

Part I

What Is Public Health?





Chapter 1

Public Health: Science, Politics, and Prevention

KEY TERMS

Assessment

Assurance

Biomedical sciences

Community

Disability

Effectiveness

Epidemiology

Health

Health outcomes

Health promotion

Infectious disease

Interventions

Life expectancy

Policy development

Public health

Risk factor

Statistics

Substance abuse

Virus

One expectation about living in a civilized society is that the living conditions will be basically healthy. Unless something unusual happens, like the outbreak of *Cryptosporidium* in the Milwaukee water supply, people assume that they are basically safe: Their water is safe to drink; the hamburger they buy at the fast food restaurant is safe to eat; the aspirin they take for a headache is what the label says it is; and they are not likely to be hit by a car—or a bullet—if they use reasonable caution in walking down the street. Even after the attacks in the fall of 2001, which severely disrupted their sense of security, most Americans regained a sense of trust in the safety of their environment.

In historical terms, this expectation is a relatively recent development. In the mid-19th century, when record-keeping began in England and Wales, death rates were very high, especially among children. Of every ten newborn infants, two or three never reached their first birthday. Five or six died before they were six years old, and only about three of the ten lived beyond the age of 25.¹ Tuberculosis was the single largest cause of death in the mid-19th century. Epidemics of cholera, typhoid, and smallpox swept through communities, killing people of all ages and making them afraid to leave their homes.

Injuries—often fatal—to workers in mines and factories were common due to unsafe equipment, long working hours, poor lighting and ventilation, and child labor.

There are a number of reasons why people's lives are basically healthier today than they were 150 years ago: cleaner water, air, and food; safe disposal of sewage; better nutrition; more knowledge concerning healthy and unhealthy behaviors; and many others. Most of these factors fall in the domain of **public health**. In fact, the term “public health” refers to two different but related concepts. We can say that the public health has improved since the 19th century, meaning that the general state of people's **health** is now much better than it was. But the measures that people take as a society to bring about and maintain that improvement are also known as public health.

Although many sectors of the community may be involved in promoting public health, people most often look to government—at the local, state, or national level—to take the primary responsibility. Governments provide pure water and efficient sewage disposal. Governmental regulations ensure the safety of the food supply. They also ensure the quality of medical services provided through hospitals, nursing homes, and other institutions. Laws regulating people's behavior prevent them from injuring each other. Laws requiring immunization of school-aged children prevent the spread of **infectious diseases**. Governments also sponsor research and education programs on causes and prevention of disease.

What Is Public Health?

Public health is not easy to define or to comprehend. A telephone survey of registered voters conducted in 1999 by a charitable foundation found that over half of the 1234 respondents misunderstood the term.² Leaders in the field have themselves struggled to understand the mission of public health, to explain what it is, why it is important, and what it should do. Charles-Edward A. Winslow, a theoretician and leader of American public health during the first half of the 20th century, defined public health in 1920 this way:

The science and the art of preventing disease, prolonging life, and promoting physical health and efficiency through organized community efforts for the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will ensure to every individual in the **community** a standard of living adequate for the maintenance of health.^{3(p.1)}

Winslow's definition is still considered valid today.

Over the following decades, public health had many successes, carrying out many of the tasks described in Winslow's definition. It was highly effective in reducing the threat of infectious diseases, thereby increasing the average lifespan of Americans by several decades. By the 1980s, public health was taken for granted, and most people were unaware of its activities. But there were signs that the system was not functioning well. Government expenditures on health were alarmingly high, but most of the spending was directed

toward medical care. No one was talking about public health. At the same time, new health problems were appearing: The AIDS epidemic broke out, concern about environmental pollution was growing, the aging population was demanding increased health services, and social problems such as teenage pregnancy, violence, and **substance abuse** were becoming more common. There was a sense that public health was not prepared to deal with these problems, in part because people were not thinking of them as public health problems.

A study conducted by the Institute of Medicine and published in 1988 called *The Future of Public Health* refocused attention on the importance of public health and did a great deal to revitalize the field. One of the first tasks the study committee set for itself was to re-examine the definition of public health, reasoning that for it to be effective, public health had to be broadly defined.⁴ The committee's report gives a four-part definition describing public health's mission, substance, organizational framework, and core functions.

The Future of Public Health defines the mission of public health as "the fulfillment of society's interest in assuring the conditions in which people can be healthy."^{4(p.40)} The substance of public health is "organized community efforts aimed at the prevention of disease and the promotion of health."^{4(p.41)} The organizational framework of public health encompasses "both activities undertaken within the formal structure of government and the associated efforts of private and voluntary organizations and individuals."^{4(p.42)} The three core functions of public health are these:

1. Assessment
2. Policy development
3. Assurance^{4(p.43)}

These core functions were later translated by another committee into a more concrete set of activities called The Ten Essential Public Health Services, shown in (**Table 1-1**).

Public Health Versus Medical Care

One way to better understand public health and its functions is to compare and contrast it with medical practice. While medicine is concerned with individual patients, public health regards the community as its patient, trying to improve the health of the population. Medicine focuses on healing patients who are ill. Public health focuses on preventing illness.

In carrying out its core functions, public health—like a doctor with his/her patient—assesses the health of a population, diagnoses its problems, seeks the causes of those problems, and devises strategies to cure them. **Assessment** constitutes the diagnostic function, in which a public health agency collects, assembles, analyzes, and makes available information on the health of the population. **Policy development**, like a doctor's development of a treatment plan for a sick patient, involves the use of scientific knowledge to develop a strategic approach to improving the community's health. **Assurance** is equivalent to the doctor's actual treatment of the patient. Public health has the responsibility of assuring that the services needed for the protection of public health in the community are available and accessible to everyone. These include environmental, educational, and basic medical

Table 1-1 The Ten Essential Public Health Services**Assessment**

1. Monitor health status to identify community health problems
2. Diagnose and investigate health problems and health hazards in the community

Policy Development

3. Inform, educate, and empower people about health issues
4. Mobilize community partnerships to identify and solve health problems
5. Develop policies and plans that support individual and community health efforts

Assurance

6. Enforce laws and regulations that protect health and ensure safety
7. Link people to needed personal health services and assure the provision of health care when otherwise unavailable
8. Assure a competent public health and personal healthcare workforce
9. Evaluate effectiveness, accessibility, and quality of personal and population-based health services

Serving All Functions

10. Research for new insights and innovative solutions to health problems

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services. If public health agencies do not provide these services themselves, they must encourage others to do so or require such actions through regulation.

Public health's focus on prevention makes it more abstract than medicine, and its achievements are therefore more difficult to recognize. The doctor who cures a sick person has achieved a real, recognizable benefit, and the patient is grateful. Public health cannot point to the people who have been spared illness by its efforts. As Winslow wrote in 1923, "If we had but the gift of second sight to transmute abstract figures into flesh and blood, so that as we walk along the street we could say 'That man would be dead of typhoid fever,' 'That woman would have succumbed to tuberculosis,' 'That rosy infant would be in its coffin,'—then only should we have a faint conception of the meaning of the silent victories of public health."^{3(p.65)}

This "silence" accounts in large part for the relative lack of attention paid to public health by politicians and the general public in comparison with medical care. It is estimated that only about 3 percent of the nation's total health spending is spent on public health.⁵ During the healthcare reform debate of 1993 and 1994, and again in 2008 during the presidential campaign, virtually all of the discussion focused on paying for medical care, while very little attention was paid to funding for public health. However, President Obama's health reform law, passed in 2010, did include provisions and funding for prevention, wellness, and public health.⁶

Effective public health programs clearly save money on medical costs in addition to saving lives. Moreover, public health contributes a great deal more to the health of a

population than medicine does. According to one analysis, the **life expectancy** of Americans has increased from 45 to 75 years over the course of the 20th century.⁷ Only 5 of those 30 additional years can be attributed to the work of the medical care system. The majority of the gain has come from improvements in public health, broadly defined as including better nutrition, housing, sanitation, and occupational safety. One responsibility of public health, therefore, as noted in the Institute of Medicine report, is to educate the public and politicians about “the crucial role that a strong public health capacity must play in maintaining and improving the health of the public . . . By its very nature, public health requires support by members of the public—its beneficiaries.”^{4(p.32)}

Public health, like medical practice, is based on science. However, even when public health scientists are certain they know all about the causes of a problem and what should be done about it, a political decision is generally necessary before action can be taken to solve it. When a doctor diagnoses a patient’s illness and recommends a treatment, it is up to the patient to accept or reject the doctor’s recommendation. When the “patient” is a community or a whole country, it is usually a government—federal, state, or local—that must make the decision to accept or reject the recommendations of public health experts. Sometimes the process starts within the community when, like a patient going to a doctor with a complaint, the people recognize a problem and demand that the government take action. This has occurred in many communities when victims of drunk drivers form organizations such as Mothers Against Drunk Driving (MADD) to lobby for stricter laws, or when neighbors of pollution-generating factories demand that the government force the industry to clean up the environment.

Politics enters the public health process as part of the policy development function and especially as part of the assurance function. Since the community will have to pay for the “treatments,” usually through taxes, they must decide how much “health” they are willing to fund. They also must decide whether they are willing to accept the possible limitations on their freedom that may be required in order to improve the community’s health. Among the assurance functions of public health is the provision of basic medical services: How this should be done has been a matter of great political controversy. Public health professionals are often impatient with politics, as the Institute of Medicine report notes, seeming to “regard politics as a contaminant of an ideally rational decision-making process rather than as an essential element of democratic governance.”^{4(p.5)}

The Sciences of Public Health

The scientific knowledge on which public health is based spans a broad range of professional disciplines. The Institute of Medicine report notes that “public health is a coalition of professions united by their shared mission” as well as by “their focus on disease prevention and **health promotion**; their prospective approach in contrast to the reactive focus of therapeutic medicine, and their common science, epidemiology.”^{4(p.40)} The disciplines of public health can be divided somewhat arbitrarily into six areas. Epidemiology and statistics are the basis for the assessment functions of public health, including the collection and analysis of information. Both assessment and policy development need an understanding of the causes of health problems in the community, an understanding that depends on

biomedical sciences, social and behavioral sciences, and environmental sciences. As part of the assurance function, public health seeks to understand the medical care system in an area of study generally referred to as health policy and management or health administration, which also includes the administration and functioning of the public health system.

Epidemiology has been called the basic science of public health. As its name suggests, epidemiology is the study of epidemics. It focuses on human populations, usually starting with an outbreak of disease in a community. Epidemiologists look for common exposures or other shared characteristics in the people who are sick, seeking the causative factor.

Epidemiology often provides the first indications of the nature of a new disease. When AIDS was first recognized in the early 1980s, the cause was unknown. Doctors reported cases of this unusual disease to the U.S. Centers for Disease Control and Prevention, and epidemiologists began looking for common characteristics of the patients. Epidemiologic research indicated that it was an infectious disease spread through blood and body fluids and suggested a virus as the cause. This prompted the biomedical scientists to step in and look for the virus.

Epidemiology is important not only for deciphering the causes of exotic new diseases, but for preventing the spread of old, well-understood diseases. Epidemiologists are mainstays of local health departments. In what is commonly known as “shoe-leather epidemiology,” they track down, for example, the source of a food-poisoning outbreak and force a restaurant to clean up its kitchen. Or they trace everyone who has been in contact with a college student diagnosed with meningitis in order to administer high doses of antibiotic to prevent further spread of that dangerous disease. Epidemiologic studies have also been important in identifying the causes of chronic diseases such as heart disease and cancer.

Because public health deals with the health of populations, it depends very heavily on **statistics**. Governments collect data on births and deaths, causes of death, outbreaks of communicable diseases, cases of cancer, occupational injuries, and many other health-related issues. These numbers are diagnostic tools, informing experts how healthy or sick a society is, and where its weaknesses are. For example, the fact that the United States ranks 27th in infant mortality among the nations of the world, 26th in life expectancy of men, and 28th of women is one indication that the public health in this country is not as good as that in many others.^{8(Tables 14,15)}

To understand what the numbers mean, it is necessary to understand certain statistical concepts and calculations. The science of statistics is used to calculate risks from exposure to environmental chemicals, for example. Statistical analysis is an integral part of any epidemiologic study seeking the cause of a disease or a clinical study testing the **effectiveness** of a new drug.

Both public health and medicine depend on the **biomedical sciences**. A major proportion of human disease is caused by microorganisms. Prevention and control of these diseases in a population require an understanding of how these infectious agents are spread and how they affect the human body. Control of infectious diseases was a major focus of public health in the 19th and early 20th centuries. Biomedical research was very successful in gaining an understanding of the major killers of that period, providing the information and techniques from which successful public health measures could bring these diseases under control.

Biomedical research is still important to the understanding and control of new diseases such as AIDS, which has become the major epidemic of the late 20th and early 21st centuries worldwide. It has also contributed increasingly to an understanding of noninfectious diseases such as cancer and heart disease, which have become increasingly important as many infectious diseases have been controlled. Recent progress in understanding human genetics is providing new insights into people's inherent susceptibility to various diseases, raising new hopes of cures as well as concerns about discrimination.

Environmental health science, a classic component of public health, is concerned with preventing the spread of disease through water, air, and food. While it is not strictly a separate science, because it shares concerns about the spread of infectious organisms with biomedical sciences and depends on epidemiology to track environmental causes of disease outbreaks, it is usually considered a separate area of public health. Much of the great improvement in public health in the United States during the 20th century was due to improved environmental health, especially the fact that most Americans have safe drinking water. In its concern with safe water and waste disposal, environmental health depends on engineering to design, build, and maintain these systems.

Despite the fact that the importance of safe air, water, and food has been recognized for so many decades, there are many new challenges to environmental health. Not only do old systems fail, as occurred in Milwaukee, but new problems arise, brought about by modern lifestyles. Thousands of new chemicals enter the environment every year, and little is known about their effects on human health. Chemicals known to be toxic have accumulated in the environment, and methods must be devised to dispose of them safely. Other environmental threats to health include ultraviolet rays in sunlight, an increasing problem as the ozone layer of the earth's atmosphere is depleted, and exposure to other kinds of radiation. Recently it has become apparent that human activities are causing changes in the climate of the earth, changes that are permanently altering our environment and are already having important effects on human health.

Increasingly, public health is concerned with social and behavioral sciences. As biomedical and environmental sciences have conquered many of the diseases that killed people of previous generations, people in modern societies are dying of diseases caused by their behavior and the social environment. Heart disease is related to nutrition and to exercise patterns; many forms of cancer are caused by smoking; abuse of drugs and alcohol is a notorious killer. Violence is a significant cause of death in our society and attracts ongoing concern.

Some subgroups of the population have poorer health overall than others, for reasons that, while not completely understood, relate to social and behavioral factors. People with low incomes are less healthy than those with a higher socioeconomic status. Black Americans have lower life expectancy overall than white Americans, even when their incomes are similar. Other ethnic minority groups, including Hispanics, Asians, and American Indians are at increased risk for a variety of health problems.

Social and behavioral sciences involve more unanswered questions than biomedical and environmental sciences do. Very little is known about why racial and ethnic groups differ in their health-related behavior, why many people of all races behave in unhealthy

ways, and how to prevent self-destructive behaviors. In the social and behavioral sciences, of all areas, research and application of its findings are most likely to make a difference in the future.

Until the beginning of the 20th century, public health and medicine overlapped substantially in their spheres of interest and activity. Both fields were concerned primarily with understanding the causes and prevention of infectious disease because medicine was relatively powerless to cure them. With the discovery of antibiotics, however, medicine gained the power to work miracles of healing, leading to a period of rapidly growing influence. Meanwhile, because of its less glamorous task of preventing disease, public health faded into obscurity.

Over the past few decades, it has become apparent that our society's emphasis on curing disease rather than preventing it has gone out of control. Medical care has become so expensive that an increasing proportion of the population cannot afford it, and spending for medical care has eaten up resources that could more profitably be used for education, housing, and the environment. Concern about runaway costs, lack of access, and questionable quality of care has led to an increasing interest in studying the medical care system, its effectiveness, efficiency, and equity, leading to a science called health services research. Traditional categorization of public health fields puts this study into the area of health policy and management or health administration.

Prevention and Intervention

Public health's approach to health problems in a community has been described as a five-step process:

1. Define the health problem.
2. Identify the **risk factors** associated with the problem.
3. Develop and test community-level interventions to control or prevent the cause of the problem.
4. Implement interventions to improve the health of the population.
5. Monitor those interventions to assess their effectiveness.⁶

Thus, a main task of prevention is to develop interventions designed to prevent specific problems that have been identified either through an assessment process initiated by a public health agency or through community concern raised by an unusual course of events. For example, statistical data may show that a community has a high rate of cancer in comparison with other similar communities. Or a series of fatal crashes caused by drunk driving may mobilize a community to demand action to prevent further tragedies.

Public health has developed systematic ways of thinking about such problems that facilitate the process of designing **interventions** that prevent undesirable **health outcomes**. One approach is to think of prevention on three levels: primary prevention, secondary prevention, and tertiary prevention. Primary prevention prevents an illness or injury from occurring at all, by preventing exposure to risk factors. Secondary prevention seeks to minimize the severity of the illness or the damage due to an injury-causing event once the

event has occurred. Tertiary prevention seeks to minimize **disability** by providing medical care and rehabilitation services.

Thus interventions for primary prevention of cancer include efforts to discourage teenagers from smoking and efforts to encourage smokers to quit. In secondary prevention, screening programs are established to detect cancer early when it is still treatable. Tertiary prevention involves the medical treatment and rehabilitation of cancer patients.

This way of thinking was very effective in developing traffic safety programs that, over the past five decades, have significantly reduced the rates of injury from motor vehicle crashes. Primary prevention focused on preventing crashes from occurring, for example, by building divided highways and installing traffic lights. Secondary prevention included the design of safer automobiles with stronger bumpers, padded dashboards, seat belts, and airbags. It also included laws requiring drivers and passengers to wear the seat belts. And tertiary prevention required the development of emergency medical services including ambulances, 911 calling networks, and trauma centers.

Another approach to designing interventions is to think of an illness or injury as the result of a chain of causation involving an agent, a host, and the environment. This approach is traditional when thinking of infectious diseases: the agent may be a disease-causing bacterium or **virus**; the host is a susceptible human being; and the environment includes the means of transmission by which the agent reaches the host, which may be contaminated air, water, or food, or it may be another human being who is infected. Prevention is accomplished by interrupting the chain of causation at any step. Rendering a potential host unsusceptible through immunization, for example, can interrupt the chain. Or the bacterium infecting a host can be killed through the use of antibiotics. Or the environment can be sanitized through the purification of water and food.

The chain of causation model can also be used for other kinds of illnesses or injuries. For example, suicide is the second leading cause of death in the age group 15 to 24.⁸(Table 21) In applying the model to prevention of youth suicide, the host is the susceptible young person; the agent is most often a gun or an overdose of pills; the environment includes the young person's whole social environment, including family, school, and the media. A public health intervention could focus on how to make young people less susceptible to self-destructive thinking; it could try to change the messages presented by television and schoolmates that may lead a young person to think he or she is unattractive or otherwise inferior. However, the public health perspective tends to be that the most effective target of intervention for youth suicide prevention is the agent, especially guns. Many adolescents are susceptible to depressed moods and think of killing themselves, but the best predictor of whether they will succeed is whether they have access to a gun.

Public Health and Terrorism

The events in the fall of 2001 disturbed the sense of complacency many people felt about the health and safety of their living conditions. Evidence that there were groups or individuals who not only wanted to cause harm to Americans at home but who had the resources and the will to succeed in that goal forced us to think about how to prevent similar events

in the future. While prevention of violent acts such as hijacking airplanes is primarily a responsibility of law enforcement, public health has an important role to play in controlling the damage caused by such events. In other words, primary prevention of terrorist acts may be out of the domain of public health, but secondary and tertiary prevention are very much a part of public health's mission. Success at these services depend on having well-designed plans in place before a disaster occurs.

The crashing of two planes into the World Trade Center triggered the activation of emergency response plans developed for New York City and New York State, plans designed as secondary prevention—minimizing the damage—and tertiary prevention—providing medical care to those injured in the disaster. Most critically important for saving lives was the ability for occupants of the buildings to get out as fast as possible. The fact that all but 2092 of the 17,400 people who were in the towers when the planes hit made it out is evidence that some aspects of the plans were effective.⁹ However, studies done later found many flaws in the emergency planning. Plans for providing medical care to survivors were not seriously tested, because the capacity—including the arrival of numerous volunteers—exceeded the number of injured survivors. The greatest problem was a lack of coordination.

The public health response to the terrorism of September 11, 2001 was essentially the same as the response needed for other emergencies and disasters: factory explosions, plane and train crashes, earthquakes, hurricanes (such as Katrina in 2005), and so on. Public health was concerned not only with coordinating emergency medical care, but also with ensuring the safety of cleanup workers and area residents. Problems with polluted water, contaminated air, spoiled food, infestation of vermin, and so on had to be dealt with in downtown Manhattan just as they must be dealt with after a natural disaster.

The importance of public health became even more obvious in the aftermath of the anthrax mailings. These bioterrorism attacks did not announce themselves in the dramatic fashion of the airplane hijackings. The first signs that a terrorist event had occurred were not recognized as such. No alarm bells rang when a few patients showed up in hospital emergency rooms with hard-to-diagnose illnesses. Anthrax announced itself in the same way that AIDS appeared, as an outbreak of something new that was reported to public health authorities, who then investigated.

The damage done by the anthrax mailings was relatively minor. However, the potential disaster that would result if a more infectious microorganism were used in a bioterror attack forced many sectors of society to pay attention to public health. In speculating about what would happen if a terrorist clandestinely released smallpox virus into a crowd, public health authorities realized that only epidemiologic methods for controlling natural epidemics could even begin to deal with the crisis. Suddenly the media and politicians began talking about public health. Ironically, the threat of bioterrorism did more to teach the public about public health than any educational program. As Robert F. Meenan, Dean of the Boston University School of Public Health, is quoted as saying, the anthrax attacks provided “a marketing campaign we could never have bought.”¹⁰ It is not clear, however, that the lessons learned about public health during those difficult times will stay with us when the public's attention shifts to the more politically demanding concerns about paying for medical care.

Conclusion

This chapter has shown that public health is a broad term that is difficult to define. It includes a goal—maximum health for all—as well as the means of attempting to achieve that goal. Public health is concerned with the prevention of disease and disability. It is aimed at benefiting the entire population in contrast with medicine, which focuses on the individual.

The functions of public health in a community can be compared with the functions of a physician in caring for a patient. Public health diagnoses and treats the community's ills by way of assessment, policy development, and assurance. It relies on the tools of science and politics. The public health sciences of epidemiology and statistics are applied in assessing a population's health. Policy is developed based on biomedical sciences, social and behavioral sciences, environmental health sciences, and the study of the medical care system. Public health depends on politics for decision making. Decisions on public health interventions to be taken by the community, insofar as they require government action, are reached through politics.

Public health focuses on prevention of disease and disability. Preventive measures can be applied at three levels: Primary prevention aims to prevent a disease or injury from occurring at all; secondary prevention aims to minimize the damage caused by the illness or injury-causing event when it occurs; and tertiary prevention seeks to minimize any ensuing disability by providing medical care and rehabilitation.

Public health prevention programs function through interventions designed to interrupt the chain of causation that leads to an illness or an injury. Interventions can be directed toward eliminating or suppressing the agent that causes an illness or injury, strengthening the resistance of the host to the agent, or changing the environment in such a way that the host is less likely to encounter the agent.

Public health is an abstract concept that is not well understood and is often neglected. The dramatic events in the fall of 2001 forced the government and the media to pay attention to the importance of public health, both in mitigating the effects of obvious disasters, and in recognizing and controlling the more insidious effects of bioterrorism, although it is not clear whether that understanding will endure.

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