



## SECTION 1

# Principles of Population Health

Section 1 of *Public Health 101: Improving Community Health* introduces you to the ways that public health affects your every waking moment, from the food you eat, to the water you drink, to the car you drive. Even sleep matters. In public health, we use bed nets to prevent malaria, we use beds that prevent back pain, and put infants to sleep on their backs to prevent sudden infant death syndrome (SIDS).

In Section 1, we will examine a range of approaches to public health that have been used over the centuries. Then we will focus on a 21st century approach known as *population health*. Population health considers the full range of options for intervention to address health problems, from community control of communicable disease and environmental health, to healthcare delivery systems, to public policies such as taxation and laws designed to reduce cigarette smoking. Population health, as reflected in Healthy People 2030, takes a life cycle approach, considering how risks to health affect the population throughout the life span. We will also look at how populations are changing and aging by examining three important transitions that affect

population health today and will continue to do so for years to come.

In this section, we will also examine an evidence-based approach to public health that focuses on defining the problem, establishing the etiology, making evidence-based recommendations, implementing these recommendations in practice, and evaluating the impacts of interventions. The population health and evidence-based approaches introduced in Section 1 provide an underpinning for all that follows.

At the end of Section 1 (and at the end of every section), there are cases with discussion questions that draw on chapters from the section. Each case is designed as a realistic description of the types of problems we face as we seek to improve community health.

In this fourth edition, a new case study has been added to Section 1 on folic acid and spina bifida, which explores in-depth the evidence-based public health approach.

So, with no further ado, let us take a look at how public health can and does affect all of our daily lives.



## CHAPTER 1

# Public Health: The Population Health Approach

## LEARNING OBJECTIVES

- Identify multiple ways that public health affects daily life.
- Define eras of public health from ancient times to the present.
- Define the meaning of “population health.”
- Describe the impact of age as a predictor of disease and disability.
- Illustrate the uses of health care, traditional public health, and social interventions in population health.
- Identify a range of determinants of disease.
- Describe the meaning and uses of leading indicators as part of Healthy People 2030.
- Describe the categories of social determinants of health as defined by Healthy People 2030.
- Describe what is meant by “health equity.”
- Identify ways that populations change over time, and how this affects health.

I woke up this morning, got out of bed, and went to the bathroom. There I used the toilet, washed my hands, brushed, and flossed my teeth, drank a glass of water, and took my blood pressure and cholesterol medication. Then I did my exercises and took a shower.

On the way to the kitchen, I didn't even notice the smoke detector I passed or the old ashtrays in the closet. I took a low-fat yogurt out of the refrigerator and prepared hot cereal in the microwave oven for my breakfast.

Then I walked out my door into the crisp, clean air feeling at least partially protected by vaccinations. I got in my car, put on my seat belt, saw the light go on for the airbag, and safely drove to work. I got to my office, where I paid little attention to the new defibrillator at the entrance, the “no smoking” signs, or the absence of asbestos. I arrived safely in my well-ventilated office and got ready to teach Public Health 101.

It wasn't a very eventful morning, but then it's all in a morning's work when it comes to improving community health through the work of public health.



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This rather mundane morning is made possible by a long list of achievements that reflect the often-ignored history of public health.<sup>1</sup> We take for granted the fact that water chlorination, hand washing, indoor plumbing, and vaccination have largely eliminated the transmission of common bacterial and viral diseases, which for centuries killed the young and not so young. Do not overlook the impact of prevention on our teeth and gums. Teeth brushing, flossing, and fluoridation of water have made a dramatic impact on the dental health of children and adults.

The more recent advances in the prevention of heart disease have been a major public health achievement. Preventive successes include the reduction of blood pressure and cholesterol, cigarette smoking prevention and cessation efforts, an understanding of the role of exercise, and the widespread availability of defibrillators. These can be credited with at least half of the dramatic reductions in heart disease that have reduced the death rate from coronary artery disease by approximately 50% in the United States and most other developed countries in the last half century.

The refrigerator was one of the most important advances in food safety, which illustrates the impact of social change and innovation not necessarily intended to improve health. Food and product safety are public health achievements that require continued attention. It was public pressure for food safety that in large part brought about the creation of the U.S. Food and Drug Administration. The work of this public health agency continues to affect all of our lives from the foods we eat, to the drugs and vaccines we take, to the cosmetics we use.

Radiation safety, like radiation itself, usually goes unnoticed, from the regulation of microwave ovens to the reduction of radon in buildings. We rarely notice when disease does not occur.

Highway safety illustrates the wide scope of activities required to protect the public's health. From seat belts, child restraints, and airbags to safer cars, highways, designated driver programs, and enforcement of drunk driving laws, public health efforts require collaboration with professionals not usually thought of as having a health focus. New technologies produce new challenges as our constant communications lead to inattention to the road. However, technology also offers new opportunities which literally help compensate for some of our "blind spots."

Vaccinations against COVID-19 and influenza as well as other diseases with respiratory spread, including measles and mumps, has made life safer and freer. An increasing number of viral and bacterial illnesses are being controlled by vaccinations

and progress is being made with parasitic diseases, including malaria.

The physical environment also has been made safer by the efforts of public health. Improvement in the quality of the air we breathe both outdoors and indoors has been an ongoing accomplishment of what we will call "population health." Our lives are safer today because of interventions ranging from installation of smoke detectors to removal of asbestos from buildings.

However, the challenges continue. Globalization increases the potential for the spread of existing and emerging diseases and raises concerns about the safety of the products we use. Climate change and ongoing environmental deterioration continue to produce new territory for "old" diseases, such as malaria, dengue fever, West Nile Virus, and Zika. Overuse of technologies, such as antibiotics, has encouraged the emergence of resistant bacteria. Overprescription of opioids has contributed to an epidemic of fatal overdoses among the young and not so young.

The 20th century and early years of the 21st century saw an increase in life expectancy of almost 30 years in most developed countries, much of it due to the successes of public health initiatives.<sup>2</sup> We cannot assume that these trends will continue indefinitely, as we saw with the COVID-19 pandemic. In the United States, the epidemics of obesity and opioids threaten to slow down or reverse the progress we have been making. The challenges of 21st century public health include the protection of health and continued improvement in quality of life, not just the quantity of years individuals are living.

To understand the role of public health in these achievements and other, ongoing challenges, let us start at the beginning and ask: What do we mean by "public health"?

## What Do We Mean by "Public Health"?

Ask your parents what "public health" means, and they might say, "Health care for the poor." They are right that public health has always been about providing services for **vulnerable populations** or those at higher than average risk of disease and/or bad outcomes of disease, either directly or through the healthcare system. Public health approaches to vulnerable populations range from reducing exposure to lead paint in deteriorating buildings, to food supplementation, to preventing birth defects and goiters. Addressing the needs of vulnerable populations has always been a cornerstone of public health. As we

will see, however, the definition of “vulnerable populations” continues to change, as do the challenges of addressing their needs.

Ask your grandparents what “public health” means, and they might say, “Washing your hands.” Well, they are right too—public health has always been about determining risks to health and providing successful interventions that are applicable to everyone. But hand washing is only the tip of the iceberg. The types of interventions that apply to everyone and benefit everyone span an enormous range: from food and drug safety to controlling air pollution, from measures to prevent the spread of COVID-19 to vaccinating against childhood diseases, from prevention and response to disasters to detection of contaminants in our water.

The concerns of society as a whole are always in the forefront of public health, though traditionally the focus of public health has been on prevention among mothers and children and the working-age population. These concerns keep changing and the methods for addressing them keep expanding. New technologies and global, local, and national interventions are becoming a necessary part of public health. To understand what public health has been and what it is becoming, let us look at some definitions of “public health.” The following are two definitions of “public health”—one from the early 20th century and one from more recent years.

Public health is “the science and art of preventing disease, prolonging life and promoting health through organized community effort.”<sup>3</sup>

The substance of public health is the “organized community efforts aimed at the prevention of disease and the promotion of health.”<sup>4</sup>

These definitions show how little the concept of public health changed throughout the 20th century; however, the concept of public health in the 21st century is undergoing important changes in a number of ways, including:

- The goal of prolonging life is being complemented by an emphasis on the quality of life. Protection of health when it already exists is becoming a focus along with promoting health when it is at risk.
  - Use of technologies, such as the Internet and social media, is redefining “community,” as well as offering new ways to communicate accurate as well as inaccurate information.
  - The enormous expansion in the options for intervention, as well as the increasing awareness of potential harms and costs of intervention
- programs, requires a new science of “evidence-based” public health.
  - Public health is increasingly attempting to predict the future, from climate change to antibiotic resistance to the evolution of COVID-19, in order to identify interventions that improve and maintain the health of the population.
  - Public health and clinical care, as well as public and private partnerships, are coming together in new ways to produce collaborative efforts rarely seen in the 20th century.
  - Complex public health problems need to be viewed as part of larger health and social systems, which require efforts to simultaneously examine multiple problems and multiple solutions rather than one problem or one solution at a time.
  - Public health increasingly needs to pay attention to the full range of health issues, not just prevention among mothers and children and the working-age population, but prevention of disability among our growing elderly populations. A full life cycle approach is now needed to improve community health.

A new 21st century definition of public health is needed. One such definition, that we will call **population health**, might read as follows:

The totality of all evidence-based public and private efforts throughout the life cycle that preserve and promote health and prevent disease, disability, and death.



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We can think of public health as “all we do together to promote and preserve health and prevent disease, disability, and death”. What we do together is key since it focuses us on the population perspective. Specifically, this definition enlarges the traditional scope of public health to include an examination of

the full range of environmental, social, and economic determinants of health—not just those traditionally addressed by public health and clinical health care. It includes an examination of the full range of interventions to address health issues, including the structure and function of healthcare delivery systems, plus the role of public policies that affect health even when health is not their intended effect.<sup>5</sup>

If your children ask you what public health is, you might respond, “It is about the big picture issues that affect our own health and the health of our community every day of our lives.” You might go on and let them know that public health is about protecting health in the face of disasters; preventing disease from addictions such as cigarettes and opioids; controlling infections such as the human immunodeficiency virus (HIV) and COVID-19; and implementing measures to ensure safety of the food we eat, water we drink, and air we breathe.

In order to better understand our 21st century definition of public health, let us take a look at how approaches to public health have changed over time.

## How Has the Approach of Public Health Changed over Time?

### Health Protection (Antiquity—1830s)

Organized community efforts to promote health and prevent disease go back to ancient times.<sup>6,7</sup> The earliest human civilizations integrated concepts of prevention into their culture, their religion, and their laws. Prohibitions against specific foods—including pork, beef, and seafood—plus customs for food preparation, including officially designated methods of killing cattle and methods of cooking, were part of the earliest practices of ancient societies. Prohibitions against alcohol or its limited use for religious ceremony have long been part of societies’ efforts to control behavior, as well as prevent disease. Prohibition of cannibalism, the most universal of food taboos, has strong grounding in the protection of health.<sup>a</sup>

The earliest civilizations have viewed sexual practices as having health consequences. Male circumcision, premarital abstinence, and marital fidelity have all been shown to have impacts on health.

Isolation or quarantine of individuals with disease or those exposed to disease has likewise been practiced for thousands of years. The intuitive notion that isolating individuals with disease could protect individuals and societies led to some of the earliest organized efforts to prevent the spread of disease. At times they were successful, but without a solid scientific basis.

During the 1700s and the first half of the 1800s, individuals occasionally produced important insights into the prevention of disease. In the 1740s, British naval commander James Lind demonstrated that lemons and other citrus fruit could prevent and treat scurvy, a then-common disease among sailors, whose daily nourishment was devoid of citrus fruit, the best source of vitamin C.

In the last years of the 1700s, English physician Edward Jenner recognized that cowpox, a common mild ailment among those who milked cows, protected those who developed it against life-threatening smallpox. He developed what came to be called a vaccine—derived from the Latin *vacca*, meaning “cow.” He placed fluid from cowpox sores under the skin of recipients, including his son, and exposed them to smallpox. Despite the success of these smallpox prevention efforts, widespread use of vaccinations was slow to develop, partially because at that time there was not an adequate scientific basis to explain the reason for its success.

### Hygiene Movement (1840–1870s)

All of these approaches to disease prevention were known before organized public health existed. Public health awareness began to emerge in Europe and the United States in the mid-1800s. The U.S. public health movement has its origins in Europe, where concepts of disease as the consequence of social conditions took root in the 1830s and 1840s. This movement, which put forth the idea that disease emerges from social conditions of inequality, produced the concept of **social justice**. Many attribute public health’s focus on vulnerable populations to this tradition.

While early organized public health efforts paid special attention to vulnerable members of society, they also focused on the hazards that affected everyone, such as contamination of the environment. This focus on sanitation and public health was often called the hygiene movement, which began even before the development of the germ theory of disease. Despite

a In recent years, this prohibition has been indirectly violated by feeding beef products containing bones and brain matter to other cattle. The development of “mad cow” disease and its transmission to humans has been traced to this practice, which can be viewed as analogous to human cannibalism.

the absence of an adequate scientific foundation, the hygiene movement made major strides in controlling communicable diseases, such as tuberculosis, cholera, and waterborne diseases, largely through alteration of the physical environment.

The fundamental concepts of epidemiology also developed during this era. In the 1850s, John Snow, often called the father of epidemiology, helped establish the importance of careful data collection and documentation of rates of disease before and after an intervention in order to evaluate effectiveness. He is known for his efforts to close down the Broad Street pump, which supplied water contaminated by cholera to a district of London. His actions quickly helped terminate that epidemic of cholera. John Snow's approach has become a symbol of the earliest formal epidemiological thinking.

Ignaz Semmelweis, an Austrian physician, used much the same approach in the mid-1800s to control puerperal fever—or fever of childbirth—then a major cause of maternal mortality. Noting that physicians frequently went from the autopsy room to the delivery room without washing their hands, he instituted a handwashing procedure and was able to document a dramatic reduction in the frequency of puerperal fever. Unfortunately, he was unable to convince many of his contemporaries to accept this intervention without a clear mechanism of action. Until the acceptance of the germ theory of disease, puerperal fever continued to be the major cause of maternal deaths in Europe and North America.

The mid-1800s in England also saw the development of birth and death records, or vital statistics, which formed the basis of population-wide assessment of health status. From the beginning of this type of data collection, there was controversy over how to define the cause of death. Two key figures in the early history of organized public health took opposing positions that reflect this continuing controversy. Edwin Chadwick argued that specific pathological conditions or diseases should be the basis for the cause of death. William Farr argued that underlying factors, including what we would today call social determinants of health, should be seen as the actual causes of death.

## Contagion Control (1880–1940s)

The methods of public health were already being established before the development of the germ theory of disease by Louis Pasteur and his European colleagues in the second half of the 1800s. The revolutions in biology that they ignited ushered in a new

era in public health. U.S. physicians and public health leaders often went to Europe to study new techniques and approaches and brought them back to the United States to use at home.

After the Civil War, U.S. public health began to produce its own advances and organizations. In 1872, the American Public Health Association (APHA) was formed. According to its own historical account, the APHA's "founders recognized that two of the association's most important functions were advocacy for adoption by the government of the most current scientific advances relevant to public health, and public education on how to improve community health."<sup>8</sup>

The biological revolution of the late 1800s and early 1900s that resulted from the germ theory of disease laid the groundwork for the modern era of public health. An understanding of the contributions of bacteria and other organisms to disease produced novel diagnostic testing capabilities. For example, scientists could now identify tuberculosis cases through skin testing, bacterial culture, and the newly discovered chest X-ray. Concepts of vaccination advanced with the development of new vaccines against bacterial toxins produced by tetanus and diphtheria.

Without antibiotics or other effective cures, much of public health in this era relied on prevention, isolation of those with disease, and case-finding methods to prevent further exposure.

In the early years of the 20th century, epidemiological methods continued to contribute to the understanding of disease. The investigations of pellagra by Goldberger and the United States Public Health Service overthrew the assumption of the day that pellagra was an infectious disease and established that it was a nutritional deficiency that could be prevented or easily cured with vitamin B6 (niacin) or a balanced diet. Understanding the role of nutrition was central to public health's emerging focus on prenatal care and childhood growth and development. Incorporating key scientific advances, these efforts matured in the 1920s and 1930s and introduced a growing alphabet of vitamins and nutrients to the U.S. vocabulary.

## Filling Holes in the Medical Care System (1950s–mid-1980s)

A new era of effective medical intervention against active disease began in force after World War II. The discovery of penicillin and its often miraculous early successes convinced physicians, scientists, public health practitioners, and the general public that a new era in medicine and public health had arrived.

During this era, public health's primary focus was on filling the holes in the healthcare system. In this period, the role of public health was often seen as assisting clinicians to effectively deliver clinical services to those without the benefits of private medical care and helping to integrate preventive efforts into the practice of medicine. Thus, the great public health success of organized campaigns for the eradication of polio was mistakenly seen solely as a victory for medicine. Likewise, the successful passage of Medicaid and Medicare, outgrowths of public health's commitment to social justice, was simply viewed as efforts to expand the practice of medicine.

This period, however, did lay the foundations for the emergence of a new era in public health. Epidemiological methods designed for the study of noncommunicable diseases demonstrated the major role that cigarette smoking plays in lung cancer and a variety of other diseases. The emergence of the randomized controlled trial and the regulation of drugs, vaccines, and other interventions by the Food and Drug Administration developed the foundations for what we now call evidence-based public health and evidence-based medicine.

## Health Promotion/Disease Prevention (Mid-1980s–2000)

The 1980s and much of the 1990s were characterized by a focus on individual responsibility for health and interventions at the individual level. Often referred to as health promotion and disease prevention, these interventions targeted individuals to effect behavioral change and combat the risk factors for diseases. As an example, to help prevent coronary artery disease, efforts were made to help individuals address high blood pressure and cholesterol, cigarette smoking, and obesity. Behavioral change strategies were also used to help prevent the spread of the newly emerging HIV/acquired immunodeficiency syndrome (AIDS) epidemic. Efforts aimed at individual prevention and early detection as part of medical practice began to bear some fruit with the widespread introduction of mammography for detection of breast cancer and the worldwide use of Pap smears for the detection of cervical cancer. Newborn screening for genetic disease became a widespread and often legally mandated program, combining individual and community components.

Major public health advances during this era resulted from the environmental movement, which brought public awareness of the health dangers of lead in gasoline and paint. The environmental movement also focused on reducing cancer by controlling

radiation exposure from a range of sources, including sunlight and radon, both naturally occurring radiation sources.

In a triumph of global cooperation, governments worked together to address the newly discovered hole in the ozone layer. In the United States, reductions in air pollution levels and smoking rates during this era had an impact on the frequency of chronic lung disease, asthma, and most likely coronary artery disease.

## Population Health (21st Century)

The heavy reliance on individual interventions that characterized much of the last half of the 20th century changed rapidly in the beginning of the 21st century. The current era in public health that is often called “population health” has begun to transform professional and public thought about health and the relationship between traditional public health and the healthcare system. From the potential for bioterrorism, to the high costs of health care, to the control of COVID-19, AIDS, and Ebola, the need for community-wide or population-wide public health efforts has become increasingly evident.

This new era is characterized by a global perspective and the need to address international health issues. The concept of One Health, which focuses on the connections among human health, animal health, and ecosystem health, is providing a framework for understanding the global health impacts that affect all of us. One Health includes a focus on the potential impacts of climate change, emerging and reemerging infectious diseases, antibiotic resistance, and the consequences of trade in potentially contaminated or dangerous products, ranging from food to toys.

**Table 1.1** outlines these eras of public health, identifies their key defining elements, and highlights important events that symbolize each era.<sup>9</sup>

Today we have entered an era in which a focus on the individual is increasingly coupled with a focus on what needs to be done at the community and population level. This era of public health can be viewed as “the era of population health.”

## What Is Meant by “Population Health”?

The concept of population health has emerged in recent years as a broader concept that stresses collaboration among traditional public health professions, healthcare delivery professionals, and a range of other

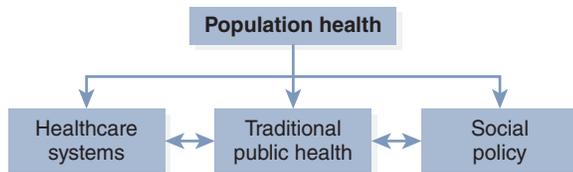
**Table 1.1** Eras of Public Health

Eras of public health	Focus of attention/paradigm	Action framework	Notable events and movements in public health and epidemiology
Health protection (Antiquity–1830s)	Authority-based control of individual and community behaviors	Religious and cultural practices and prohibited behaviors	Quarantine for epidemics; sexual prohibitions to reduce disease transmission; dietary restrictions to reduce food-borne disease
Hygiene movement (1840–1870s)	Sanitary conditions as basis for improved health	Environmental action on a community-wide basis distinct from health care	Snow and cholera; Semmelweis and puerperal fever; collection of vital statistics as empirical foundation for public health and epidemiology
Contagion control (1880–1940s)	Germ theory: demonstration of infectious origins of disease	Communicable disease control through environmental control, vaccination, sanatoriums, and outbreak investigation in general population. Investigation of viruses and appreciation of nutritional deficiency disease	Linkage of epidemiology, bacteriology, and immunology to form tuberculosis (TB) sanatoriums; outbreak investigation, e.g., Goldberger and pellagra
Filling holes in the medical care system (1950s–mid-1980s)	Integration of control of communicable diseases, modification of risk factors, and care of high-risk populations as part of medical care	Public system for control of specific communicable diseases and care for vulnerable populations distinct from general healthcare system, beginning of integrated healthcare systems with integration of preventive services into general healthcare system	Antibiotics; randomized controlled trials; concept of risk factors; Surgeon General reports on cigarette smoking; Framingham study on cardiovascular risks; health maintenance organizations and community health centers with integration of preventive services into general healthcare system
Health promotion/disease prevention (Mid-1980s–2000)	Focus on individual behavior and disease detection in vulnerable and general populations	Clinical and population-oriented prevention with focus on individual control of decision-making and multiple interventions	AIDS epidemic and need for multiple interventions to reduce risk; reductions in coronary heart disease and cigarette smoking through multiple interventions
Population health (21st century)	Coordination of public health, health care, and public policy based upon shared evidence and systems thinking	Evidence-based recommendations and information management, focus on harms and costs as well as benefits of interventions, globalization	Evidence-based collaboration between medicine and public health; information technology; social media information and misinformation; antibiotic resistance; global collaboration, e.g., One Health; tobacco control; climate change, and a full life cycle approach to improving community health

Data from Awofeso N. What's new about the “New Public Health”? *American Journal of Public Health*. 2004;94(5):705–709.

professions that affect health. Population health provides an intellectual umbrella for thinking about the wide spectrum of factors that can and do affect the health of individuals and the population as a whole. **Figure 1.1** provides an overview of what falls under the umbrella of population health.

Population health also provides strategies for considering the broad range of potential **interventions** to address these issues. By “intervention,” we mean the full range of strategies designed to protect health and prevent disease, disability, and death. Interventions include preventive efforts, such as nutrition and



**Figure 1.1** The Full Spectrum of Population Health

vaccination; curative efforts, such as antibiotics and cancer surgery; and efforts to prevent complications and restore function, from chemotherapy to physical therapy. Thus, population health is about improving community health.

The concept of population health can be seen as a comprehensive way of thinking about the modern scope of public health. It utilizes an evidence-based approach to analyze the determinants of health and disease and the options for intervention to preserve and improve health throughout the life cycle. Operationalizing, or putting population health into practice, requires us to define what we mean by “health issues” and what we mean by “population(s).” It also requires us to define what we mean by “society’s shared health concerns,” as well as “society’s vulnerable groups.”<sup>b</sup>

To understand population health, we therefore need to define what we mean by each of these four components:

- Health issues
- Population(s)
- Society’s shared health concerns
- Society’s vulnerable groups

## What Are the Implications of Each of the Four Components of Public Health?

All four of the key components of public health have changed in recent years. Let us take a look at the historical, current, and emerging scopes of each component and consider their implications.

For most of the history of public health, the term “health” focused solely on physical health. **Mental health** has now been recognized as an important part of the definition; conditions such as depression and substance abuse make enormous contributions to death and disability in populations throughout the world. The boundaries of what we mean by

“health” continue to expand, and the limits of health are not clear. Many novel medical interventions—including modification of genes and treatments to increase height, improve cosmetic appearance, and improve sexual performance—confront us with the question: Are these health issues?



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The definition of “population,” likewise, is undergoing fundamental change. For most of recent history, a population was defined geographically. Geographic communities, such as cities, states, and countries, defined the structure and functions of public health. The current definition of “population” has expanded to include the idea of a global community, recognizing the increasingly interconnected issues of global health. The definition of “population” is also focusing more on nongeographic communities. Universities now speak of an online-learning community, health care is delivered to members of a health plan community, and the Internet is constantly creating new social media communities. All of these new definitions of “population” are affecting the thinking and approaches needed to address public health issues.

What about the meaning of society-wide concerns—have they changed as well? Historically, public health and communicable disease were nearly synonymous, as symbolized by the field of epidemiology, which actually derives its name from the study of communicable disease epidemics. In recent decades, the focus of society-wide concerns has greatly expanded to include toxic exposures from the physical environment, transportation safety, and the costs of health care. However, communicable disease never went away as a focus of public health, and there is a recent resurgence in concern over emerging infectious diseases, including COVID-19, HIV/AIDS, Ebola, and Zika, as well as newly drug-resistant diseases, such as staph infections and tuberculosis. Additional

<sup>b</sup> The term **population health management** has also gained widespread use in recent years. Population health management focuses on the delivery of healthcare services but utilizes many of the concepts of population health. Population health management can be viewed as a specialized application of population health.

concerns, ranging from the impact of climate change to the harms and benefits of new technologies, are altering the meaning of society-wide concerns.

Finally, the meaning of “vulnerable populations” continues to transform. For most of the 20th century, public health focused on maternal and child health and high-risk occupations as the operational definition of “vulnerable populations.” While these groups remain important to public health, additional groups now receive more attention, including the disabled, the frail elderly, and those without health insurance. Attention is also focused on the immunosuppressed, due to disease or medical interventions, which makes them especially vulnerable to communicable diseases as well as those whose genetic code results in special vulnerabilities to disease and reactions to medications.<sup>c</sup>

Public health has always been about our shared health concerns as a society and our concerns about vulnerable populations. These concerns have changed over time, and new concerns continue to emerge. **Table 1.2** outlines historical, current, and emerging components of the population health approach to public health. As illustrated by communicable diseases, past concerns cannot be relegated to history.

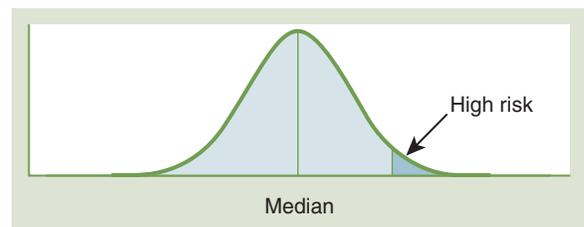
## Should We Focus on Everyone or on Vulnerable Groups?

Public health is often confronted with the potential conflict of focusing on everyone and addressing society-wide concerns versus focusing on the needs of vulnerable populations.<sup>10</sup> This conflict is reflected

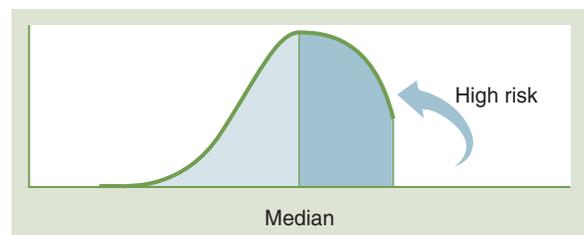
in the two different approaches to addressing public health problems. We will call them the **high-risk approach** and the **improving-the-average approach**.

The high-risk approach focuses on those with the highest probability of developing disease and aims to bring their risk close to the levels experienced by the rest of the population. **Figure 1.2A** illustrates the high-risk approach.

The success of the high-risk approach, as shown in **Figure 1.2B**, assumes that those with a high probability of developing disease are heavily concentrated among those with exposure to what we call **risk factors**. Risk factors include a wide range of exposures, from cigarette smoke and other toxic substances to high-risk sexual behaviors.



**Figure 1.2A** High Risk

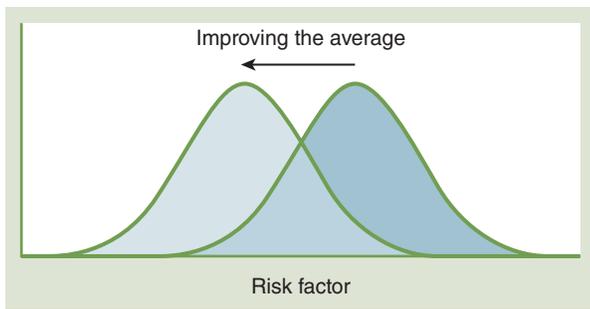


**Figure 1.2B** Reducing High Risk

**Table 1.2** Components of Population Health

	Health	Population	Examples of society-wide concerns	Examples of vulnerable groups
Historical	Physical	Geographically limited	Communicable disease	High-risk maternal and child, high-risk occupations
Current	Physical and mental	Local, state, national, global, governmentally defined	Toxic substances, product and transportation safety, communicable diseases, costs of health care	Disabled, frail elderly, uninsured
Emerging	Cosmetic, genetic, social functioning	Defined by local, national, and global communications	Disasters, climate change, technology hazards, emerging infectious diseases	Immunosuppressed, genetic vulnerability

<sup>c</sup> Issues of maternal health have not disappeared from the public health agenda. Maternal mortality in the United States has increased in recent years especially among African-Americans while it has declined in most developed countries. Maternal mortality has become an issue of health equity requiring renewed effort to dramatically reduce this mostly preventable tragedy.



**Figure 1.3** Improving the Average

The improving-the-average approach focuses on the entire population and aims to reduce the risk for everyone. **Figure 1.3** illustrates this approach.

The improving-the-average approach assumes that everyone is at some degree of risk and the risk increases with the extent of exposure. In this situation, most of the disease occurs among the large number of people who have only modestly increased exposure. The successful reduction in average cholesterol levels through changes in the U.S. diet and the anticipated reduction in diabetes via a focus on weight reduction among children illustrate this approach.

One approach may work better than the other in specific circumstances, but in general, both approaches are needed if we are going to successfully address today's and tomorrow's health issues. These two approaches parallel public health's long-standing focus on both the health of vulnerable populations and society-wide health concerns.<sup>d</sup>

Now that we have outlined what we mean by “population health,”<sup>e</sup> let us take a look at the range of approaches that may be used to promote and protect health.

## What Do We Mean by Population Health's Focus on the Life Cycle?

To improve community health, population health approaches need to consider the impacts on health throughout the life cycle. Issues of health risks

actually extend from prenatal to postmortem. The prenatal in utero environment has long been known to affect health after birth, while the Ebola epidemic reminded us that direct contact with the recently deceased can be a major source of spread of disease.

Age is the single most important factor influencing the causes of death and disability. To allow us to focus on age, public health has long divided age into age groups. These age groups may be defined by biological impacts such as the different impacts that occur among the very young and the very old. They may also be defined by changing social issues, the most common of which is the age for entering and leaving the workforce.

The way we divide populations by age has changed over time and continues to change. The category we call adolescents and youth is evolving as the transition to the workforce is occurring at an older age. As the healthy life span increases, a new age category, sometimes called the young elderly, is emerging between the traditional end of full-time work and the onset of the stage we will call the old elderly.

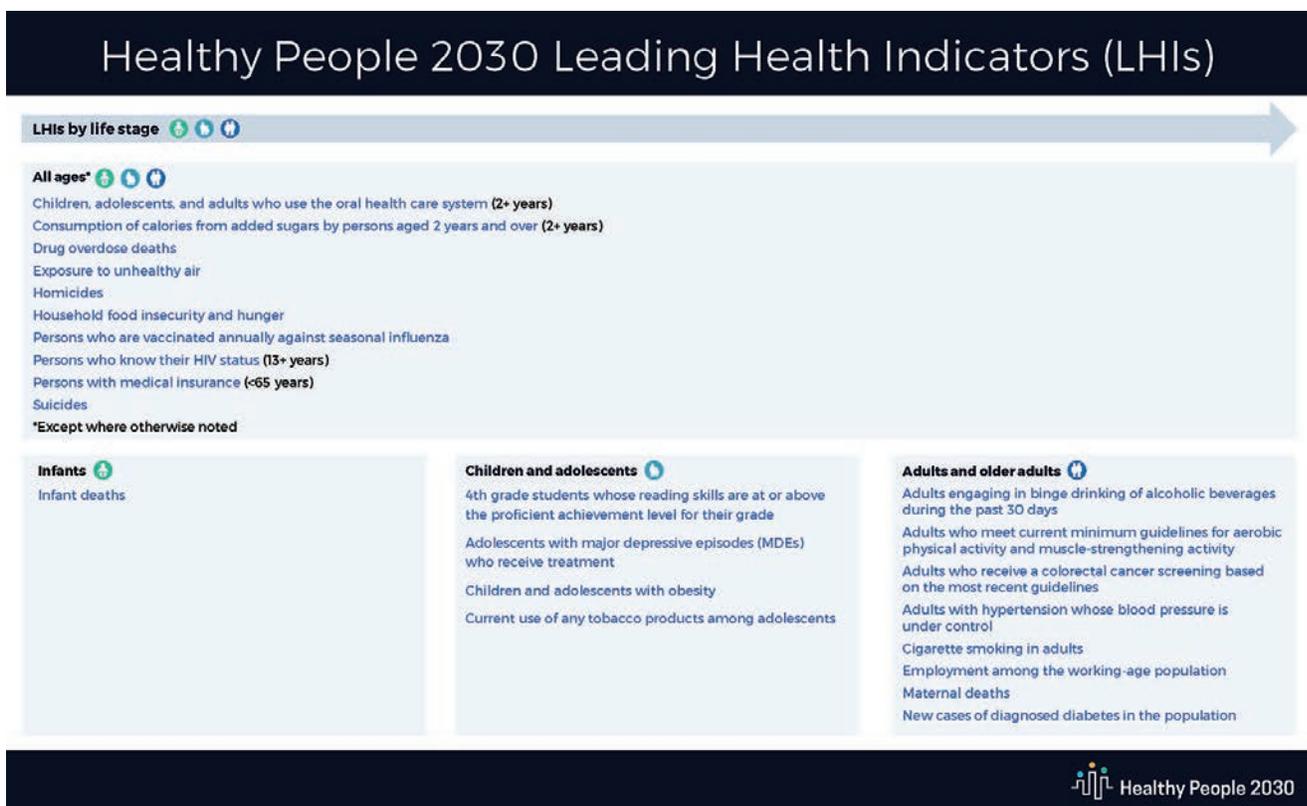
The importance of age as a predictor of disease and disability has led to a life cycle approach, recognizing the importance of different diseases at different ages. Healthy People 2030, the once-a-decade effort to set national health goals for the United States, has taken a life cycle approach. To accomplish this, Healthy People 2030 has developed a set of **leading indicators**, which are factors that impact major causes of death and disease in the United States.

A set of 23 leading indicators organized by life stage has been identified to direct attention, and hopefully funding, for factors that impact major causes of death and disease in the United States.<sup>11</sup> **Figure 1.4** displays the leading indicators organized across the life span.

Age not only affects the frequency of diseases and conditions, but it may also affect how a disease presents. **Box 1.1** illustrates how depression can present throughout the life cycle.

<sup>d</sup> An additional approach, which can be called narrowing the spread of the risk, includes reducing differences in risk by narrowing the curve so that the gap is reduced between the lowest of the low-risk and the highest of the high-risk. For instance, this might be accomplished by transferring financial resources and/or health services from the low-risk to the high-risk category through taxation or other methods. Depending on the distribution of the factors affecting health, this approach may or may not reduce the overall frequency of disease more than the other approaches. The distribution of risk in Figures 1.2 and 1.3 assumes a bell-shaped or normal distribution. The actual distribution of factors affecting health may not follow this distribution.

<sup>e</sup> The term “population health” is increasingly being used by a wide range of health professionals and now carries a range of meanings. It may be used to refer to the health of a clinical population served by a hospital, a group practice, or a health plan. It may also be used to refer to a high-risk group or those who already have a specific disease. All these uses of the term population health share a focus on a defined population. Whenever the term population health is used, it is important “which population?”



**Figure 1.4** Healthy People 2030 Leading Health Indicators by Life Stage

U.S. Department of Health and Human Services. Leading Health Indicators. Available at: <https://health.gov/healthypeople/objectives-and-data/leading-health-indicators>. Accessed October 9, 2022.

### Box 1.1 Depression Through the Life Cycle

Major depression affects one in six persons during their lifetime and ranks at or near the top of reasons for disability worldwide. Depression is often defined as a change in mood producing sadness or loss of interest in previously enjoyable activities severe enough to interrupt daily activities over a period of at least 2 weeks. Depression may produce changes in sleep, appetite, energy, ability to concentrate, or self-esteem. Major depression may be associated with thoughts of suicide, often just as the depression is beginning to improve.

Depression may occur in episodes over an entire life span, but it may express itself differently in children, adolescents, and adults.<sup>12</sup>

Depression can be diagnosed among children as young as 3 years. Young children may express depression differently, including being irritable or angry, leading to behavioral problems at home and at school. Their depression may be expressed as physical aches and pains. Young children may also have other symptoms of depression including sadness, inability to enjoy previously fun activities, changes in sleep and eating, and feeling worthless or helpless.<sup>13</sup>

Teenage depression may be difficult to distinguish from the usual ups and downs of adolescence. Suicidal thoughts and suicide attempts are especially

likely among teenagers with depression, often impulsively with little or no warning. Teens may have many of the classic symptoms of depression but are often hesitant to talk about them with parents or other adults.

Pregnancy and the postpartum period is associated with an increased incidence of depression, with over 10% of women experiencing postpartum depression. Risk factors for depression during pregnancy and postpartum include poor self-esteem, childcare stress, prenatal anxiety, life stress, decreased social support, single/unpartnered relationship status, history of depression, difficult infant temperament, previous postpartum depression, lower socioeconomic status, and unintended pregnancy.

Depression is common among older adults. Risk factors for depression include disability and poor health status related to medical illness, complicated grief, chronic sleep disturbance, loneliness, and a history of depression. Suicide, especially among older men, is especially common.<sup>14</sup>

Depression has been referred to as the “under disease” since it is often underdiagnosed, underdiscussed, and undertreated. This feature of depression is a fact of life throughout the life cycle.

## What Are the Approaches Available to Protect and Promote Health?

The wide range of strategies that have been, are being, and will be used to address health issues can be divided into three general categories: healthcare, traditional public health, and public policy interventions.

Health care includes the delivery of services to individuals on a one-on-one basis. It includes services for those who are sick or disabled with illness or diseases, as well as for those who are asymptomatic. Services delivered as part of clinical prevention have been categorized as vaccinations, behavioral counseling, screening for disease, and preventive medications.<sup>14</sup>

Traditional public health efforts have a population-based preventive perspective utilizing interventions targeting communities or populations, as well as defined high-risk or vulnerable groups. Communicable disease control, reduction of environmental hazards, food and drug safety, and nutritional and behavioral risk factors have been key areas of focus of traditional public health approaches.

Both health care and traditional public health approaches share a goal to directly affect the health of those they reach. In contrast, public policy interventions are primarily aimed at achieving other non-health goals, such as increasing convenience, pleasure, economic growth, and equity. Public policy interventions range from improving housing, to improving education and services for the poor, to increasing global trade. These interventions may have

dramatic and sometimes unanticipated positive or negative health consequences. Public policy interventions, like increased availability of high-quality food, may improve health, while the availability of convenient high-fat or high-calorie foods may pose a risk to health.

**Table 1.3** describes the characteristics of healthcare, traditional public health, and public policy approaches to population health and provides examples of each approach.

None of these approaches is new. However, they have traditionally been separated or put into silos in our thinking process, with the connections between them often ignored. Thinking in systems and connecting the pieces is an important part of the 21st century challenge of defining public health.

Now that we have explained what we mean by “public health” and seen the scope and methods that we call “population health,” let us continue our big picture approach by taking a look at what we mean by the “determinants of health and disease.”



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**Table 1.3 Approaches to Population Health**

	Characteristics	Examples
Health care	Systems for delivering one-on-one individual health services, including those aimed at prevention, cure, palliation, and rehabilitation	Clinical services, including preventive services such as vaccinations, behavioral counseling, screening for disease, and preventive medications
Traditional public health	Group- and community-based interventions directed at health promotion and disease prevention	Communicable disease control, control of environmental hazards, food and drug safety, reduction in risk factors for disease
Public policy interventions	Interventions with another non-health-related purpose, which have secondary impacts on health	Interventions that improve the built environment, increase education, alter nutrition, or address socioeconomic disparities through changes in tax laws; globalization and mobility of goods and populations

## What Factors Determine the Occurrence of Disease, Disability, and Death?

To complete our look at the big picture issues in public health, we need to gain an understanding of the forces that influence or determine disease and the outcomes of disease, including what in public health has been called morbidity (disability) and mortality (death).<sup>f</sup>

To understand the development of disease, we need to establish what are called contributory causes based on evidence. **Contributory causes** can be thought of as immediate causes of disease. For instance, HIV and cigarette smoking are two well-established contributory causes of disease, disability, and death. They directly produce disease, as well as disability and death. However, knowing these contributory causes of disease is often not enough. We need to ask: What influences or determines whether people will smoke or come in contact with HIV? What determines their course once exposed to cigarettes or HIV? In public health, we use the term **determinants** to identify these underlying factors, or “causes of causes” that ultimately bring about disease.

Determinants look beyond the known contributory causes of disease to factors that are at work often years before a disease develops.<sup>15,16</sup> These underlying factors or influences may be thought of as “upstream” forces. Like great storms, we know the water will flow downstream, often producing flooding and destruction along the way. We just do not know exactly when and where the destruction will occur.

There is no official list or agreed-upon definition of what is included in determinants of disease.<sup>g</sup> Nonetheless, there is wide agreement that the following factors are among those that can be described as determinants in that they increase or at times decrease the chances of developing conditions that threaten the quantity and/or quality of life. Some but not all of these factors are related to social factors and, as we will see, are increasingly described as **social determinants of health**:

- Behavior
- Infection
- Genetics
- Geography
- Environment
- Medical care
- Socioeconomic-cultural

**BIG GEMS** provides a convenient device for remembering these determinants of disease. Let us see what we mean by each of the determinants.

**Behavior**—Behavior implies actions that increase exposure to the factors that produce disease or protect individuals from disease. Actions such as smoking cigarettes, exercising, eating a particular diet, consuming alcohol, having unprotected intercourse, and using seat belts are all examples of the ways that behaviors help determine the development of disease.

**Infection**—Infections are often the direct cause of disease. In addition, we are increasingly recognizing that early or long-standing exposures to infections may contribute to the development of disease or even protection against disease. Diseases as diverse as gastric and duodenal ulcers, gallstones, and hepatoma (cancer originating in the liver) are increasingly thought to have infection as an important determinant. Early exposure to infections may actually reduce disease and disability ranging from polio to asthma to a type of childhood arthritis through their impact on the microbial environment in our gastrointestinal tract, increasingly referred to as our **microbiome**.

**Genetics**—The revolution in genetics has focused our attention on roles that genetic factors play in the development and outcome of disease. Even when contributory causes, such as cigarettes, have been clearly established as producing lung cancer, genetic factors also play a role in the development and progression of the disease. While genetic factors play a role in many diseases, they are only occasionally the most important determinant of disease.

**Geography**—Geographic location influences the frequency and even the presence of disease. Infectious diseases such as malaria, Chagas disease, schistosomiasis, and Lyme disease occur only in defined

<sup>f</sup> We will use the term “disease” as shorthand for the broad range of outcomes that includes injuries and exposures that result in death and disability.

<sup>g</sup> Health Canada<sup>15</sup> has identified 12 determinants of health, which are: (1) income and social status, (2) employment, (3) education, (4) social environments, (5) physical environments, (6) healthy child development, (7) personal health practices and coping skills, (8) health services, (9) social support networks, (10) biology and genetic endowment, (11) gender, and (12) culture. Many of these are subsumed under socioeconomic-cultural determinants in the BIG GEMS framework. The World Health Organization’s Commission on Social Determinants of Health has also produced a list of determinants that is consistent with the BIG GEMS framework.

geographic areas. Geography may also imply local geological conditions, such as those that produce high levels of radon—a naturally occurring radiation that contributes to the development of lung cancer. Geography implies that special locations are required to produce disease, such as altitude sickness, frostbite in cold climates, or certain types of snake bites in the tropics. The higher frequency or prevalence of a communicable disease in a geographic area may increase the probability of being exposed.

Environment—Environmental factors determine disease and the course of disease in a number of ways. The unaltered or “natural” physical world around us may produce disability and death from sudden natural disasters, such as earthquakes and volcanic eruptions, to iodine deficiencies due to low iodine content in the food-producing soil. The altered physical environment produced by human intervention includes exposures to toxic substances in occupational or nonoccupational settings. The physical environment built for use by humans—the **built environment**—produces determinants ranging from indoor air pollution, to “infant-proofed” homes, to hazards on the highway. The impacts of environmental and geographic determinants may overlap and be difficult to separate.

Medical care—Access to and the quality of medical care can be a determinant of disease. Medical care, especially efforts aimed at prevention, can affect the development of disease. When a high percentage of individuals are protected by vaccination, nonvaccinated individuals in the population may be protected as well. Cigarette smoking cessation efforts may help smokers to quit, and treatment of infectious disease may reduce the spread to others. Medical care, however, often has its major impact on the course of disease by attempting to prevent or minimize disability and death once disease develops.

Socioeconomic-cultural—In the United States, socioeconomic factors have been defined as education, income, and occupational status. These measures have all been shown to be determinants of diseases as varied as breast cancer, tuberculosis, and occupational injuries. Cultural and religious factors are increasingly being recognized as determinants of diseases because beliefs sometimes influence decisions about treatments, in turn affecting the outcome of the disease. While most diseases are more frequent in lower socioeconomic groups, others, such as breast cancer, may be more common in higher socioeconomic groups.

In recent years there has been a great deal of interest in a subset of the determinants of health that have been called social determinants of health. There

is growing acceptance of the need to address social determinants of health in order to reduce **health disparities**, disabilities, and death.

Determinants of disease come up again and again as we explore the work of population health. Historically, understanding determinants has often allowed us to prevent diseases and their consequences even when we did not fully understand the mechanism by which the determinants produced their impact. For instance:

- Scurvy was controlled by citrus fruits well before vitamin C was identified.
- Malaria was partially controlled by clearing swamps before the relationship to mosquito transmission was appreciated.
- Hepatitis B and HIV infections were partially controlled even before the organisms were identified through the reduction in use of contaminated needles and the establishment of standards for blood transfusions.
- Tuberculosis death rates were greatly reduced through less crowded housing, the use of TB sanitariums, and better nutrition.

Using asthma as an example, **Box 1.2** illustrates the many ways that the BIG GEMS framework of determinants can affect the development and course of a disease.

## What Are Social Determinants of Health?

A subset of all the determinants of health, increasingly called social determinants of health have been defined as “the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.”<sup>17</sup>

Healthy People 2030 has developed the framework depicted in **Figure 1.5** for displaying and describing the social determinants of health.<sup>17</sup> Each component is linked to a specific goal and to measurable 10-year outcomes. You can think of this framework as a structure of taking action to address the health disparities that result from social determinants of health.

Healthy People 2030’s website describes each component of their social determinants of health framework and the goal it is intended to achieve as follows:<sup>17</sup>

### Economic Stability

Goal: Help people earn steady incomes that allow them to meet their health needs.

## Box 1.2 Asthma and the Determinants of Disease

*Jennifer, a teenager living in a rundown urban apartment in the Bronx with high levels of air pollution, develops severe asthma. Her mother also has severe asthma, yet both of them smoke cigarettes.*

*Her clinicians, medical residents in a local teaching hospital, prescribed medications to prevent asthma attacks, but she takes them only when she experiences severe symptoms. After an especially severe bout of asthma, Jennifer felt faint and had a very rapid heart rate. At the emergency department she was told she had used her “rescue inhaler” too often.*

*Jennifer is hospitalized twice with pneumonia due to common bacterial infections. She then develops an antibiotic-resistant infection. During this hospitalization, she requires intensive care on a respirator. After several weeks of intensive care, Jennifer gradually recovered.*

*Jennifer and her mother vow to do everything they can to be sure this never happens again.*

Asthma is an inflammatory disease of the lung coupled with an increased reactivity of the airways, which together produce a narrowing of the airways of the lungs. When the airways become swollen and inflamed, they become narrower, allowing less air through to the lung tissue and causing symptoms such as wheezing, coughing, chest tightness, breathing difficulty, and predisposition to infection. Once considered a minor ailment, asthma is now the most common chronic disorder of childhood. It affects over 6 million children younger than 18 years in the United States alone.

Jennifer’s story illustrates how a wide range of determinants of disease may affect the occurrence, severity, and development of complications of a disease. Let us walk through the BIG GEMS framework and see how each determinant had impacts on Jennifer.

**Behavior**—Behavioral factors play an important role in the development of asthma attacks and in their complications. Cigarette smoking makes asthma attacks more frequent and more severe. It also predisposes individuals to developing infections such as pneumonia. Treatment for severe asthma requires regular treatments along with more intensive treatment when an attack occurs. It is difficult for many people, especially teenagers, to take medication regularly, yet failure to adhere to treatment greatly complicates the disease.

**Infection**—Infection is a frequent precipitant of asthma, and asthma increases the frequency and severity of infections. Infectious diseases, especially pneumonia, can be life threatening in

asthmatics, requiring prompt and high-quality medical care. The increasing development of antibiotic-resistant infections poses special risks to those with asthma.

**Genetics**—Genetic factors predispose people to childhood asthma. However, many children and adults without a family history develop asthma.

**Geography**—Asthma is more common in geographic areas with high levels of naturally occurring allergens due to flowering plants. However, today even populations in desert climates in the United States are often affected by asthma, as irrigation results in the planting of allergen-producing trees and other plants.

**Environment**—The physical environment, including that built for use by humans, has increasingly been recognized as a major factor affecting the development of asthma and asthma attacks. Indoor air pollution due to wood burning is the most common form of air pollution in many developing countries. Along with cigarette smoke, air pollution inflames the lungs acutely and chronically. Cockroaches often found in rundown buildings have been found to be highly allergenic and predisposing to asthma. Other factors in the built environment, including mold and exposure to pet dander, can also trigger wheezing in susceptible individuals.

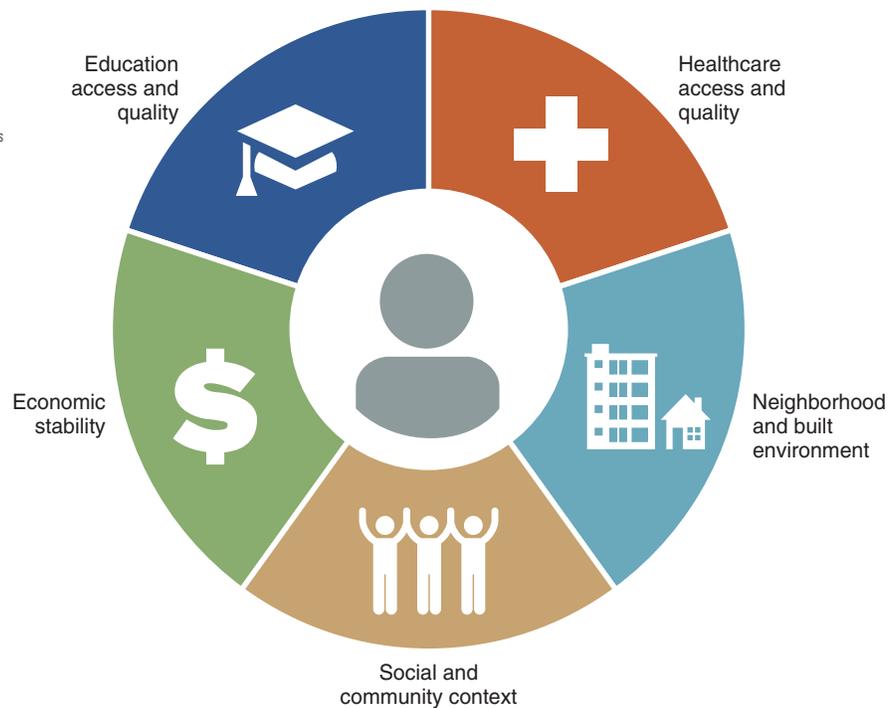
**Medical care**—The course of asthma can be greatly affected by medical care. Management of the acute and chronic effects of asthma can be positively affected by efforts to understand an individual’s exposures, reducing the chronic inflammation with medications, managing the acute symptoms, and avoiding life-threatening complications. Medical care can also be a cause of disease and disability. Misuse of medications such as rescue inhalers can produce life-threatening side effects.

**Socioeconomic-cultural**—Disease and disease progression are often influenced by an individual’s socioeconomic status. Air pollution is often greater in lower socioeconomic neighborhoods of urban areas. Mold and cockroach infestations may be greater in poor neighborhoods. Access to and the quality of medical care may be affected by social, economic, and cultural factors.

Asthma is a condition that demonstrates the contributions made by the full range of determinants included in the BIG GEMS framework. No one determinant alone explains the bulk of the disease. The large number of determinants and their interactions provide opportunities for a range of healthcare, traditional public health, and public policy interventions.

**Figure 1.5** Healthy People 2030 Framework for Social Determinants of Health

Healthy People 2030, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Available at <https://health.gov/healthypeople/objectives-and-data/social-determinants-health>. Accessed October 9, 2022.



In the United States, 1 in 10 people live in poverty, and many people cannot afford things like healthy foods, health care, and housing. Healthy People 2030 focuses on helping more people achieve economic stability.

People with steady employment are less likely to live in poverty and more likely to be healthy, but many people have trouble finding and keeping a job. People with disabilities, injuries, or conditions like arthritis may be especially limited in their ability to work. In addition, many people with steady work still do not earn enough to afford the things they need to stay healthy.

Employment programs, career counseling, and high-quality childcare opportunities can help more people find and keep jobs. In addition, policies to help people pay for food, housing, health care, and education can reduce poverty and improve health and well-being.

## Education Access and Quality

**Goal:** Increase educational opportunities and help children and adolescents do well in school.

People with higher levels of education are more likely to be healthier and live longer. Healthy People 2030 focuses on providing high-quality educational opportunities for children and adolescents—and on helping them do well in school.

Children from low-income families, children with disabilities, and children who routinely experience forms of social discrimination—like bullying—are more likely to struggle with math and reading. They are also less likely to graduate from high school or go to college. This means they are less likely to get

safe, high-paying jobs and more likely to have health problems like heart disease, diabetes, and depression.

In addition, some children live in places with poorly performing schools, and many families cannot afford to send their children to college. The stress of living in poverty can also affect children's brain development, making it harder for them to do well in school. Interventions to help children and adolescents do well in school and help families pay for college can have long-term health benefits.

## Health Care Access and Quality

**Goal:** Increase access to comprehensive, high-quality healthcare services.

Many people in the United States do not get the healthcare services they need. Healthy People 2030 focuses on improving health by helping people get timely, high-quality healthcare services.

About 1 in 10 people in the United States do not have health insurance. People without insurance are less likely to have a primary care provider, and they may not be able to afford the healthcare services and medications they need. Strategies to increase insurance coverage rates are critical for making sure more people get important healthcare services, like preventive care and treatment for chronic illnesses.

Sometimes people do not get recommended healthcare services, like cancer screenings, because they don't have a primary care provider. Other times, it's because they live too far away from healthcare providers who offer them. Interventions to increase

access to healthcare professionals and improve communication—in person or remotely—can help more people get the care they need.

## Neighborhood and Built Environment

Goal: Create neighborhoods and environments that promote health and safety.

The neighborhoods people live in have a major impact on their health and well-being. Healthy People 2030 focuses on improving health and safety in the places where people live, work, learn, and play.

Many people in the United States live in neighborhoods with high rates of violence, unsafe air or water, and other health and safety risks. Racial/ethnic minorities and people with low incomes are more likely to live in places with these risks. In addition, some people are exposed to things at work that can harm their health, like secondhand smoke or loud noises.

Interventions and policy changes at the local, state, and federal levels can help reduce these health and safety risks and promote health. For example, providing opportunities for people to walk and bike in their communities—like by adding sidewalks and bike lanes—can increase safety and help improve health and quality of life.

## Social and Community Context

Goal: Increase social and community support.

People's relationships and interactions with family, friends, coworkers, and community members can have a major impact on their health and well-being.

Healthy People 2030 focuses on helping people get the social support they need in the places where they live, work, learn, and play.

Many people face challenges and dangers they can't control, like unsafe neighborhoods, discrimination, or trouble affording the things they need. This can have a negative impact on health and safety throughout life.

Positive relationships at home, at work, and in the community can help reduce these negative impacts. But some people—like children whose parents are in jail and adolescents who are bullied—often do not get support from loved ones or others. Interventions to help people get the social and community support they need are critical for improving health and well-being.

To have an impact on health outcomes, an understanding of the importance of social determinants of health needs to be followed by tools for measuring the social determinants of health. Tools for use at both the individual and the population level are needed and are being developed. **Box 1.3** looks at some of these measurement tools.



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### Box 1.3 Measuring the Social Determinants of Health

The Robert Wood Johnson Foundation has supported the Health Leads grant program, which included development of a Health Leads screening tool to identify an individual's health needs based on a social determinants of health approach. The Health Leads screening tool incorporates the following types of questions:

- In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?
- In the last 12 months, has the electric, gas, oil, or water company threatened to shut off your services in your home?
- Are you worried that in the next 2 months, you may not have stable housing?
- Do problems getting child care make it difficult for you to work or study?
- In the last 12 months, have you needed to see a doctor, but could not because of cost?

- In the last 12 months, have you ever had to go without health care because you didn't have a way to get there?
- Do you ever need help reading hospital materials?
- Do you often feel that you lack companionship?

The Health Leads questionnaire is designed to identify social determinants of health that need attention or may affect the ability to implement individual health services. It is not intended to produce an overall adversity or severity score.<sup>18</sup>

Disaster prevention and preparation has become an increasingly important role for public health. One important role played by public health has been to identify communities down to the size of census tracts that are especially vulnerable to injuries in the face of disasters. The Centers for Disease Control and Prevention (CDC) has developed what it calls the Geospatial Research Analysis and Services Program (GRASP), which categorizes census tracts in the

United States based on their social vulnerability score. Social vulnerability is measured using four components: (1) social economic status; (2) household composition (e.g., single parent); (3) race, ethnicity, and language; and (4) housing and transportation.

**Figure 1.6** from the CDC provides detailed information on the social vulnerability score.<sup>19</sup>

The Social Vulnerability Index has been used as a tool to identify communities in greatest need as part of disaster or emergency response. It may find additional uses in disaster preparation, community needs assessment, and other efforts to deal with social determinants of health at the population or community levels.

## CDC's Social Vulnerability Index (SVI)

A tool to identify socially vulnerable communities GRASP

### CDC's SVI

**What is social vulnerability?**  
Every community must prepare for and respond to hazardous events, whether a natural disaster like a tornado or disease outbreak, or a human-made event such as a harmful chemical spill. A number of factors, including poverty, lack of access to transportation, and crowded housing may weaken a community's ability to prevent human suffering and financial loss in a disaster. These factors are known as **social vulnerability**.

**What is CDC's Social Vulnerability Index?**  
ATSDR's Geospatial Research, Analysis & Services Program (GRASP) created databases to help emergency response planners and public health officials identify and map communities that will most likely need support before, during, and after a hazardous event.

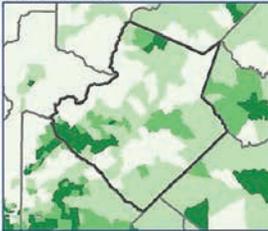
CDC's SVI uses U.S. Census data to determine the social vulnerability of every census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. The SVI ranks each tract on 15 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes. Maps of the four themes are shown in the figure below. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking.



Hurricane Sandy - Breezy Point, NY      Photographer - Pauline Tran

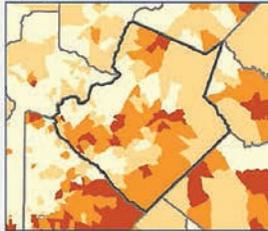
SVI Themes

Socioeconomic Status



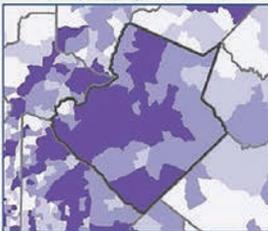
Highest: Vulnerability Lowest

Household Composition



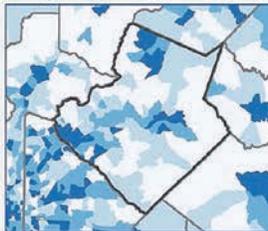
Highest: Vulnerability Lowest

Race/Ethnicity/Language



Highest: Vulnerability Lowest

Housing/Transportation



Highest: Vulnerability Lowest

**How can CDC's SVI help communities be better prepared?**

The SVI can help public health officials and local planners better prepare for and respond to emergency events like hurricanes, disease outbreaks, or exposure to dangerous chemicals.

CDC's SVI databases and maps can be used to:

- Estimate the amount of needed supplies like food, water, medicine, and bedding.
- Help decide how many emergency personnel are required to assist people.
- Identify areas in need of emergency shelters.
- Plan the best way to evacuate people, accounting for those who have special needs, such as people without vehicles, the elderly, or people who do not understand English well.
- Identify communities that will need extra funding and support before, during, and after a disaster.

Maps show the range of vulnerability in Gwinnett County, Georgia for the four themes.

For more information, please contact CDC's SVI Coordinator ([svi\\_coordinator@cdc.gov](mailto:svi_coordinator@cdc.gov)) or visit <http://svi.cdc.gov>.

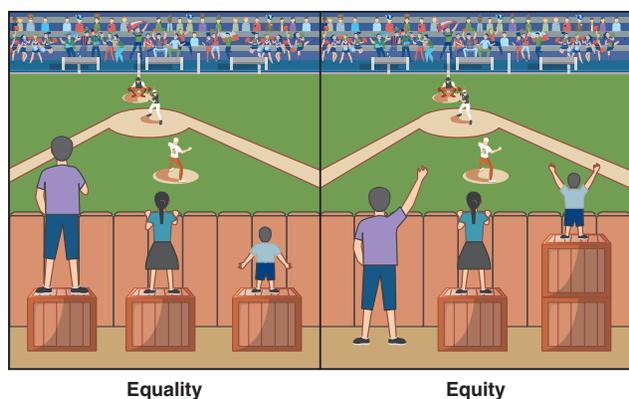
Geospatial Research, Analysis, and Services Program (GRASP)  
Division of Toxicology and Human Health Sciences, ATSDR

GRASP

**Figure 1.6** CDC's Social Vulnerability Index

Centers for Disease Control and Prevention. CDC's Social Vulnerability Index (SVI). <https://svi.cdc.gov/Documents/FactSheet/SVIFactSheet.pdf>. Accessed May 23, 2022.

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**Figure 1.7** Equality vs. Equity

Interaction Institute for Social Change. Illustrating Equality VS Equity. Available at <http://interactioninstitute.org/illustrating-equality-vs-equity/>. Accessed October 9, 2022

## What Are We Trying to Achieve by Addressing the Social Determinants of Health?

The overall goal of addressing social determinants of health is to produce **health equity**. Health equity means that everyone has a fair and just opportunity to be healthy. Equity needs to be distinguished from equality, which implies that everyone is treated the same. **Figure 1.7** provides an illustration of the distinction between equality and equity.<sup>20</sup>

Achieving health equity will not result in everyone obtaining the same degree of health. As we have seen, there are far too many determinants of health to expect everyone to have the same morbidity and mortality. Health equity, however, can produce equal opportunity to achieve a maximum obtainable disability-free life span.

Achieving health equity requires multiple approaches, including changes in laws and policies, health systems, and individual behavior. Therefore, we will come back to issues of health equity throughout *Public Health 101*.

Population health is not a static, unchanging approach. It is affected by changes that have and continue to occur in all societies. Let us take a look at some of the ways that populations have changed and are changing that affect population health.

## What Changes in Populations over Time Can Affect Health?

A number of important trends or transitions in the composition of populations that affect the pattern of

disease have been described in recent years. These transitions have implications for what we can expect to happen throughout the 21st century. We will call these the demographic, epidemiological, and nutritional transitions.

The **demographic transition** describes the impact of falling childhood death rates and extended life spans on the size and the age distribution of populations.<sup>21</sup> During the first half of the 20th century, death rates among the young fell dramatically in today's developed countries. Death rates continued their dramatic decline in most parts of the developing world during the second half of the 20th century.

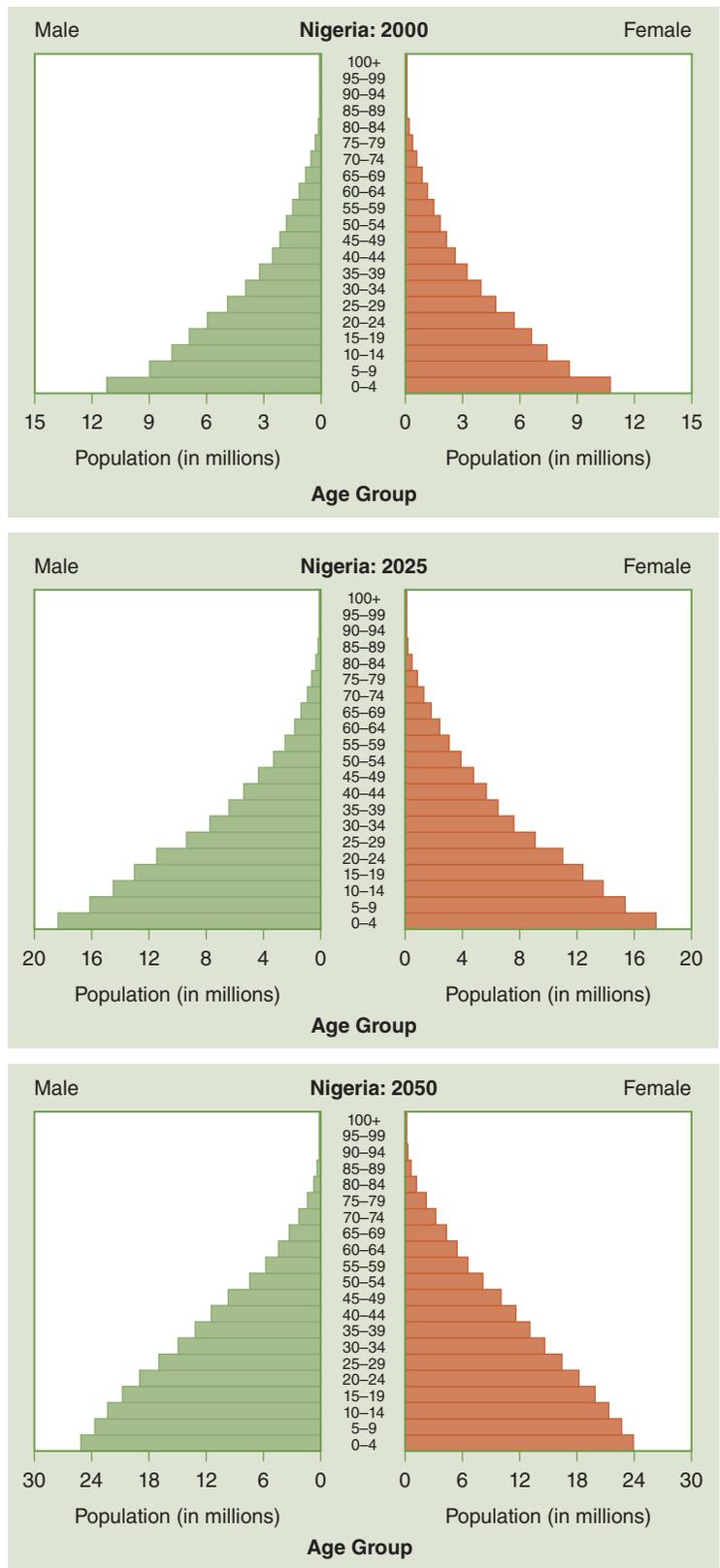
Birth rates tend to remain high for years or decades after the decline in deaths. High birth rates paired with lower death rates lead to rapid growth in population size, as we have seen in much of the developing world. This trend continues today, though interrupted by the COVID-19 pandemic, and is expected to go on in many parts of the world well into the 21st century.

**Population pyramids** are often useful for displaying the changes in the age distribution that occur over time. Population pyramids display the number of males and females that are present or expected to be present for each age group in a particular year. The population pyramids in **Figure 1.8** illustrate how the population of Nigeria is expected to grow through 2050 due to a high birth rate and a lowered death rate.<sup>21</sup>

Despite the delay, a decline in birth rates reliably occurs following the decline in childhood deaths. This decline in births gradually leads to aging of the population and can eventually lead to declining population numbers in the absence of large-scale immigration. We are now seeing societies in much of Europe and Japan as well as the United States with rapidly growing elderly populations. Over one-third of the population of Japan is currently older than 65 years, compared to approximately 20% in the United States.

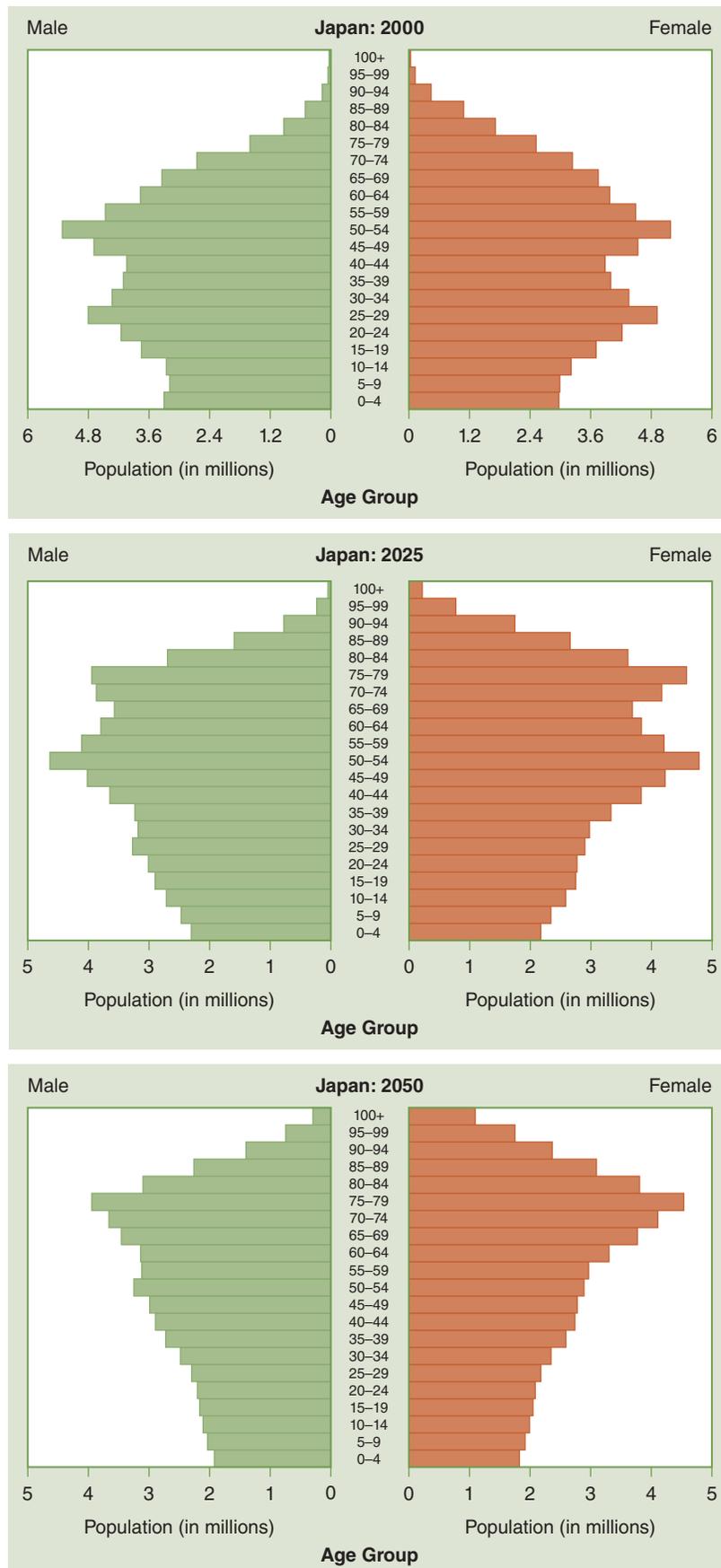
Take a look at the population pyramids in **Figure 1.9**, which show what is expected to occur in the coming years in much of Europe and Japan.<sup>23</sup> Japan is used as an example of the emergence of an inverted population pyramid, with a smaller young population and a larger older population. Populations with a large number of the elderly relative to the number of younger individuals have a heavier burden of disease and create the conditions for aging to become a public health issue.

The large number of immigrants to the United States and their generally higher birth rates have slowed this process in the United States, but the basic trend of a growing elderly population continues. The population pyramids for the United States are displayed in **Figure 1.10**.<sup>21</sup>



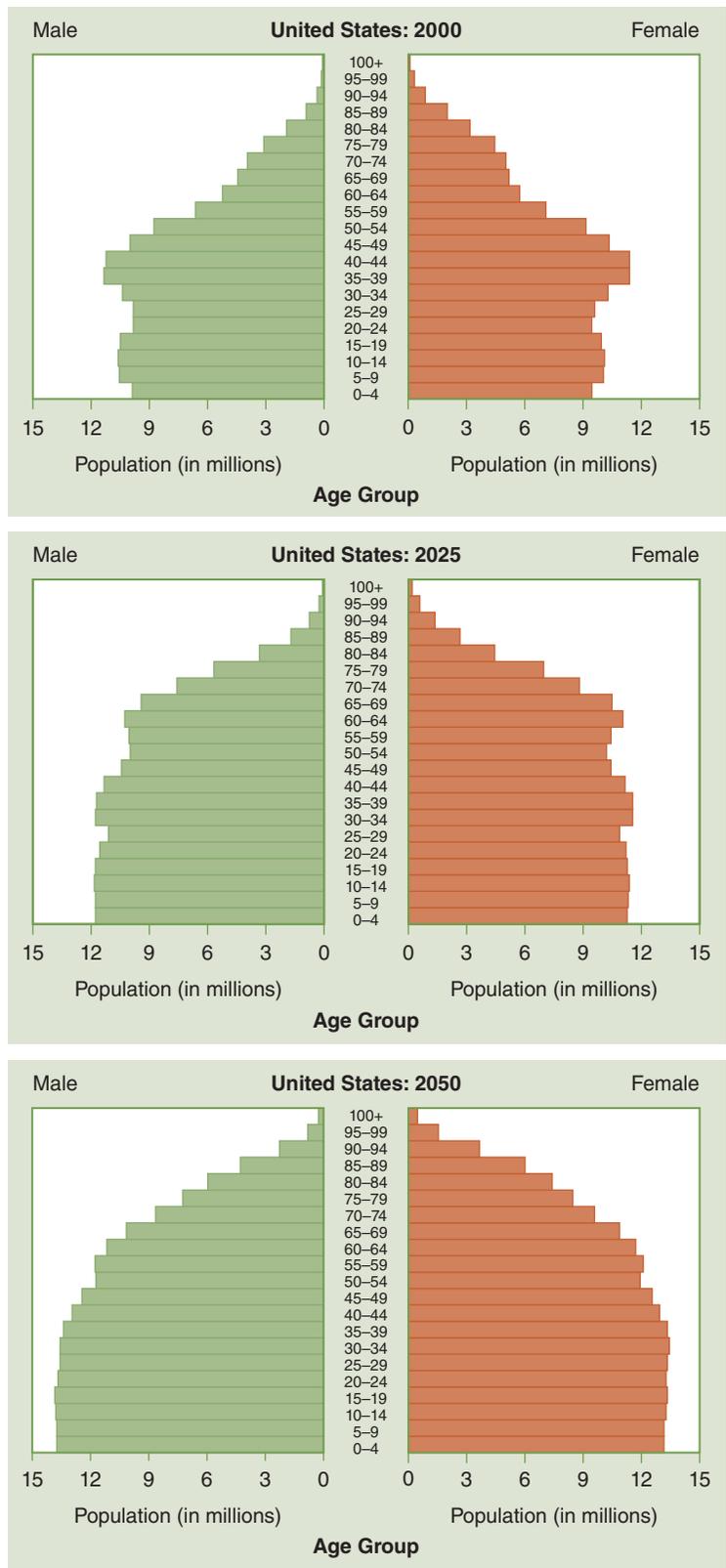
**Figure 1.8** Population Pyramids Expected for Nigeria

U.S. Census Bureau. International Database. [https://www.census.gov/data-tools/demo/ridb/#/country?YR\\_ANIM=2010&FIPS\\_SINGLE=\\*&dashPages=DASH](https://www.census.gov/data-tools/demo/ridb/#/country?YR_ANIM=2010&FIPS_SINGLE=*&dashPages=DASH). Accessed January 17, 2021.



**Figure 1.9** Population Pyramids Expected for Japan

U.S. Census Bureau. International Database. [https://www.census.gov/data-tools/demo/idb/#/country?YR\\_ANIM=2010&FIPS\\_SINGLE=\\*&dashPages=DASH](https://www.census.gov/data-tools/demo/idb/#/country?YR_ANIM=2010&FIPS_SINGLE=*&dashPages=DASH). Accessed January 17, 2021.



**Figure 1.10** Population Pyramids Expected for the United States

U.S. Census Bureau. International Database. [https://www.census.gov/data-tools/demo/ridb/#/country?YR\\_ANIM=2010&FIPS\\_SINGLE=\\*&dashPages=DASH](https://www.census.gov/data-tools/demo/ridb/#/country?YR_ANIM=2010&FIPS_SINGLE=*&dashPages=DASH). Accessed January 17, 2021.

**Box 1.4** looks at the impacts that an increasing elderly population can be expected to have in the United States in the coming years and the challenges faced by public health.

A second transition has been called the **epidemiological transition**,<sup>24</sup> or public health transition. The epidemiological transition implies that as social and economic development occurs, different types of

**Box 1.4 Aging as a Public Health Issue**

The proportion of the elderly in the United States is increasing rapidly in the second decade of the 21st century as the “baby boomers” born between 1946 and 1964 continue to enter the 65- to 74-year-old age group. **Figure 1.11** illustrates the rapid increase that is occurring and is expected to continue in the coming decades among those 65 and older and 85 and older.<sup>22</sup> By 2030, the proportion of those older than 65 years is expected to reach approximately 25% of the population, compared to the current level of approximately 20%.

The impact of aging is felt throughout the life span as working-age adults are increasingly responsible for taking care of their aging parents as well as their own children, and all taxpayers shoulder the costs of programs for the elderly. Government programs for the elderly are already under financial strain. The finances of Social Security, Medicare, and Medicaid-financed nursing home care have become key issues in national political debates.

The ability of a slowly growing workforce to support a rapidly aging population will have major implications in the United States for decades to come. These impacts, though great, are not expected to have the same consequences as in Japan and areas of Europe, where overall population numbers are declining, while the elderly, especially those older than 85 years, continue to increase.

The social and economic consequences of an aging population will be felt personally by most of today’s college students. They will face a future with

elderly parents and a society that is challenged to help address their needs.

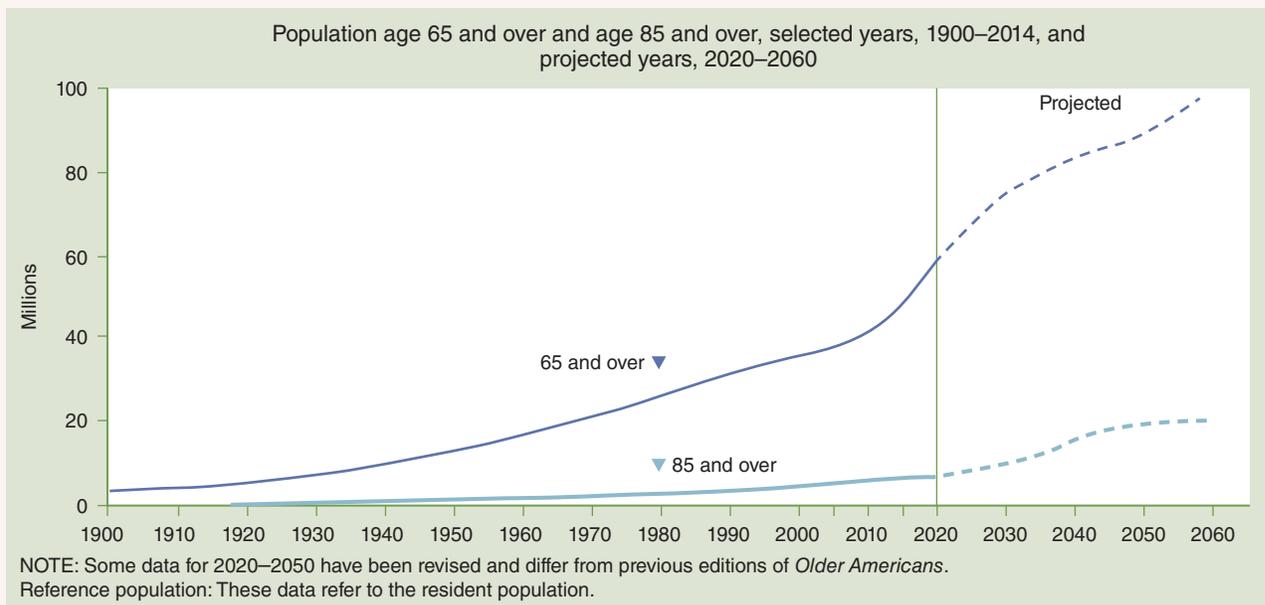
The most dramatic impacts of an aging population will occur as a higher percentage of the elderly population reach age 85 years and older. Dementia, including Alzheimer’s disease and other conditions that chronically impair memory, rapidly increases among those 85 and older. Less than 4% of those 65 to 69 years are diagnosed with dementia, but the percentage rises to almost 25% from ages 85 to 90 and over 35% beginning at age 90.<sup>22</sup>

The burden of dementia is rapidly becoming a major financial and social burden to the elderly and their families. The social isolation and depression that often accompany aging in general and dementia in particular are factors that can and should be addressed by public health and healthcare interventions.

Those 85 and older are the largest contributor to a vulnerable population known as the frail elderly. Over 25% of those older than 85 can be classified as frail elderly. The frail elderly are susceptible to a range of health issues including falls, infection, and depression.

Gerontologists suggest that if someone has three or more of the five following factors, then that person should be considered frail:<sup>23</sup>

- Unintentional weight loss (10 pounds or more in a year)
- General feeling of exhaustion
- Weakness (as measured by grip strength)
- Slow walking speed
- Low levels of physical activity



**Figure 1.11** Population Aged 65 and Older and Age 85 and Older, Selected Years 1900–2014 and Projected Years 2020–2060

Federal Interagency Forum on Aging-Related Statistics. *Older Americans 2016: Key Indicators of Well-Being*. Federal Interagency Forum on Aging-Related Statistics. Washington, DC: U.S. Government Printing Office; August 2016, page 2. <https://agingstats.gov/docs/LatestReport/Older-Americans-2016-Key-Indicators-of-WellBeing.pdf>. Accessed May 17, 2022.

Fortunately, there are a number of public health, healthcare, and social interventions that can prevent frailty or minimize its consequences; they are often described as follows:

- Food: maintain intake
- Resistance exercises
- Atherosclerosis prevention (e.g., blood pressure, low-density lipoprotein cholesterol reduction, smoking cessation, etc.)
- Isolation prevention
- Limit pain
- Tai chi or other balance exercises
- Yearly check for testosterone deficiency

Impaired vision, impaired hearing, and dental problems are perhaps the most common modifiable incapacitating impairments of the elderly. Yet Medicare does not generally provide coverage for these treatable conditions. Efforts to support the frail elderly and prevent falls, social isolation, and other preventable conditions are increasingly seen as part of the population health's commitment to improving the health of the elderly.

Focusing on the health of the elderly is an increasingly important part of population health. It is becoming an important way to improve the health of the community both for the elderly and for those who hope to live a long life.

diseases become prominent. Deaths in less developed societies are often dominated by epidemic communicable diseases and diseases associated with malnutrition and childhood infections. As a country develops, communicable diseases often come under control, and noncommunicable and chronic diseases, such as heart disease, often predominate.

A related transition known as the **nutritional transition**<sup>25</sup> implies that countries frequently move from poorly balanced diets often deficient in nutrients, proteins, and calories to a diet of highly

processed food, including fats, sugars, and salt. The consequences of both under- and overnutrition, often occurring in the same country, will continue to affect the public's health well into the 21st century.

As we have seen, population health focuses on the big picture issues and the determinants of disease. Increasingly, public health also emphasizes a focus on research evidence as a basis for understanding the cause or etiology of disease and the interventions that can improve the outcome. Let us now explore what we mean by “evidence-based public health.”

## WRAP-UP

### Key Words

BIG GEMS	Health equity	Nutritional transition
Built environment	High-risk approach	Population health
Contributory causes	Improving-the-average approach	Population pyramids
Demographic transition	Interventions	Risk factors
Determinants	Leading indicators	Social determinants of health
Epidemiological transition	Mental health	Social justice
Health disparities	Microbiome	Vulnerable populations

### Discussion Question

Think about a typical day in your life and identify ways that public health affects it.

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