (Dehghan, Akhtarr-Danesh, & Merchant, 2005). Thailand experienced an increase in childhood obesity from 12.2% to 16.6% in only 2 years (2009). However, developing countries tend to have difficulty reporting credible BMI data to the WHO because few studies of childhood obesity are conducted, and those that are conducted often have data collection problems. Nevertheless, the findings are suggestive.

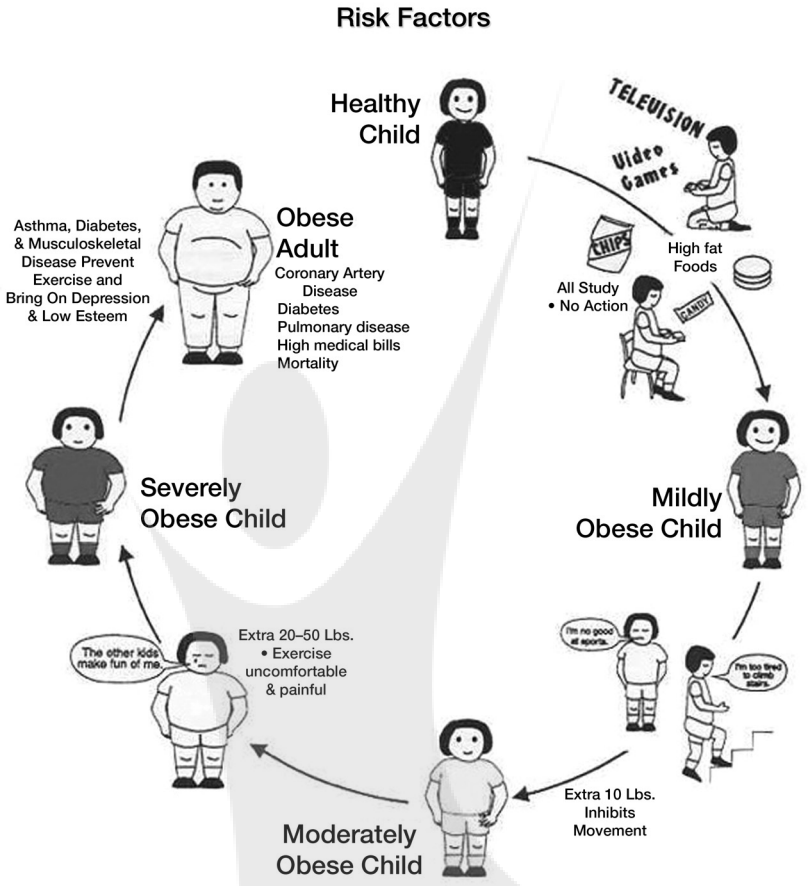
In general, childhood obesity is not as great a problem in poor, developing nations compared to richer countries. However, developing nations tend to report higher obesity rates among children of the wealthy. Childhood obesity studies have also shown that wealthy societies typically have higher rates of childhood obesity. This seeming paradox is explained by the socioeconomic status of the children (Khan & Bowman, 1999). Lower socioeconomic status children in wealthy nations are at greater risk for obesity than children of higher socioeconomic status in these nations. Conversely, children of high socioeconomic status in poor nations are at the greatest risk for obesity in these nations.

In the United States, lower socioeconomic status is one of the most important risk factors for childhood obesity, as is minority race and/or ethnicity (see Figure 5.5). African Americans, Hispanics, and Native Americans have the highest rates of childhood obesity in the United States. The explanation for the associations between socioeconomic status, race and ethnicity, and childhood obesity is highly related to nutrition: fewer healthy choices in supermarkets in low-income, minority neighborhoods; more eating at fast food restaurants because of convenience and availability; and the high cost of more nutritious, lower calorie foods.

Lack of physical activity is another important risk factor for childhood obesity (see Figure 5.6). Coupled with poor eating habits, a sedentary life style is highly likely to lead to excessive weight gain. Time in front of the television and computer is particularly implicated (Hu, Li, Colditz, Willet, & Manson, 2003; Robinson, 1998). The adverse effect of television watching on physical activity is compounded by the accompanying exposure to advertising for poor food choices such as sweetened beverages and breakfast foods. Other technologies such as video games further reduce the time children in the United States spend in physical activity.

Parental behavior is another risk factor for childhood obesity. Children tend to learn their eating habits from their parents. A child's risk of becoming obese doubles if one or both of the parents are obese (Institute of Medicine [IOM], 2004). On the other hand, parents can influence children to eat healthily by setting an example and providing nutritious meals at home. In addition, schools can have a large impact on food choices, impacting childhood obesity for better or worse. A school cafeteria that provides a soda vending machine is enabling a child to make a poor choice.

Like many health conditions, obesity may have a genetic component. One theory links an imbalance in the hormone Leptin to excess weight (Strauss,

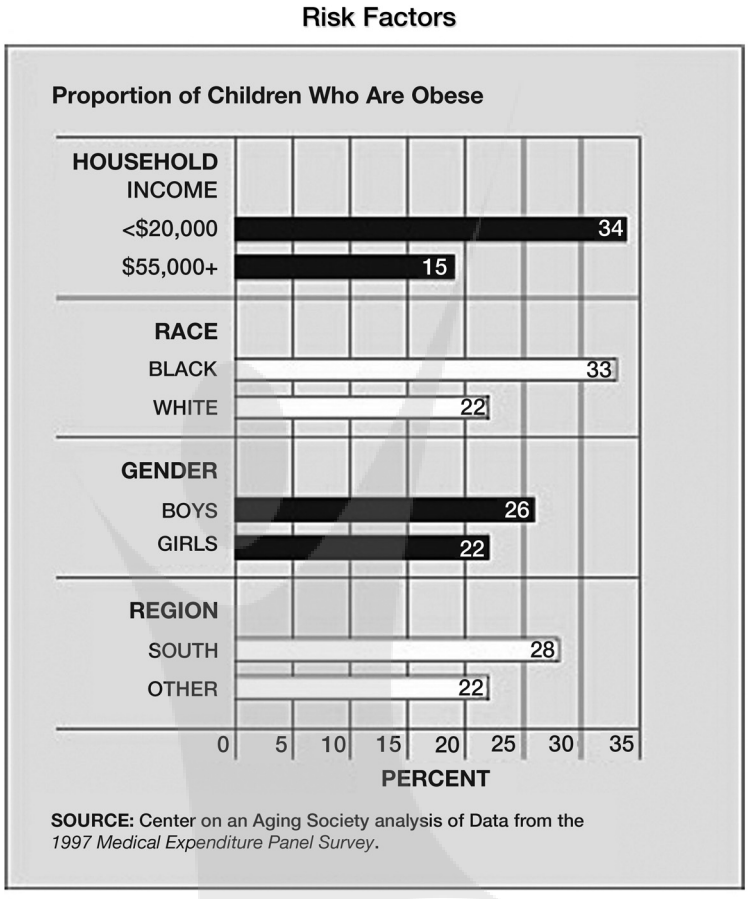


- Diet is one of the major risk factors of childhood obesity
- A poor diet will lead to an increase in BMI as a result of excess fat
- The socioeconomic status of a child is one of the most important risk factors associated with childhood obesity
- Nurture is another risk factor for childhood obesity

FIGURE 5.5 The vicious cycle of childhood obesity.

2000). Leptin is believed to regulate the storage of body fat, and an imbalance of this hormone would increase the ability of the body to store adipose tissue. The imbalance is believed to be of genetic origin, and thus, the risk factor would be familial.

The increased number of obese children in the United States has resulted in an increased prevalence of serious medical conditions in this population. Diseases that were once considered adult problems are now being diagnosed in obese children including diseases of the kidneys, pancreas, heart, and circulatory system. Pediatricians have become accustomed to treating diseases in the child population that were previously prevalent only in adults, and the



- The actual place where a child is raised could be a risk factor for childhood obesity
- In the U.S, Native Americans, African Americans, and Hispanics have a higher prevalence of obesity
- Asians and Pacific Islanders have lower rates of obesity
- Lack of physical activity and a sedentary lifestyle will result in excessive weight gain when coupled with a poor eating regimen

FIGURE 5.6 Risk factors for childhood obesity.

childhood obesity epidemic has changed the practice of pediatrics, such that pediatricians now commonly treat type II diabetes, hypertension, elevated cholesterol, and hyperlipidemia. Obese children have been found to have an increased risk of type 2 diabetes (Trevino et al., 2008). The circulatory system of the obese child is also affected. Obese children are more likely than normal weight children to have elevated cholesterol, hypertension, and hyperlipidemia (Freedman, Khan, Dietz, Srinivasan, & Berenson, 2001). Hypertension, or high blood pressure, stresses the heart because the heart muscle has to work

harder to pump blood throughout the body. Obesity in childhood increases the amount of time throughout the life span in which the heart is undergoing stress. Children who are obese also suffer from hyperlipidemia, an excess of fat in the blood, at a higher rate than nonobese children. The circulatory system expends more effort to move blood through the body as a result of hyperlipidemia. These three disorders have a major effect on the heart later in the obese child's life. A child with these conditions will have an increased likelihood of adult heart and circulatory problems.

In addition to physical health problems, childhood obesity has a negative impact on social relationships and sense of well-being. Not surprisingly, research has found that obese children are at greater risk than their normal weight counterparts of having low social status in school (Friedlander, Larkin, Rosen, Palermo, & Redline, 2003; McNeely & Crosnoe, 2008). They are more likely to be the targets of bullying, teasing, and scorn, which have long-term emotional consequences including depression and low self-esteem (Moran, 1999).

Prevention Policies and Practices

A major partnership for developing interventions to prevent and control childhood obesity is the Nutrition, Physical Activity and Obesity Program (NPAO), a cooperative agreement between the DNPAO and 23 state health departments. NPAO's goal is to prevent and control obesity and other chronic diseases through healthful eating and physical activity. "The state programs develop strategies to leverage resources and coordinate statewide efforts with multiple partners to address all of the following DNPAO principal target areas:

- Increase physical activity
- Increase the consumption of fruits and vegetables
- Decrease the consumption of sugar sweetened beverages
- Increase breastfeeding initiation, duration and exclusivity
- Reduce the consumption of high energy dense foods
- Decrease television viewing (CDC, 2012d).

The most authoritative public health plan for preventing and controlling obesity has been developed by the CDC. Notably, the strategies are aimed at changing the social and physical environments at the local level. It is very much a community-based plan to ensure that there are opportunities and incentives for all to obtain nutritious food and engage in physical activity, thereby addressing the underlying causes of obesity. The strategies do not rely on education alone. Rather they are implemented through policy changes and partnerships with local organizations. As the authors write, "This product is the result of an innovative and collaborative process that

seeks to reverse the U.S. obesity epidemic by transforming communities into places where healthy lifestyle choices are easily incorporated into everyday life. To reverse the obesity epidemic, we must change our physical and food environments to provide more opportunities for people to eat healthy foods and to be physically active on a daily basis" (Keener et al., 2009). The 24 strategies, which the CDC recommends to encourage and support healthy lives, are contained in Table 5.3. Each strategy is illustrated by a community-based example of its implementation.

There is some evidence that public health strategies to reduce obesity are working, as shown in Figure 5.7. The CDC found that declines in obesity among low-income preschoolers were observed in 19 of 43 states/territories examined. Prevention efforts are still needed to sustain and expand the implementation and evaluation of population-level interventions to prevent childhood obesity (CDC, 2013d).

The Robert Wood Johnson Foundation has focused on six areas of childhood obesity to address through prevention strategies. They include issues surrounding food, such as access to healthy and affordable food, as well as school-based interventions, such as physical activity at school and access to healthy foods at school. They also focus on the way unhealthy foods are marketed to children. These focus areas are:

- **School foods and beverages:** 35% of a child's daily calories are consumed at school, and so it makes sense to try to improve what is offered there. This means replacing high-calorie foods and sugary drinks with healthier choices.
- **Healthy affordable food:** Having access to affordable, healthy foods is important for making healthy choices. However, today many families, especially low-income families, live in a food desert where there are few to no healthy options that are also affordable. By working to bring grocery stores to these areas and improve healthy options at the existing convenience stores, more families will be able to make healthy food choices.
- **Physical activity at school:** School should be a place that promotes physical activity. This can be done many ways, including physical education classes, promoting walking and biking to school, and through after-school activities.
- **Pricing strategies:** Pricing can be used as an incentive to purchase healthy foods, and also used as a disincentive to not purchase less nutritious foods.
- **Physical activities in the communities:** Through strategies that target safety and the built environment, communities can create an environment that is more conducive to physical activity. These strategies include neighborhood watches and traffic controls, building parks and playgrounds, and promoting bike and walking paths.
- **Marketing restrictions to children:** Restricting the marketing of unhealthy food and drink options to children is believed to be very cost effective (Robert Wood Johnson Foundation, 2013).

TABLE 5.3 COMMUNITY-BASED CHANGES IN THE ENVIRONMENT

Category 1: Strategies to promote the availability of affordable healthy food and beverages
Strategy 1: Increase availability of healthier food and beverage choices in public service venues *Community Example* • In St. Paul, Minnesota, the "Five a Day Power Plus Program" increased the variety of fruits and vegetables offered in schools by providing an additional fruit item on days baked desserts were served, promoting fruits and vegetables at point-of-purchase, and enhancing the attractiveness of fruits and vegetables. Evaluation of the program found that fruit and vegetable consumption increased significantly among children in the intervention group as compared with a control group. • The Farm to School Network, which works to bring local produce into schools, improves the health of the children by providing increased access to healthy food. It also promotes living a healthy lifestyle by introducing the students to community gardens, cooking lessons, and field trips to local farms. An added bonus is that the community farmers are able to sell their crops close to home. This program is active across the country, with a program in every state.
Strategy 2: Improve availability of affordable healthier food and beverage choices in public service venues *Community Example* • The New York City Department of Health operates the Health Bucks Program to make fruits and vegetables more affordable to residents who receive food stamps. For every $5 worth of food stamps spent at farmers' markets, individuals receive a $2 Health Bucks coupon that can be redeemed year round at more than 30 farmers markets citywide. In 2007, the City Health Department reported that New Yorkers used more than 40% of the 9,000 Health Bucks distributed in 2006.
Strategy 3: Improve geographic availability of supermarkets in underserved areas *Community Example* • The Philadelphia Food Marketing Task Force investigated the lack of supermarkets in Philadelphia and released 10 recommendations to increase the number of supermarkets in Philadelphia's underserved communities. A new funding initiative was created using public funds to leverage supermarket development. To date, the initiative has committed $67 million in funding for 69 supermarket projects in 27 Pennsylvania counties, creating or preserving 3,900 jobs.
Strategy 4: Provide incentives to food retailers to locate in and/or offer healthier food and beverage choices in underserved areas *Community Example* • The city of Richmond, California, attracted a national discount grocery store to an urban retail center with adjacent affordable housing by offering an attractive incentive package, which included land sold at a reduced cost to the developer; a Federal Urban Development Action Grant of $3.5 million for commercial development; a zoning designation that provided tax incentives; assistance in negotiations with State regulatory agencies; improvements to surrounding sidewalks, streetscape, and traffic signals; and concessions on design standards.

Category 1: Strategies to promote the availability of affordable healthy food and beverages

Strategy 5: Improve availability of mechanisms for purchasing foods from farms

Community Example

- In 2005, Jefferson Elementary School, in Riverside, California, launched a farm-to-school salad bar program that provides elementary school students access to a daily salad bar stocked with a variety of locally grown produce as an alternative to the standard hot lunch. Two small, locally owned family farms, within 30 miles of the school, sell their produce at an affordable price and make weekly deliveries to the school. Since implementing the farm-to-school salad bar program, the Riverside school district has expanded the program to four additional elementary schools.

Strategy 6: Provide incentives for the production, distribution, and procurement of foods from local farms

Community Example

- The Hartford Food System (HFS) in Connecticut is a nonprofit organization working to create an equitable and sustainable food system that addresses the underlying causes of hunger and poor nutrition facing low-income and elderly residents. In addition to developing innovative projects and initiatives that tackle food cost, access, and nutrition, the organization actively participates in public policy initiatives aimed at increasing production, distribution, and procurement of foods from local farms at the local, state, and federal government levels.

Category 2: Strategies to support healthy food and beverage choices

Strategy 7: Restrict availability of less healthy foods and beverages in public service venues

Community Example

- The city of Baldwin Park, California, established nutrition standards for all snack foods and beverages sold in over 30 afterschool programs (including snack offerings in vending machines). The afterschool nutrition standards primarily focus on eliminating less healthy snacks and beverages that exceed recommended fat, calorie, and sugar intake for school-aged children.

Strategy 8: Institute smaller portion size options in public service venues

Community Example

- Although the following example describes a program that targets private restaurants, it may serve as a model for local communities that wish to promote greater access to healthy portion sizes in public service venues.
- The Texas Department of State Health Services developed the *Tex Plate* program to assist Texas restaurants in serving healthier portion sizes to consumers. Participating restaurants receive specialized 9-inch plates that indicate proper portions of key food groups such as vegetables, protein, and whole grains. The program is designed to encourage participating restaurants to increase the vegetable portion of the meal and decrease the entrée and starch portions of the meal.

(continued)

TABLE 5.3 COMMUNITY-BASED CHANGES IN THE ENVIRONMENT *(continued)*

Category 2: Strategies to support healthy food and beverage choices

Strategy 9: Limit advertisements of less healthy foods and beverages

Community Example

- The Mercedes Independent School District in Mercedes, Texas, adopted a comprehensive Student Nutrition/Wellness Plan in 2005 that includes a marketing component. The policy states that schools will promote healthy food choices and will not allow advertising that promotes less nutritious food choices. The plan also defines and prohibits possession of foods of minimal nutritional value at school.

Strategy 10: Discourage consumption of sugar-sweetened beverages

Community Example

- In 2002, the Los Angeles Unified School District adopted the Motion to Promote Healthy Beverage Sales. The motion bans the sale of soft drinks on school campuses; prohibits schools from entering into new or extended sales contracts of unapproved beverages; allows only approved beverages to be sold in vending machines, cafeterias, and student stores; monitors compliance through an audit program; disseminates information on healthy beverage sale options; and develops a new revenue model to make up for anticipated net loss of Associated Student Body monies related to the ban on soft drinks.

Category 3: Strategy to encourage breastfeeding

Strategy 11: Increase support for breastfeeding

Community Example

- In 1998, California passed the Breastfeeding at Work law, which requires all employers to ensure that employees are provided with adequate facilities for breastfeeding or expressing milk. In 2002, the State passed Lactation Accommodation, which expands prior workplace provisions to require adequate break time and space for breastfeeding or milk expression, with a violation penalty of $100.

Category 4: Strategies to encourage physical activity or limit sedentary activity among children and youth

Strategy 12: Require physical education in schools

Community Example

- In 2006, West Virginia enacted Senate Bill 785, which calls for the Department of Education to establish a requirement that every student enrolled in a public school participate in physical education (PE) classes during the school year. The bill also specified participation times for PE classes by grade level. For example, elementary school students are required to participate in at least 30 minutes of PE class 3 days a week, middle school students are required to participate in at least one full period of PE each school day for a semester, and high school students are required to complete no less than one full course credit of PE class prior to graduation.

Category 4: Strategies to encourage physical activity or limit sedentary activity among children and youth

Strategy 13: Increase the amount of physical activity in physical education programs in schools

Community Example

- Owensboro, Kentucky, overhauled its school-based PE curriculum after a study found that 60% of the Owensboro-area population was obese or overweight. A partnership was formed between the city's hospitals and schools and $750,000 was donated to equip 11 school-based fitness centers with treadmills, stationary bikes, rowing machines, and weightlifting stations. PE teachers were trained using "new PE" techniques, which stress the importance of keeping students physically active for at least 30- to 60-minute increments during class time.
- Equestrian Trails Elementary School, located in Wellington, Florida, received a STARS award from the National Association for Sport and Physical Education in recognition of its outstanding PE program. The PE staff at Equestrian Trails Elementary designed a yearly plan of instruction using physical activity and fitness components as the primary foundation for its curriculum. The curriculum teaches students the basic skills of several movement forms, including team, dual, and individual sports, and dance.

Strategy 14: Increase opportunities for extracurricular physical activity

Community Example

- The city of Eugene, Oregon, and the Bethel School District pooled their resources to purchase and develop a 70-acre parcel of land. The property now includes a 35-acre site for Meadow View School and 35 acres for Bethel Community Park, which includes wetlands, a running path, ball fields, and a skate/community park. Many students can walk through the park to get to school.
- Michelle Obama's "Let's Move" Campaign is the First Lady's initiative to reduce the rates of childhood obesity. It focuses on giving parents the tools to encourage healthy eating, promoting physical activity for young people, and working to ensure all people have access to healthy, affordable food. This is an example of just one of many very prominent public figures that have brought the issue of childhood obesity to the forefront of the social conversation.

Strategy 15: Reduce screen time in public service venues

Community Example

- In 2006, the New York City Department of Health and Mental Hygiene Board of Health implemented an amendment to the New York City Health Code, which regulates group day care in New York City. The amended article prohibits television, video, and visual recordings for children younger than 2 years of age. In addition, television, video, and visual recordings are limited to 60 minutes per day of educational programming for children 2 years or older.

(continued)

TABLE 5.3 COMMUNITY-BASED CHANGES IN THE ENVIRONMENT *(continued)*

Category 5: Strategies to create safe communities that support physical activity

Strategy 16: Improve access to outdoor recreational facilities

Community Example

- KaBOOM! is a national nonprofit organization that empowers local communities to build playgrounds in neighborhoods that lack play spaces for children. The KaBOOM! process helps residents of local communities bring together the capacity, resources, volunteers, and planning needed to fulfill the vision of a great place to play within walking distance of every child in America. The KaBOOM! Website provides information and resources for community residents to apply for a KaBOOM!-led playground build or to follow detailed steps to build their own playground.

Strategy 17: Enhance infrastructure supporting bicycling

Community Example

- In May 2005, Boulder, Colorado, was awarded Gold status as a Bicycle-Friendly Community by the League of American Bicyclists. The city committed 15% of its annual transportation budget, $3.1 million, toward bicycle enhancement and maintenance activities. More than 95% of Boulder's arterial streets have bicycle facilities and all local and regional buses are equipped with bike racks. In addition, Boulder has created an online bike routing system that provides cyclists a direct and safe bike route to travel within city limits.

Strategy 18: Enhance infrastructure supporting walking

Community Example

- In 2002, Oakland, California adopted a Pedestrian Master Plan which designates a network of pedestrian facilities and distinguishes segments and intersections in need of particular attention for safety enhancements. The city estimated pedestrian volumes throughout the city based on land use, population, and other network characteristics, and used these estimates in conjunction with crash data, traffic data, and community input to identify and prioritize areas with both safety problems and high pedestrian demand.
- The Walk-Bike to School campaign, which encourages children to walk to school through the promotion of safe walking paths, National "Walk-To-School" and "Bike-To-School" days.

Strategy 19: Support locating schools within easy walking distance of residential areas

Community Example

- In 2005, the City of Milwaukee began its Neighborhood Schools initiative. As a result of this initiative, the city decided to build six new schools from the ground up and spent millions of dollars revamping and expanding dilapidated schools that were located in and around community neighborhoods. The goals of the initiative were to reduce the number of students being bused to schools around the city and to increase the number of students walking or biking to schools that were centrally located and close to their neighborhoods.

Strategy 20: Improve access to public transportation

Community Example

- Local business owners and residents of the South Park neighborhood of Tucson, Arizona, received funding from the local government and the Federal Transit Administration (FTA) to implement a series of improvements to the existing public transit system. Funds were used to install six new artistic bus shelters, new traffic signals, and additional sidewalk and curb access ramps for public transit users, bicyclers, and pedestrians. As a result of the efforts to revitalize its public transit infrastructure, South Park has experienced renewed pride in its community and helped to rebuild its local economy.

Category 5: Strategies to create safe communities that support physical activity

Strategy 21: Zone for mixed-use development

Community Example

- The concept of mixed-use development is the official growth management policy for Eugene, Oregon, which focuses on integrating mixed-use developments within the city's urban growth boundary. The city's regional transportation master plan targets dozens of potential "mixed-use centers" for development into quality neighborhoods that enjoy higher densities, more transportation options, and convenient access to shopping, consumer services, and basic amenities. By combining mixed-use centers with improved transit options, the plan aims to reduce dependence on automobile travel, encourage walking, and reduce the need for costly street improvements.

Strategy 22: Enhance personal safety in areas where persons are or could be physically active

Community Example

- Detroit, Michigan, has one of the highest home foreclosure rates in the country, resulting in a dramatic increase in the number of abandoned buildings and boarded-up homes which attract vandals and petty crime. In response, Urban Farming, an international nonprofit organization, joined forces with the local county government to transform 20 abandoned properties into active fruit and vegetable garden plots that feed the homeless and improve the aesthetic appeal of city neighborhoods. Since establishing the gardens, residents report less vandalism and blight in their community and the local county government donates water to maintain the city gardens on an ongoing basis.

Strategy 23: Enhance traffic safety in areas where persons are or could be physically active

Community Example

- In the mid-1990s, the City of West Palm Beach, Florida, adopted a downtown-wide traffic calming policy to improve street safety for nonmotorized users. The city's main streets were retrofitted with important pedestrian safety measures, including raised intersections, two-way streets, road narrowings and roundabouts to slow traffic, wide sidewalks, tree-lined streets, and shortened pedestrian crossings. As a result of these efforts, city streets are perceived as safe by pedestrians, property values more than doubled in the downtown area, and commercial retail space is 80% occupied.

(continued)

TABLE 5.3 COMMUNITY-BASED CHANGES IN THE ENVIRONMENT *(continued)*

Category 6: Strategy to encourage communities to organize for change

Strategy 24: Participate in community coalitions or partnerships to address obesity

Community Example

- PedNet Coalition in Columbia, Missouri, is a community coalition that includes 5,000 individuals and 75 businesses, government agencies, and nonprofit organizations. The goal of the coalition is to develop and restore a network of nature trails and urban "pedways" connecting residential subdivisions, worksites, shopping districts, parks, schools, and recreation centers.

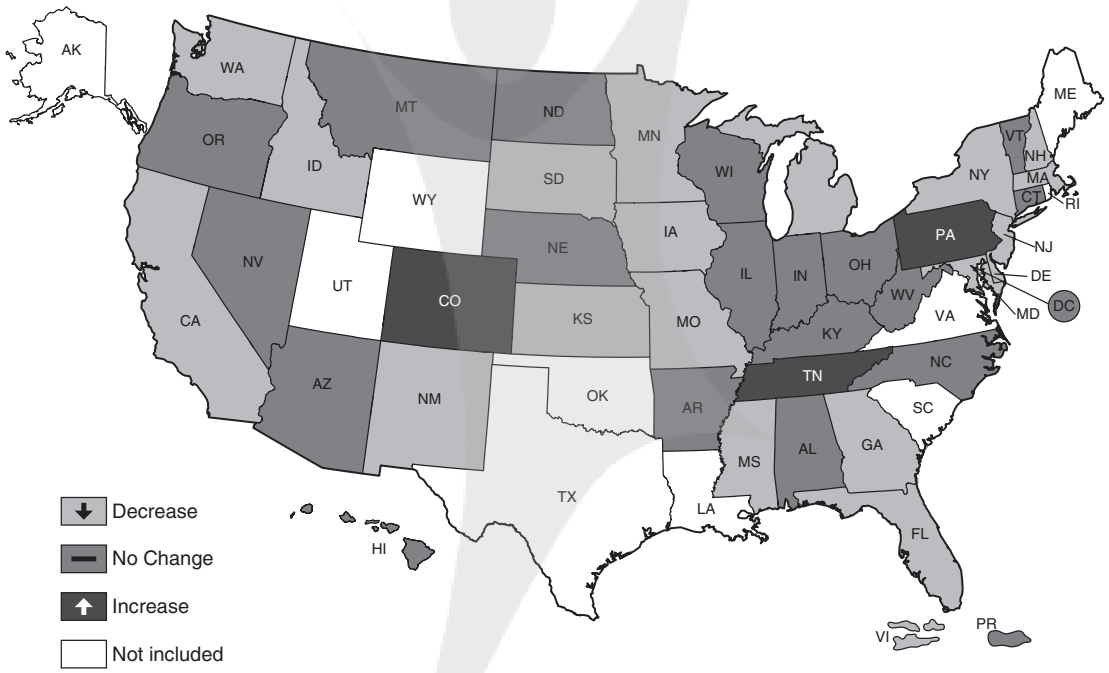


FIGURE 5.7 Many states and US territories are showing decreases in childhood obesity.

Improving Access to Medical Care

Access to quality health care is essential to secondary and tertiary prevention, and therefore, to public health. Without timely and adequate health care, an acute health problem, such as an injury, that if treated appropriately would have no long-term consequences, becomes a chronic condition and a chronic condition, such as diabetes, is exacerbated. When primary prevention fails and people sustain injuries or become obese—the subjects of the previous sections—they require access to health care. This topic is discussed in the final chapter of the book.

STUDY QUESTIONS

Q: What is the disease burden of chronic diseases in the United States?

Q: What is the disease burden of injuries in the United States?

Q: Describe a community-based approach to reducing obesity that emphasizes the bottom layer of the Health Impact Pyramid (socioeconomic factors).

Q: Describe a community-based approach to reducing obesity that emphasizes changing the context to make individuals' default decisions healthy (Health Impact Pyramid, layer 2).

Q: Describe a community-based approach to reducing obesity that emphasizes long-lasting protective interventions (Health Impact Pyramid, layer 3).

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PUBLIC HEALTH SYSTEM PERFORMANCE

OBJECTIVES

Readers will learn . . .

1. What is evidence-based public health and why it is important.
2. That system performance is judged on effectiveness, efficiency, and equity.
3. What are the indicators of public health system performance at the population level.
4. The role of professional organizations in measuring and improving U.S. public health performance.
5. How well the U.S. public health system performs based on various performance measures.

ACCOUNTABILITY AND EVIDENCE-BASED PUBLIC HEALTH

Evaluation of the public health system is increasingly important in this era of accountability and finite budgets. Like the health care system, the public health system's performance is generally evaluated on three criteria: (a) effectiveness, (b) efficiency, and (c) equity (Aday, Begley, Lairson, & Slater, 1993; Aday, Begley, Lairson, & Balkrishnan, 2004). Therefore, the overall evaluation of public health performance asks the question: How effective, efficient, and equitable is public health in achieving its mission to prevent disease, injury, disability, and premature death by "assuring conditions in which people can be healthy?" (Institute of Medicine [IOM], 1988, p. 1)

Effectiveness focuses on whether the desired benefits of public health practices—programs, policies, services—are achieved. Efficiency focuses on how the benefits achieved by public health compare to the resources expended to realize them, and whether alternate practices would have achieved greater benefits or the same benefits using fewer resources. "Equity addresses the fairness and effectiveness of policies in minimizing population health disparities" (Aday, 2005, p. 2). The effectiveness, efficiency, and equity criteria are often complementary. Improving effectiveness while holding resources constant increases efficiency, and those increases in efficiency may create opportunities for improved effectiveness and equity. These criteria—effectiveness, efficiency, and equity—provide a basis for evaluating the performance of the public health system, as they do for evaluating the health care system.

It is a tremendously complex undertaking to provide answers to questions about public health performance. At what level do we measure success? What indices of success do we use? Public health performance may be assessed at the micro level—for single groups, organizations, communities, and geographically specific populations—or at the macro level—for counties, regions, states, and nations. For example, at the micro level, we may be interested in the success rate of one public health program to prevent smoking in a single group within a community. At the macro level, we may want to know how one state compares to another in rates of smoking.

Performance indicators may be specific to a single public health service, or general, reflecting the performance of numerous services and disease-specific initiatives. For example, we may evaluate food inspection services in a county based on rates of foodborne illnesses in that county, or we may assess the overall effectiveness of all public health services in the county based on a general measure of health status such as premature death rates. We can evaluate public health performance against several types of referents. We can use a "gold standard" to determine whether we have achieved the recognized "best" possible performance, if there is a "gold standard." We can use our own previous performance as a "benchmark" to determine whether we have improved over time. We can use a "benchmark" from another entity to determine whether we are doing as well as or better than an appropriate referent—organization, community, population, region, state, or nation.

The movement to evaluate public health performance, systematically, has resulted in the need to substantiate what works and what does not work in public health practice—*evidence-based public health*—based on scientifically valid empirical research. We explicitly seek to base our initiatives, programs, and policies aimed at preventing disease, injury, disability, and premature death in populations on knowledge that has resulted from sound research about the effectiveness, efficiency, and equity of public health practices. As Kohatsu and his colleagues write, "Decisions and policies in public health are frequently driven by crises, political concerns, and public opinion. A number of researchers, however, are proposing a more evidence-based approach to public health, based on the advances of evidence-based medicine" (Kohatsu, Robinson, & Torner, 2004, p. 417).

> The logic of evidence-based practice identifies a cyclic relation between evaluation, evidence, practice, and further evaluation. It is based on the premise that evaluations determine whether anticipated intervention effects occur in practice, and identify unanticipated effects. The reports of such evaluations are a valuable source of evidence to maximize the benefits, and reduce the harms, of public health policy and practice. The evidence can also inform evaluation planning, and thus improve the quality and relevance new research. (Rychetnik, Hawe, Waters, Barratt, & Frommer, 2004, p. 541)

Table 6.1 compares three well-known definitions of evidence-based public health. Taken together, we see that the essence of *evidence-based public health* is the development of information, using scientific principles, which can inform public health practice so that it is effective, efficient, and equitable.

The importance of community preferences is explicitly noted in the most recent definition (Kohatsu, Robinson, & Torner 2004), because this issue has considerable bearing on the effectiveness of public health practices, as discussed later in this chapter.

Evidence-based public health is an activity with direct parallels to evidence-based medicine. The goals and general methods are the same, although some of the specifics differ because of the differences between medicine and public health. As some authors have noted, public health is a broader, more diverse field, and therefore a wider range of scientific approaches is needed to gather information for practice improvement. Kohatsu et al. (2004) have identified differences between evidence-based medicine and evidence-based public health, which are summarized in Table 6.2.

In general, performance evaluation takes place at two levels: (a) the individual program, policy, or service level; or (b) the population level using population mortality and morbidity measures, where these global measures are

TABLE 6.1 THREE DEFINITIONS OF EVIDENCE-BASED PUBLIC HEALTH

DEFINITION 1[a]	DEFINITION 2[b]	DEFINITION 3[c]
EBPH is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of communities and populations in the domain of health protection, disease prevention, and health maintenance and improvement (health promotion)	EBPH is the development, implementation, and evaluation of effective programs and policies in public health through application of principles of scientific reasoning, including systematic uses of data and information systems and appropriate use of program-planning models	EBPH is the process of integrating science-based interventions with community preferences to improve the health of populations

Note: EBPH, evidence-based public health.
Source: Kohatsu, Robinson, and Torner (2004).
[a] Jenicek (1997), [b] Brownson, Gurney, and Land (1999), Brownson, Baker, Leet, and Gillespie (2003).
[c] Kohatsu et al. (2004).

TABLE 6.2 A COMPARISON OF PROCESSES: EVIDENCE-BASED MEDICINE VERSUS EVIDENCE-BASED PUBLIC HEALTH

STEP	EVIDENCE-BASED MEDICINE[a]	EVIDENCE-BASED PUBLIC HEALTH[b]
1. State the scientific question of interest	Convert the need for information (about prevention, diagnosis, prognosis, therapy, causation) into an answerable question	Develop an initial statement of the issue
2. Identify the relevant evidence	Track down the best evidence to answer that question	Search the scientific literature and organize information
3. Identify the relevant evidence	Critically appraise that evidence for its validity (closeness to the truth), impact (size of the effect), and applicability (usefulness in one's clinical practice)	Quantify the issue using sources of existing data
4. Determine what information is relevant to answering the scientific question of interest	Integrate the critical appraisal with one's clinical expertise and with the patient's unique biology, values, and circumstances	Develop and prioritize program options; develop an action plan and implement interventions.
5. Determine the best course of action considering the patient or population	Evaluate one's effectiveness and efficiency in executing Steps 1 to 4 and seek ways to improve both for the next time	Evaluate the program or policy

Source: Kohatsu et al. (2004).
[a] Sackett, Straus, Richardson, Rosenberg, and Haynes (2000); [b] Brownson, Gurney, and Land (1999); Brownson, Baker, Leet, and Gillespie (2003).

used to assess macro-level performance. Evidence-based public health usually refers to the program, policy, or service level.

Evaluations at the level of specific programs, services, or policies have identified goals that are targeted at defined populations. Therefore, measures of effectiveness, that is, measures that indicate whether the desired or intended result was brought about, are population and program specific. The basic components of any evaluation—program or system—are structure, process, and outcomes. When assessing a program, service, or policy, structure refers to the resources available to the public health program, including organization and financing; the characteristics of the populations targeted by the program, service, or policy; and the physical, social, and economic environments in which the program occurs. Process refers to the implementation of the public health program, service, or policy. Outcomes refer to the expected results of implementation. Program-specific outcomes usually consist of short-term goals, such as a change in knowledge and attitudes; longer-term goals, such as

change in behavior; and impact, such as change in health status. Each of these goals would be specific to the program and the targeted population.

Issel (2009) provides an excellent description of the types of program evaluations. The two most useful concepts are process and outcomes evaluations. "Process evaluations focus on the degree to which the program has been implemented as planned and on the quality of the program implementation. Process evaluations are known by a variety of terms, such as monitoring evaluations, depending on their focus and characteristics" (p. 19). Outcome evaluations, often used interchangeably with impact evaluations, focus on whether the goals of the program, service, or policy have been achieved and whether the changes desired can be attributed to the program (Issel, 2009).

As an example, a project in a local school used theater to reduce intolerance among 10th graders. The theater production was developed by a group of young actors using the results of focus groups with 10th-grade students. The focus groups identified concerns of the student body. The theater production contained skits based on the personal experiences of students, increasing the relevance of the production to the audience. The short-term goals of the program—by the end of the performance—were to increase knowledge about what constitutes intolerance and how intolerance is perceived by both the victim and perpetrator. The longer-term goal—during the remainder of the school year—was to increase discussions among students about tolerance issues. The desired impact of the program was a decrease in the number of incidences of intolerance reported in high school.

Population-Level Outcomes[1]

Population-level indicators are often the measure of impact of a program, service, or policy. These include population mortality and morbidity rates. Table 6.3 identifies and defines the most widely used measurements of these rates. Historically, population health indicators have been age-adjusted death rates, disease-specific death rates, life expectancy, time lost to premature death, and infant mortality rate (IMR). The United Nations International Children's Emergency Fund's (UNICEF) definition of IMR is the probability of dying between birth and exactly 1 year of age (UNICEF, 2010). This rate is expressed per 1,000 live births per year. IMR is an important measure that indicates the well-being of infants, children, and pregnant women, as it is associated with maternal health, quality and access to care, and public health in a given population. Life expectancy is defined by the World Health Organization (WHO) as the number of years of life that can be expected on average in a given population.

By using the life expectancy within that population, the time lost to premature death, also called years of potential life lost or YPLL, can be calculated. YPLL indicates that death occurred at an age less than what would be expected, and the more premature a death, the greater the loss of life (WHO,

2011). A more recent concept of population health takes into account quality of life. Healthy life expectancy (HALE) at birth is defined by WHO as the "average number of years that a person can expect to live in 'full health' by taking into account years lived in less than full health due to disease and/or injury" (WHO, 2011). HALE is a measure that "combines length and quality of life into a single estimate that indicates years that can be expected in a specified state of health" (Kindig, 1997, p. 45). Other health-adjusted life expectancy measures are quality-adjusted life years (QALY), which emphasizes the individual's perceived health status as the indicator of quality of life; disability-adjusted life years (DALY), which combines mortality and disability measures; and years of healthy life (YHL), which combines perceived health and disability activity limitation measures from the National Health Interview Survey (Kindig, 1997).

Mortality rate is the number of deaths in a given population per year (WHO, 2011). The age-adjusted mortality rate takes into account the population's age distribution when calculating mortality rate. Using a statistical method that "standardizes" the target population to a reference population, this measure is commonly used when comparing mortality rates across different populations.

TABLE 6.3 MORTALITY AND MORBITITY RATE MEASUREMENTS

TERM	DEFINITION
Infant mortality rate	The probability of dying between birth and exactly 1 year of age
Life expectancy	The number of years of life that can be expected in a given population
Years of potential life lost (YPLL)	Years of potential life lost due to death before the age of 75
Healthy life expectancy (HALE)	The average number of years that a person at birth can expect to live in full health
Quality-adjusted life years (QALY)	An individual's perceived health status as an indicator of quality of life
Disability-adjusted life years (DALY)	Number of years lost due to disability
Mortality rate	The number of deaths in a given population per year
Age-adjusted mortality rate	The number of deaths in a given population per year adjusted for the population's age distribution

Sources of Evidence-Based Public Health

The following sites provide links to scientific studies and published reports that provide practical guidance to local health departments, health care providers, community leaders, employers, and others on the effectiveness of programs, services, and policies on achieving public health goals:

Agency for Healthcare Research and Quality

- Electronic Preventive Services Selector
- Offers a practical tool to assist clinicians with identifying appropriate preventive, screening, and counseling services for patients (www.ahrq.gov)

Association of State and Territorial Health Officials

- Archives of evidence-based public health initiatives and research focused on increasing the evidence base supporting public health interventions (www.astho.org).

Centers for Disease Control and Prevention (CDC)

- CDC's *Guide to Community Preventive Services* provides a summary of effective community interventions that promote health and prevent disease. The *Guide* is a valuable source of systematic reviews and evidence-based recommendations for public health practice. In addition, the Task Force on Community Preventive Services and CDC, who sponsor the *Guide*, have developed methods that may be used to evaluate the impact of evidence-based public health interventions (www.cdc.gov).

The Cochrane Collaboration

- Library of systematic reviews of the effects of health care interventions. The Collaboration's Health Promotion and Public Health Field (HPPHF) is aimed at increasing the quality and quantity of systematic reviews that can be used to provide evidence to answer practical, public health questions (www.cochrane.org).

E-Roadmap to Evidence-Based Public Health Practice

- Comprehensive database of evidence-based public health practice programs and a learning tutorial that teach skills to identify and use effective programs (www.healthsolutions.org).

National Association of County and City Health Officials (NACCHO)

- Model Practices Database is a searchable database of local health agency model practices, divided into community, environmental, and public health categories (www.naccho.org).

New York State Department of Health

- Community Health Assessment Clearinghouse links to evidence-based practice resources, examples of strong community health assessments, data, and describes the 10-step process for conducting community health assessments (www.health.state.ny.us/).

PUBLIC HEALTH SYSTEM IMPROVEMENT

As discussed previously, there are two basic types of evaluation: process and outcomes evaluation. This is true of systems as well as programs, services, and policies. In this section on public health system performance, we turn first to process improvement initiatives.

Accreditation and Credentialing

Desired outcomes result from well-thought out, well-executed processes. This is true of the public health system, as it is of any other system. Therefore, the performance of the public health system depends first on the quality and commitment of the workforce; second, on the quality of policies, services, and programs in public health organizations at every level—local, state, and federal; and third, on the quality of data that are available to assess performance. There are several initiatives intended to ensure the quality of these three aspects of the public health system. The quality of the workforce is addressed by the accreditation of public health programs and schools by the Council on Education for Public Health (CEPH); the core competencies project developed by the Public Health Foundation's (PHF) Council on Linkages Between Academia and Public Health Practice; and the certification of individual public health professionals by the National Board of Public Health Examiners (NBPHE). The quality of policies, services, and programs in public health organizations is addressed by the accreditation of state and local public health departments by the Public Health Accreditation Board (PHAB). Data that are needed to assess and improve public health system performance are continually being developed, and some important sources of evidence-based public health are listed earlier in this chapter (under "Sources of Evidence-Based Public Health"). One that we will discuss later is the report card initiative.

The organizations involved in improving public health performance are private, nonprofit entities, supported by members and organizations, chief among them are the American Public Health Association, the Association of Schools and Programs of Public Health (ASPPH), and the Association for Prevention Teaching and Research. The Association of State and Territorial Health Officials, the National Association of County and City Health Officials, the National Association of Local Boards of Health, and the National Indian Health Board have also been heavily involved with accreditation of health departments. Several private foundations have been committed to improving public health performance through these initiatives, including the Robert Wood Johnson Foundation, the American Legacy Foundation, the Foundation to Advance Public Health through Certification, and the Josiah Macy, Jr. Foundation. Each certification—individual, educational program, and public health organization—is voluntary at this time, although CEPH accreditation confers many benefits on schools and programs of public health and their graduates.

Council on Education for Public Health

The CEPH is one of the oldest of the initiatives. CEPH is "an independent agency recognized by the U.S. Department of Education to accredit schools of public health and certain public health programs offered in settings other than schools of public health" (CEPH, 2013, para. 1). These schools and programs prepare students for entry into careers in public health. The primary professional degree is the Master of Public Health (MPH), but other masters and doctoral degrees are offered as well. The goal of the Council is "to enhance health in human populations through organized community effort" (CEPH, 2013, para. 6).

The Council's focus is the improvement of health through the assurance of professional personnel who are able to identify, prevent, and solve community health problems. The Council's objectives are:

1. To promote quality in public health education through a continuing process of self-evaluation by the schools and programs that seek accreditation;
2. To assure the public that institutions offering graduate instruction in public health have been evaluated and judged to meet standards essential for the conduct of such educational programs;
3. To encourage—through periodic review, consultation, research, publications, and other means—improvements in the quality of education for public health. (CEPH, 2013, para. 6)

CEPH evaluates the curriculum of programs and schools of public health, which must contain five core areas (biostatistics, environmental health sciences, epidemiology, health policy and management, and social and behavioral sciences) and seven crosscutting areas (communications and informatics, diversity and cultural proficiency, leadership, professionalism and ethics, program planning and assessment, public health biology, and systems thinking).

As of the writing of this book, there were 51 accredited schools of public health and 102 accredited programs in public health, mostly in the United States (CEPH, 2013).

Core Competencies for Public Health Professionals Project

The PHF has developed a set of core competencies for public health professionals through its Council on Linkages Between Academia and Public Health Practice. The most recent version of the core competencies has three tiers, which differentiate the skills needed by entry-level individuals, individuals with management and/or supervisory responsibilities, and senior-level managers and/or leaders of public health organizations. There are eight skill domains within the core competencies: analytical/assessment; policy development/program planning; communication; cultural competency; community dimensions of practice; public health sciences; financial planning; and management. Core competencies are used by educational

programs to build their curriculum and by public health organizations to identify their workforce needs. As of writing this book, the Council on Linkages is in the process of reviewing and revising the Core Competencies (PHF, 2014).

National Board of Public Health Examiners

The NBPHE was established in 2005 as an independent organization to make certain that students and graduates from CEPH-accredited schools and programs of public health have mastered the knowledge and skills required by contemporary public health. To this end, the NBPHE has administered the Certified in Public Health (CPH) exam each year, beginning in 2009. In addition to developing, administering, and scoring the exam, the NBPHE prepares students to take the exam through study guides and study sessions. The CPH exam is another method of ensuring the quality of the public health workforce.

The goals of credentialing are to:

- Increase recognition of the public health professions
- Raise the visibility of public health
- Set standards of knowledge and skills in public health
- Foster environment of a professional community
- Encourage life-long learning (NBPHE, 2014, para. 2)

To be eligible for the CPH exam, applicants must have a graduate-level degree from a CEPH-accredited school or program of public health. CPH professionals are required to obtain 50 hours of continuing education every 2 years and to complete a reassessment every 10 years. The CPH exam covers the core areas of knowledge in CEPH-accredited schools and programs and is based on the Master of Public Health competencies. There were 558 persons in the Charter Class of Certified in Public Health Examinees (NBPHE, 2014).

Public Health Accreditation Board

The newest accrediting body for public health is the PHAB, whose goal is "to improve and protect the health of every community by advancing the quality and performance of public health departments" (PHAB, 2014, para. 1). State and local health departments are the target for this accreditation initiative:

> The goal of the accreditation program is to improve and protect the health of every community by advancing the quality and performance of public health departments. Accreditation standards define the expectations for all public health departments that seek to become accredited. National public health department accreditation has been developed because of the desire to improve service, value, and accountability to stakeholders. (PHAB, 2014, para. 1)

The initiative to accredit local health departments originated with the groundbreaking report, *The Future of Public Health*, which was sponsored by the Institute of Medicine (IOM, 1988). The report galvanized public health with a study that had been in the making for 10 years after the IOM assessment that there was a "deplorable lack of reliability, even availability, of an identifiable local component of the public health system in many parts of the country and an unexplainable variability in configuration and performance in the rest of the country" (Tilson, 2008, p. xv). Tilson has written an excellent summary of the history of public health accreditation, part of which is repeated in the following:

> The IOM committee reframed the mission of public health as "fulfilling society's interest in assuring conditions in which people can be healthy" (8, p. 7). And the committee created a new conceptual framework with which to comprehend the scope of public health's activities as core functions at all government levels: assessment, policy development, and assurance. Into that landmark IOM report a prior thread was woven to strengthen the fabric. *The Model Standards for Community Preventive Health Services* (1) were recognized as providing necessary materials with which to weave this new cloth.
>
> These standards, in turn, had undergone a ten-year development process under the leadership of the Centers for Disease and Prevention (CDC). They were initiated at CDC in response to the public health delivery system's failure in the United States to respond adequately or coherently to the substantial challenges in a short-notice nationwide immunization initiative against swine influenza in 1976. For each of the major content areas of public health practice, indicators recognizable and countable in any local community were identified through a consensus process deriving from the same leadership organizations now working together on accreditation. As model standards, the proposal outlined the challenges to the local community using an open-ended, fill-in-the-blanks approach to modeling: By 19xx, the rate of problem Y will not exceed (or will be reduced to) Z. In association with the Healthy People 2000 undertaking, an effort at depicting benchmarks, the project developed either national averages or synthetic composite metrics from multiple reporting jurisdictions about each of the objectives in the *Model Standards*, now still part of the Healthy People publications. . . . The IOM and many other advocates saw that accreditation could be done in such a way as to recognize local unique situations but still achieve the dual purposes of accountability and continuous process improvement. They based this position on what they observed to be a breakthrough concept, the National Public Health System Performance Standards, which "provide a way to conceptualize the system as the unit of accreditation and, from there, to evaluate the role of the agencies in facilitating the work of the system." (Tilson, 2008, p. xvi)

The current accreditation program administered by the PHAB has three core components: domains, standards, and measurements. Domains are the competencies and broad areas of responsibility for a health department and are based on the 10 essential public health services, National Public Health Performance Standards System (NPHPSS), the NACCHO Operational Definition, and others. "Standards are expected levels of performance that reflect a specific responsibility within a domain. For example, the NPHPSP (local level) has 32 model standards for its 10 domains. A measure consists of a metric to assess the extent to which a standard is met. Each standard can have one or more measures that reflect a specific level of performance achievement and skill competency" (Bialek, Duffy, & Moran, 2009, p. 54).

Eligible applicants for PHAB accreditation are "any government entity with primary legal responsibility for public health in a state, territory, and tribe or at the local level" (PHAB, 2014). The domains are:

1. Conduct and disseminate assessments focused on population health status and public health issues facing the community.
2. Investigate health problems and environmental public health hazards to protect the community.
3. Inform and educate about public health issues and functions.
4. Engage with the community to identify and address health problems.
5. Develop public health policies and plans.
6. Enforce public health laws.
7. Promote strategies to improve access to health care services.
8. Maintain a competent public health workforce.
9. Evaluate and continuously improve processes, programs, and interventions.
10. Contribute to and apply the evidence base of public health.
11. Maintain administrative and management capacity.
12. Maintain capacity to engage the public health governing entity.

Report Card Initiatives

The report card initiatives can be viewed as outcome evaluations of the public health system as a whole. They collect, organize, and present information about the outcomes that are central to the public health system: population health status, morbidity, and mortality. These indicators are used in macro-level performance evaluations of such areas as cities, counties, regions, states, and nations. We assume the impact of public health care on these rates even though we are not directly measuring exposure to any specific public health service, program, or initiative among the population considered. If, for example, an infectious disease-specific mortality rate is higher in one region than another, we assume that the public health system (and health care system) has not been optimal in the region with the higher mortality rate.

The initiatives discussed here are Healthy People, state report cards, and America's Health Rankings.

Healthy People

Healthy People, the health-promotion and disease-prevention agenda for the United States, sets health objectives for the nation, monitors progress toward achieving those objectives, and issues regular reports on the results. Healthy People has been a highly influential initiative for assessing the health of the nation and, by implication, the performance of the public health system. The Healthy People initiative acknowledges that even though the agenda is national, the improvements will come through local actions, which will then affect the state, regional, and national outcomes reports.

The history of Healthy People spans 3 decades (CDC, 2010a; 2010b). The initiative is an outgrowth of *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention* (Office of the Assistant Secretary for Health and Surgeon General, 1979), a document presenting quantitative goals to reduce preventable death and injury by 1990. In 1980, the U.S. Public Health Service released a companion report, which contained specific, quantifiable objectives to achieve the Healthy People goals. Since then, the U.S. Department of Health & Human Services (DHHS) has updated these national health promotion and disease prevention goals and objectives each decade in Healthy People 2000 (IOM, 1990) and Healthy People 2010 (DHHS, 2000).

The goals of the first Healthy People initiative were to reduce mortality among four age groups—infants, children, adolescents and young adults, and adults—and increase independence among older adults. There were 15 priority areas and 226 objectives. Healthy People 2000 had three overarching goals: to increase years of healthy life, reduce disparities in health among different population groups, and achieve access to preventive health services. There were 22 priority areas, with 319 supporting objectives. Healthy People 2010 had two overarching goals: to increase quality and years of healthy life and to eliminate health disparities, which served to guide the development of objectives that would be used to measure progress. There were 28 focus areas (changed from priority areas) and 467 objectives. Healthy People 2020 has four goals: to attain longer, healthier, and higher-quality lives; to eliminate health disparities; to create environments both social and physical that promote good health; and to promote healthy lifestyles across all life stages. These goals reflect the state of the United States, which has an aging population and many health disparities. Healthy People 2020 contains 42 topic areas with a total of 1,200 objectives. This is by far the most ambitious Healthy People initiative yet, with far more objectives than any years and 13 new topic areas, which include Older Adults and Lesbian, Gay, Bisexual, and Transgender Health. The process of selecting priority/focus areas for Healthy People has become more participatory over time.

> The process for creating objectives evolved from one that was largely expert-driven with opportunities for feedback from the public (for the 1990 Health Objectives), to one that emphasized public engagement, feedback, and participation throughout the development process (for Healthy People 2010). Emphasis on public participation has continued in the two-phased process for developing Healthy People 2020. (DHHS, 2013, para. 3)

The CDC's National Center for Health Statistics (NCHS) is responsible for monitoring Healthy People objectives using its own and other data sources. As a result, there is a great deal of dependence on the data collected at state and local levels from government and nongovernment organizations. The NCHS makes data available through DATA2010, an interactive database system accessible through the NCHS website, and the CDC WONDER system. The online *Tracking Healthy People 2010* publication informs that effort. This report includes technical information on general data issues and major data sources, detailed definitions for each objective, and additional resources (DHHS, 2013).

Healthy People has become a strategic management tool for the federal government, states, communities, and many private sector partners:

> To date, 47 States, the District of Columbia, and Guam have developed their own Healthy People plans. Most states have emulated national objectives, but virtually all have tailored them to their specific needs. A 1993 National Association of County and City Health Officials survey showed that 70 percent of local health departments use Healthy People 2000 objectives. Within the Federal Government, Healthy People provides a framework for measuring performance in the Government Performance and Results Act. Success is measured by positive changes in health status or reductions in risk factors, as well as improved provision of services. Progress reviews are conducted periodically on each of the 22 priority areas and on population groups, including women, adolescents, people with disabilities, and racial/ethnic groups. Healthy People objectives have been specified by Congress as the metric for measuring the progress of the Indian Health Service, the Maternal and Child Health Block Grant, and the Preventive Health and Health Services Block Grant. Ongoing involvement is ensured through the *Healthy People Consortium*—an alliance of 350 national membership organizations and 300 state health, mental health, substance abuse, and environmental agencies. (Healthy People 2000, 2010)

As with all initiatives, Healthy People has encountered challenges and been the target of criticisms. Criticisms include its printed format that constrains usability; the extensive list of objectives that is hard to manage; a disease-specific approach to organizing objectives that has not encouraged crosscutting collaboration around risk factors; lack of transparency about target-setting methods for specific objectives; and lack of data to assess progress.

Several criticisms about Healthy People seem inappropriate, including lack of progress or slow progress in achieving objective targets; inadequate guidance on how to achieve the objectives; and lack of guidance to users in setting priorities. As a report card system, it can be argued that the Healthy People initiative is not responsible for achieving the targets. Rather, the public health system, as a whole, is accountable for progress toward Healthy People objectives.

Table 6.4 contains summary information about the nation's progress toward achieving Healthy People objectives. There was a greater success in achieving 1990 objectives than those in 2000 or 2010 (midcourse)—32%, 21%, and 6% achieved, respectively. Also note that 40% of the 2010 objectives could not be assessed, because of insufficient tracking data.

Healthy People has raised awareness—as all good report cards do—about the public health problems that we have, the progress that we have made toward solving them, and the problems that remain unsolved, and, therefore, are in need of continued attention and action. Healthy People results show, especially, that we have not been able to eliminate health disparities between White and minority populations at the community level (DHHS, 2014). Although health care has been proposed as the solution to health disparities, the ecological orientation of public health tells us that health care alone will not eliminate them. "Health disparities, however, are multidimensional, complicated issues that cannot be addressed through the provision of health care alone. Health disparities are rooted in fundamental social structure inequalities" (Aday, 2005, p. 241).

State Report Cards

Many states and local health departments provide report cards on their progress and a report of the status in that geographical area. An example is New York State, which has report cards for the state and its counties. The

TABLE 6.4 MOST RECENT DATA ON ACHIEVEMENT OF PAST HEALTHY PEOPLE OBJECTIVES

MOST RECENT DATA SOURCE	OBJECTIVES/ TARGETS	ACHIEVED TARGET	TOWARD TARGET	REGRESSED FROM TARGET	DATA UNAVAILABLE
1990 Health objectives *(Final review, NCHS, 1992)*	226 objectives, 266 targets[a]	32%	34%	11%	23%
Healthy People 2000[b] *(Final review, NCHS, 2001)*	319	21%	41%	17%	10%
Healthy People 2010[c] *(Final review, NCHS, 2012)*	969	17.5%	17.5%	36%	24%

Note: NCHS, National Center for Health Statistics; DHHS, U.S. Department of Health & Human Services.
[a] All percentages for the 1990 Health objectives reflect attainment of the 266 measured *targets*.
[b] Percentages for Healthy People 2000 objectives do not add up to 100% in this table because 11% of objectives (35) that showed mixed progress have been excluded.
[c] Percentages for Healthy People 2010 objectives do not add up to 100% in this table because 5% of objectives (39) that showed no progress have been excluded.

Community Health Assessment Clearinghouse is a "one-stop" resource for community health planners, practitioners, and policy developers.

Data

- County Health Assessment Indicators (CHAI; updated October 2013)
- County Health Indicators by Race/Ethnicity (CHIRE; revised October 2013)
- County Health Indicator Profiles (updated August 2013)
- Data for states, including New York
- National public health data sets

How-To Guide

- New York State Community Health Assessment Guidance Documents
- 10-step assessment process with worksheets

Examples

- U.S. sources of evidence-based public health
- International sources of evidence-based public health
- Promising Practices Resources
- Community health assessments and report cards

See New York State Department of Health (NYS DOH) website for additional information at www.health.state.ny.us/statistics/chac/index.htm

America's Health Rankings™

America's Health Rankings is a 24-year-old report card initiative that ranks each state on health outcomes and health determinants for the purpose of helping localities, counties, states, and regions make decisions about how to improve population health.

> The ultimate purpose of the America's Health Rankings™ report is to stimulate action by individuals, elected officials, health care professionals, public health professionals, employers, educators, and communities to improve the health of the population of the United States. We do this by promoting public conversation concerning health in our states, as well as providing information to facilitate citizen, community, and group participation. We encourage participation in all elements: behaviors, community and environment, clinical care, and policy. Each person individually, and in [his or her] capacity as an employee, employer, educator, voter, community volunteer, health care professional, public health professional, or elected official, can contribute to the advancement of the healthiness of [his or her state]. Proven, effective, and innovative actions can improve the health of people in every state, whether the state is ranked first or 50th. (America's Health Rankings™, 2013)

The initiative is a joint project of the United Health Foundation, the American Public Health Association, and Partnership for Prevention.

The model used by America's Health Rankings is reproduced in Figure 6.1. It is an ecological model that includes behaviors, policy, health care, and the community and other environments. Table 6.5 contains the measures that are included in each state's scores.

As an example, Table 6.6 contains information from America's Health Rankings for 2013. The top five– and bottom five–ranked states on premature death are listed, along with their rankings on other measures including socioeconomic indicators, health behaviors, medical care, and public health funding. There is a general tendency for the states to be similarly ranked on premature death and other indicators. With a few exceptions, the top 5 are ranked higher than 15 and the bottom 5 are ranked lower than 35. Public health funding is the least associated with premature death, however.

Another table demonstrates the variation within states (see Table 6.7). Information about the county-level indicators was obtained from the Population Health Institute at the University of Wisconsin (2013). States ranked high by America's Health Rankings on overall health such as Vermont, Massachusetts, and New Hampshire have counties that are doing poorly. Likewise, states that are poorly ranked, such as Mississippi, Alabama, and Louisiana, have some counties that are doing well. These findings point to the importance of community-based efforts to improve health in the nation and to the disparities that exist between populations and regions.

County Health Rankings

The Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute worked as partners to create the County Health Rankings & Roadmaps program (County Health Rankings, 2013). The program focuses on determinants of health and provides health rankings for almost every county in America. It builds on the efforts of America's Health Rankings, and is based on the idea that population health outcomes, such as mortality

FIGURE 6.1 Components of health.

Source: America's Health Rankings™ (2009). A call to action for individuals and their communities. Minnetonka, MN: United Health Foundation.

TABLE 6.5 AMERICA HEALTH RANKINGS, CORE MEASURES

BEHAVIOR	CLINICAL CARE
Prevalence of smoking	Prenatal care
Prevalence of binge drinking	
Prevalence of obesity	
High school graduation	Primary care physicians
Sedentary lifestyle	Preventable hospitalizations
Community and Environment	**Outcomes**
Violent crime	Poor mental health days
Occupational fatalities	Poor physical health days
Infectious disease	
Children in poverty	
Air pollution	
	Geographic disparity
	Infant mortality
	Cardiovascular deaths
	Cancer deaths
	Premature death
	Diabetes
Public and Health Policies	
Lack of health insurance	
Public health funding	
Immunization coverage	

Source: America's Health Rankings™ (2009).

and morbidity, are influenced by health factors and policies and programs. The health factors included in the rankings formula include:

- Health behaviors
  - Tobacco use
  - Diet and exercise
  - Alcohol use
  - Sexual activity
- Clinical care
  - Access to care
  - Quality of care
- Social and economic factors
  - Education
  - Employment
  - Income
  - Family and social support
  - Community safety

TABLE 6.6 FIVE OVERALL HIGHEST- AND FIVE OVERALL LOWEST-RANKED STATES IN 2012, WITH RANKINGS ON OTHER SELECTED DETERMINANTS

TOP 5 STATES OVERALL	OBESITY	SMOKING	DIABETES	PHYSICAL INACTIVITY	BINGE DRINKING	PREMATURE DEATH	PUBLIC HEALTH FUNDING	CHILDREN IN POVERTY	IMMUNIZATION COVERAGE
1. Vermont	13	11	4	5	27	2	3	15	11
2. Hawaii	2	3	11	6	43	18	1	14	9
3. New Hampshire	16	17	15	11	30	3	36	1	25
4. Connecticut	7	5	19	22	21	5	27	9	2
5. Minnesota	15	11	3	8	44	1	48	7	6
BOTTOM 5 STATES OVERALL	**OBESITY**	**SMOKING**	**DIABETES**	**PHYSICAL INACTIVITY**	**BINGE DRINKING**	**PREMATURE DEATH**	**PUBLIC HEALTH FUNDING**	**CHILDREN IN POVERTY**	**IMMUNIZATION COVERAGE**
46. South Carolina	42	39	49	39	8	42	31	48	31
47. West Virginia	48	49	48	48	2	49	4	42	48
48. Arkansas	44	48	44	44	5	45	18	46	22
49. Mississippi	50	46	50	50	6	50	33	41	38
49. (TIE) Louisiana	49	45	46	47	9	47	13	49	7

TABLE 6.7 THREE HIGH AND THREE LOW RANKED STATES ON PREMATURE DEATH, WITH SELECTED HEALTH DETERMINANTS BY COUNTY

SELECTED COUNTIES RANKED ON OVERALL HEALTH	POOR OR FAIR HEALTH	ADULT OBESITY	COLLEGE DEGREES	CHILDREN IN POVERTY PARENT	SINGLE-PARENT HOUSEHOLDS	UNINSURED ADULTS
TWO HIGHEST- AND TWO LOWEST-RANKED COUNTIES ON SELECTED INDICATORS						
1. Vermont						
Chittenden	8%	19%	45%	8%	9%	12%
Addison	10%	21%	30%	10%	8%	13%
Orange	12%	26%	30%	14%	8%	15%
Essex	17%	25%	15%	21%	9%	16%
3. Massachusetts						
Nantucket	7%	20%	42%	5%	7%	20%
Norfolk	9%	19%	47%	6%	6%	10%
Hampden	15%	26%	24%	25%	12%	12%
Suffolk	17%	21%	37%	28%	11%	15%
5. New Hampshire						
Grafton	10%	23%	34%	10%	8%	14%
Rockingham	10%	23%	36%	6%	7%	10%
Sullivan	12%	27%	25%	12%	10%	13%
Coos	17%	27%	17%	17%	9%	12%
47. Louisiana						
St. Tammany	14%	26%	30%	15%	9%	23%
Lafayette	16%	25%	28%	22%	12%	22%
Madison	21%	33%	13%	49%	16%	14%
East Carroll	20%	34%	14%	56%	18%	12%
48. Alabama						
Shelby	11%	28%	39%	9%	7%	13%
Baldwin	13%	25%	26%	15%	9%	21%
Greene	20%	44%	12%	44%	16%	15%
Lowndes	N/A	40%	12%	43%	15%	15%

SELECTED COUNTIES RANKED ON OVERALL HEALTH	POOR OR FAIR HEALTH	ADULT OBESITY	COLLEGE DEGREES	CHILDREN IN POVERTY PARENT	SINGLE-PARENT HOUSEHOLDS	UNINSURED ADULTS
TWO HIGHEST- AND TWO LOWEST-RANKED COUNTIES ON SELECTED INDICATORS						
50. Mississippi						
DeSoto	16%	32%	20%	11%	11%	20%
Rankin	17%	29%	28%	14%	10%	19%
Tallahatchie	37%	36%	12%	40%	16%	16%
Holmes	25%	42%	12%	51%	22%	13%

N/A, Not available.
Source: Population Health Institute (2013).

- Physical environment
  - Environmental quality
  - Built environment

In addition to the health rankings, the program also develops County Health Roadmaps, which help people make changes in their community to improve people's health. The roadmaps consist of three pieces, which include how to take action to improve your community's health, how to use the rankings data, and how to find evidence-based programs and policies that work. The roadmaps emphasize connecting people from different communities to learn what works from each other. The program also provides grants to both local and national organizations to improve the health of communities.

The County Health Rankings and Roadmaps program has helped empower people to understand what challenges people living in their county or community face and ways they can address these issues through specific, easy-to-understand, and up-to-date data. Community members, public policymakers, and businessmen can use the rankings to support their efforts to improve health in their county and to connect to and learn from other communities that have been successful (County Health Rankings, 2013).

Effectiveness and Equity of Public Health System

In the following section, we develop an informal report card for the U.S. public health system by comparing population-level indicators across countries and within subgroups of the United States. Although these indicators are not specific to any one public health program, service, or policy, we assume the overall impact of the public health system on two of the performance criteria—effectiveness and equity—is reflected in these measures.

Life Expectancy and Age-Adjusted Mortality

As an example of how population-level outcomes are used to assess public health performance, consider the case of life expectancy and age-adjusted mortality rates. Life expectancy can be used as an assessment measure in at least two ways. First, we can compare the life expectancy in one society to life expectancy in another. Second, we can compare life expectancies among subgroups within one society. In the first case, life expectancy rates indicate that the United States has a problem with public health effectiveness. In the second case, life expectancy rates indicate that the United States has a problem with equity.

First, we consider life expectancy in the United States compared to other nations. In 2004, WHO comparisons of 13 peer countries indicated that the United States ranked 10th out of 13 in life expectancy at birth for males, and 12th out of 13 in life expectancy at birth for females (WHO, 2006b). These countries are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Japan, The Netherlands, Spain, Sweden, the United Kingdom, and the United States. Next, we examine life expectancy and age-adjusted mortality among subgroups within the United States. There are significant differences among population subgroups (Adler, Boyce, Chesney Folkman, Syme, 1993; IOM, 2003; Pappas, Queen, Hadden, & Fisher, 1993). In 2002, the projected life expectancy at birth for U.S. residents was 77.3 years (U.S. Census Bureau, 2005, Table 96). For men, it was 74.5 years; for women, 79.9 years. These numbers were all up from those observed in 1990, respectively, 75.4, 71.8, and 78.8. In 2002, the age-adjusted death rate was 8.5 per 1,000 population: 10.1 for males and 7.2 for females (U.S. Census Bureau, Table 99). (Age adjustment statistically accounts for the fact that life expectancy from birth is shorter for males than for females.) Again, this was an improvement over 1990, when the age-adjusted death rate was 9.4 per 1,000 population, 12.0 for males and 7.5 for females. In 2002, there was a marked difference in life expectancy at birth by race: 75.1 for White males and 68.8 for African American males (U.S. Census Bureau, Table 98). Similarly, White females had a life expectancy at birth of 80.3 compared to 75.6 for African American females. The age-adjusted death rate for White males in 2002 was 9.9 per 1,000 population, and for African American males it was 13.4 (U.S. Census Bureau, Table 99). White females had an age-adjusted mortality rate of 7.0 compared to that of African American females with 9.0. The difference in life expectancy and mortality between Whites and African Americans is thought, in part, to reflect differences in the standard of living, as well as access to health services (Geiger, 1996; IOM, 2003; Schwartz, Kofie, Rivo, & Tuckson, 1990).

Quality of Life-Adjusted Measure

The WHO (2006b) comparisons of the United States to 12 peer countries indicate, once again, that the U.S. population is not as healthy as we would expect, again indicating a problem with effectiveness. In 2002, HALE at birth for males was 67.2 years in the United States, the lowest-ranked country of the 13. Japan was ranked first (72.3 years). For HALE at birth for females, the United States

was ranked 12th out of 13 in 2002. In 2002, the age standardized DALY per 100,000 population for all causes of death was higher in the United States than in any of its 12 peer countries (12,781/100,000 population). The next-highest DALY was 10,878/100,000 population in Belgium.

Infant, Neonatal, and Maternal Mortality

Comparison of IMRs in the United States to the same 13 peer countries also indicates a problem of public health effectiveness and equity in the United States. In 2004, the U.S. IMR was 6.0 per 1,000 live births (WHO, 2006b). Although this rate is low, it is the highest of the 13 peer countries. In 2000, neonatal mortality was highest in the United States (5 per 1,000 live births) compared to its peer countries, and maternal mortality was third highest (14 maternal deaths per 100,000 live births). The subgroup comparison of infant mortality within the United States also indicates problems. The difference in the IMR in the United States between Whites and African Americans is striking. In 2002, the IMR was 5.8 for Whites and 13.8 for African Americans (U.S. Census Bureau, 2005, Table 105). The African American IMR has been at least double that for Whites since 1915, when the rate was first recorded as 99.9 per thousand overall (Grove & Hetzel, 1968).

SUMMARY

Performance of the public health system can be evaluated at the micro level of programs, policies, and services that are targeted at defined populations, and it can be evaluated at the system level using population health indicators such as IMR, life expectancy, and premature death rate for geographic locales and subpopulations. The criteria for evaluating the public health system, as a

STUDY QUESTIONS

Q: What is evidence-based public health and how does it relate to evidence-based medicine?

Q: What is meant by public health system effectiveness, efficiency, and equity?

Q: How well does the U.S. public health system perform? What measures are you using to evaluate the system?

Q: What organizations collect information on the performance of the U.S. public health system?

Q: Where does the information on performance come from?

Q: What organizations evaluate U.S. public health organizations?

whole, as well as its component programs, policies, and services are effectiveness, equity, and efficiency. There is strong evidence from the report card initiatives that the effectiveness and equity of the system are not satisfactory, and, therefore, the efficiency of the system cannot be acceptable either.

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SEVEN

PUBLIC HEALTH LEADERSHIP

OBJECTIVES

Readers will be able to . . .

1. Define the difference between technical and adaptive leadership and the situations associated with each of those sets of skills.
2. Describe the roles of beliefs and values in adaptive change.
3. Describe the attributes of an extreme leader.
4. Describe the essential steps to change cultural beliefs and values.
5. Describe the role of community engagement to effect adaptive change.

Good leadership is essential for the well-being of any organization, including public health. Public health along with the rest of the health care system in the United States faces major challenges, and change will require exceptional management and extreme leadership skills to effectively transition to meet the health and wellness needs of the nation.

What Is Leadership?

The following phrases have been used to describe leadership:

- The art of mobilizing others to struggle for shared aspirations (Farber, 2009, p. 5)
- Organizing people around a common goal (Farber, 2009, p. 5)
- Sticking your neck out when it's the right thing to do (Farber, 2009, p. 5)
- Living dangerously, often exceeding authority, and withstanding criticism (Heiftez & Linsky, 2002, p. 2)
- Usually lonely
- A process of social influence in which one person can enlist the aid and support of others in the accomplishment of a common task (Chemers, 1997)
- Love, edge (energy), audacity, and proof (LEAP; Farber, 2009, p. 19)
- Leadership is like an extreme sport that involves taking risks (Farber, 2009, p. 19)
- Committed, continually improving leadership skills, outward focused, serving others, interdependent (Assemblies of God, personal communication, March 10, 2013)
- Somebody whom people follow: somebody who guides or directs others (Kirkpatrick & Locke, 1991; Richards & Engle, 1986)
- More committed to achieving key goals versus advancement
- Demonstrating situational perception and action, power, vision and values, charisma, and intelligence

Many of these phrases and traits begin to capture the definition of leader. An extreme leader possesses competencies and skills that are somewhat different from a leader-manager. Many executives are good managers (technical leadership) and yet have an additional set of skills to guide organizations through perilous and confusing times (adaptive/extreme leadership). Knowing when and where to use these various leadership skills requires knowledge of the differences and appropriate judgment to use them effectively. Certain individuals may have many personal qualities that propel them into leadership positions, yet they can enhance their leadership skills, both technical and adaptive, through experiential learning, appropriate training, and mentorship opportunities.

Adaptive/extreme leaders often express the following attributes:

- Technical and adaptive leadership skills matched to organizational needs
- Deeply committed to the organization's beliefs and values
- Leadership by example
- Take appropriate risks
- Willing to commit time and energy to reach the vision, mission, and goals of the organization
- Committed to outcomes versus advancement
- Able to manage fear
- Appropriately audacious
- Delegate authority and responsibility
- Tolerate hostility
- Excellent judgment
- A history of stable leadership beliefs and values
- Accept casualties

Technical/Management Leadership

Responses to organizational challenges often fall into either the technical (management) or adaptive/extreme categories, or both. Technical responses generally result in no significant loss to individuals. The "know how" and procedures are already in place and many times the solution is fairly obvious to an experienced manager. The leader/manager can orchestrate the technical fix with relatively little risk. Technical leadership is relatively comfortable since it doesn't require changes in the deep-engrained cultural beliefs and values of the organization. Technical problems tend to be problems of individuals or small groups versus the organization as a whole.

Adaptive/Extreme Leadership

Adaptive responses cause significant losses associated with changes of the deep beliefs, values, habits, or current way of doing things within the organization. Adaptive problems are often considered crises, though the crises may be either acute or chronic.

The adaptive solution in these situations is not readily apparent and will likely be determined by ideas and recommendations coming from the organizational community, not the leader. A leader can throw all the technical/management ideas/fixes he or she can construct at an adaptive problem and the problem still persists. Adaptive change requires that the organizational community assumes ownership of the problem and resultant solutions. This is the realm of community engagement. The role of the adaptive/extreme leader in this process is not to provide his or her solutions (technical/management) to fix the problem, but to facilitate the organizational community to own their adaptive problem and solutions (true community engagement) no matter how painful the process.

At the beginning of an adaptive process, organizational members fail to see how things will be better, yet they clearly perceive the losses they are being asked to endure; a break from tradition. This loss commonly results in significant resistance to the whole adaptive process and often resistance to the adaptive/extreme leader.

Adaptive change often requires a change in the organization's deep beliefs and values and to abandon these is tantamount to disloyalty to self and those who are deeply committed to those beliefs and values, often people who have committed their lives to the organization and are deeply respected. If leadership caves to organizational pressures to maintain the status quo in an adaptive situation, which often seems to be a reasonable, short-term, easy way out, the adaptive problem persists and the organization's future may be in jeopardy. Adaptive situations are the territory of extreme leaders. They are created to change their world. They are not necessarily easy people to work with since they are passionate, energetic, creative, not afraid to challenge tradition, and willing to take risks that scare the Dickens out of managers. Adaptive/extreme leadership is risky and uncomfortable. It may result in a leader

being ignored or even fired. Adaptive/extreme leadership is not commonly a position that people relish but is desperately needed to solve critical, complex problems.

In many of these complex situations there are both technical and adaptive elements to the solution and the leader must adeptly navigate the organization to appropriate technical and adaptive fixes. Effective leaders must have skills to handle both these situations (technical and adaptive) for the organization's health and well-being.

Leadership and Culture

Behaviors are the result of deeper cultural influences, as represented in the cultural egg (Figure 7.1).

It all starts in the center, with worldview or deep beliefs; concepts of self/humans, nature, the super-nature, and time (past, present, and future). It's upon these deep beliefs that cultures and communities build their values (things they feel are important). These values inform cultural and community institutions like marriage, education, law, governance—and the way communities, organizations, and businesses are run. Finally, all of these deeper layers ultimately emerge as behaviors. This area of behaviors is what public health seeks to impact to improve the wellness and health of a community.

Technical/management solutions generally operate using the deep beliefs and values of the organization but require adjustments at the institutional and behavioral level. So even though there is a change in the way things are being done in the organization, there is also substantial organizational comfort in knowing the worldview/deep beliefs and values are still intact (Figure 7.2).

Adaptive/extreme leadership solutions, on the other hand, almost always require changes in the deep beliefs and values of an organization, the very core of the cultural egg. In other words, the very heart and soul of the organization must be changed (Figure 7.3).

Organizations and their members don't like to change their deep beliefs and values since they sincerely believe that the way they think, feel, and

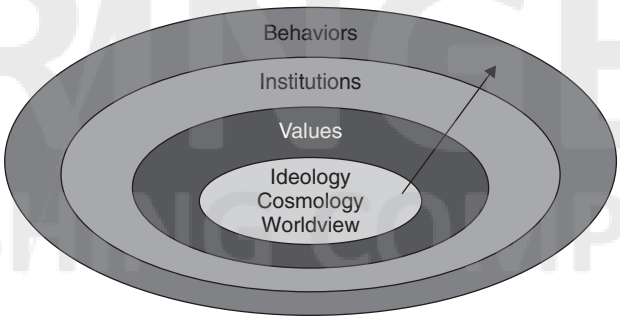

FIGURE 7.1 Cultural egg.
Adapted from G. Linwood Barney's Layers of Culture.

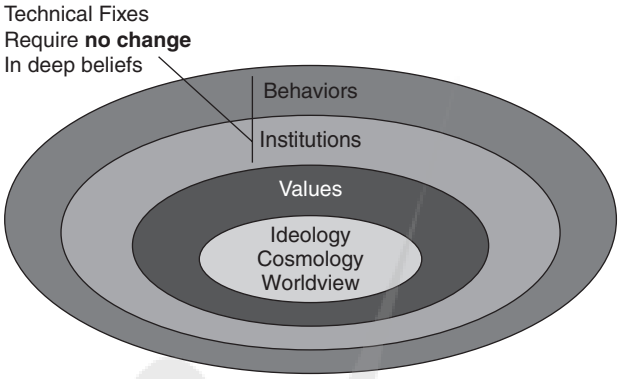

FIGURE 7.2 Technical/management solutions.
Adapted from G. Linwood Barney's Layers of Culture.

believe is the way to think, feel, and believe, and anyone who disagrees is obviously wrong, and therefore they often vigorously resist those changes when suggested.

Leadership by Example

Humans learn through three mechanisms: experience, teaching, and imitation (Hall, 1973). Learning by experience is based on trial and error, making mistakes and corrections. Even though this method is a common way to learn, it can be dangerous and even fatal. A person may learn from personal experience that smoking actually causes cancer after 20 years of smoking cigarettes. Even though that experience can be valuable as an example of the dire consequences of risky behavior for others, his or her personal learning may be too late to prevent the disease. With that example in mind, public health often tries to avoid the trial-and-error method of learning.

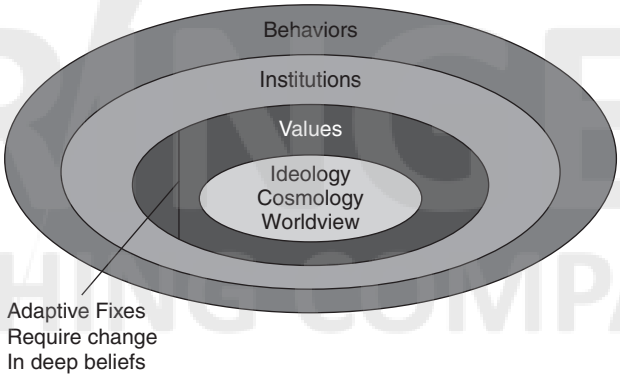

FIGURE 7.3 Adaptive/extreme leadership solutions.
Adapted from G. Linwood Barney's Layers of Culture.

A teacher uses a variety of methods to convince or persuade students to learn. Teaching is most effective when reinforcing, as opposed to contradicting what is being learned through other mechanisms, particularly that through imitation. Hall contends that a great part of culture, including beliefs and values, is learned through imitation, and suggests that if we want to introduce changes, particularly in basic beliefs of a culture, we must introduce or at least strongly reinforce using the imitation model.

An effective adaptive leader must take personal responsibility for his or her actions. He or she must not only embody the beliefs and values of the organization but also practically practice what is preached through his or her behaviors.

> A leader lives under a microscope. I'm not saying it's fair or just, but people watch everything a leader does. Everything. They watch the body language and facial expressions; they listen to the tone of voice; they observe the decisions the leader makes; they listen to the leader's questions and how they're asked. Therefore, the most powerful tool a leader has is himself or herself. (Farber, 2009, p. 22)

Leaders are being watched, and many people in the organization will imitate leaders they respect. It's an awesome responsibility to be a leader by example. It's not just about accomplishing the organization's vision, mission, and goals. During the day-to-day leadership process, leaders are actually training by example the next generation of leaders; part of succession planning for the organization. It has been suggested that leaders should

> Do what you love in the service of people who love what you do. There are three parts (to this statement): 'Do what you love.' Make sure that your heart's in your work, and that you're bringing yourself fully and gratefully into everything you do. If you're not connected to your own work, you can't expect to inspire others in theirs. 'In the service of people' will keep you true, honest, and ethical at the very least. If you're doing what you love, you'll make yourself happy. But extreme leadership is not only about you: it's about your impact on others. 'Who love what you do' doesn't mean that you find people who love you and then serve them: it means it's your responsibility to give everyone you serve something to love about you and what you're doing. (Farber, 2009, p. 60)

Beliefs and Values

Adaptive/extreme leaders are commonly more committed to outcomes than personal advancement. They want to change the world through what they do. Extreme leaders are not those that bolt at the first opportunity for a better-paying job or at the first sign of organizational problems. To the extreme leader a challenging problem is an incredible stimulus to seek a solution, a blast of

heightened awareness and interest, an adrenaline boost to the system. Extreme leaders often run toward problems instead of away from them. This is what they were created for. They find supreme satisfaction in working through difficult challenges. It is who they are. This trait defines them. Yet there is one caveat: This enhanced commitment often stems from the close alignment of the leader's personal beliefs and values with those of the organization. It would be difficult for leaders to accept risks that could ultimately cost them a job or credibility if they didn't deeply believe in the concepts behind the risks. Therefore, before taking a position, a leader should sincerely ask, "How do my beliefs and values align with the organization?" realizing that the answer to that question is the base to his or her level of commitment and ultimately his or her leadership performance in that organization. This alignment of beliefs and values, vision and mission, is much more important than salary or position for an extreme leader that wants to change the world.

Vision

Debuono, Gonzalez, and Rosenbaum (2007) stated:

> Leadership qualities begin with a unique vision—the ability to see the broader social dimensions of what otherwise might be viewed as problems specific to certain individuals or communities. They understand that what might appear at first to be individual conduct cannot be truly understood if that conduct is disconnected from the society in which individuals live . . . Is it possible to acquire long-term vision, or are people born with it? It is true that the ability to see life in its full and broad context has an aspect of personality to it. At the same time, it is possible to learn to see the world against which individual conduct unfolds (p. 204).

Vision is not simply a sensory gift of perception; it is deeply influenced by a leader's beliefs and values, worldview, the glasses through which he or she sees and ultimately interprets the world around him or her.

> Every business book you pick up will tell you that you need to have a vision statement, so any company that's done its required reading will have one. A vision statement doesn't generate energy, love does, great ideas do, principles and values do. A vision statement that comes from a workshop exercise is usually about as energizing and memorable as a saltine cracker.
>
> Vision from the heart is—by definition—an expression of love . . . and not only is that more energizing, it is energy. It's juice . . . Martin Luther King's 'I have a dream' speech was juice for a generation. He didn't have to hand out 250,000 laminated cards at the Lincoln Memorial on that hot August day in 1963. Watch the tape: It was pure energy. Juice. Life itself. This illustrates the love and edge (energy) of the LEAP acronym.

> The extreme leader's job is to connect all the hearts (of an organization). . . Without that heart connection, you may have an employer—employee thing going on, or a bureaucratic boss—subordinate 'relationship.' But people who don't have that heart connection won't try to change the world together. And if you're not trying to change the world, you haven't entered the realm of the extreme leader.
>
> (You establish that heart connection) by revealing yourself as a human being to those you hope to lead. So, instead of reciting a vision statement, feel the intent of that statement, reflect on the ideals that it represents, and take it all into your own heart. Then at every opportunity—whether you're talking one-on-one or standing in front of a crowd—you say, in essence, 'This is who I am, this is what I believe. This is what I think we can do together if we put our hearts into it. Look how magnificent our future can be. Please join me and let's help each other make this happen.' Then you can burn the document (the vision statement) because, in effect, you've become the vision. . . Energy. . . Generated straight from the heart. (Farber, 2009, pp. 71–82)

When the beliefs and values of the organization and leader closely align, leaders are positioned to be extreme leaders in their organizations.

Risk and Fear

An adaptive/extreme leader must be willing to take risks but will only do that if his or her beliefs and values say, "It's worth it."

> It's very easy to say (that taking risks is important), but in business, especially, [this is] very hard to do. The irony is, risk is a natural part of the human experience, and we accept it in many areas of our lives without realizing it. But a lot of businesspeople who call themselves leaders want things to be easy and painless. They're either kidding themselves or lying. (Farber, 2009, p. 15)

Organizations commonly face serious challenges that threaten the whole enterprise. They need capable, committed adaptive/extreme leaders willing to tackle these situations, taking necessary risks, for the survival and growth of the organization.

Risk comes with fear and

> . . . we've been conditioned to believe that fear is bad. And, yeah, fear can save your life or keep you from doing something stupid, but avoiding it can also keep you from doing something great, from learning something new, and from growing as a human being. Fear is a natural part of growth, and since growth, change, and evolution are all on the extreme leader's agenda, fear comes with the territory. (Farber, 2009, p. 21–22)

> So risk and fear are associated with growth, which is what leaders want to do: grow in their ability to lead. It's like growing pains in adolescence. The pain is an indicator of growth: tendons and muscles being stretched by rapidly growing bones, to the point of discomfort. Analogously, taking risks and their associated fears are indicators of leadership growth. No fear, little growth. That is not necessarily a comforting thought, but should be encouraging for an extreme leader in the midst of a proverbial trench with bullets flying overhead: though dangerous and scary, this is the substance of growth.
>
> (Extreme) leadership is always substantive and rarely fashionable . . . It is intensely personal and intrinsically scary, and it requires us to live the ideas we espouse—in irrefutable ways—every day of our lives, up to and beyond the point of fear. (Farber, 2009, p. 19)

Audacity

Audacity is one of the leadership qualities of the acronym LEAP (love, edge, audacity, and proofs). Webster's Thesaurus adds that audacity is synonymous with courage, but in another sense with impudence, temerity, and brazenness. Audacity described by impudence, temerity, and brazenness is often driven by ego and meant to draw attention to the leader where audacity based on heart is courageous; that is, it is the kind of audacity that will change the world (Farber, 2009).

CASE STUDY: AUDACITY AND COURAGE

Tim Wiedrich, the Emergency Preparedness and Response (EPR) Director for the North Dakota Department of Health, received notice of a new federal legal ruling that certain key EPR resources, including key personnel, could only be used for planning and not response. This meant that during an actual emergency the people who designed and knew the most about the EPR systems in the state would need to be either sent home or detailed to other planning activities while others were called in to run the actual response. This did not make sense and was contrary to the whole idea of the cooperative agreements first initiated in 2002. The whole point of EPR funding was to create a system that could "respond" to a variety of disasters (all hazards), including terrorist attacks like 9/11, floods, hurricanes, tornados, train derailments, etc.: not just plan, plan, plan. Tim was courageous enough to kick back against the ruling, spending a number of hours debating, discussing, and persisting in his demands for an appropriate change in this policy not only for North Dakota but the nation. He was committed to changing his world. He stood up for what he believed was right. Sometimes this seemed very lonely, with few of his EPR colleagues standing with him on this issue with federal leaders. Working with others in the Department and the Association of State and Territorial Health Officials through numerous discussions with federal colleagues the policy was changed. Tim's courage to respond and dogged persistence were based on

his beliefs and values (his heart) regarding the whole purpose of the nation's EPR system. Leaders can't be courageous or audacious about issues they don't deeply believe in. It's just not worth the risk if the leader's heart is not in it.

Delegation

Leaders are often confronted with a plethora of technical, adaptive, and complex, mixed problems with only so much time to invest in solutions. "The adaptive process takes an extraordinary level of presence, time and artful communication, but it may also take more time and trust than you have" (Heifetz & Linsky, 2002, p. 52). A reasonable option in a time crunch is to appropriately delegate, if possible, the technical problems to other competent staff, thus freeing an adaptive/extreme leader to focus on the adaptive challenge.

Judgment and Compromise

The intent of any general is to win wars, not just a single battle. Sometimes, the loss of a battle in one situation may actually strategically position an army to win a war. Adaptive/extreme leaders in adaptive situations often encounter this. Ideological polarization may paralyze movement toward real solutions. An extreme leader must see the big picture, how to get from point A to point B, even if it means strategically compromising with opponents on certain issues to get there. This compromising may be interpreted as "caving in"; a sign of weakness by some, even those in the leader's camp. The difficult task of the extreme leader in these scenarios is to somehow facilitate the organization, if possible, to own their adaptive problems and identify optimal solutions to reach the goal, even though it may entail humbling compromise. Sometimes the extreme leader must make that decision alone.

> "The success of extreme leaders often lies in the capacity to deliver news and raise difficult questions in a way that people can absorb, prodding them to take up the message rather than ignore it or kill the messenger . . . Adaptive leadership is an art" (Heifetz & Linsky, 2002, pp. 12–20).

As in art, there is a strong element of judgment in adaptive leadership, in sometimes going beyond one's authority, compromising, and in disturbing people in the organization and yet surviving. Survival in these situations takes exceptional judgment; that is, knowing how far one can push the envelope of disturbing people and not be eliminated in the process.

CASE STUDY: JUDGMENT AND COMPROMISE

In 2005, a bill was introduced to eliminate smoking in all public places in North Dakota. It was clear that the bill in that form would not pass the legislature,

so a compromise was reached exempting bars. Many public health folks were not pleased with any compromise. Yet passage of that compromise bill protected at least 30,000 workers in the state from second-hand smoke. An initiated measure in 2012 completed the work by eliminating smoking in all public places. Many leaders felt the compromise in 2005 was a necessary step to achieve the longterm goal, despite the criticism they received.

Casualties

Leaders would prefer not to think about casualties since it's always uncomfortable, painful, and a situation they want to avoid. Leaders want everyone to agree and work together to make adaptive changes. They realize that there will be conflict and challenges but hope that by using good facilitation techniques everyone will eventually understand and come along as one big happy family. Unfortunately, that generally isn't true. Adaptive change will leave casualties. Sometimes these casualties are close friends: "people who simply will not or cannot go along" (Heifetz & Linsky, 2002, pp. 98–99) with the proposed change. They will need to go. If we are committed to making an adaptive change we must be willing to accept those casualties. This is not easy for leadership but is an all-too-frequent reality for adaptive /extreme leaders.

SUMMARY

Leadership is composed of both technical and adaptive leadership skills. Technical leadership is management. Adaptive leadership is the area of extreme leadership. Leaders, including those in public health, must know when and how to use both of these skill sets for the health and wellness of the organization.

STUDY QUESTIONS

Q: Define the difference between management and extreme leadership.

Q: What are the core cultural forces driving the way people do things, including their institutions and personal behaviors?

Q: How can a leader present vision passionately to his or her organization?

Q: What are the five major steps to changing organizational culture?

Q: Explain the role of horizontal communicators in the community engagement process.

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EIGHT

BUILDING HEALTHY COMMUNITIES

OBJECTIVES

Readers will be able to . . .

1. Describe the three major approaches for changing risky behaviors.
2. Describe the differences between the population-based tools of social marketing and community engagement.
3. Describe the five groups of communities.
4. Describe the nine principles of community engagement.
5. Describe the role of integration in comprehensive worksite wellness.

There is incredible power within local communities to truly build healthy communities, and public health organizations must understand how to tap that power in order to be successful. Since all communities are unique in composition and needs, there is no single model to do that. Rather, healthy communities must be built community by community. Having the tools to facilitate true community engagement is the key to success. Unfortunately, much of what has been done historically in the name of community engagement is actually community coercion (Dwelle & Musumba, 2013).

Many community initiatives start with a single person or organization within the community and blossoms as community members and organizations identify with and discuss perceived needs and solutions at the community level. There are three major approaches to changing risky behaviors: policy, influencing individuals or families in a clinic-like setting, and population-based interventions (see Figure 8.1).

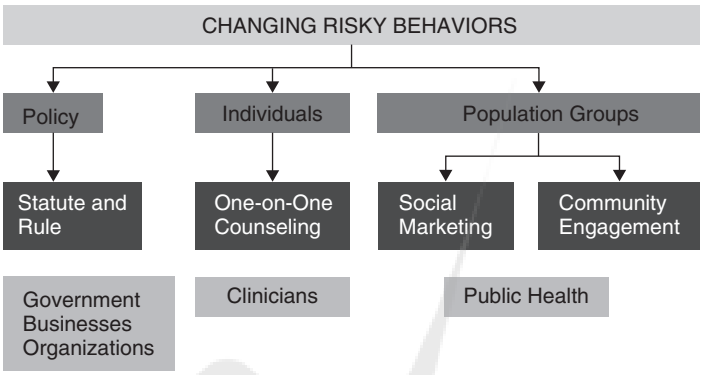

FIGURE 8.1 Changing risky behaviors involves individuals, groups, and policy.
Source: Dwelle and Musumba (2013).

> "Policy developed by local, state and federal governments, businesses, and organizations is an effective tool to encourage healthy behaviors but must be implemented and enforced to be effective. Clinicians are trained in one-on-one counseling, another powerful strategy to encourage the change of risky behaviors. Population-based interventions provide yet another potent behavioral impact and can be divided into two tool subsets; social marketing and community engagement" (Dwelle & Musumba, 2013, p. 35).

Additional elements contributing to building healthy communities are effective local coalitions and community-level integration among policy, clinical, and public health interventions. All of these approaches are important to building healthy communities and must be integrated through more collaboration and partnerships.

Important community policy issues may include those around major risk factors like tobacco, diet and exercise, nutrition, alcohol and substance abuse, and the built environment. There is increasing recognition that the built environment can have a major influence on community health. The built environment includes things like community design and organization to decrease exposure to environmental contaminants, to increase access to healthy foods, to encourage adequate exercise, and to decrease the risk of injury or decrease the risk of violence and crime.

Population-based expertise lies primarily in the discipline of public health. Increased public health investments, especially in low-resource communities, has been associated with decreased mortality from preventable causes of death, including those associated with infant mortality and deaths due to cardiovascular disease, diabetes, and cancer. For each 10% increase in local public health spending, mortality rates fell between 1.1% and 6.9% (Mays & Smith, 2011).

COMMUNITY ENGAGEMENT

Consistent with the World Health Organization's (WHO) definition of health (1946), health is generally defined by most cultures as much more than absence

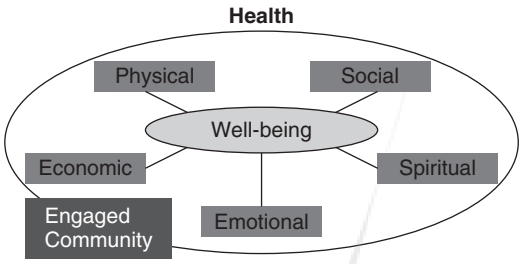

FIGURE 8.2 Engaged communities support individual health.

of disease. It often includes the physical, social, economic, emotional, and spiritual well-being of a person and community.

A major role of active, engaged communities throughout history has been to support and encourage the health and well-being of community members. Some cultures define health as harmony with one's self, others, the supernatural, and the environment. A community's perception of the world, including its definition of health and wellness, stems from the community's deep cultural beliefs (worldview) and values (things deemed important in life). Communities will only express interest and invest their time and resources in issues they feel are important to them (their perceived needs). These community perceptions define the boundaries of community engagement and ownership and are essential for public health professionals working with communities on health issues (See Figure 8.2).

Building sustainable healthy communities requires community ownership. It takes exceptional patience and special community engagement skills and competencies to appropriately facilitate community ownership of problems and solutions as they move from unhealthy behaviors to health and wellness. This approach is often not supported by the rigid requirements and timelines of grants. The special skills of a community engagement specialist include expertise in facilitating group participatory discussions using concepts like LePSA(S) (Learner-centered training which involves three phases: Problem-posing, Self-discovery, and Action). (Lennon & Coombs, 1992) or Open Space Facilitation (Owen, 1993), which fosters group ownership.

To a community engagement facilitator, a community is often much more than a geopolitical area. A true community exhibits the following key characteristics: people who know each other by first name and have a sense of shared responsibility for each other. If these characteristics are met, community engagement concepts can often be used to facilitate community ownership of their problems and solutions.

People are generally members of not just one, but multiple communities. These communities impact how members think, act, and believe, often through the influence of horizontal communicators, also known as opinion leaders or champions. These individuals are most often informal rather than formal leaders and due to their community status can exert exceptional impact on the beliefs, values, institutions, and behaviors of community members. A major goal of a public health community engagement facilitator is to find and engage these horizontal communicators in target communities.

Communities that meet the definition of community can be divided into five general categories, including:

- Rural villages and towns (not larger than 1,000–1,500 people)
- Worksites
- Schools (represent multiple subcommunities)
- Faith-based groups
- Other groups (e.g., Optimists, Rotary, Knights of Columbus, NAACP, etc.)

Fundamental community engagement concepts generally apply to engaging all of these and other communities. Yet there are unique concepts that apply to each group and must be mastered by facilitators to truly engage them. Faith-based communities have a strong belief in the supernatural. A facilitator must understand how to encourage using those deep beliefs to change risky behaviors. In the school community, it is essential to understand the worldview and development of children and youth versus adults. In the worksite, a facilitator must appreciate that impact on the bottom line of the business is always an essential consideration.

Another major concept of community engagement is realizing that a community does not exist in a vacuum within a target area. Community members are commonly members of multiple communities or subcommunities in that area (e.g., churches, school organizations, and worksites). Consistent messages within all the communities to which an individual belongs will usually result in reaching a behavioral threshold more quickly. Therefore, an effective community engagement strategy is to engage as many communities in a target area as possible. Rural target areas can generally use community engagement in all five of these community groups while urban areas are often limited to worksites, faith-based groups, schools, and other organizations.

Community Engagement and Maslow's Hierarchy of Needs

Maslow described a hierarchy of needs that can be further divided into deficiency needs and growth needs (Figure 8.3).

The deficiency needs include physiologic, safety and security, love and belonging, and esteem, where the growth needs fall into the area of self-actualization. In a way, Maslow's hierarchy of needs defines the scope of the determinants of health. Deficiency needs are generally more temporal in nature, focusing on the now, while growth needs relate to longer-term goals and strategies. Public health and community development primarily relate to longer-range goals, therefore falling into the area of self-actualization. Community deficiency needs must be met to a significant degree to release community energy for self-actualization. Therefore, some early community building interventions may need to address the social determinants around deficiency needs first before being able to facilitate community engagement

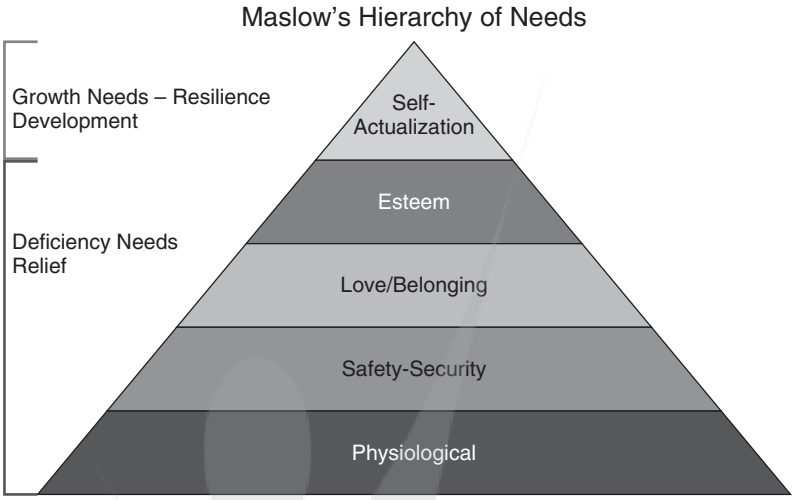

FIGURE 8.3 Maslow's hierarchy of needs.
Adapted from Maslow (1954).

for longer-range goals. Public health must be willing to collaborate, partner, and strategize with key stakeholders to significantly meet the deficiency needs of communities during the community-building process. Many organizations attempt to short-circuit this process, resulting in failure. Transitional strategies are often important to allow adequate time for community infrastructure, political, and policy changes. Progressive change is a necessary part of life and public health indicating healthy growth. As childhood growth is often associated with growing pains, public health growth is also associated with discomfort and sometimes even disapproval from colleagues, friends, the public, and politicians. Public health must always seek to improve the well-being of people using good science, but also use wisdom to design reasonable transitional strategies to reach the goal.

Community Engagement and Social Marketing

Behaviors are the result of deeper influences on individuals from their cultures and communities. Behaviors arise from an individual's worldview, that is, their deep beliefs in four areas (Redfield, 1957):

- Self (humanity)
- Nature
- The supernatural
- Time (past, present, and future)

It is from this worldview that we build our belief systems including ideology or philosophy of life and cosmology (where everything comes from). Values, the things we feel are important in life, are developed based on deep beliefs. It's upon these deep beliefs and values that we build our institutions,

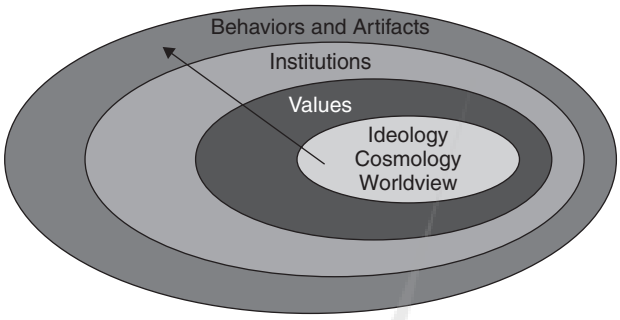

FIGURE 8.4 The cultural egg.

Adapted from Barney GL, "The Supracultural and the Cultural: Implications for Frontier Missions," unpublished manuscript, n.d., 2.

how we do things, including: how we govern ourselves, how we educate our children, how we marry, how we organize and run our businesses, and how we develop our laws. Finally, all of these deeper layers emerge as our behaviors and artifacts. Cultural communications experts strongly suggest that to make permanent changes in the risky behaviors of a society, the underlying beliefs and values that drive those risky behaviors must be changed. This is a major premise of community engagement (see Figure 8.4).

Social marketing has been a major part of health messaging since the 1970s, when Kotler and Zaltman (1971) recognized that tools used to market items could be used to influence health-related behaviors. Social marketing strategy may be described with this statement, "I don't really care what a person thinks, feels, or believes. I just want a change in the target behavior." Social marketing works by relying on things like convincing presentations with good, culturally appropriate messages, and using effective message channels at key times. A common problem with social marketing is permanency of change, since the underlying beliefs and values that ultimately drive risky behaviors are not often addressed with these techniques. Social marketing works at the outer behavioral layer of the cultural egg and is particularly useful in one-time behaviors like immunizations and cancer screenings. It commonly utilizes highly trained communication specialists who are often external to a target community.

Community engagement is the facilitation of communities in the process of problem solving, encouraging communities to own their problems and solutions. Community engagement could be described as "Changes in the beliefs, feelings and thinking of individuals. . . essential for permanent changes of risky behaviors." Community engagement focuses on the center of the cultural egg, the area of worldview, deep beliefs, and values, and as such changes the forces that drive more permanent risky community behaviors. Community engagement requires specialized skills and patience to move at the pace of the community and utilizes the horizontal communication systems within the

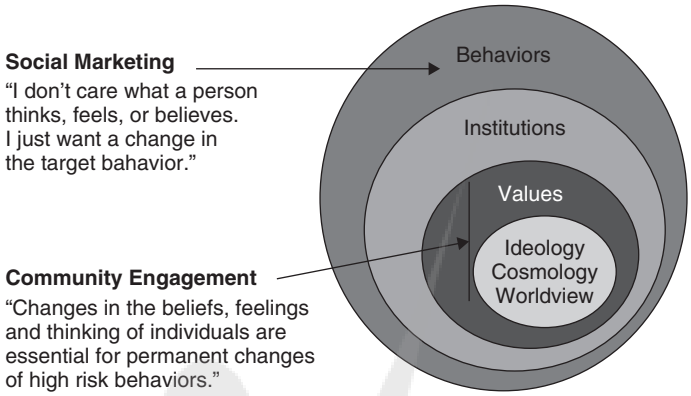

FIGURE 8.5 Community engagement, social marketing, and the cultural egg.
Source: Dwelle and Musumba (2013).

community to reach into the area of beliefs and values that drive risky behaviors (see Figure 8.5).

Principles of Community Engagement

The Centers for Disease Control and Prevention (CDC) identified nine key principles of community engagement (Clinical and Translational Science Awards Consortium, 2011). These principles can be further stratified into three sections: (1) items to consider prior to beginning the engagement process; (2) items necessary for engagement to occur; and (3) items to consider for making engagement successful.

The nine principles of community engagement include:

Items to consider prior to beginning the engagement process:

1. "Be clear about the purposes or goals of the engagement effort and the populations and/or communities you want to engage.
2. Become knowledgeable about the community's culture, economic conditions, social networks, political and power structures, norms and values, demographic trends, history, and experience with efforts by outside groups to engage it in various programs. Learn about the community's perceptions of those initiating the engagement activities."

Items necessary for engagement to occur:

3. "Go to the community, establish relationships, build trust, work with the formal and informal leadership (horizontal communicators), and seek commitment from community organizations (not structures) and leaders to create processes for mobilizing the community.
4. Remember and accept that collective self-determination is the responsibility and right of all people in a community. No external entity should assume it can bestow on a community the power to act in its own self-interest (community engagement versus coercion)."

Items to consider for making engagement successful:

5. "Partnering with the community is necessary to create change and improve health.
6. All aspects of community engagement must be recognized, and respect the diversity of the community. Awareness of the various cultures of a community and other factors affecting diversity must be paramount in planning, designing, and implementing approaches to engaging a community.
7. Community engagement can only be sustained by identifying and mobilizing community assets and strengths and by developing the community's capacity and resources to make decisions and take action.
8. Organizations that wish to engage a community as well as individuals seeking to effect change must be prepared to release control of actions or interventions to the community and be flexible enough to meet its changing needs.
9. Community collaboration requires long-term commitment and patience by the engaging organization and its partners."

Case Studies: Community Engagement

Religiosity and Dietary Beliefs and Behaviors

Lukwago, Kreuter, Bucholtz, Holt, & Clark (2001) conducted a study of African American women from Alabama, St. Louis, and Kansas. They used a scale that they previously developed and validated. Seventy-four percent of the women identified with the Christian faith, 11.8% had no religious group identification, 0.9% were Muslim, 1.7% were Jehovah's Witnesses, and 9.4% were unspecified. The results demonstrated that women who engaged in religious behaviors and/or held strong religious beliefs consumed more fruits and vegetables.

These findings support some association between religious beliefs in African American women in the South and positive dietary habits, particularly regarding fruit and vegetable intake. Another study of White women from the Northwest did not show a similar positive association between religiosity and fruit and vegetable intake, but did show a positive association between religiosity and low-fat dietary behaviors. Observed association between religious beliefs and positive dietary behaviors could suggest an enhanced role for faith-based organizations in health messaging to target communities.

Parent Religiosity and Teens' Transition to Sex and Contraception

The 1997 National Longitudinal Survey of Youth obtained information from sexually inexperienced adolescents aged 12 to 14 years, and looked for the association between parent and family religiosity and transition to first sexual experience and contraceptive use at first sex during the teen years. More frequent parental religious attendance and family religious activities were related

to later timing of sexual initiation but did not translate into improved contraceptive use (Manlove, Terry-Humen, Ikramullah, & Moore, 2006).

Effectiveness of Faith-Based HIV Intervention for African American Women

A large African American church with 25,000 members, 98% of whom were African American, participated in an Emory University study (Wingood et al., 2013). A 10-member Church Advisory Board (CAB) was formed, which included the Director of Pastoral Services, the Co-Director of Health Services Ministries, the Director of the College and Singles Ministry, and members of the church's Women's Ministry. CAB members were able to modify the study as desired to avoid risks to participants and perceived undermining of the churches beliefs and values.

Participants were randomly assigned to either two 3-hour SISTA (Sisters Informing Sisters about Topics on AIDS) or two P4 for Women sessions. HIV testing was provided to all participants. Table 8.1 compares the general content of the SISTA and P4 for Women intervention programs.

Both the SISTA and P4 for Women programs had statistically significant effects on condom use and other sexual behaviors in the previous 90 days. P4 for Women had a statistically significant impact on the number of weeks participants were abstinent and on all measures of religious social capital. P4 for Women was more acceptable to participants than SISTA. Programs like P4 for Women may assist churches in helping African American women change risky behaviors.

COMPREHENSIVE WORKSITE WELLNESS: THE ENGAGED WORKPLACE

Comprehensive worksite wellness provides an excellent opportunity for the integration of public health and primary care. Poor health is bad for business. The costs of health care, reflected in insurance premiums for businesses, have skyrocketed, with up to 50% of company profits currently being spent on employee health care costs. Sixty-seven percent of the United States workforce is overweight or obese, costing businesses $73 billion annually. One hundred fifty-three billion dollars are lost to businesses each year due to absenteeism from workers who are overweight or obese or have associated chronic conditions. Overweight and obese workers miss an additional 450 million work days each year. One in four Americans has heart disease and one in three has high blood pressure (Public Health Institute, 2013).

Poor health impacts the bottom line of the workplace in several ways, including:

- Clinical care—outpatient clinics and hospital costs
- Pharmaceuticals—medications
- Absenteeism—employees absent from work due to poor health
- Presenteeism—employees at work but not performing up to their potential due to poor health

TABLE 8.1 INTERVENTION CONTENT FOR SISTERS INFORMING SISTERS ABOUT TOPICS ON AIDS (SISTA) AND P4 FOR WOMEN

DISCUSSION/ACTIVITIES SESSION CONTENT	SISTA	P4 FOR WOMEN
Session 1: Ethnic and Gender Pride	The joys and challenges of being an African American woman	The values of being an African American Christian woman
	Role models and how they positively influence our lives	The role Christianity has played in the African American community
	Reviewing HIV risk reduction strategies	Promoting sexual abstinence and safer sex
	Personal values clarification	Enhancing norms supportive of sexual abstinence
Session 2: Enhancing Coping and Skills	Enhancing norms supportive of HIV risk reduction	Exploring the use of religious coping (i.e., participation in church ministries and religious activities, talking to peers and leaders within church) to remain sexually abstinent
	Building sexual negotiation, condom use, and partner selection skills	Building sexual negotiation, condom use, and partner selection skills
	Exploring risk levels involved in behaviors	Encouraging HIV and STI testing

Note: STI, sexually transmitted infection. SISTA is a Centers for Disease Control and Prevention, evidence-based HIV intervention for African American women. P4 for Women is a faith-based adaption of SISTA.

A study published by Loeppke and colleagues (2009) demonstrated that 35% of business health care costs were associated with presenteeism, 33% absenteeism, 24% clinical costs, and 8% medications.

Another study by Burton and colleagues (2005) looked at the productivity loss of individuals with a variety of risk factors (e.g., smoking, obesity, inadequate exercise, inadequate diet, stress, etc.) and found a baseline loss of 14.7% for employees having 0 to 2 risk factors. Productivity loss dramatically increased, with the number of risks approaching 83% above baseline, with five or more risk factors (see Figure 8.6). It is highly desirable to identify and reduce risk factors in employees. Risk factor reduction is primary prevention and the major mission of public health in worksite wellness.

A big question for business is if worksite wellness actually works. The answer is yes, if done appropriately. Chapman (2005) conducted a meta-analysis of 56 peer-reviewed articles on worksite wellness. A qualifying worksite wellness program had to have at least three of the following programs:

- Smoking prevention and cessation
- Physical fitness
- Nutrition
- Stress management
- Medical self-care
- High blood pressure control
- Cholesterol reduction
- Cardiovascular disease prevention
- Prenatal care
- Seat belt use
- Back injury prevention
- Back pain prevention
- Weight management
- Nutrition education

In qualifying worksites, absenteeism decreased by 26%, health care costs decreased by 26.1%, and worker's compensation costs decreased by 32% with a benefit/cost ratio of 5.81/1. Even with relatively few interventions, worksite wellness, if done appropriately, significantly impacts the bottom line of businesses.

Seven Steps to Successful Worksite Wellness Programs

Seven steps to successful worksite wellness programs have been identified by the Wellness Council of America, and include:

1. Get management support
2. Create a team
3. Collect data
4. Create an operating plan
5. Choose interventions
6. Create a supportive environment
7. Evaluate

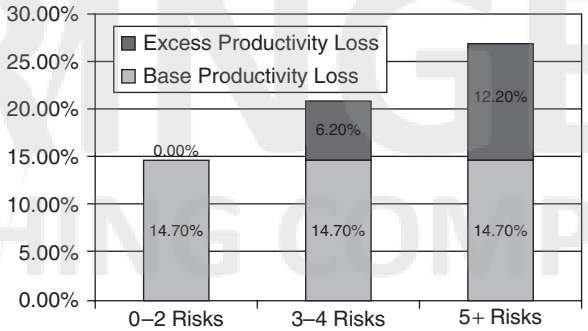

FIGURE 8.6 Employee risk behavior increases productivity loss.
Source: Burton et al. (2005).

Upper- and middle-level management support is absolutely essential, without which the program will fail. A worksite wellness program must help meet the main mission of the business. It must impact the bottom line. A business will not generally do a program just because it is a good thing to do.

A team needs to be developed—a worksite wellness committee—that represents all key groups in the business, including the healthy, those that exercise and those that don't, the disabled, the overweight, and smokers; not just the marathoners. This team ideally must design and run the program if employee ownership is desired. This is key to true community engagement in the workplace.

Collection of data is important. What is not measured is generally not addressed. Important data include:

- Health risk assessments—gives specific individual data and aggregate data for the program
- Health screenings—for example, lipid profiles, blood pressure, blood sugar, body composition, and so forth
- Medical claims data—worker's compensation, disability claims, pharmaceutical costs, and so forth
- Absenteeism records from human resources data
- Perceived needs—manager and employee interest surveys
- Environmental assessments
- Cultural assessments

An operating plan should answer the vision, mission, goals, and objectives of the workplace. Vision is essentially where a workplace wants to be in the future. Mission is what we need to do and why we need to accomplish the vision. Goals and objectives are the detailed steps needed to accomplish the mission. Mission, vision, goals, and objectives set the framework for effective reporting and evaluation.

Programs need to be personalized to health issues and the employees' perceived needs, designing an appropriate mix of awareness, education/motivation, and interventions to meet those needs. Employees will participate in what they feel is important (ownership). Designing a specific worksite wellness program for a business is a major role for the worksite wellness committee.

A supportive environment helps retain employees and establishes policies that encourage healthy choices in areas including physical activity, tobacco use, nutrition, ergonomics, alcohol/substance abuse, mental health, seat belt safety, and other safety and emergency procedures.

A supportive environment needs to consider employee benefits, including:

- Health insurance
- Life insurance
- Sick leave/well days off
- Vacation
- Flex time
- Work at home/telecommuting

- Family leave
- Health promotion programs
- Employee assistance

Cooper Institute suggests that a worksite must invest at least $25 per employee per year to see a return on investment.

Evaluation is essential. It is a key to program success and helps adjust program activities. A facilitator should avoid wasting time on a worksite not committed to a significant evaluation plan. Top elements to measure include:

- Participation
- Satisfaction
- Improvements in knowledge, attitudes, and behaviors
- Biometrics
- Risk factors
- Physical environment/corporate culture
- Productivity
- Return on investment

An effective comprehensive worksite wellness program will be optimally effective if it strategically combines population-based interventions (wellness behavior change) using social marketing and community engagement techniques, along with appropriate clinical interventions (chronic disease management, case management, call-a-nurse, and onsite clinical services). This is a sustainable integration of a public health and primary care model that will significantly impact the fiscal bottom line of businesses (see Figure 8.7).

Meaningful Use and Comprehensive Worksite Wellness

The 2009 Health Information Technology for Economic and Clinical Health Act (HITECH Act) incentivized Medicare and Medicaid programs to encourage physician adoption of electronic medical/health record (EMR/EHR) systems.

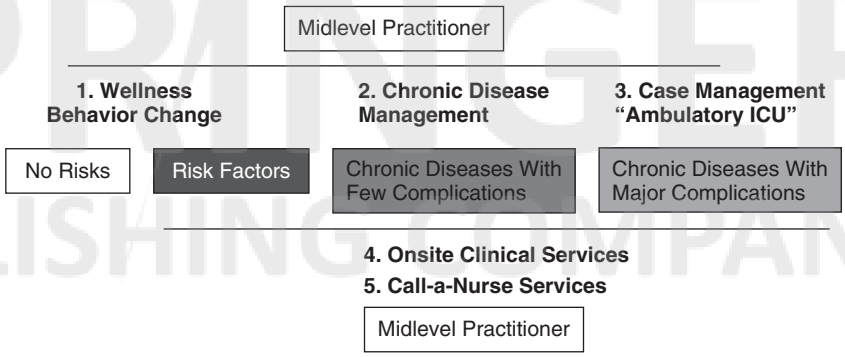

FIGURE 8.7 A comprehensive worksite wellness program.

A "meaningful use" core set of 15 objectives was identified to help guide clinics and clinicians in developing integrated EMR/EHRs including:

1. Provide a computerized provider order entry for medications
2. Provide drug–drug and drug–allergy interaction checks
3. Generate and transmit permissible prescriptions electronically
4. Record patient demographics
5. Maintain an up-to-date problem list of current and active diagnoses
6. Maintain an active medication list
7. Maintain an active medication allergy list
8. Include vital signs
9. Include smoking status
10. Implement one clinical decision support rule and have the ability to track compliance with that rule
11. Calculate and transmit Centers for Medicare & Medicaid Services (CMS) quality measures
12. Provide an electronic copy of health information
13. Provide clinical summaries
14. Exchange key clinical information
15. Provide appropriate privacy and security (Hsiao & Hing, 2012)

Appropriately integrated EMR/EHRs can improve the effectiveness and efficiencies of all aspects of a comprehensive worksite wellness program, including programs that identify and address risky behaviors as well as worksite clinical services integrated with external participating health care systems and networks.

Unfortunately, the United States is generally a long way from appropriately integrating health care data for comprehensive worksite wellness, though some areas of the country have more robust regional and local integration to support business health and wellness.

- In 2012, 72% of office-based physicians used EMR/EHR systems, up from 48% in 2009.
- About 40% of office-based physicians reported having a system that met the criteria for a basic system, up from 22% in 2009.
- In 2012, 66% of office-based physicians reported that they planned to apply, or already had applied, for 'meaningful use' incentives.
- In 2012, 27% of office-based physicians who planned to apply or already had applied for meaningful use incentives had computerized systems with capabilities to support 13 (the first 13 of the above-listed 15 objectives) of the Stage 1 Core Set objectives for meaningful use (Hsiao & Hing, 2012, p. 1).

Case Study: Johnson & Johnson Worksite Wellness Program

The Johnson & Johnson Company created a wellness program in 1978 and reorganized the program in 1995 with a mission to encourage employees to accept responsibility (ownership) for their health and well-being by providing

them and their families with resources and opportunities that would result in healthier lifestyles. To do this, the program focused on the following goals:

- Decrease use of the medical system
- Decrease absenteeism
- Decrease injuries
- Increase morale
- Decrease stress

Key program features included:

- Focus on prevention and education
- Health benefits links
- Targeted health interventions
- Cost-effective health care delivery

A health risk assessment (HRA) was administered via a web-based application to 26,000 employees to identify personal risks and interest in changing risky behaviors. Ninety-eight percent of employees who took the HRA felt it was worthwhile. Online health profiles were developed and updated every 2 years for each participating employee.

Health resources provided to participants included:

- Online action planning guides
- Access to call-a-nurse services
- Access to health coaches
- Access to case management services for high-risk patients
- Linked to $500 benefit incentives

All health and wellness measures together demonstrated a savings of $225 per employee except emergency department costs, which actually increased by $10.87 per person (see Figure 8.8).

There were improvements in risk factors, including cholesterol parameters, fiber diet, exercise, smoking, blood pressure control, seat belt use, and drinking and driving (see Figure 8.9).

Johnson & Johnson saved $8.5 million for approximately 37,000 employees. Health risks improved. High-risk patients receiving case management saved the company approximately $890,000, or $390 per employee per year.

Building Healthy Communities by Integrating Primary Care and Public Health

The main mission of public health is to provide primary population-based prevention services to prevent risk factors associated with disease and death. Secondary and tertiary prevention services are the main mission of clinical institutions. The Institute of Medicine (IOM) in 2012 strongly suggested that enhanced integration of public health and primary care with more true

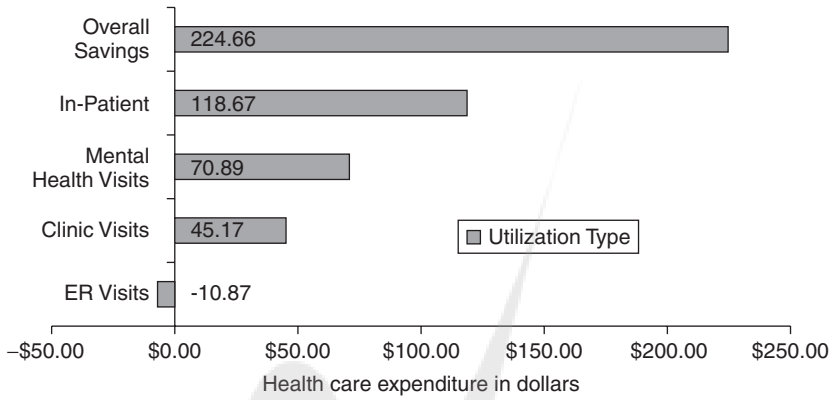

FIGURE 8.8 Health and wellness impact on medical costs and employee health, Johnson & Johnson Worksite Wellness Program.

collaboration and partnerships is essential to building healthy individuals and communities in the future. The IOM expert committee on integration identified a continuum of integration for primary care and public health from isolation to merger (Figure 8.10).

Current integration of public health and primary care primarily rests in mutual awareness and cooperation with less true collaboration or partnership. Integration requires a commitment to an ongoing process and continual dialogue that should lead to greater collaboration, partnerships, and even merging of public health and primary care (IOM, 2012). Public health is well positioned to lead and facilitate that dialogue. The IOM additionally identified essential principles for successful integration, including:

- A shared goal of population health improvement
- Community engagement in defining and addressing population health needs

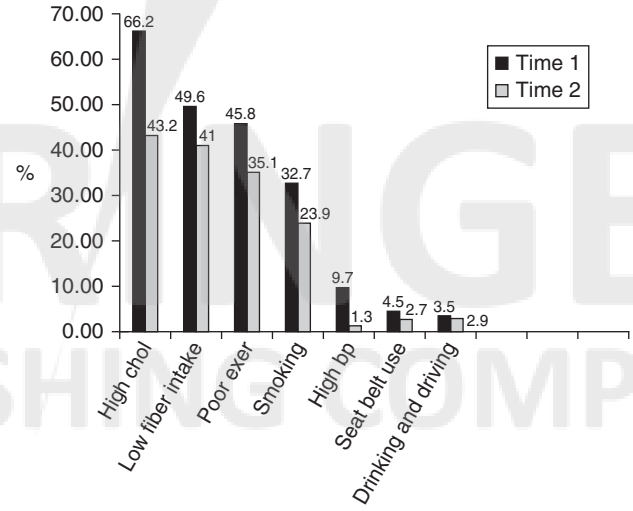

FIGURE 8.9 Health and wellness impact on employee risk factors, Johnson & Johnson Worksite Wellness Program.

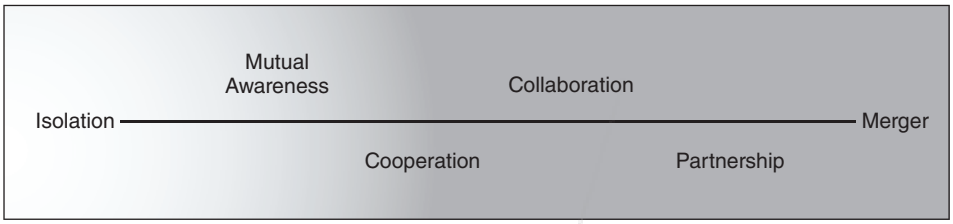

FIGURE 8.10 Degrees of primary care and public health integration.

- Aligned leadership that bridges disciplines, programs, and jurisdictions to reduce fragmentation and foster continuity
- Clarifies roles and ensures accountability, develops and supports appropriate incentives
- Has the capacity to manage change
- Sustainability, the key to which is the establishment of a shared infrastructure
- Building for enduring value and impact
- The sharing and collaborative use of data and analysis (IOM, 2012, pp. 5–6)

The ongoing process and dialogue should lead to greater collaboration, partnerships, and even merging of public health and primary care programs. Comprehensive worksite wellness by integrating best practices of primary prevention with clinical interventions of chronic disease management, case management, call-a-nurse services, and onsite clinics represents "low-hanging fruit" for sustainable integration of public health and primary care at the community level. Other examples of sustainable integration include public–private partnerships for community-based chronic disease management, case management with clinical services provided by private clinics, and home visitation by public health nursing.

STUDY QUESTIONS

Q: What are the three major approaches for changing risky behaviors?

Q: What situations are most effectively addressed with social marketing?

Q: What situations are most effectively addressed with community engagement?

Q: What are the nine principles of community engagement?

Q: Explain how the worksite is a venue for the integration of public health and primary care.

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NINE

PUBLIC HEALTH: PROMISE AND PROSPECTS

OBJECTIVES

Readers will become aware of . . .

1. American values that shape public health practice.
2. The impact that the Affordable Care Act may have on public health practice and funding.
3. The impact that the Affordable Care Act may have on the quality and accessibility of health care services.
4. Major global threats to human health that public health will face in the future.
5. How public health is meeting the challenges of new technologies that impact human health.

Throughout this book, we have referred to public health's mission, articulated by the Institute of Medicine's (IOM) Committee for the Study of the Future of Public Health (IOM, 1988), as the promise of public health:

> The broad mission of public health is to "fulfill society's interest in assuring conditions in which people can be healthy." (IOM, 1988, p. 1)

The promise of public health, then, is the assurance that the context in which people live their lives will promote health. Public health, as a field and as a collection of professionals, aspires to provide people with the opportunity to be healthy by ensuring that environments, in the broadest sense, advance

health. Healthy communities! Healthy cities! Healthy workplaces! Healthy schools! Each of these phrases, which are often rallying cries for public health, expresses the aspirations of public health to create healthful environments.

Thus, the cornerstone of public health practice is prevention, particularly primary prevention, whereby disease and injury do not occur. Prevention is public health's historic and ideal approach to promoting health, and the distinguishing public health prevention strategy is to influence the "conditions" (i.e., the environment in the fullest sense) in which people live.

"Social justice is the foundation of public health" (Krieger & Birn, 1998, p. 1603), and the commitment to social justice defines the "public health sensibility." Public health assumes that all people are deserving of conditions that promote health—not just the rich, but people of all incomes; not only the young or the old, but also people of all ages; not exclusively the majority race or ethnic group, but people of all races and ethnicities. Public health is a leader and plays an integral role in carrying out this societal obligation to ensure that all people have the opportunity to be healthy. For this reason, public health is often associated with advocating and providing health services for the structurally disadvantaged—those with the least power, wealth, and status—in their social circumstances.

Indeed, public health practice may be thought of as applied social justice.

HAS PUBLIC HEALTH LIVED UP TO ITS PROMISE?

Population indicators of public health success include increasing life expectancy; decreasing rates of premature death; decreasing rates of disease, injury, and disability among the young; and decreasing rates of preventable health problems such as injuries. We discussed some of these indicators in Chapter 6, finding that public health in the United States has had many significant successes. They began in the 19th century, with developments that improved the food and water supplies and waste disposal. As Nancy Tomes has written in *The Gospel of Germs*:

> Most nineteenth-century Americans showed little concern about those forms of casual contact with other people, or contamination of water and food, that are today shunned in the name of health. . . . They coughed, sneezed, and spit with blithe disregard for the health consequences to those around them. They stored and cooked their meals with scant concern for foodborne illness. They drank unfiltered water from wells and streams, often using a common dipper or drinking cup. Last but not least, they urinated and defecated in chamber pots and outdoor privies with little regard for where the contents ended up in relation to the community water supply. (Tomes, 1998, p. 3)

This statement illustrates how drastically things have changed in a few hundred years as a result of public health interventions.

The 20th century saw steady increases in life expectancy and declines in death by infectious disease. Public health improvements to the infrastructure as well as the development of the vast organizational structures, largely within the Centers for Disease Control and Prevention (CDC) that study, monitor, develop vaccines. An encouraging finding was the drop in age-adjusted premature death rates for many leading causes of death between 1980 and 2010 (National Center for Health Statistics [NCHS], 2012, Table 20). Overall, years of potential life lost declined for diseases of the heart, including ischemic heart disease, malignant neoplasms, chronic lower respiratory diseases, cerebrovascular diseases, influenza and pneumonia, chronic liver disease and cirrhosis, diabetes mellitus, Alzheimer's disease, human immunodeficiency virus (HIV), unintentional injuries including motor vehicle–related injuries and poisoning, suicide, and homicide. Years of potential life lost before age 75 from diseases of the heart declined from 2,238.7 years per 100,000 population in 1980 to 1,071.0 years per 100,000 population in 2010. Years lost to malignant neoplasms decreased from 2,108.8 to 1,563.1, and this includes declines in tracheal, bronchus and lung, colorectal, prostate, and breast cancer. The only increases in years of potential life lost between 1980 and 2006 came from diabetes mellitus, chronic lower respiratory diseases, and unintentional injuries caused by poisoning. On a percentage basis, loss of potential years of life for males declined more than for women (37% versus 28%). Although the starting point was so much worse for males (13,777 years versus 7,350 years in 1980), males still had more potential years of life lost than females in 2010 (8,667.9 versus 5,306.6). Overall declines in years of potential life lost for Whites was approximately 34%, Blacks 45%, and Native Americans 49%.

Thus, looking at the overall improvement in premature death suggests that efforts have been very successful. However, the rate of premature death and years of potential life lost still remained higher for Blacks and Native Americans than for Whites in 2010, at 9,832.5 years, 6,771.3, and 6,342.8 years, respectively. These disparities indicate that conditions that produce health remain unequal. Disparities are also apparent among those who have private health insurance and those who do not. In 2011, the percentage of persons under the age of 65 who had private health insurance and were White was 64.9%, compared to 79.9% in 1984. Yet, the percentage of Blacks and Native Americans with private health insurance in 2011 was 45.9% and 33.7%, respectively. Examining disparities related to socioeconomic status, the number of persons under the age of 65 with private health insurance and below 100% of the Federal Poverty Level (FPL) was 17.2%, 100% to 199% FPL was 35.1%, 200% to 399% FPL was 71.1%, and those 400% or above FPL was 90.7% (NCHS, 2012, Table 21).

In addition, the United States does poorly on most indicators compared to other highly developed nations, including life expectancy, infant mortality, and premature death. Most importantly, health disparities within the United States indicate that some people have not been provided with the same opportunities to be healthy as others, particularly Blacks, Hispanics, Native Americans, and the poor. For example, years of potential life lost in 2010 was 6,345.8 years per 100,000 population for Whites and 9,832.5 years per 100,000 population for Blacks. Furthermore, the rates for years of potential life lost per

100,000 population were 142.7 and 358.1 years for cerebrovascular diseases for Whites and Blacks, respectively; 1,375.8 for Whites and 1,796.7 years for Blacks for malignant neoplasms; and 139.0 and 316.4 years for diabetes mellitus for Whites and Blacks, respectively (NCHS, 2012, Table 21).

Life expectancy, premature death rates, and so forth are outcome measures of public health performance, but we can also examine process indicators, that is, the practices of public health in the United States. Does public health practice produce the "conditions" that people need to be healthy? If we take physical health[1]—infectious and noninfectious diseases and injury—we might say that there are certain physical requirements and tangible services needed to ensure health. These would include adequate and safe housing; safe workplaces; nutritious and toxin-free food; clean air and water; safe transportation; opportunities for exercise and recreation; and access to quality health care. The public health system, including formal public health—the federal, state, and local health agencies that provide public health leadership and services, the nongovernmental organizations (NGOs), and private partner organizations, address all of these conditions to varying degrees and with varying success.

For example, there is a strong and effective infectious disease prevention effort that includes development of vaccines, vaccination programs, processes for maintaining a food and water supply free from infectious disease agents, and surveillance of emerging diseases. The infectious disease rates reflect the effectiveness, by and large, of this prevention effort. AIDS provides an instructive illustration. AIDS, when first diagnosed in the 1980s, was a "death sentence" for those who contracted it—largely homosexual men, intravenous drug users and their partners, children of infected mothers, and hemophiliacs. A massive effort to understand the disease etiology, develop treatments, and prevent spread was undertaken, and this effort has been quite successful. By the late 1990s, AIDS diagnoses and deaths related to AIDS began to decline sharply primarily because of the success of highly active antiretroviral therapies introduced in 1996 (CDC, 2010a; Osmond, 2003). However, the decline was not uniform across all groups of people with HIV/AIDS.

> The greatest disparity in rates of persons living with AIDS and persons dying of AIDS is that between Black men and White men. Although more than a third (34%) of persons living with AIDS in 2000 were White men, this group accounted for only 19% of deaths. In contrast, Black men accounted for 42% of persons living with AIDS and 57% of AIDS deaths. (CDC, 2010a, Mortality Trends, para. 6)

These disparities were the result primarily of differences in access to testing and treatment.

What Are the Barriers to Public Health's Success?

The public health mission to provide people with conditions in which they can be healthy runs counter to the very strong orientation in the United States

toward individual accountability and responsibility for one's own actions and situation. Changing the environment to change behavior is less consistent with the value of individual accountability than attempting to hold the individual accountable for his or her own behavior. For example, the view that obesity in the United States should be reduced by changing an environment that encourages weight loss, rather than by educating and motivating people to lose weight themselves, is not an acceptable strategy to many. They view the problem of obesity as one of individual motivation, rather than as a situational determinant. Reducing access to sweetened beverages, providing convenient places to exercise, and structuring grocery store food selections—some of the current public health strategies to reduce the prevalence of obesity (Khan et al., 2009)—are less preferable than strategies that emphasize individual responsibility for food and physical activity choices.

However, public health is increasingly favoring the view that changes to the environment have the most influence on health and must be included in public health prevention strategies. Referring back to the health impact pyramid discussed in Chapter 1, Frieden (2010), Director of the CDC, states that changes in socioeconomic factors such as reduction in poverty and increased education have the greatest impact on health. This bottom layer is followed in impact by "changing the context to make individuals' default decisions healthy" (p. 591).

As another example, obesity is strongly related to onset of noninfectious diseases, including cardiovascular disease, stroke, and diabetes. Obesity rates have risen steadily since the 1970s. Between 1988 and 1994, and 2009 and 2010, the prevalence of overweight among preschool-age children 2 to 5 years of age nearly doubled, from 7.2% to 12.1%; among adults 20 to 74 years of age, obesity rates have more than doubled since 1976 to 1980. From 1976 to 1980, to 2007 to 2010, the percentage of adults who were obese increased from 15.1% to 35.3% (age adjusted) (NCHS, 2012, p. 3).

As we saw in Chapter 5, the CDC-recommended community strategies to prevent obesity (Khan et al., 2009) are heavily weighted to changing the environment by limiting access to sweetened beverages, increasing availability of healthier food and beverage choices in public service venues, improving the geographic availability of supermarkets in underserved areas, and providing incentives to food retailers to locate in and/or offer healthier food and beverage choices in underserved areas.

In addition to clashing with cultural values associated with individualism, the development of the public health system as a predominantly government endeavor goes against a strong conservative segment of the population that prefers the private over the public sector in all societal activities. This explains much of the collaboration between public, private, and nongovernmental nonprofit organizations in public health today. The private sector is strong and rich. Conflict, compromise, and the weakening of public health initiatives have resulted when private interests and the public good are not aligned. Moreover, the 2010 Supreme Court ruling that lifts limits on corporate spending for elections (*Citizens United v. Federal Election Commission*, 130 S.Ct. 876 (2010)) will make the private sector even more powerful.

The 2010 health care reform legislation (Patient Protection and Affordable Care Act, also known as the Affordable Care Act, or ACA) is an example of the power of the private sector to influence public health policy for its own well-being, in this case, for insurance companies. The legislation does not have a public option, as public health would have preferred. It maintains and promotes the mixed public/private system of health care coverage with continued and expanded participation by health insurance companies, adding inefficiencies, difficulty with oversight, administrative costs, and complexities of the new system. As a result, the health care reform bill is not optimal, and even President Obama admits that it will need revision in the coming years. However, the legislation was the compromise reached to get a bill of any kind because of the influence of the private sector.

The history of efforts to prevent lead exposure provides another example of the difficulty of achieving public health goals when private sector interests are threatened.

> The history of child lead poisoning in the past century is a good example of how powerful economic interest can prevent the implementation of a useful truth. . . . In 1786 Benjamin Franklin listed in a letter to a friend every profession for which lead posed a health hazard. He then predicted that years would pass before the truth of a public health tragedy would be confronted. In fact, long after the lead and lead paint industries became aware of the hazards posed by lead, particularly in young children, they continued to market their products aggressively. They lobbied legislatures to stall all regulation, suppressed research findings, and advertised falsely, and in doing so created a problem that grew to major proportions over decades. Benjamin Franklin's prediction proved correct. (DeBuono, 2006, p. 41)

Public health efforts to reduce exposure to lead continued with battles to remove lead from paint, manufacturing processes, and especially gasoline, to which it had been added since the mid-1940s:

> In 1986, a complete ban finally took effect and all gasoline was unleaded. This was successful in reducing child blood lead level. Before the ban was implemented, 88% of children in the United States had blood levels higher than 10 ug/dl. Afterwards, only 9% had elevated blood levels. The blood lead levels of all Americans declined 78% between 1978 and 1991, falling in exact proportion to the declining levels of lead in the overall gas online supply. As a result of EPA's regulatory efforts to remove lead from gasoline between 1980 and 1999, emission of lead from the transportation sector declined by 95% and levels of lead in the air decreased by 94%. Following years of heated debate, congress banned

> lead-based paints for use in housing in 1978. By the time the ban went into effect, the industry no longer opposed the ban, reeling from negative publicity and a precipitous decline in sales of lead-based paint. (DeBuono, 2006, p. 44)

The story of public health's difficulty in controlling exposure to lead is not unique. Efforts to prevent exposure to other disease-producing substances including cigarettes, pesticides such as dichlorodiphenyltrichloroethane (DDT), mercury in vaccines and manufacturing processes, and carbon monoxide are much the same. Removal of DDT from the environment is another instructive story. Rachel Carson, who wrote *Silent Spring* in 1962, was a trained marine biologist, and her book became a "call to arms" for the environmental movement. Unlike other insecticides that were narrow in their targets, DDT killed hundreds of species at once. Carson observed the effects of DDT on wildlife, particularly how damaging it was to the eggshells of raptors such as eagles, falcons, and hawks, leading to a significant decline in their population, which, in turn, reverberated through the ecosystem. Although *Silent Spring*'s message was powerful enough to lead to a public demand for a ban on DDT, the government began with an increase in oversight on DDT use. It was not until 1972 that the Environmental Protection Agency (EPA) instituted a total ban, a major victory for the environmental movement.

The chemical industry, led by Monsanto, characterized Carson's findings as one-sided for failing to point out how pesticides had eliminated malaria, typhus, and other human scourges. (These industrial attacks were and are common in the tobacco, oil, and chemical industries.) The chemical industry suffered a backlash when the public recognized Carson's solid research and the interconnectedness of the natural environment (Cox, 2000). Carson earned a reputation as a careful researcher and compelling author. In the 1950s, she wrote two popular books, *The Sea Around Us* and *The Edge of the Sea,* introducing the general public to ecology.

The history of community health centers is another example of major reform in public health that succeeded in spite of strong opposition (Lefkowitz, 2007). Community health centers were developed by H. Jack Geiger in the 1970s with grassroots support, beginning from one center in Mississippi and growing eventually to more than a thousand. They were intended to serve those without resources or advantages—the poor and powerless. They addressed health and social problems comprehensively, including health care services, housing, food, job creation, and education. They offered comprehensive services for health improvement. Geiger saw them as necessary for social justice. Public financing of the community health centers was opposed by conservative legislators who held to individual accountability. Community health centers were originally implemented as a pilot project with slight funding. With their success, they gained federal funding, although, in the more conservative Reagan era, their budgets were constrained and the scope of their activities became limited to health care.

HOW WILL HEALTH CARE REFORM AFFECT THE FUTURE OF PUBLIC HEALTH?

Access to quality health care is essential to secondary and tertiary prevention, and, therefore, to public health. Without timely and adequate health care, an acute health problem, such as an injury, that if treated appropriately would have no long-term consequences, becomes a chronic condition, and a chronic condition, such as diabetes, is exacerbated. When primary prevention fails and people sustain injuries or develop chronic conditions—the subjects of the previous sections—they require access to health care. Until recently, however, the United States was the only wealthy nation that did not guarantee at least a basic level of health care for its citizens. As a result, public health advocates universal health coverage, or as it is often called, health care reform.

The history of health care reform in the United States is long and tortuous. Debate over reform has recurred with regularity since the early part of the 20th century. There have been many failed attempts to achieve universal coverage. In 1912, Teddy Roosevelt and his Progressive Party endorsed social insurance, including health insurance. In 1915, the American Association for Labor Legislation published a draft bill for compulsory health insurance, which was not enacted. In 1939, Senator Wagner introduced the National Health Bill in Congress, which did not get out of committee. In 1944, President Franklin Roosevelt identified medical care as a right in his State of the Union address. The Social Security Board called for compulsory national health coverage a few months later in 1945. President Truman took up the cause and was a strong advocate for national health reform after he took office in 1945. His election in 1948 seemed to be a mandate for health care reform. However, he failed, like those before him, in this case because of efforts to label the reform socialist.

Rather, health care benefits have been achieved piecemeal and inconsistently throughout the 20th century, covering some groups, but never all, and providing us with the hodgepodge that we have today, whereby many people have no health insurance, and among those who have benefits, coverage ranges from inadequate to comprehensive—often within the same family. The greatest reforms came under President Lyndon Johnson in the 1960s, when Medicaid and Medicare were passed into law. Medicare, a federal program, provides basic health coverage for people over 65, regardless of their resources and health condition. Medicaid, a federal–state program, covers low-income people who are uninsured. However, because each state has its own Medicaid program with unique eligibility criteria, people may qualify for Medicaid in one state, but not in another. Even after the passage of Medicare and Medicaid, many people were uninsured, since for the remainder, health insurance was tied to employment. People without employer-based health insurance went without or paid large sums to purchase it themselves in the private market.

By the early 1990s, there was another attempt to achieve a health insurance system that would provide all people with at least basic health coverage. Under President Bill Clinton, health care reform was proposed, but ultimately defeated. Not until 2010, under President Barack Obama, did the United States finally achieve universal coverage by passage of the ACA. The structure created under the ACA is not simple, administratively, as are both the Medicare and Medicaid programs. It is not a single payer, but a multiple-payer system,

and the bill is still being scrutinized by all stakeholders to determine its costs and benefits (Steinbrook, 2009).

However, the ACA holds the promise of improving not just access to medical care, but public health itself. The ACA funds two initiatives—the National Prevention, Health Promotion and Public Health Council (NPHPPHC) and the Patient-Centered Outcomes Research Institute (PCORI)—that address issues that hold public health back from achieving its mission. These include: (1) a well-funded organization (NPHPPHC) charged with coordinating public health activities among all levels of government with funds from the newly created Prevention and Public Health Fund; and (2) a well-funded initiative to investigate systematically the effectiveness of health care treatments (PCORI). Funding for both initiatives is outside the normal appropriations stream, coming from a tax on health insurers based on the number of their beneficiaries. Both initiatives aim to decrease health care costs—PCORI by reducing the use of ineffective medical treatments, and NPHPPHC by reducing the demand for medical care through primary prevention, that is, public health measures that reduce the number of people who require medical care.

The Affordable Care Act and the Prevention and Public Health Fund

The National Prevention, Health Promotion, and Public Health Council is responsible for coordinating federal prevention, wellness, and public health activities (Summary of the Affordable Care Act, 2013). The Chair of the Council is the Surgeon General. The Council has 20 members consisting of cabinet secretaries, chairs, directors, and administrators of federal departments (DHHS, 2014).

The Council developed the National Prevention Strategy with a goal to "increase the number of Americans who are healthy at every stage of life" (NPHPPHC, 2013). The Strategy's vision is "Working together to improve the health and quality of life for individuals, families, and communities by moving the nation from a focus on sickness and disease to one based on prevention and wellness." Four Strategic Directions and seven targeted Priorities have been identified by the National Prevention Strategy. The four Strategic Directions are: Healthy and Safe Community Environments; Clinical and Community Preventive Services; Empowered People; and Elimination of Health Disparities. The seven Priorities include: Tobacco-Free Living; Preventing Drug Abuse and Excessive Alcohol Use; Healthy Eating; Active Living; Injury and Violence Free Living; Reproductive and Sexual Health; and Mental and Emotional Well-Being (National Prevention Strategy, 2012).

Funding for the Council's work is from the Prevention and Public Health Fund. Prevention research, health screenings, and educational and immunization programs are among the activities funded. "It is the nation's first mandatory funding stream dedicated to improving our nation's public health. By law, the Fund must be used 'to provide for expanded and sustained national investment in prevention and public health programs to improve health and help restrain the rate of growth in private and public health care costs" (American Public Health Association, 2014a). The fund may not be reduced or eliminated except through new legislation. The Prevention and Public Health Fund was

appropriated $7 billion for fiscal years 2010 to 2015 and $2 billion each year after fiscal year 2015 (ACA, 2013).

In 2010, the primary areas of the Prevention and Public Health Fund were Community Prevention, Clinical Prevention, Public Health Infrastructure and Training, Research and Tracking, and building on other initiatives that promote prevention (U.S. Department of Health & Human Services [DHHS], 2011). Community Prevention focuses on programs such as the Community Transformation Grant Program, Tobacco Prevention, and Obesity Prevention and Fitness; $298 million is allocated to these programs from the Prevention and Public Health Fund. Clinical Prevention programs are meant to improve the access to preventive services and provide necessary care for a diverse range of health care needs (HealthCare.gov, 2014; Kaiser Family Foundation, 2014). The Prevention and Public Health Fund will provide $182 million for programs that support these initiatives. $137 million is used to improve Public Health Infrastructure and Training. This funding is used to ensure proper staffing for the public health workforce. It also ensures that public health programs are meeting current challenges. Research and tracking programs support the scientific study of prevention to and the translation of research into practice (U.S. Department of Health & Human Services, 2011).

In January 2013, the American Public Health Association's (APHA) Government Relations office summarized the importance of the Prevention and Public Health Fund to public health when it issued the following statement (APHA, 2014b):

> . . . some recent congressional activity that will have a significant effect on federal public health funding, which is critical for many state, local and community-based prevention and wellness activities.
>
> The FY 2014 Consolidated Appropriations Act, which President Barack Obama is expected to sign over the weekend, provides necessary funding for important public health agencies and programs and, contrary to some reports by the media, the bill fully allocates the funds available through the Prevention and Public Health Fund for FY 2014.
>
> This measure marks the first time since FY 2012 that Congress has produced an appropriations bill for the departments of Labor, Health and Human Services and Education. It is a welcome improvement that provides agencies and grantees with greater budgetary certainty compared to operating under another continuing resolution.
>
> Of the $1 billion available in FY 2014 through the fund, more than $830 million was transferred to the Centers for Disease Control and Prevention for activities to address heart disease, tobacco control, diabetes prevention, prevention of health care-associated infections and other critical public health priorities. The remaining funds went to agencies including the Substance Abuse and Mental Health Services Administration, the Administration for Community Living's Administration on Aging and the Agency for Healthcare

> Research and Quality. Sen. Tom Harkin, D-Iowa, chief author of the fund delivered a floor statement debunking the rumored cuts to the fund and citing APHA's support for the allocation of the fund.
>
> The bill provides a nearly $569 million boost to CDC's total program-level funding compared to the post-sequestration FY 2013 levels. The bill also restores about 60 percent of the 2013 sequestration cuts to the Health Resources and Services Administration.
>
> While APHA welcomes these increases, the funding levels are still not nearly adequate to address the growing public health challenges faced by our nation, and we look forward to working with you as we continue our efforts to advocate for increased funding for public health.

It is still unknown how effective the Council and the Prevention and Public Health Fund will be in coordinating public health efforts across organizations and states and updating the public health infrastructure. However, there is great promise in this legislative development and great hope that it will help the United States to achieve the goal of providing all Americans with a healthful environment.

The Affordable Care Act and Comparative Effectiveness Research

A working definition from the IOM defines Comparative Effectiveness Research (CER) as "the generation and synthesis of evidence that compares the benefits and harms of alternative methods to prevent, diagnose, treat, and monitor clinical conditions or to improve the delivery of care. The purpose of CER is to assist consumers, clinicians, purchasers, and policy makers to make informed decisions that will improve health care at both the individual and population levels" (Sox & Greenfield, 2009).

Conducting medical studies on the comparative effectiveness of treatments is not a new concept. Additionally, devising a national program for CER, for the purposes of improving health care policy, is not a new concept. Several other countries have made health care policy decisions using CER as a guiding principle. Countries such as Australia, the United Kingdom, Germany, and France have developed national CER programs that are meant to aid in making health care policy decisions (Chalkidou et al., 2009).[2] Efforts to utilize the results of CER in making decisions on health care have been ongoing since the 1970s. The efforts have been driven by the fact that the United States has the most expensive health care system in the world, paying 30% to 40% more for health care than other developed countries (Ashton & Wray, 2013). Since the early 2000s, the United States has made great progress in developing a federal policy that will assist in prioritizing and coordinating research efforts. The overall goal of CER is to provide evidence to determine the most efficient and cost-effective treatments for patients on an individual and population level.

The evidence comes from population health data and patient data, such as medical records, that can be used to compare medical treatments for patients. These include patients with chronic conditions such as diabetes, heart disease, and asthma, as well as acute conditions such as infectious diseases and injuries. Although there is a tremendous amount of health care research conducted now—health services research, drug therapy research, and health outcomes research—much of it is on a relatively small scale. The irony is that more data will permit greater tailoring of medical treatment. More patient information allows a greater understanding of the differences between people (Berger, Mamdani, & Atkins, 2009; Rogers, 2014; Sox, 2010; Tunis, Benner, & McClellan, 2010; VanLare, Conway, & Sox, 2010).

The ACA continued the work that had been started on a national CER program. The most noteworthy change that the ACA made was to the agency in charge of implementing and coordinating CER. Proponents for a government-run agency, like AHRQ, argued that "the activities were subject to congressional oversight, that it already had the statutory authority to include comparative effectiveness research in its portfolio, that it had the infrastructure and well-worked out, time-honored, peer-reviewed process for awarding federal research grants, and that creating a new organization was duplicative and wasteful" (Ashton & Wray, 2013). The opposition's argument was that having an agency under the federal government subjected it to "congressional oversight." Many feared this would lead to the ability of the government to control when, how, and what medical treatment a patient may receive based on the cost effectiveness. The opposition "won" this debate when the Federal Coordinating Council for Comparative Effectiveness Research was terminated and the PCORI was established.

Patient-Centered Outcomes Research Institute

The newly formed PCORI was "neither an agency nor establishment of the Federal Government" (Ashton & Wray, 2013). PCORI was given much of the same responsibilities that the Federal Coordinating Council was previously given, which was to oversee the coordination of CER and identify research priorities.

The ACA mandated that PCORI

> assist patients, clinicians, purchasers and policymakers in making informed health decisions by advancing the quality and relevance of evidence concerning the manner in which disease, disorders, and other health conditions can effectively and appropriately be prevented, diagnosed, treated, monitored, and managed through research and evidence synthesis that considers variations in patient subpopulations, and the dissemination of research findings with respect to the relative health outcomes, clinical effectiveness and items . . . (Ashton & Wray, 2013).

In addition to establishing PCORI, the ACA specifically mandated how the agency would be governed (PCORI, 2011).

Similarities are evident in the way the Recovery Act established the governance of the Federal Coordinating Council versus how the ACA mandated specific attributes for the board of directors of PCORI. The amount of influence from the government versus outside stakeholders is the most significant difference between the two mandates.

Governance

A 21-member Board of Governors oversees PCORI. The ACA mandates that the Board of Governors be made up of a variety of stakeholders to ensure that there is a balance of power in setting research priorities. The Board must be composed of "7 members representing physicians and providers, including 4 members representing physicians (at least one of whom is a surgeon), 1 nurse, 1 State-licensed integrative health care practitioner, and 1 representative of a hospital" (Public Law 111-148, 2010). Each member will serve a 6-year term, but cannot serve for more than two terms (PCORI, 2013). Board members are appointed by the Comptroller General of the United States, who is also responsible for designating the Chairperson and Vice-Chair (Ashton & Wray, 2013).[3]

Funding

Funds for CER are distributed from the Patient-Centered Outcomes Research Trust Fund (PCORITF). The revenues supporting the PCORITF come from three sources: (1) appropriations from the general fund of the Treasury; (2) funds transferred from the Medicare Trust Funds; and (3) fees imposed on health insurance and self-insured plans (Ashton & Wray, 2013). PCORITF was set up to be available to fund CER through fiscal year 2019, and has forecasted available funds to reach $3.5 billion (PCORI, 2013). During financial years 2010 to 2012, the Trust Fund received a total of $210 million in revenues solely through appropriations. The Trust Fund began receiving fee revenue in addition to appropriations in 2013. The estimated total revenues for 2013 is $320 million, with $150 million from appropriations and the remaining from the $1 fee per insured life from Medicare, federal, and private health insurers. The forecasted revenues for 2014 are a total of $650 million, with $150 million in appropriations and $2 in fee assessments. The ACA also mandated that each year 20% of funding from PCORITF is to go to the Department of Health & Human Services and the remaining 80% is to go to AHRQ (PCORI, 2013).

PCORI and the CER that it will fund hold promise for public health in at least two ways. First, secondary and tertiary medical care may be improved. More people with injuries and chronic illnesses will be treated with the most effective methods in a timely way because of comparative effectiveness research and its translation into medical practice. This will reduce unnecessary suffering and impairment among individuals. Second, a more effective medical care system—one that treats health problems effectively at the lowest cost—should drive down the costs of health care. This, in turn, could free money for other purposes. The hope is that the Prevention and Public Health Fund will provide evidence-based research on the cost benefit of primary

prevention and that, in turn, much of the savings from more effective medical care will be used to improve primary prevention.

WHAT ARE THE EMERGING GLOBAL THREATS TO THE PUBLIC'S HEALTH?

As we look about the world today, there are many potential threats to global health that will affect or have affected health in the United States, directly or indirectly. These include infectious disease pandemics, worldwide water and food shortages, climate change, declining air quality, and environmental degradation from population growth and industrialization.

Not surprisingly, public health in the United States and worldwide has the leadership role in infectious disease prevention and control. Trends in movement throughout the globe have brought increased and more rapid transmission of infectious disease agents. More people are traveling internationally more frequently than ever before. An example of the consequences of current travel patterns is the rapid spread of SARS (severe acute respiratory syndrome), an infectious disease transmitted by person-to-person contact, which began in Asia in February 2003 and spread within several months to more than two dozen countries in North America, South America, Europe, and Asia before it was controlled. A total of 8,098 persons contracted SARS during 2003, and 774 died (CDC, 2010b). Global infectious disease outbreaks are a serious threat, and public health, principally through the World Health Organization (WHO), the CDC, and their partner organizations throughout the world provide leadership in the prevention and control of infectious disease spread through continual monitoring and development of responses.

Another present and serious threat to health worldwide is war. The health consequences of war are staggering, not just in terms of the injury, disability, and death of combatants, but in terms of civilian morbidity, mortality, and displacement. Destruction of civil societies through war and the flood of refugees that often ensues are a public health problem of major proportions.

There are also what are called Black Swan events, such as massive industrial accidents that have direct and indirect health consequences. Black Swan events (Taleb, 2007) are described as extremely high impact with low probability of occurrence. The 2010 British Petroleum (BP) oil leak from a deepwater well in the Gulf of Mexico and the 1986 Chernobyl nuclear accident are examples of Black Swans. These and natural disasters such as Hurricane Katrina are threats to health that have huge impacts on public health and should be incorporated into public health practice.

With regard to other emerging and serious threats to health such as climate change, water and food shortages, and environmental degradation, public health's role has been to advocate for primary prevention, but to put most efforts into providing or preparing for secondary and tertiary prevention. That is, the public health system in the United States is involved more in responding

to the consequences of these threats than in trying to prevent them. For example, the CDC describes its response to climate change as follows:

> To lead efforts to anticipate, prevent and respond to the broad range of effects on the health of Americans and the nation's public health infrastructure. CDC's expertise and programs in environmental health, infectious disease, and other fields form the foundation of public health efforts in preparedness for climate change. (CDC, 2010b, para. 1)

Public health in the United States must participate optimally with partners throughout the world in global efforts to prevent and control the adverse consequences of these theats.

Population Growth, Climate Change, and Food and Water Scarcity

Historically, public health has been concerned with the safety of food and water supplies—two pillars of human health. Public health efforts related to food have focused on foodborne diseases, including those caused by infectious agents such as *Escherichia coli (E. coli)* and those caused by chemical contaminants, pesticides, natural toxins, and metals (FDA, 2013). However, newer threats to health are looming in the form of global and sustained scarcity of food and water. While there have always been periods of famine and drought, especially in some parts of the world, climate change and population growth are projected to make scarcity of food and water a problem of greater magnitude in the future.

The world population reached approximately 7 billion people by the end of 2013, with an annual growth rate of 1.092%. Despite a declining annual growth rate in world population since 1963 (when it was 2.23%), the world population continues to increase. If growth continues as projected by the U.S. Census Bureau (2014), the population is expected to reach 7.6 billion by 2020, 8.3 billion by 2030, and 8.9 billion by 2040. In recent years, there has been a shift in demographics, with a decrease in the number of births and an increase in life expectancy. Lee reports that "the total fertility rate (TFR) has fallen well below the replacement level of 2.1 births per woman in most rich countries and also in many developing nations in East Asia and elsewhere" (Lee, 2011, p. 571). The reduction in number of births is attributed to the increased mean age of childbearing in developed countries and some developing countries. Life expectancy has affected the growth in population, as well, with many more elderly living longer than in the past. "The mortality decline across the transition is due in part to economic progress, in part to improved waste disposal and water supply, in part to public health interventions, and in part to curative medicine" (Lee, 2011, p. 570). However, many developing countries still maintain fertility rates of about five births

per woman, placing ever-growing demands on scarce natural resources in poor countries.

Another impact on food and water scarcity will be climate change. According to the CDC, the changing climate will have both direct and indirect effects on human health (CDC, 2010c), including at least two that will have a direct effect on food and water scarcity.

Increased Temperatures

With the increase in global temperature as a result of climate change, negative health effects can occur, resulting in increased morbidity and mortality. The heat can have a number of different consequences, ranging from increased incidence of heat stroke to the aggravation of chronic diseases and increased allergies and respiratory irritation (CDC, 2010c). According to the National Weather Service, extreme heat results in hundreds of death in the U.S. each year, and in Europe, a heat wave in late summer of 2003 killed over 50,000 people (National Weather Service, 2013). Many believe that increased heat waves and temperatures are a result of climate change. One study found that with current global climate models, North America and Europe could expect increased heat waves that are more intense and last longer in the 21st century (Meehl & Tebaldi, 2004).

Extreme Weather Events

Climate change will result in an increased number of hurricanes and increased severity of storms this century (Geophysical Fluid Dynamics Laboratory, 2013). There is also likely to be an increase in precipitation and flash flooding (CDC, 2010c, 2010d). Extreme weather events in Maryland, Ohio, Virginia, and West Virginia in 2012 led to power outages and damage. When an extreme heat wave hit the area shortly afterward, over 30 people died due to the heat and lack of power for air conditioning. This combination of extreme weather events and excessive heat was deadly (CDC, 2013).

Climate change and population growth are stressing essential resources such as food and water. Population increase will also impact demand for health services. "The growing elderly population, accompanied by the increasing prevalence of chronic diseases associated with aging, have profound implications for the health care system for decades to comes" (West, Storm, & Dall, 2013).

Water Scarcity

Water-stressed areas, which have runoff of less than 1,000 m^3 per capita per year, were already home to 1.4 billion people in 1995. Projections have estimated that without climate change that number will rise to 2.9 billion people by 2025, and to 5.6 billion people by 2055. With climate change, the number of people facing water scarcity will grow even more (Arnell, 2004). One study estimates that as the global temperature rises, nearly one fifth of the world will

face severe water shortages (Schiermeier, 2013). As the population increases, demand for water will also increase, while the supply will shrink in quantity as well as quality. Areas such as South America, southern Africa, and some parts of Europe and the Mediterranean are already water stressed, and this will only increase (Arnell, 2004).

Climate change will affect water supply and water events in different ways. It will increase heavy precipitation events in some regions, which in turn will increase the likelihood for flash floods. In other regions, droughts will become more common, which will create water and food shortages, result in land degradation, and may result in more wildfires (Bates, Kundzewicz, Wu, & Palutikof, 2008).

Some countries are already making changes to how they use water in anticipation of climate change's negative effects. The United States, Australia, Germany, and the Netherlands are just a few that are preparing for changing water supplies through flood preparation and water use (Bates et al., 2008). Ethiopia is another example of a country that is preparing for changes in climate and water supply. This country in the horn of Africa faces water shortages, extreme drought, and rising temperatures due to climate change. Eighty-three percent of the country's population is dependent on agriculture for their income, and therefore drought affects not only the food supply but also people's livelihood. Rainfall in Ethiopia is unpredictable, and projections for the country suggest rainfall to decrease more in coming years while temperature increases, both as a result of climate change. The country is working to battle these by creating an early warning system for drought and flood, increased irrigation of land, and crop insurance to help farmers whose crops have been hurt by flood or drought (Evans, 2012).

Food Scarcity

Climate change will impact food security. Food security was defined by the World Food Summit as existing when everyone, at all times, has both physical and economic access to sufficient, safe, and nutritious foods to meet their dietary needs and preferences (WHO, 2012). As the climate changes, increased prevalence of droughts and floods may ruin crops, which in turn will drive up market prices. Rising global temperatures may change growing cycles, making foods ready to harvest weeks earlier. They may also reduce yields, which would again drive up prices and create a volatile food market. Weeds and fungi thrive in warmer temperatures, which will hurt crops and force farmers to use even more pesticides (Gregory, Ingram, & Brklacich, 2005).

Livestock will also be affected by rising temperatures; longer and more intense heat waves could kill livestock in great numbers and reduce milk production. Mild winters and warmer springs can increase the prevalence of parasites and bacteria, further threatening the well-being of livestock and the supply of meat (EPA, 2013a).

Fisheries are especially vulnerable to climate change. Some species, such as lake trout, cannot survive in the increasingly warmer waters (National Wildlife Federation, 2014). Changes in water temperature affect migration and reproduction patterns, and some bacteria and parasites flourish as the temperature

increases (EPA, 2013b). As other resources, such as oil, have been in higher demand, there has been increased drilling. The resulting oil spills have hurt the fisheries environment in many ways. Directly, oil spills pollute the water and harm fish and mollusks. Indirectly, those in the fishing industry are harmed as the lack of fish directly impacts their livelihoods. The rise in Somali pirates is a prime example of the negative impacts that oil spills can have on both the fisheries and those that depend on them to survive (Uddin, Phillips, & Austin, 2013).

Women and children will be especially vulnerable to food scarcity. Women, especially in low-income countries, are most likely to go hungry. Those in countries that are already food insecure, such as South Asia and Southern Africa, will be negatively affected by a disruption in the food supply due to climate change (Lobell et al., 2008). For example, in India, 41% of women have low body mass index due to insufficient food access and 61 million children are undernourished. This country is projected to see a decrease of 30% in its food production in the future (WHO, 2012).

Scarce food and water supply resulting from population growth and climate change are major concerns to public health. Programs promoting conservation of fuel, water, and other natural resources will help slow the depletion rates. Fertility rates have declined in past decades in more developed countries where the use of contraceptives or other methods of family planning have been used. Investing in family planning programs in less-developed countries will help to slow population growth in areas that are already highly vulnerable to shortages. Some strategies that may help reduce food insecurity in the future include working to reduce the volatility of food prices, promoting education of good nutrition, especially for women and young children, and promoting climate-resilient agricultural practices, such as using crops that are more resilient to heat and drought (WHO, 2012).

Case Study: Oil Boom in North Dakota

North Dakota has been an oil-producing state for over 50 years. Deep well drilling, hydro-fracturing, and other practices to release oil and gas from the earth have resulted in an unprecedented oil boom in western North Dakota. The number of permitted oil wells has increased from just over 3,000 in 2008 to over 6,000 in 2012. It is anticipated that a total of 30,000 to 40,000 wells will be drilled to fully develop the Bakken Formation using current technology over the next 15 years.

The oil boom in North Dakota has been very beneficial economically but also has been associated with challenges. Though there are significant environmental concerns, the major challenges are related to surface activities supporting oil development with the primary drivers associated with the large rapid influx of an out-of-state workforce and the rapid industrialization of a

previously rural agricultural society. North Dakota has experienced one of the largest in-migration of people since the Great Depression.

There are essentially two phases of oil development; an early drilling phase and a late maintenance phase. The early drilling phase is associated with a demographic of mainly young, single, transient workers who require temporary housing. These individuals often cycle through working for a few weeks and then return to their home state for a few weeks. The late maintenance phase workforce consists of more permanent families. The late phase is also associated with approximately half the number of individuals engaged in the early drilling phase. This information is important for municipal planners to build the appropriate amount of temporary and permanent housing and infrastructures to prevent an economic bust when transitioning between phases. The demographic associated with the early drilling phase is associated with more prostitution, alcohol and drug use, and increased domestic crime.

Environmental Impacts

Geologic factors play a major role in the limitation of environmental impacts of drilling. The Bakken oil-bearing formation is at least 5,000 feet below the surface and several thousand feet below the state's groundwater resources used for municipal and private domestic use. Useable ground water is also separated from the oil-bearing formations by multiple layers of dense, low-permeability geologic formations. Most flowback water that cannot be recycled or handled as oilfield waste, such as oilfield brines, is commonly deep-well injected into formations below 5,000 feet below grade.

Air Quality

Each of the wells and associated support infrastructure are potential air emission sources of hydrocarbons and volatile organic compounds. Emission control technologies and best management practices along with continued monitoring will be required to ensure continued compliance with ambient air quality standards. Mobile emissions sources associated with trucks and automobiles have increased and pose a potential impact to air quality. Stationary sources such as compressors, gas-fired power plants, and proposed refineries will require state-of-the-art air emission controls to ensure minimal air quality impact.

Even with this enhanced activity, North Dakota continues to be in compliance with all national ambient air quality standards as determined by data generated from a statewide ambient air quality monitoring network. The majority of the monitors are maintained within the oil-producing counties. Dust generated from truck traffic on gravel roads will continue to be a concern for local and regional residents. New methods to control generated dust such as construction methods and chemical application to roads need to be developed. An additional environmental problem is that of Erionite, a gravel-like substance from the Arikaree formation that has asbestos-like fibers. This

substance has been used to surface several hundred miles of roads in the west for 20 to 30 years.

Water Quality

Water and wastewater infrastructure has struggled to keep pace with development. Mobile oil drilling platforms generate up to 1 million gallons of untreated waste water per week. The increase in permanent and temporary housing developments away from existing engineered treatment facilities requires that waste water must be transported to existing treatment facilities or find alternative treatment methods. Resultant problems have been the illegal disposal of wastewater resulting in potential public health issues. Construction of additional infrastructure capacity as well as updating existing regulations to increase oversight with an increased regulatory field presence have enhanced compliance.

Waste Management

The increase in population and industrial activity has increased the quantity and complexity of waste generated in the oil producing counties. Approximately 16 applications for the construction of special oil waste handling landfills were received by the department in 2012 compared to only one application over the previous 10 years. The quantity of Naturally Occurring Radioactive Material (NORM) generated in the state has increased exponentially, estimated at around 75 tons per day, which requires proper handling and disposal. Current state regulations do not allow disposal of a vast majority of the NORM waste in-state (e.g., waste with greater than five picocuries of radioactivity). Most of this current NORM waste is shipped to Colorado and Texas for disposal. The state is currently developing rules to appropriately handle NORM waste in North Dakota. Due to enhanced use, the useful life of municipal landfills has decreased significantly. Normally, prior to oil development, municipal landfills in the west had sufficient capacity for 30 years. That useful life has decreased to 10 years.

Municipal Facilities

Water supplies and infrastructure are being tested to their limits. Region-wide development of the oilfield needing large quantities of water and the scattered diffuse housing developments has exceeded the natural capacity of the environment to supply needed water and distribution systems to provide adequate treated water for domestic purposes. Significant state general fund investment by the legislature to update water treatment facilities and distributions systems has been provided to help offset this challenge.

Spills

The number of reported spills of crude oil and associated materials has essentially tripled over a 3-year period from approximately 580 per year in 2009 to

1,470 in 2012. Many of these situations require extensive cleanup and monitoring from industry with close health department oversight. The Department of Health created a website in 2013 reporting all spills, available to the public, press, and political leadership.

Social Determinants

Economically, North Dakota did not see the recent recession. The oil boom brought billions of dollars in revenue to the state along with jobs. With most other states seeing significant declines in public health funding in 2012 to 2013, the North Dakota Department of Health saw an increase of general funds to its budget of over 30%, primarily due to the economic benefits of oil development in the west.

Using January unemployment rates from 2008 to 2013 for North Dakota and the United States, North Dakota, mainly due to the economic influence of oil development, saw little impact during the financial recession. During that period the United States, unemployment rates ranged from 5.4% to a high of 10.6% in January of 2010, with an average of 8.6%, where North Dakota's unemployment rates ranged from 3.7% to a high of 5.1% in January of 2009, with an average of 4.4%.

Housing is a problem for local residents and workers, including governmental agency personnel. Many Department of Health staff had to drive from Bismarck to the Williston area, a 5-hour trip, to work a few hours and then drive home. This problem impacts efficiency and production. Rapid demand for housing drove apartment leases in several communities in the west to extremely high levels ($2,000 to $3,000 for a single-bedroom apartment) forcing long-term residents, particularly the elderly on fixed incomes, to move east.

Other challenges include such issues as roads, injuries, motel and food services, and regulation.

Public Health and Response

Public health has a responsibility to do what it can to improve the comprehensive health of all residents in our states. In many instances public health is well positioned to gather stakeholders to discuss creative ways to address problems such as the challenges of oil development. In North Dakota, public health organized monthly meetings with health care providers, civic officials, private sector companies, mental health providers, emergency preparedness and response personnel, academic institutions, law enforcement, and so forth, to discuss problems and collaborative solutions.

Some collaborative projects initiated from these monthly meetings include:

- Three emergency preparedness and response-led immunization clinics to augment health care facilities in the Williston area
- Coordinated discussions between the University of North Dakota School of Medicine and Health Sciences and the University of North Dakota Department of Nursing to provide short-term primary care personnel for the west clinics and hospitals

- Coordinated discussions to increase primary care and nursing training to increase long-term recruitment of health care providers in the west
- Developed a plan for sustainable emergency medical services by expanding the role of community paramedics providing billable services in rural communities
- Augmented entry-level domestic/mental health services by providing training for community chaplains based on the military chaplain model
- Provided training of businesses for comprehensive worksite wellness to deal with primary, secondary, and tertiary care of employees

CHALLENGES FOR PUBLIC HEALTH IN THE UNITED STATES

In the United States, there are compelling cultural values and preferences for individualism and the private sector, which are supported by powerful interests that favor the status quo and constrain the ability to change the environment in ways that would promote health. Thus, these values and preferences work against an optimally effective public health system. Therefore, having the skills to bring about change within this context are essential for public health professionals if we are to realize public health's potential to control and

STUDY QUESTIONS

Q: How do you think the public health system will approach the problem of water scarcity in the United States? What is the basis for your answer?

Q: Do you think that the global public health system is ready to tackle global problems such as water scarcity? Why or why not?

Q: Explain the role of the Affordable Care Act's Prevention and Public Health Fund in health care reform. Do you think that the public health system will be improved by this initiative? Why or why not?

Q: Explain the role of the Affordable Care Act's Patient-Centered Outcomes Research Institute in health care reform. Do you think that health care quality will be improved by this initiative? Why or why not?

prevent disease, injury, and premature death in the United States. Grassroots support and mobilization are vital. Public health professionals must develop organizing capabilities to mobilize communities, regions, and populations to fight for the conditions they need to ensure health for all. These conditions

that produce health include, at a minimum, adequate and safe housing; safe workplaces; nutritious and toxin-free food; clean air and drinking water; safe transportation; opportunities for exercise and recreation; and access to quality health care. They must also include sustaining incomes for all and education that prepares all adults for meaningful participation in the economy. Finally, public health in the United States must participate in the reduction and prevention of global health problems, both because these affect health in the United States and because doing so is consistent with the "public health sensibility."

NOTES

1 Although mental health and physical health are highly correlated, public health is not as active in mental health prevention and control, and this issue will not be taken up here.
2 The programs that include CER for each country are: United Kingdom's National Institute for Health and Clinical Excellence (NICE), France's Haute Autorité de Santé (HAS), Australia's Pharmaceutical Benefits Scheme (PBS), and Germany's IQWiG.
3 The Comptroller General of the U.S. leads the Government Accountability Office (GAO). It is an independent agency that is hired by the government to perform audits, investigations, reports, policy analysis, and issue legal opinions.

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