## CHAPTER 1

# **Global Health Transitions**

Global health brings together partners from around the world to solve shared population and environmental health concerns. Investments in global health are motivated by a desire to improve millions of lives, prevent avoidable illnesses and deaths, mitigate transnational threats like pandemics and climate change, promote health equity, and protect international trade and security.

#### 1.1 Defining Global Health

**Global health** is a field of academic study, research, and applied practice that seeks to improve population health worldwide. The word "global" conveys two meanings: worldwide and comprehensive. Some global health initiatives focus on health concerns that primarily affect people who live in low-income countries, but most seek to address complex transnational problems that affect or have the potential to affect people in every country. Global health researchers take a holistic approach to examining the many socioeconomic, environmental, political, and other contributors to health and well-being, and global health practitioners apply tools from public health, medicine, environmental science, the social sciences, engineering, law, and other professions toward the improvement of population and environmental health in countries and communities across the globe.

Some of the core values that guide global health can be summarized by the acronym PACES: population, action, cooperation, equity, and security (Figure 1.1). The Population dimension of global health emphasizes that global health interventions typically target health issues that adversely affect large numbers of people across multiple world regions. Some global health initiatives focus on the diseases that cause the most deaths, disability, and lost productivity worldwide. Some target emerging threats to population health that have the potential to affect every country in the world in the future, such as pandemic influenza and global warming. Some aim to improve the socioeconomic and environmental conditions that cause millions or even billions of people worldwide to have suboptimal health status.

The Action lens accentuates the value of global health principles and theories leading to improved health in the real world. Global health researchers use scientific studies to identify the most effective and economical

© Tavarius/Shutterstock

<b>P</b> opulations	Global health prioritizes the exposures and diseases that cause a considerable proportion of preventable deaths and/or disabilities in multiple world regions.
<b>A</b> ction	Global health uses evidence-based, cost-effective, sustainable interventions to prevent illness and injury, treat existing diseases, and alleviate suffering.
<b>C</b> ooperation	Global health uses international, multisectoral partnerships to solve complex health concerns.
<b>E</b> quity	Global health reduces health disparities by prioritizing the needs of low-income countries and other disadvantaged populations.
<b>S</b> ecurity	Global health tackles the health issues that are most likely to contribute to political and economic instability and conflict.

Figure 1.1 PACES: Global health values.

interventions for prioritized health issues, then practitioners use those research findings to design and implement policies and practices that will prevent new population health problems and solve existing concerns. Many global health initiatives seek to increase access to health literacy, safe drinking water, essential medicines, nutritious foods, and other fundamental tools for preventing, diagnosing, and treating health problems, because these have been identified as some of the "best buys" that yield the greatest benefits for population health per dollar spent.

The Cooperation aspect of global health recognizes that there are many cross-border threats to population health and well-being that can only be solved through international partnerships. Pollution generated in one country may adversely affect the air and water quality of many neighboring lands. A drug-resistant strain of tuberculosis or another infection that emerges in one nation may quickly spread around the globe. One country acting alone cannot contain these hazards to health. Solving these global challenges will require governments and representatives from business and other sectors in many countries to work together to identify priorities, generate action plans, and follow through on achieving shared goals.

An Equity lens brings attention to health issues that predominantly affect low-income countries and other disadvantaged populations

and marginalized groups. Health equity is present when everyone has an equal opportunity to be as healthy as possible.1 Highincome countries have experienced significant improvements in population health status over the past century as they have become wealthier, built infrastructure that supports healthy living, and expanded access to medication, surgery, vaccines, and other health technologies. Health status in low-income countries is improving, but life expectancy and other health metrics are still less favorable in these areas than in higher-income places. Besides these between-country gaps in health status, there are also within-country health inequalities. For example, people with mental health disorders in any country may encounter systematic challenges to accessing health care and social services. Many global health campaigns are guided by social justice principles and seek to ensure that the voices of individuals who represent marginalized groups are heard so that the needs of their communities can be acknowledged and acted on.

The Security aspect of global health underscores health as a foundation for safe and peaceful societies. Places that are burdened by infectious disease outbreaks, chronic hunger, or high rates of preventable disability and early death due to lack of access to routine medical, surgical, and psychological care may experience economic turmoil and political

3

unrest. Instability may lead to violent conflict, and conflict in one place may lead to disruptions and violence in other locations. Investments in global health can support economic growth, political stability, and national and international security.

Many diseases, environmental hazards, and other population health issues are classified as global health priorities based on the PACES criteria. Pandemics are one obvious example of a global health priority. Within a few months after COVID-19 was first identified in late 2019, the coronavirus had spread to dozens of countries and met all five of the PACES criteria:

- Population: Billions of people were at risk of SARS-CoV-2 infection, millions became infected, and hundreds of thousands of people died from the infection.
- Action: Control measures, such as testing, contact tracing, and isolation and treatment of infected individuals, were widely deployed to slow the spread of the virus while researchers worked to develop and test medications and vaccines.
- Cooperation: National efforts to respond to the pandemic relied on global sharing of information about the most effective protocols for diagnosing SARS-CoV-2 infection and treating COVID-19 patients, and decisions related to international travel and trade were dependent on reliable access to up-to-date statistics about case counts and locations.
- Equity: The pandemic affected some populations disproportionately, with healthcare, food service, and other essential workers at high risk of on-the-job exposure to SARS-CoV-2 and older adults and people with chronic diseases especially vulnerable to severe illness and death after contracting the virus.
- Security: The emergence of COVID-19 caused major social and economic disruptions due to school and workplace closures, travel bans, supply chain interruptions, and other hardships.

The PACES criteria can similarly be used to justify investment in interventions for a diversity of other health issues, such as HIV/AIDS, maternal mortality, child hunger, hypertension, lower back pain, and depression. All these health concerns, and many more, can become global health foci when groups of people representing diverse cultures and nationalities work together to raise awareness about health issues and then solve them.

#### **1.2 Population Health**

The goal of global health is to improve the health of the world's people. Health is often defined as the absence of disease or injury, but that is an incomplete explanation because the focus is on what health is not, rather than on what health is. Some definitions of health emphasize the ability to conduct normal daily activities, but that construct is inadequate because the definition of "normal" varies from person to person. For example, many people assume that it is normal for an older adult to have limited mobility and forgetfulness, but that is not an inevitability. Many older people are very active and mentally sharp, and therapy and assistive technologies could improve the quality of life of many seniors who have joint pain and memory loss. Similarly, parents in many parts of the world assume that it is normal for children to have intestinal worms. Even though a cheap medication can kill these parasites, millions of children are currently living with untreated intestinal worms that can significantly impair their health, growth, and school performance.

A more comprehensive definition of health encompasses both physical and mental health as well as the presence of social connections that facilitate health. The Constitution of the World Health Organization (WHO), written in 1948, defines **health** as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."<sup>2</sup> This definition recognizes that health is about more than just biology; it is also about psychology, sociology, and a host of other factors. Although there is almost no one in the world today who would be classified as having "complete" health according to the WHO statement,<sup>3</sup> this definition provides a target for medical and public health professionals and organizations as they work together to improve the health status of individuals and communities.

Global health initiatives aim to improve health at the population level. A **population** is a group of individuals, communities, nations, or other entities. Some global health interventions seek to improve the well-being of large regions or the entire world population. For example, strengthening early warning systems for emerging infectious diseases that could cause pandemics is an action that protects all humans, not just a few selected individuals or countries. Some global health interventions provide services directly to individuals because healthier individuals collectively will form healthier populations. Health is improved when infectious diseases (such as HIV, tuberculosis, cholera, influenza, measles, and malaria) and noncommunicable diseases (such as cardiovascular disease, cancer, and diabetes) are prevented, managed, or cured. Health is improved when nutritional deficiencies like protein-energy malnutrition and iron deficiency anemia are remediated. Health is improved when women do not die in childbirth, when people who have depression and anxiety have access to counseling and medications, and when people who are injured in a traffic collision or an act of violence have access to surgery and rehabilitation that restore function.

**Population health** encompasses health outcomes and the determinants of health in groups of humans at the community, regional, national, and/or worldwide level.<sup>4</sup> The **determinants of health** are the biological, behavioral, social, environmental, political, and other factors that influence the health status of individuals and populations. Individual behaviors like handwashing often, eating several portions of fruits and vegetables daily, and using sidewalks rather than walking in traffic contribute to reducing the risk of infections, managing chronic diseases, and preventing injuries at the individual level, but the ability of individuals to engage in these activities is a function of both individual willpower and community resources. If someone lives in a community that does not have public washrooms, affordable fresh foods, and pedestrian walkways, these actions may be impossible. Community-wide interventions related to these determinants of health will enable individuals to adopt healthier behaviors that improve their own health outcomes. When the health outcomes for individuals improve, the overall health status of their community also improves. A similar pattern exists for the health of nations. Worldwide efforts related to the determinants of health can improve health outcomes in all the participating countries.

### **1.3 Prevention and Intervention Science**

Global health is an action-oriented field that works to improve health status for every age group and extend healthy life expectancy. For an individual, an ideal health trajectory begins with a consenting adult becoming pregnant and that pregnancy leading to an uneventful full-term delivery of a healthy newborn. After birth, the ideal health trajectory continues with that healthy infant growing into adulthood without experiencing serious infections, illnesses, or injuries and that adult remaining healthy and active for many decades. Because everyone eventually dies, the ideal health trajectory ends in very old age with a gentle death that is not preceded by months or years of disability and pain. However, few people achieve this ideal pathway (Figure 1.2A).

In very low-income communities, a large proportion of children are born with low birthweight and struggle with repeated bouts



Figure 1.2 Examples of health trajectories.

of infectious diseases like pneumonia and malaria, and it is not uncommon for young women to die in childbirth (Figure 1.2B). A healthy child may develop permanent physical impairments due to a catastrophic car crash in adolescence, have reduced health status from alcohol abuse or misuse of prescription painkillers in middle adulthood, and then die from a heart attack before reaching retirement age (Figure 1.2C). Even when people live to be very old, they usually experience a gradual decline in function and loss of independence prior to dying (Figure 1.2D). Actions implemented at the individual, community, and higher levels can prevent many of these events that decrease health status and can lessen the level of reduced health associated with them.

In global health, an **intervention** is a strategic action intended to improve individual and population health status. A variety of medical, behavioral, social, economic, environmental, and other interventions and changes can help individuals and their communities make progress toward having longer, healthier life trajectories.<sup>5</sup> For example, nutrition support programs for pregnant and breastfeeding

women can reduce the risk of low birthweight and malnutrition in infants: the use of antibiotics to treat childhood pneumonia soon after the onset of a cough can prevent life-threatening illness; the availability of skilled birth attendants can prevent women from dying during childbirth; and numerous other interventions during adulthood, such as injury prevention technology, mental health care, and lifestyle changes that reduce the risk of heart attacks, can improve both quality of life and the number of years lived (Figure 1.3). Together, these interventions can have a strong positive impact on an individual's health, allowing a person who might otherwise have experienced poor health in childhood and died young to instead have a healthy childhood and live to old age. When these interventions reach millions of people, they make a huge difference in population health, happiness, and productivity.

The adage that prevention is better than a cure expresses one of the foundational principles of global health. It is usually cheaper to spend relatively small amounts of money on interventions that keep people healthy across the life span than it is to spend relatively large amounts of money helping people recover from



Figure 1.3 Examples of interventions that improve health trajectories across the life span.



**Figure 1.4** Maintaining good health status through preventive interventions is less costly than paying for rehabilitation after health crises.

health crises (Figure 1.4). Lengthy hospitalizations, long-term disabilities, and untimely deaths are expensive and exhausting for the affected individuals and their families and caregivers. They are also costly for the communities and nations that lose the economic, social, and other contributions the affected individuals would have made through work productivity, tax revenue, and service if they had lived longer, healthier lives. Systems thinking is the process of identifying the underlying causes of complex problems so that sustainable solutions can be developed and implemented. Prevention science is the process of determining which preventive health interventions are effective at improving health status, how successful those interventions are in various populations, and how readily they can be scaled up for widespread implementation.6 Implementation science is the scientific study of how to increase uptake of evidence-based practices

and policies after effective interventions have been identified.

There are three levels of prevention that together capture the full range of health interventions (Figure 1.5). Primary prevention consists of protective actions that help keep an adverse health event from ever occurring. Some primary prevention interventions promote healthy behaviors, such as vaccinating children to reduce their risk of contracting measles and polio infections, keeping mosquitoes out of homes to reduce the risk of malaria and other vector-borne diseases, and using a seat belt to reduce the risk of severe injuries during a motor vehicle collision. Some primary prevention programs work to modify the health environment by increasing access to improved sanitation facilities to prevent diarrheal infections, spraying insecticides to kill the mosquitoes that spread dengue virus, implementing clean delivery room practices

Level	Goal	Target Population	Key Interventions	Examples
Primordial prevention	Prevent risk factors for disease	People without disease	Prevention	<ul><li>Healthy lifestyles</li><li>Healthy environments</li></ul>
Primary prevention	Prevent disease from ever occurring	People without disease	Prevention	<ul> <li>Vaccinating children to protect them from paralytic polio</li> <li>Giving vitamin A capsules to at-risk children to prevent blindness</li> </ul>
Secondary prevention	Reduce the severity of disease and prevent disability and death	People with early, nonsymptomatic disease	Early diagnosis	<ul> <li>Checking blood pressure routinely to detect the onset of hypertension</li> <li>Screening with mammography to detect early stage breast cancer</li> </ul>
Tertiary prevention	Reduce impairment and minimize suffering	People with symptomatic disease	Treatment and rehabilitation	<ul> <li>Extracting teeth with severe decay to alleviate pain</li> <li>Providing physical therapy to people who have been injured in a vehicle collision to restore function</li> </ul>

Figure 1.5 Levels of prevention.

to prevent infections of newborns and their mothers, and building roads that are safe for bicyclists and pedestrians. Others use policy changes to improve access to healthcare services, essential medications, and nutritious foods. Primary prevention interventions are often the most cost-effective interventions, but there are many adverse health conditions for which the risk factors remain poorly understood and the options for primary prevention therefore remain limited.

**Secondary prevention** is the detection of health problems in asymptomatic individuals at an early stage when the conditions have not yet caused significant damage to the body and can be treated more easily. (**Asymptomatic** means not symptomatic.) Cancer screening tests, such as mammography for breast cancer, Pap smears for cervical cancer, and colonoscopies that look for the polyps that are precursors to colorectal cancer, are forms of secondary prevention. Similarly, routine HIV tests, blood pressure checks in adults, and sports physicals for student athletes are intended to detect health issues in people who might otherwise have remained unaware of the presence of manageable but potentially serious health conditions for many years.

**Tertiary prevention** consists of interventions that reduce impairment, minimize pain and suffering, and restore function in people with symptomatic health problems. Examples of tertiary prevention include managing chronic diseases with medication, alleviating the pain that can be caused by advanced cancer, and providing physical therapy and occupational therapy to people recovering from strokes or serious injuries.

Given the three levels of prevention, there is almost always some intervention that could

improve the health of individuals who are vulnerable to various adverse health conditions or are already sick. Primary prevention is the preferred option, especially when a cost-effective intervention is available. When primary prevention is not possible with current technologies and when health problems are already present, secondary prevention and tertiary prevention can improve longevity and quality of life.

#### **1.4 Risk Factors**

The ability of individuals, nations, international partnerships, and other groups to make informed decisions about what interventions to invest in and collaborate on is dependent on understanding the risk factors for adverse health outcomes. Etiology is the cause of a disease or another adverse condition. The proximal cause is the most immediate cause of an adverse event. For diseases, the proximal etiological agents may be intrinsic (internal) causes, such as genetics and psychological factors, or extrinsic (external) causes, such as infections and environmental hazards. Beyond proximal causes, there are many other factors that contribute to creating the situations in which illnesses and diseases occur.7 A distal cause is a social, environmental, or other factor that is not an immediate cause but contributes to the causal pathway for an adverse event. Epidemiologists and prevention scientists are often able to identify a variety of immediate exposures that are associated with increased risk of illness, but it is harder to quantify the ways that social, economic, political, historic, and other distal factors that are parts of causal webs have created and perpetuated public health problems.8 Research by anthropologists, sociologists, and other social scientists and humanities scholars provides insights about the ways that political structures (like colonialism and capitalism), prejudices (like racism and sexism), and other contextual factors have shaped and continue to shape health.9

For most adverse health conditions, there are many different combinations of events that might lead to the onset and progression of the disease or disorder. Multicausality describes a causal pathway in which many different risk factors contribute to an adverse event occurring.<sup>10</sup> The terms necessary and sufficient are often used to describe the various sets of exposures that can lead to adverse outcomes. A risk factor is said to be a necessary part of the disease pathway if it must be present for a person to develop a disease. For example, an individual can have a genetic disorder only if he or she carries the gene for that disorder. The gene is necessary. A risk factor is sufficient if that exposure or characteristic by itself can cause disease. Being exposed to a high dose of radiation could be sufficient to cause some types of cancer, but most of those cancers could also develop in someone who was never exposed to radiation. Radiation is sufficient but not necessary to cause cancer. Some exposures are necessary but not sufficient on their own to cause disease. Many adverse health outcomes result from dozens or even hundreds of exposures that are neither sufficient nor necessary on their own but in the aggregate can lead to a situation in which an infection, illness, or injury occurs.

Consider the example of child pneumonia, which is a more frequent cause of pediatric mortality than diarrheal diseases, malaria, HIV, or injuries.<sup>11</sup> Nearly 1 million children die from pneumonia each year, and almost all these deaths occur in lower-income countries.12 A variety of pathogens can cause child pneumonia, and there are countless sets of distal and proximal causes that may lead to a child contracting a respiratory infection. Medical interventions tend to focus on the proximal causes of pneumonia cases and deaths, emphasizing primary prevention methods like vaccination and tertiary prevention methods like access to antibiotics. A more comprehensive prevention package will include interventions related to distal causes as well as proximal ones.

9

An **exposure** is a personal characteristic, behavior, environmental encounter, or intervention that might change the likelihood of developing a health condition. Individuals may have different risks of infection, disease, and complications from disease as a result of age, genetics, immunology, comorbidities, nutritional status, health behaviors, psychological factors, environmental hazards, and many other characteristics. A risk factor is an exposure that increases the likelihood of experiencing a particular health outcome. Some risk factors are specific to one disease, but many biological, behavioral, environmental, and other risk factors are associated with a diversity of adverse health outcomes (Figure 1.6).<sup>13</sup> For child pneumonia, some of the risk factors are biological. Infants and young children may have underdeveloped immune systems that leave them vulnerable to certain types of pathogens, or they may have poor immune response due to being chronically undernourished. Some risk factors are environmental. Children who are exposed to indoor air pollution from cooking fires and children exposed to outdoor air pollution because they live near dirty industrial areas are more susceptible to respiratory infections. Some risk factors are social, economic, or behavioral. Parents who have never attended school or had the opportunity to learn how to read may not have the education to recognize when a child requires medical assistance. Parents who are subsistence farmers or work for very low wages might not have the money to pay for transportation to a hospital when a child is critically ill.

In prevention science, the term primor**dial prevention** is sometimes used to describe the general lifestyle habits and environmental conditions that prevent risk factors for adverse health events from developing. In that framework, primordial prevention is about general conditions that protect health—such as eating a nutritious diet, exercising, avoiding tobacco and other harmful substances, and getting adequate sleep each night-and primary prevention is about specific actions that mitigate the risk of developing specific diseases. A person who eats a low-fat diet to keep blood lipid levels low is practicing primordial prevention; a person with elevated blood lipid levels who takes cholesterol-lowering medication to reduce the risk of cardiovascular disease later on is practicing primary prevention. A person who chooses not to start smoking is engaging in primordial prevention; a tobacco-using person who works to quit smoking to reduce the risk of developing lung cancer later on is engaging in primary prevention. For child pneumonia, primordial prevention includes conditions such as adequate nutrition and clean air.

Health-Related	Nutritional Exposures	Environmental	Untreated Medical
Behaviors		Exposures	Conditions
<ul> <li>Tobacco use</li> <li>Physical inactivity</li> <li>Unsafe sex</li> <li>Alcohol abuse</li> <li>Injecting drug use</li> </ul>	<ul> <li>Obesity and overweight</li> <li>Child underweight</li> <li>Low fruit and vegetable intake</li> <li>Suboptimal breastfeeding</li> <li>Vitamin A deficiency</li> <li>Zinc deficiency</li> <li>Iron deficiency</li> </ul>	<ul> <li>Indoor smoke from solid fuels</li> <li>Unsafe water, sanitation, and hygiene</li> <li>Urban outdoor air pollution</li> <li>Occupational risks</li> <li>Lead exposure</li> </ul>	<ul> <li>High blood pressure</li> <li>High blood glucose</li> <li>High cholesterol</li> <li>Unmet contraceptive need</li> </ul>

Figure 1.6 Examples of modifiable risk factors for adverse health outcomes.

Data from Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks. Geneva: World Health Organization; 2009.

The links between hundreds of exposures and child pneumonia have been confirmed by health researchers. Causation is a relationship in which an exposure directly causes an outcome. A causal factor is an exposure that has been scientifically tested and shown to occur before the disease outcome and contribute directly to its occurrence. An association is a statistical relationship between two variables, but tests of association are not enough to prove that a relationship is or is not causal. The presence of causality is typically determined by using both quantitative analysis, such as laboratory testing and statistics, and a qualitative consideration of causal theory. The Bradford Hill criteria are a set of conditions that provide support for the existence of a causal relationship between an exposure and an outcome, such as the strength of the association, the presence of a doseresponse relationship between the exposure and outcome, and the consistency of the risk across numerous studies (Figure 1.7).<sup>14</sup> There

is no expectation that all of the Bradford Hill criteria have to be met for an exposure to be considered causal, but the evidence for causality is stronger when more criteria are met.<sup>15</sup> When many different exposures contribute to the onset and progression of a disease, many different interventions can be effective at preventing adverse outcomes.

An individual's health status at any age is a function of his or her experiences throughout the life course.<sup>16</sup> Some of the circumstances that lead to adverse health outcomes are ones that cannot be altered. A **nonmodifiablerisk factor** is a risk factor that cannot be changed through health interventions. We do not have the ability to change a person's age or the technology to change a person's inherited genes, and we cannot erase past behaviors and previous medical events that have damaged the body. However, there are many actions that support improved health today and reduce the risk of health problems in the future. A **modifiable risk factor** is

Criterion	Key Question
Temporality	Did the exposure happen before the onset of disease?
Strength of association	Is the statistical association between the exposure and outcome strong?
Dose–response relationship/ biological gradient	Do people with a higher level of exposure have a higher risk of the outcome than people with a lower level of exposure?
Cessation	Does stopping the exposure reduce the risk of the outcome?
Specificity	Are the exposure and outcome both narrowly defined rather than general concepts?
Theoretical plausibility	Is there a reasonable biological explanation for why the exposure might cause the outcome?
Consistency	Has a potentially causal relationship between the exposure and outcome been observed in other studies and other populations?
Coherence	Is a causal relationship between the exposure and outcome congruent with other knowledge about the variables?
Consideration of alternate explanations	Are there reasons why what appears to be a causal relationship might not actually be causal?

Figure 1.7 Criteria for evaluating whether an exposure causes a disease or other health outcome.

a risk factor that can be avoided or mitigated. For example, a **behavioral risk factor** is a behavior that can be adopted, stopped, or changed in order to reduce the risk of disease. Behavior change interventions may encourage the reduction of hazardous behaviors or may promote the adoption of healthier behaviors.

Some modifiable risk factors can be mitigated with behavior change at the individual or household level. For child pneumonia, health education programs can encourage parents not to cook indoors without adequate ventilation and can teach parents the importance of seeking medical care for children with moderate breathing difficulties rather than waiting until the onset of severe respiratory distress. However, many risk factors can only be mitigated at the community level or higher levels. One family cannot force a factory to stop releasing toxins into the air. Reducing outdoor air pollution might require a national clean air law to be enacted and enforced. One small rural community will not have the resources to build and staff a hospital that provides affordable, high-quality health services. Rural communities could pool their funds to establish a network of clinics, but they would probably need to coordinate their efforts with an urban referral hospital and with a national organization that trains and certifies rural health workers and other clinical care providers. One county or parish will not be able to develop and manufacture all the medications and vaccines its residents need. Pharmaceutical products are typically developed by international research teams, and few factories have the technical capacity to produce chemically complex substances that are reliably safe and effective. One nation cannot prevent antibiotic-resistant bacterial strains from emerging and spreading across the globe. If all countries do not work together to promote antimicrobial stewardship and combat drug resistance, respiratory infections that are currently curable may cause widespread death in the future. Reducing child deaths from pneumonia requires a mix of individual- and

household-level, community-level, national-level, and global interventions.

It can be comforting to assume that individuals have the power to control their own health destiny, but that is a false assumption. Health is a complex function of individual (intrapersonal) factors plus interpersonal factors (relationships), institutional and organizational factors, community factors, and public policy.17 Many people do not have the ability to choose to eat healthy meals, exercise daily, breathe fresh air, get enough sleep, access routine medical screenings, and manage mild health conditions so that they do not become severe. Low-income individuals and households may not have the money to buy adequate amounts of nutritious food, time to do much of anything other than work, or the resources to access health services. Even the world's richest people do not have full control over their personal health trajectories. Some people who apply the best available science to every aspect of their lives will still become seriously ill long before they reach old age. The factors that cause their health status to diminish may be ones that they cannot control. Even billionaires do not have the ability on their own to ensure that the influenza vaccine they get annually will protect against the strains that end up circulating in a particular year, that the air they breathe outside their homes is clean, or that the other motorists they encounter on public roads will not be driving recklessly.

Individuals can and should accept responsibility for their own health decisions, but there are some threats to health that can only be solved at the population level. The health of individuals is a function of their own biology and behaviors, and it is also a function of a broad set of economic, social, cultural, political, environmental, occupational, and other factors.<sup>18</sup> For many adverse health outcomes, the distal causes of the health problem are ones that cannot be solved by individuals or even by states, provinces, or nations acting alone. Many threats to health can only be resolved with global cooperation.

#### **1.5 Health Transitions**

A **health transition** is a shift in the health status of a population that usually occurs in conjunction with socioeconomic development (Figure 1.8). One hundred years ago, most populations across the globe had similar health profiles: high birth rates, high child mortality rates, short life expectancies, and a considerable proportion of illnesses and deaths due to infections and undernutrition. During the 20th century, high-income nations transitioned to having longer life expectancies and lower rates of infection and chronic hunger. Low-income countries did not experience such dramatic improvements in population health status. Because low-income countries did not undergo the health transitions observed in high-income countries, gaps in health equity between the highest- and lowestincome countries increased.

Population health status is related to socioeconomic and environmental factors. Places with more poverty and pollution tend to have limited access to health services and less favorable health profiles (Figure 1.9). Economic growth, infrastructure development, and new health technologies in high-income countries in the 20th century enabled highincome countries to improve population health in all age groups. In the United States, for example, the leading causes of death in both 1800 and 1900 were pneumonia (including pneumonia caused by influenza), tuberculosis, and diarrhea, all of which are infectious diseases.19 Many of these deaths occurred in children and young adults. By 1950, the risk of dying in childhood or early

Type of Transition	Pre-transition Populations	Post-transition Populations
Fertility transition	The typical woman gives birth to several children.	The typical woman gives birth to only one child or two children.
Demographic transition	The total population size may be increasing due to high birth rates.	The total population size may be shrinking because birth rates are so low.
Obstetric transition	Pregnancy-related conditions are a major cause of death in women of reproductive age.	The maternal mortality rate is very low.
Nutrition transition	Underweight is a major population health concern.	Obesity is a major population health concern.
Risk transition	Environmental exposures like unsafe drinking water and polluted indoor air are major contributors to disease.	Lifestyle factors like physical inactivity and tobacco use are major contributors to disease.
Epidemiologic transition	Infectious diseases in children are a significant burden to the population.	Chronic diseases in adults are the dominant health concern in the population.
Mortality transition	High death rates in children and reproductive-age adults mean that few people live to very old age.	Low mortality rates for children and reproductive-age adults allow many people to live to old age.
Aging transition	Children comprise the majority of the total population.	Older adults are a growing proportion of the population.

Figure 1.8 Examples of health transitions.

То	day, in Very LOW-Income Populations	Today, in Very HIGH-Income Populations		
	There are high rates of poverty, illiteracy, and unemployment, which can have negative effects on personal, family, and community health.	<ul> <li>Most people have access to the basic tools for health, although there are still health disparities based on socioeconomic status.</li> </ul>		
	Many people do not have access to an outhouse or other type of toilet, and many do not have reliable access to safe drinking water.	<ul> <li>Almost everyone has indoor plumbing and safe drinking water.</li> </ul>		
•	Many infants and young children die from diarrhea, pneumonia, malaria, and other infections.	<ul> <li>Almost every baby will survive to adulthood.</li> </ul>		
	The typical woman gives birth to many children, and it is not uncommon for women to die in childbirth.	<ul> <li>The typical woman gives birth to one or two children, and very few women die due to pregnancy-related conditions.</li> </ul>		
•	The median (average) age of the population is 15 to 20 years.	<ul> <li>The median (average) age of the population is 40 to 45 years.</li> </ul>		
•	The typical adult dies at around 65 years of age.	<ul> <li>The typical adult dies at around 85 years of age.</li> </ul>		
•	Visits to hospitals and clinics are usually because of infections (such as malaria or tuberculosis) or serious injuries.	<ul> <li>Visits to hospitals and clinics are usually due to chronic noncommunicable diseases (such as arthritis, back pain, hypertension, and diabetes).</li> </ul>		
•	Access to effective management of chronic diseases (such as hypertension and diabetes) is very limited.	<ul> <li>Screening tests often detect emerging health problems early, so they can be treated or managed before they cause severe disease.</li> </ul>		
	Undernutrition (including protein energy and micronutrient deficiencies) remains a significant public health concern.	<ul> <li>Overweight and obesity are major public health concerns, and many people have diets that are high in fat and calories.</li> </ul>		
•	Very few people with mental health disorders receive clinical care because there are so few psychiatrists and psychologists.	<ul> <li>Clinical mental health services are usually available, but they are often underused.</li> </ul>		
	Serious injuries often lead to death because no surgical services are available.	<ul> <li>Serious injuries can often be treated with surgery and rehabilitation.</li> </ul>		

**Figure 1.9** Examples of significant differences in health status and access to the tools for health in low-income and high-income countries.

adulthood had decreased considerably and the most frequent causes of death had shifted to heart disease, cancer, and stroke, the same aging-associated diseases that remain the most frequent causes of death in the United States today.<sup>20</sup> These changes in population health status were attributed in part to vaccines, antibiotics, contraceptives, and other medical advances, but they were also the result of improved sanitation, better nutrition, increased education, and economic growth.<sup>21</sup>

The **risk transition** is a health transition characterized by a shift from exposures like undernutrition, unsafe water, and indoor air pollution that increase the risk of childhood infectious diseases causing most preventable morbidity and mortality in a population to exposures like obesity, physical inactivity, and

© Jones & Bartlett Learning LLC, an Ascend Learning Company. NOT FOR SALE OR DISTRIBUTION.

tobacco use that increase the risk of chronic diseases being the most prominent risk factors.<sup>13</sup> As the risk transition occurs (**Figure 1.10**),<sup>22</sup> the major causes of illness and death change (**Figure 1.11**).<sup>23</sup> Comparing high-, middle-, and low-income countries provides insights into how these health transitions occur. Middleincome countries tend to have health and risk profiles that are somewhere between those of low-income and high-income countries. Middle-income countries usually continue to have some populations burdened by undernutrition and infectious diseases while other populations within the same country experience the challenges associated with obesity and chronic noncommunicable conditions. This need for health systems in middle-income countries to be responsive to both pre-transition and posttransition health problems is sometimes called the dual or double burden of disease.

Some health and risk transitions are not wholly favorable ones. Global health interventions seek to postpone death and prevent disability. People who live in high-income

	Low-Income Countries	Middle-Income Countries	High-Income Countries
#1	Child and maternal malnutrition	High blood pressure	Tobacco
#2	Air pollution	Tobacco	High body mass index (overweight and obesity)
#3	Unsafe water, sanitation, and handwashing	Dietary risks (such as a diet that is high in sodium and low in whole grains and fruits)	High fasting plasma glucose (blood sugar)

**Figure 1.10** Major risk factors for reduced health status and early death in countries with low-, middle-, and high-sociodemographic status.

Data from GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396:1223-1249.

		Low-Income Countries	Middle-Income Countries	High-Income Countries
Leading causes	#1	Cardiovascular diseases	Cardiovascular diseases	Cardiovascular diseases
of death	#2	Respiratory infections (such as tuberculosis and pneumonia)	Cancer	Cancer
	#3	Maternal and neonatal disorders (such as preterm birth)	Chronic respiratory diseases	Neurological disorders (such as Alzheimer's disease)
	#4	Enteric infections (diarrheal diseases)	Diabetes and chronic kidney disease	Chronic respiratory diseases
	#5	Cancer	Respiratory infections	Diabetes and chronic kidney disease

**Figure 1.11** Leading causes of death in countries with low-, middle-, and high-sociodemographic status.

Data from GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396:1204-1222. countries often live to old age, but many older adults are disabled by chronic diseases and experience a lot of pain. Increasing rates of obesity and sedentary lifestyles among younger adults are likely to exacerbate the burden from noncommunicable diseases in post-transition countries in the coming decades. However, transitions that shift the burden of death and disease from children and young adults to older adults are considered to be population health successes. Everyone will eventually die of something, but a population is healthier when the typical age at death is 85 years rather than 65 years. Since hunger and infectious diseases tend to disproportionately burden children, a shift toward obesity and chronic diseases that usually affect older adults is a relative improvement in population health.

A **health disparity** (also called a health inequality) is an avoidable difference in health status between population groups. Health disparities can be observed between countries and within countries. One of the key goals of global public health is to reduce health disparities by increasing the health status of disadvantaged populations through interventions that target proximal or distal causes of suboptimal health.<sup>24</sup> Minimizing health disparities by reducing the health status of advantaged populations would not be a global health gain. Health equity is only achieved when progress toward greater health occurs in all populations.

#### 1.6 Global Health History and Functions

Long before bacteria were first viewed through a microscope, people were aware that travel and trade could bring deadly diseases into vulnerable populations. Thousands of years ago, people with skin lesions and other signs of disease were ostracized and forced to live away from healthy-looking people. Hundreds of years ago, port authorities started requiring incoming ships to stay in harbor for several weeks before they could dock and allow crew members to disembark and goods to be offloaded.<sup>25</sup> Modern transportation has accelerated the speed at which pathogens can spread to new locations through international travel and trade, but the population health threats associated with globalization are longestablished concerns.

One of the primary goals of early international health pacts was to limit the spread of dangerous infections. For example, a series of International Sanitary Conferences held in various European cities starting in 1851 assembled representatives from several countries to discuss concerns about the shipping industry spreading cholera to new ports.26 The delegates sought to identify policies and practices that would protect population health while allowing international supply chains to flow uninterrupted.27 The signatories of the resulting agreements committed to notifying other countries about outbreaks of cholera, plague, yellow fever, and other epidemic diseases, and they pledged to monitor health at ports and impose quarantines on disease-carrying ships.<sup>28</sup> By the early 1900s, international regulations also incorporated several other crossborder health issues, including ones related to water pollution; alcohol, opium, and other drugs; and occupational health and safety.29 These treaties set the stage for the International Sanitary Regulations, later renamed the International Health Regulations, which were approved by the World Health Organization 100 years later in 1951 and are still in force today.

Economic and political interests were central to early investments in international health.<sup>30</sup> By around 1870, the industrial revolution had transformed manufacturing and rail networks enabled mass movement of people and goods across land. European countries that had colonized the Americas and parts of Asia and the Pacific in previous centuries began laying imperial claim to more of Africa's natural resources. The United States, Russia, and Japan also acquired overseas territories so



The Panama Canal. Courtesy of Pixabay

that they could access raw materials, take advantage of cheap labor, expand the market base for the goods they produced, and control strategic military positions. Many of these colonies and territories were located in tropical climates where mosquito-borne infections like malaria and yellow fever were constant threats. The field of tropical medicine was established in the late 1800s and early 1900s as more European (and American) businessmen, military personnel, and their families relocated to tropical areas to oversee commercial and defense activities.<sup>31</sup> Tropical medicine specialists aimed to protect settlers and visitors from parasitic and infectious diseases and to ensure that the workforce in these areas was healthy enough to be productive.32

Today, some of the functions of tropical medicine are performed by travel medicine specialists. Tropical medicine was also the precursor for the field of **international health**,<sup>33</sup> a term that in current usage usually describes efforts to alleviate poverty-related health conditions in lower-income areas, not just the tropics.34 International health interventions typically involve cooperative efforts between a high-income country sponsor and one or more lower-income country recipients who work together to improve a health issue that is a public health priority in the lower-income country.35 Many international health programs have humanitarian origins and aims that overlap with commercial and diplomatic motivations.<sup>36</sup> Charitable projects that improve the health

of adults and children in recipient countries enable more workers and consumers in those countries to participate in the global economy. That outcome can generate economic and other benefits for all the collaborating countries.

One of the criticisms of some traditional ways of doing international health is that partnerships between high-income donor countries and lower-income recipient countries perpetuate power hierarchies rather than promoting true equity among partners.<sup>36</sup> Calls to "decolonize" global health push for wider recognition of how colonialism and settler-colonialism (which occurred when European immigrants to the United States, Canada, Australia, and other places participated in a systematic process that displaced Indigenous populations and took possession of their lands) have harmed and continue to harm individual, public, and global health.9 Decolonizing global health requires rethinking global health concepts and practices as well as improving diversity, equity, and inclusion within the global health workforce.37

The distinction between international health and global health is still under debate, but global health interventions are more likely to include partners from many countries across the income spectrum (rather than being sponsored by one high-income country), emphasize how globalization processes affect the health of all people (rather than focusing exclusively on the most disadvantaged populations), and apply interprofessional and multisectoral lenses to the development and implementation of public health interventions.35 International health efforts often have an intergovernmental focus, whereas global health initiatives typically welcome partners from governments, nonprofit foundations, and corporations.38

The global HIV epidemic of the late 1990s demanded new models for how countries from all world regions and all income levels can work together to respond to shared threats to population health. The success of the broadbased collaborations that were formed to accelerate scientific discoveries related to HIV/ AIDS and to increase access to HIV medications showed that global partnerships can achieve their goals.<sup>39</sup> Over the past 20 years, many large global partnerships have been formed to address numerous population health issues. Some focus on security threats that require commitments from every country in the world, such as antimicrobial resistance, food safety, emerging infectious diseases, global climate change, and geopolitical violence. Some focus on the traditional foci of international health investments: infectious disease prevention and control, including support for vaccination and eradication campaigns; responses to famines, natural disasters, and humanitarian crises; and promotion of maternal and child health and survival through literacy programs, microloans, and other community development activities as well as directly health-related ones. Some partnerships have goals related to noncommunicable diseases, mental health promotion, injury prevention, and healthy aging. A century ago, international health was a recognized tool for promoting economic and political stability, a component of diplomatic efforts, and a foundation for economic and infrastructural development. Today, global health continues to serve an important role in enabling international trade and travel, fostering safety and security, and promoting sustainable development.

#### 1.7 Global Health Achievements

Innovations in health technology over the past 100 years have created an incredible set of tools for global health work. New antibiotics were discovered along with a host of medications for managing and treating noncommunicable diseases like heart disease, cancer, and diabetes. Life-saving vaccines were developed. Smallpox was eradicated. Oral contraceptives transformed family planning, and assisted reproductive technologies enabled many couples with infertility to



© Cavan Images/Getty Images

have biological offspring. Electrocardiographs, magnetic resonance imaging, and other new diagnostic tools improved the quality of medical care. New therapies like dialysis for kidney disease and contact lenses for vision impairments enhanced quality of life. Modern surgical techniques made joint replacements, open heart surgery, and organ transplants routine in some parts of the world. These technological advances enabled many of the top 10 public health achievements of the 20th century that were highlighted by the U.S. Centers for Disease Control and Prevention (CDC) at the start of the new millennium (**Figure 1.12**)<sup>40</sup> as well as many

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

Figure 1.12 The U.S. CDC's top 10 public health achievements of the 20th century (1900–1999).

Centers for Disease Control and Prevention. Ten great public health achievements: United States, 1990–1999. MMWR Math Mort Wkly Rep. 1999;48:241–243.

of the leading global health achievements during the first years of the 21st century (**Figure 1.13**).<sup>41</sup>

While these health technologies are indisputably beneficial, the uneven distribution of access to them generated a massive intensification of health disparities during the 20th

1	Reductions in child mortality
2	Vaccine-preventable diseases
3	Access to safe water and sanitation
4	Malaria prevention and control
5	Prevention and control of HIV/AIDS
6	Tuberculosis control
7	Control of neglected tropical diseases
8	Tobacco control
9	Increased awareness and response for improving global road safety
10	Improved preparedness and response to global health threats

**Figure 1.13** The U.S. CDC's top 10 global health achievements in the first decade of the 21st century (2001–2010).

Centers for Disease Control and Prevention. Ten great public health achievements: worldwide, 2001–2010. MMWR Marb Mart Wkly Rep. 2011;60:814–818.

century. People living in the world's richest countries now have access to an array of tools for health that would have been unimaginable 100 years ago, while children living in the world's poorest areas continue to succumb to easily preventable conditions like starvation and vaccine-preventable and antibiotic-treatable infectious diseases. Global health aims to end these disparities by using a holistic, comprehensive approach to improving population and planetary health worldwide. Thanks to coordinated global health and development initiatives, the 21st century has already seen improvements in health equity. Life expectancies and other health metrics are improving in low- and middle-income countries even as these measures hold steady or continue to improve in highincome countries.42 The goals of global health in the 21st century include continuing to create innovative solutions to public health problems; increasing access to health, healthcare services, and health technologies around the world; and expanding global communication and action about shared health concerns. Population health is not a "zero sum game" in which one country can "win" only when another country "loses." Everyone gains when world health increases.

#### References

- 1. Braveman P, Gruskin S. Defining equity in health. J Epidemiol Community Health. 2003;57:254–258.
- Constitution of the World Health Organization. New York: United Nations; 1946.
- 3. Huber M, Knottnerus JA, Green L, et al. How should we define health? *BMJ*. 2011;343:d4163.
- 4. Kindig D, Stoddart G. What is population health? *Am J Public Health.* 2003;93:380–383.
- Keller LO, Strohschein S, Lia-Hoagberg B, Schaffer MA. Population-based public health interventions: practice-based and evidence-supported. *Public Health Nurs.* 2004;21:453–468.
- Flay BR, Biglan A, Boruch RF, et al. Standards of evidence: criteria for efficacy, effectiveness and dissemination. *Prev Sci.* 2005;6:151–175.

- Krieger N. Epidemiology and the web of causation: has anyone seen the spider? Soc Sci Med. 1994;39:887–903.
- Richardson ET. Epidemic Illusions: On the Coloniality of Global Public Health. Cambridge MA: MIT Press; 2020.
- Büyüm AM, Kenney C, Koris A, Mkumba L, Raveendran Y. Decolonising global health: if not now, when? *BMJ Glob Health*. 2020;5:e003394.
- Rothman KJ, Greenland S. Causation and causal inference in epidemiology. *Am J Public Health*. 2005;95(Suppl 1):S144–S150.
- UNICEF, WHO, World Bank, UN-DESA Population Division. Levels and Trends in Child Mortality Report 2019: Estimates Developed by the UN Inter-agency

Group for Child Mortality Estimation. New York: UNICEF; 2019.

- 12. McAllister DA, Liu L, Shi T, et al. Global, regional, and national estimates of pneumonia morbidity and mortality in children younger than 5 years between 2000 and 2015: a systematic analysis. *Lancet Glob Health*. 2019;7:e47-e57.
- Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks. Geneva: World Health Organization; 2009.
- Howick J, Glasziou P, Aronson JK. The evolution of evidence hierarchies: what can Bradford Hill's 'guidelines for causation' contribute? *J Roy Soc Med.* 2009;102:186–194.
- Susser M. What is a cause and how do we know one? A grammar for pragmatic epidemiology. Am J Epidemiol. 1991;133:635–648.
- Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life course epidemiology. J Epidemiol Community Health. 2003;57:778–783.
- McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q.* 1988;15:351–377.
- Committee on Assuring the Health of the Public in the 21st Century. The Future of the Public's Health in the 21st Century. Washington DC: National Academies Press; 2002.
- Jones DS, Podolsky SH, Greene JA. The burden of disease and the changing task of medicine. *New Engl J Med.* 2012;366:2333–2338.
- Guyer B, Freedman MA, Strobino DM, Sondik EJ. Annual summary of vital statistics: trends in the health of Americans during the 20th century. *Pediatrics*. 2000;106:1307–1317.
- Martens P. Health transitions in a globalising world: towards more disease or sustained health? *Futures*. 2002;34:635–648.
- 22. GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet.* 2020;396:1223–1249.
- 23. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet.* 2020;396:1204–1222.
- Innov8 Approach for Reviewing National Health Programmes to Leave No One Behind: Technical Handbook. Geneva: World Health Organization; 2016.
- Gensini GF, Yacoub MH, Conti AA. The concept of quarantine in history: from plague to SARS. J Infect. 2004;49:257–261.

- Huber V. The unification of the globe by disease? The International Sanitary Conferences on cholera, 1851–1894. *Historical J.* 2006;49:453–476.
- Harrison M. Disease, diplomacy, and international commerce: the origins of international sanitary regulation in the nineteenth century. J Global History. 2006;1:197–217.
- Fidler DP. From International Sanitary Conventions to global health security: the new International Health Regulations. *Chinese J Int Law.* 2005;4:325–392.
- 29. Fidler DP. The globalization of public health: the first 100 years of international health diplomacy. *Bull World Health Organ.* 2001;79:842–849.
- Birn AE. The stages of international (global) health: histories of success or successes of history? *Glob Public Health.* 2009;4:50–68.
- 31. Gibson AD. Miasma revisited: the intellectual history of tropical medicine. *Aust Fam Physician*. 2009;38:57–59.
- 32. Brown ER. Public health in imperialism: early Rockefeller programs at home and abroad. *Am J Public Health*. 1976;66:897–903.
- Packard RM. A History of Global Health: Interventions Into the Lives Other Peoples. Baltimore MD: Johns Hopkins University Press; 2016.
- Koplan JP, Bond TC, Merson MH, et al. Towards a common definition of global health. *Lancet*. 2009;373:1993–1995.
- Holst J. Global health: emergence, hegemonic trends and biomedical reductionism. *Global Health*. 2020;16:42.
- 36. Abimbola S, Pai M. Will global health survive its decolonisation? *Lancet.* 2020;396:1627–1628.
- Affun-Adegbulu C, Adegbulu O. Decolonising global (public) health: from western universalism to global pluriversalities. *BMJ Glob Health*. 2020;5:e002947.
- Brown TM, Cueto M, Fee E. The World Health Organization and the transition from "international" to "global" public health. *Am J Public Health*. 2006;96:62–72.
- Brandt AM. How AIDS invented global health. N Engl J Med. 2013;368:2149–2152.
- Centers for Disease Control and Prevention. Ten great public health achievements: United States, 1990–1999. MMWR Morb Mort Wkly Rep. 1999; 48:241–243.
- Centers for Disease Control and Prevention. Ten great public health achievements: worldwide, 2001–2010. MMWR Morb Mort Wkly Rep. 2011;60:814–818.
- Goli S, Moradhvaj A, Chakravorty S, Rammohan A. World health status 1950–2015: converging or diverging. *PLoS One.* 2019;14:e0213139.

© Jones & Bartlett Learning LLC, an Ascend Learning Company. NOT FOR SALE OR DISTRIBUTION.