Global Health and Health Transitions

One hundred years ago, most populations around the world had similar disease profiles, with a high burden from infectious diseases. Modern medical technologies like antibiotics and vaccines have enabled many people to live longer, healthier lives. But modern lifestyles put a large number of people at risk for serious chronic diseases, and the disparities in health between the rich and the poor have increased. Global health draws on a wide variety of disciplines in order to understand and improve the health of people around the world.

1.1 DEFINING HEALTH

Health is often defined as the absence of disease (or the absence of illness, injury, infection, pain, tumors, or other physical disorders), but this is an incomplete explanation because it focuses on what health is *not* rather than on what health *is*. Some definitions of health try to capture its essence by emphasizing health as the ability to conduct normal daily activities. But that kind of statement is also limited, because the definition of "normal" varies from person to person. For example, some people assume that it is normal for an older person to have limited mobility and forgetfulness, but this is not true. Many older people are very active and mentally sharp, and many of those who have joint pain or memory loss could be helped by therapy and medication. Similarly, in many parts of the world parents think it is normal for their children to have intestinal worms. This is also not true, and untreated worm infections significantly reduce the health, growth, and school performance of millions of children around the world.

A more comprehensive definition of health addresses both physical and mental health as well as the presence of a social system that facilitates 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*." This definition recognizes that health is not just a function of biology. Health stems from biology, 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,[1] this definition provides a target for medical and public health systems to aim for as they work together to promote the improved health status of individuals and communities.

1.2 MEDICINE AND PUBLIC HEALTH

Medicine is concerned with the health of individuals, and clinical health practitioners like physicians, surgeons, dentists, nurses, and physical therapists are instrumental in helping individuals and families reach and maintain health by providing preventive, diagnostic, and therapeutic health services.

But because individual health is often the result of socioeconomic, environmental, and other factors, medicine by itself is a limited approach to health. Clinicians, other health workers, social workers and counselors, spiritual advisors, government officials, trash collectors, farmers, and many other people in many other professions all make important contributions to the social, economic, policy, and physical environments that promote or inhibit the health of communities and nations and, by extension, the health of individuals and families.

Public health focuses on the health of populations, whether small villages or entire world regions. The public health system, which addresses health at local, state and provincial, national, and international levels, also works to keep individuals safe and healthy. The goals of public health include preventing illnesses, injuries, and deaths at the population level, identifying and mitigating environmental hazards, promoting healthy behaviors, ensuring access to essential health services, and providing health education targeted toward at-risk groups of people (**Table 1–1**).[2] Both public health and medicine make important contributions to global health, but public health plays an especially important role because of its population focus (**Figure 1–1**). (The line between medicine and public health is also fairly blurry, with community health nurses and preventive medicine physicians working in both domains.)

Table 1–1 Essential public health services.

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

Source: Reproduced from the Centers for Disease Control and Prevention (2010). National Public Health Performance Standards Program (NPHPSP): 10 Essential Public Health Services. http://www.cdc.gov/nphpsp/essentialservices .html. Last updated December 9, 2010. Accessed August 31, 2012.
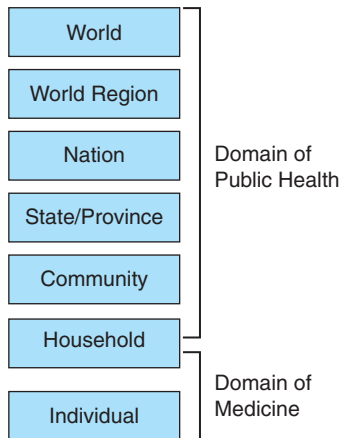

Figure 1–1 The domains of medicine and public health.

1.3 THE EMERGENCE OF GLOBAL HEALTH

Global health refers to *transnational health*, health concerns that cross national borders. The term *global health* is sometimes used interchangeably with *international health*, but **international health** is now more often used to describe a focus on the health issues of people who live in lower-income countries.[3,4]

Global health is not new. Infectious diseases have long been spread by migration and trade. By the mid-1800s, European countries had cooperation agreements in place to help control the spread of cholera, plague, yellow fever, and other epidemic diseases, and by the early 1900s international regulations addressed drugs and alcohol sales, occupational health and safety, and water pollution.[5]

In recent decades, global health as a field of work and study has expanded in scope and recognition as modernization and globalization have occurred. Modern transportation allows infectious diseases to spread across the world at an alarming rate. Advances in medical technology and pharmaceuticals are curing diseases that used to be untreatable, but new technologies have also created superbugs that are resistant to current antibiotic therapies. And the threat of bioterrorism requires coordination of public health responses from many nations. The increasing attention on global health also arises from the continued and growing disparities in health status between nations and within nations, which raise human rights concerns and may contribute to insecurity.

Although the main health concerns of communities in rural Africa (often HIV/AIDS and malaria) are very different from the key health concerns of urban Americans (often heart disease and cancer), there are important commonalities across the globe. Emerging infections such as multidrug-resistant tuberculosis (MDR-TB), rising cancer rates, and the high prevalence of mental health disorders are concerns for everyone. Global health helps communities, nations, and the world prepare to respond appropriately to emergent health concerns.

1.4 HEALTH TRANSITIONS IN THE 20TH CENTURY

One hundred years ago, most populations across the world had similar health profiles: high birth rates, high death rates, short life expectancies, and a lot of disease and death due to infections and undernutrition. During the 20th century, most high-income nations made a transition to a lower

birth rate, a lower death rate, longer life expectancies, and a higher burden from the chronic diseases often associated with overnutrition. Low-income countries have not experienced such dramatic changes, but the health profiles of middle-income areas are currently shifting. These demographic, epidemiologic, and nutrition transitions are summarized in **Table 1–2**.

In the United States, the leading causes of death in 1800 and 1900 were pneumonia (including pneumonia caused by influenza), tuberculosis, and diarrhea—all infectious diseases.[6] By 1950 the death rate had dropped significantly, life expectancy had increased, and the most common causes of death had shifted to heart disease, cancer, and stroke, the same noncommunicable diseases that are the most frequent causes of death today.[7] These changes in population health status were due to a variety of factors, including new health technologies (such as new

Table 1–2 Health transitions.

Category	Low-Income Areas (and most of the world 100 years ago)	Middle-Income Areas	High-Income Areas
Demographic Transition	High fertility rate	Intermediate fertility rate	Low fertility rate
	Relatively high child mortality rate	Low child mortality rate	Very low child mortality rate
	Relatively high mortality rate	Intermediate mortality rate	Relatively low mortality rate
	Relatively low life expectancy	Intermediate life expectancy	Relatively high life expectancy
	Children are a large proportion of the population	Intermediate aging profile	Older adults are a sizeable proportion of the population
Epidemiologic Transition	High burden from diseases of poverty (infectious diseases)	Dual burden of infectious and chronic diseases	High burden from diseases of affluence (chronic diseases)
Nutrition Transition	Underweight is a major concern	Concerns about underweight in some populations and obesity in others	Overweight and obesity are major concerns

vaccines, new antibiotics, and new contraceptives), improved nutrition, increased education, and economic growth.[8]

1.4.A Demographic Transitions

The **demographic transition** describes a shift toward lower birth and death rates that often occurs as populations move from being low-income economies (often referred to as developing countries) to being high-income economies (often called developed countries) (**Figure 1–2**).[9] Pre-transition populations have high birth rates and high death rates, and the population maintains a stable, but relatively small, number of people. During the early stages of the demographic transition, increased food security and improved health care reduce the death rate, but the birth rate stays high and the population size increases, possibly drastically. In later stages, education, technology, economic growth, and other factors reduce the birth rates—a process called the
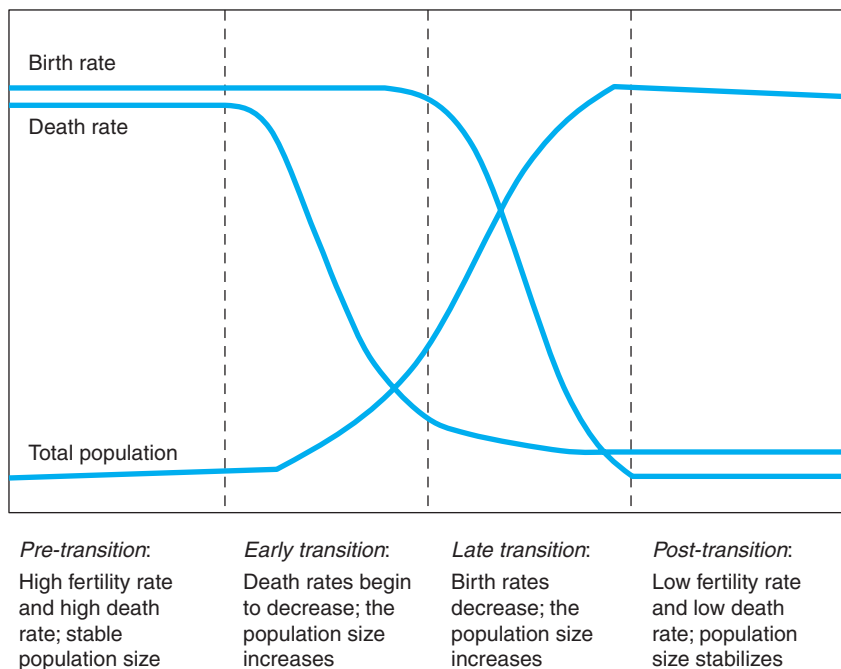

Pre-transition: High fertility rate and high death rate; stable population size

Early transition: Death rates begin to decrease; the population size increases

Late transition: Birth rates decrease; the population size increases

Post-transition: Low fertility rate and low death rate; population size stabilizes

Figure 1–2 The demographic transition.

fertility transition—and the population begins to stabilize at its larger size. Eventually, prolonged low birth rates may lead to a slow decline in population size.

1.4.B Epidemiologic Transitions

The **epidemiologic transition**, a shift from infectious diseases to chronic, noncommunicable diseases (NCDs) being the primary health problem in a population, often follows the demographic transition as the economic status of a population improves (**Figure 1–3**).[10] The epidemiologic transitions that occurred in many high-income countries in the past century are now being seen in many middle-income areas.[11] During the years of transition, many of these countries are experiencing a **dual burden** of disease, as some population groups continue to suffer from diseases of poverty (such as infections, undernutrition, and complications of childbirth), while other population groups bear a considerable burden from diseases of affluence (NCDs).

The complex epidemiologic profile of middle-income countries highlights two key points. One is that socioeconomic conditions have a huge
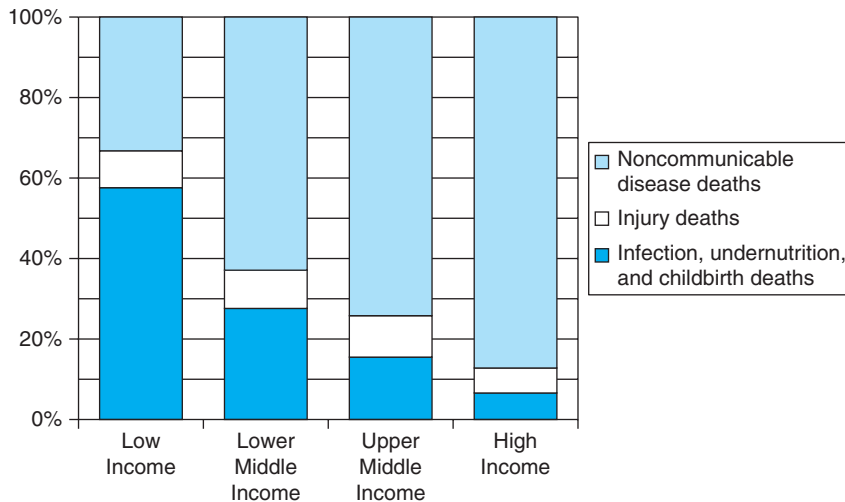

Figure 1–3 Proportion of deaths from various causes by country income level in 2008.

Source: Data from *The global burden of disease: 2004 update (May 2011 update).* Geneva: WHO; 2011.

influence on the diseases experienced by individuals and populations. There is heterogeneity in the disease profile within every country, with urban professionals in every part of the world having a very different health profile than the urban poor and rural residents surviving by subsistence farming. The other key observation is that every population at every income level has health concerns. Reducing deaths from infections and childbirth is an excellent public health achievement, especially because these conditions tend to kill young people. But those averted deaths will be replaced with other causes of death, often deaths from heart disease and cancer.

Thus, the goal of public health is not to prevent death, because everyone will eventually die of something. The goal of public health is to prevent *premature* death, and to promote long and healthy lives. By this standard, shifting the burden of disease from children and young adults to older adults is a good outcome, and that is what happens during the epidemiologic transition. The burden of disease in pre-transition populations falls heavily on the young, while the burden of disease in post-transition populations falls mostly on the elderly. This can be seen in the age distributions of deaths in low- and high-income countries. In some low-income countries, more than one-third of the deaths that occur are of children; in high-income countries, nearly all deaths occur in older adults (**Figure 1–4**).[12]
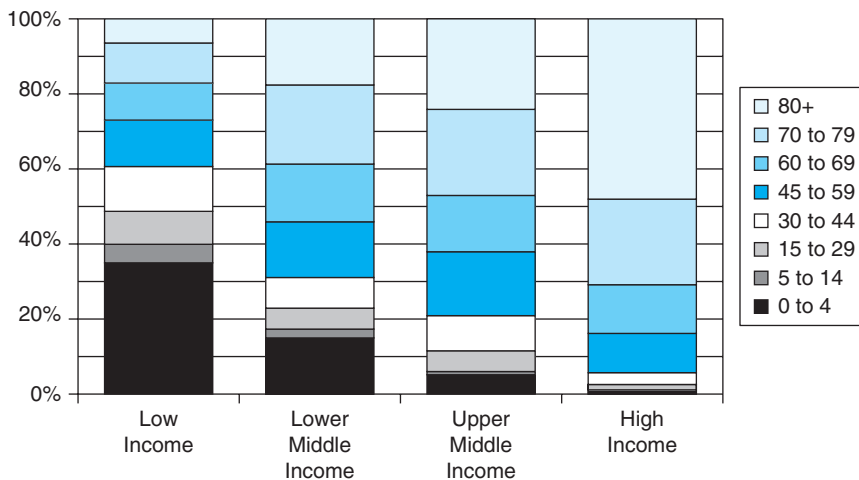

Figure 1–4 Proportion of deaths by age group and country income level in 2008.
Source: Data from *The global burden of disease: 2004 update (May 2011 update).* Geneva: WHO; 2011.

It is also important to note that while the epidemiologic transition is a helpful model for understanding the differences in health status between higher- and lower-income countries and regions, the health changes that occur with economic development are much less predictable than the model implies.[13] Although many illnesses and deaths in low-income nations are due to infection and undernutrition and most illnesses and deaths in high-income nations are due to NCDs, globalization is reintroducing infectious diseases into industrialized nations and introducing new chronic diseases into developing nations. Every country in the world experiences a mix of deaths from infection, noncommunicable conditions, injuries, and other causes, even though the relative proportion of these causes of deaths differs by the country's income level.

1.4.C Nutrition Transitions

The **nutrition transition** describes a population shift from a stage in which undernutrition and nutrient deficiencies are prevalent to an intermediate stage in which undernutrition and obesity are both problems in the population to a stage in which overweight and obesity are the dominant nutritional disorders.[14] Pre-transition populations are concerned about having too little food and may consume primarily energy-dense foods that have a lot of calories but are low in nutrients. Children are at high risk of vitamin and mineral deficiencies because starchy staple foods form the bulk of the diet, and many children have stunted growth because they eat too few calories or too little protein. Few convenience foods are available, and a lot of effort goes into acquiring and preparing foods for consumption. Post-transition populations consume a greater variety of nutritious foods, but also eat more refined and processed foods, foods of animal origin, and fats. Most of these populations have shifted toward an industrialized economy that demands less physical labor from its workers, which exacerbates rising rates of obesity.

The nutrition transition provides a helpful framework for understanding the changing nutritional status of populations around the world, but an important new trend has emerged with the globalization of the food supply and with increasing urbanization in low-income countries: **lifestyle diseases** related to obesity and physical inactivity are now found among some populations even in pre-transition countries where the majority of families are food insecure and famine is a potential threat.[15]

1.5 RISK FACTORS

A first step toward improving population health is identifying major health problems and conducting research to identify the characteristics of the people most likely to be affected by those conditions. After data about a population have been collected, statistics are used to see if an exposure or characteristic is associated with an increased likelihood of having a particular disease. If a statistically significant **association** is present, then the next step is to try to determine whether the exposure causes the disease. A causal factor is an exposure that has been scientifically tested and shown to occur before the disease outcome and to contribute directly to its occurrence. Identifying **causation** requires more than just statistics. It also requires logical thinking (**Table 1–3**).[16,17] For example, there may be a statistical association between hot weather and the number of shark attacks, but that does not prove that hot weather causes sharks to fall into a frenzy. A more likely explanation is that hot weather increases the number of humans in the water, which increases the number of humans attacked. For that matter, there may be an association between ice cream sales and shark attacks. Removing the "risky" exposure by banning ice cream sales at the beach would probably not do much to prevent shark attacks, unless people stopped going to beaches because of the absence of ice cream.

A **risk factor** is an exposure or characteristic that increases the likelihood of developing a particular disease. Age, ethnicity, and genetic markers for certain diseases are examples of **unmodifiable risk factors** that cannot be changed. **Behavioral risk factors**, such as tobacco smoking and exercise habits, and other **modifiable risk factors** can be altered, even if making lifestyle changes is challenging for the individuals and the communities who are trying to adopt healthier behaviors. The goal of public health is not merely to identify problems, but to use that information to promote health and prevent disease. Once a major risk factor for a disease has been found, policy or programmatic interventions to reduce exposure to the risk factor (or to promote a protective factor) can be designed and implemented.

Some diseases have no currently known modifiable risk factors. It is not always possible to identify the **etiology**, or cause, of a particular disease or the risk factors for it, at least not with current technology. For example, the etiology of many neurological conditions like Parkinson's disease and epilepsy are unknown in most cases, as are the causes of many mental illnesses, autoimmune diseases, and other conditions. For these disorders, the

Table 1–3 Criteria for causation.

Criterion	Explanations/Examples
Is the association strong?	If smokers are 15 times more likely to develop lung cancer than nonsmokers, that is stronger evidence of causality than if smokers are 1.1 times more likely to develop lung cancer. Prevalence of the disease (the total amount of disease in a population) should be significantly higher in those exposed to the risk factor than those not. In studies that follow people over time (longitudinal studies), the incidence of the disease (number of new cases in a population) should be significantly higher in those exposed to the risk factor than those not exposed.
Is there clear temporality (time sequence)?	Exposure to the agent or risk factor must precede development of the disease, and the disease should follow exposure to the risk factor within a predictable time frame.
Is there a dose–response effect?	If exercising for 3 hours a week is slightly protective against breast cancer and exercising for 6 hours a week is more protective, it is more likely that exercise is protective than if the extra hours of exercise are not associated with increased protection. If exposure to radiation is harmful, then people with higher radiation exposure should be sicker than people with minimal exposure.
If an experiment removes the risk factor does that reduce the risk of the disease?	People who are exposed to the risk factor should develop the disease more frequently than those who do not have the exposure, and exposure to the risk factor should be more frequent among those with the disease than those without. Reducing or eliminating the risk factor should reduce the risk of the disease.
Other criteria	Is the link between the exposure and the outcome specific, biologically plausible, and consistent with existing knowledge? Have alternate explanations for the apparent causation been considered? Have different studies in different populations made consistent conclusions?

Source: Causal criteria from Hill AB. The environment and disease: association or causation? *Proc R Soc Med.* 1965;58:295–300; and Evans AS. Causation and disease: the Henle-Koch postulates revisited. *Yale J Biol Med.* 1976;49:175–195.

public health focus is on research to identify causal factors and on support for the individuals and families affected by the conditions.

But most diseases do have known risk factors and known protective factors. Many diseases are **multifactorial**, which means that they have many different causes and multiple risk factors. 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. A risk factor is **sufficient** if that exposure or characteristic by itself can cause disease. Some exposures are necessary but not sufficient on their own to cause disease. Some exposures are sufficient but not necessary. Few risk factors are both necessary and sufficient. However, when several risk factors are present together they can create a situation in which disease can develop.

For example, heart disease is caused by the build-up of plaque on the walls of the arteries that supply blood to the heart. This build-up is associated with high cholesterol levels in the blood, inflammation, infection, and genetics. Diet, stress, and physical inactivity also contribute to the development of cardiovascular disease. Thus, there are many risk factors for heart disease and many targets for prevention. A broken hip may directly result from a fall, but the underlying cause of the fracture might be osteoporosis (loss of bone density) caused by genetics, inactivity, lack of calcium in the diet during childhood, endocrine disorders, or one of many other medical conditions, and the fall itself may have occurred because of a loss of balance due to a nervous system disorder like Parkinson's disease or multiple sclerosis, or because of vision problems, or because of not living in a barrier-free home or with someone who can assist with tasks that require reaching or balancing. Addressing any one of these contributing factors may prevent a negative health outcome.

Public health considers personal biology, psychology, behavior, and other characteristics to be only a starting point for understanding the risk factors for disease. A person's friends, family, and coworkers also contribute to the health problems that an individual is likely to encounter, whether that is an increased risk of knee injuries in a person whose closest friends are avid basketball players or an increased risk of obesity in a person whose family gatherings are built around high-calorie foods. Living and working conditions, such as the quality of housing available in a person's neighborhood and whether local employers provide health insurance, add another layer of factors that affect health. And broader social, cultural, economic, political, environmental, and policy considerations also influence individual and community health.[18] Targeting a risk factor at any one of these levels can improve personal and public health (**Figure 1–5**).
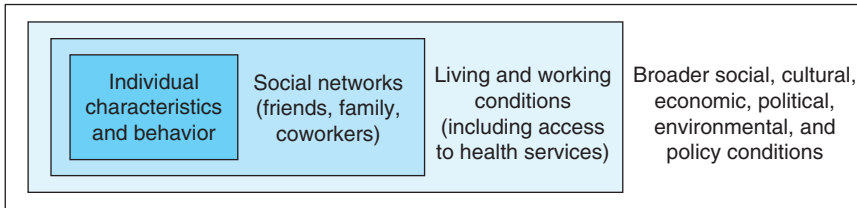
Figure 1–5 Contributors to individual and population health.

Source: Adapted from the 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.

1.6 PREVENTION

A **causal web** can be used to display the relationships among the many different biological, behavioral, social, economic, political, and environmental exposures that might have a causal relationship with a particular health outcome. Causal webs indicate the immediate causes of disease and also show more distant causes. For example, **Figure 1–6** shows the
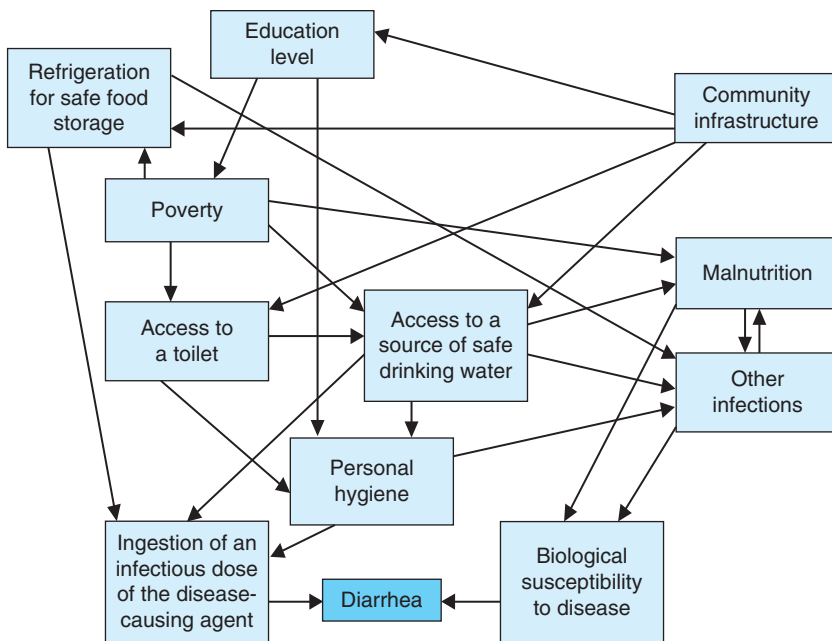

Figure 1–6 Sample causal web for infectious diarrhea.

relationships between both direct and less direct causes of infectious diarrhea, which is usually acquired through the ingestion of fecally contaminated food or water.

When a complex set of characteristics contribute to causing disease, there are also multiple paths to a solution. Interrupting any of the pathways shown on a causal diagram may prevent the disease outcome for at least some members of a population. An intervention that removes any one of the arrows in Figure 1–6, whether by introducing electricity to a rural community to allow for refrigeration, teaching illiterate mothers to read, or bringing low-cost water filters to an urban slum, could be successful in preventing at least some cases of childhood diarrhea. Solutions to community and global health concerns often must address broad socioeconomic and environmental issues and not just household problems.

There are three levels of prevention (**Table 1–4**). When modifiable risk factors for a disease have been identified, the goal is **primary prevention**, preventing the disease from ever occurring. Primary prevention methods include immunizations, improved nutrition, adequate sleep, safety devices, health education, and any interventions that reduce susceptibility to infection, injury, or disease. The goal of **secondary prevention** is to diagnose disease at an early stage when it has not yet caused significant damage to the body and can be treated more easily. The aim of **tertiary prevention** is to reduce complications in those with symptomatic disease in order to prevent death or minimize disability.

Given the three levels of prevention, there is almost always some intervention that could improve the health of those who are vulnerable to a particular disease or are already sick. Most public health campaigns focus on primary prevention, such as the promotion of handwashing, breastfeeding, mosquito net use, family planning methods, and immunizations. Some prevention work focuses on changing the health environment by spraying insecticides to kill the mosquitoes that spread infections, implementing clean delivery room practices to prevent infections of new mothers and newborns, and increasing access to improved sanitation facilities to prevent diarrhea. Other efforts focus on improving access to health care and health insurance, to essential medications and micronutrient supplements, and to healthy foods through community-building and policy changes. These are in addition to secondary prevention activities such as screening promotions and tertiary prevention methods that treat existing diseases and disabilities.

Table 1–4 Levels of prevention.

Level	Also Called…	Target Population	Goal	Examples
Primary Prevention	Prevention	People without disease	Prevent disease from ever occurring	• Giving vitamin A capsules to at-risk children to prevent blindness • Giving tetanus shots to pregnant women to prevent tetanus
Secondary Prevention	Early diagnosis	People with early, non-symptomatic disease	Reduce the severity of disease and prevent disability and death	• Screening with mammography to detect cases of breast cancer in early stages • Checking blood pressure routinely to detect early hypertension
Tertiary Prevention	Treatment and rehabilitation	People with symptomatic disease	Reduce impairment and minimize suffering	• Detecting cases of acute respiratory infections in children early so they can be treated with antibiotics • Checking for foot problems among diabetic persons so they do not develop into severe ulcers • Providing physical therapy to people who have been injured in a vehicle accident in order to prevent long-term disability

1.7 CAREERS IN GLOBAL HEALTH

Global health professionals work in a variety of fields to promote population health. Among other roles, global health workers track outbreaks of infectious diseases, develop new vaccines, monitor the safety of medications, assess environmental risk factors for disease, educate communities about diabetes

care, and promote HIV/AIDS awareness and prevention. Public health geneticists determine which genes are associated with an increased risk of cancer. Public health educators and nutritionists work with schools and communities to reduce risky behaviors, such as unsafe sex, drug use, and reckless driving, and to promote healthy behaviors such as wearing bicycle helmets, getting screened for cervical cancer, and eating vegetables. Environmental public health experts develop plans for communities that want to reduce the spread of infections caused by insect bites. Public health administrators work with hospitals and physicians, elected officials and lawyers, biomedical researchers, the pharmaceutical industry, and others to promote health.

People who want to work in global health need to understand the social and environmental contributors to disease and the biological causes of disease. They must be familiar with the traditional areas of international health, such as infectious disease, nutrition, child health, reproductive health, and water and sanitation. They must also be knowledgeable about emerging global public health concerns, such as aging, mental health, injury prevention, and food safety. An understanding of the impact of poverty, culture, and economic globalization on health is also essential.

The diversity of work within global health means that there are many pathways to getting started in a global health career. Many professionals working in the field have training in at least one of the core disciplines of public health, which include health education and health behavior; epidemiology and biostatistics (the fields that focus on measuring health status in populations); environmental health; and health policy, health economics, and health administration and management. Global health professionals may also specialize in areas such as public health nutrition, maternal and child health, emergency preparedness and response, and public health research. Common undergraduate majors for those preparing for global health careers include biology, psychology, sociology, and the health sciences, and majors in fields like business, communications, economics, political science, international relations, and statistics can also offer excellent preparation. Every area of study provides tools that can be applied to improving public health as a professional or as a volunteer.

1.8 DISCUSSION QUESTIONS

1. How has the medical system contributed to your health? Based on the list of public health services in Table 1–1, how has the public health system contributed to your health? What are the differences in how medicine and public health influence your health?

2. What are some of the most significant health concerns in your community? Are these concerns that are likely to be shared by other communities in your country and in other parts of the world? Could these problems be considered global health issues?

3. Do you agree that shifting the burden of disease and death from the young to the old is a successful public health outcome?

4. Choose one relatively common disease affecting health in your community, then list as many risk factors for that disease as you can think of in 2 minutes. How many of the risk factors on your list are modifiable? How many are necessary? How many are sufficient? What interventions would reduce the number of people in your community who develop the disease?

5. Sketch out a causal web for a relatively common disease in your country, adding at least 10 risk factors to the figure. Based on the arrows on your web, what interventions might prevent the disease from occurring?

6. What are some examples of primary prevention, secondary prevention, and tertiary prevention activities you have engaged in during the past year?

7. How does global health relate to your major field of study and/or the field you are working in?

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