CHAPTER 2

Social Epidemiology

Candace Miller, ScD, MHS, Brenda Waning, MPH, Jennifer Beard, PhD, MPH, and Anna Knapp, MPH

Society enters the body in many ways. From the dawn of civilization, throughout history and time and across geography and place, the society within which we live has influenced health and illness. Whereas *epidemiology* is the discipline that studies the distribution and causes of disease, *social epidemiology* is the discipline focused on the societal factors that determine the patterning of disease within and across populations. Social epidemiologists seek to explain how society "gets into the body" and to identify complex patterns of morbidity and mortality that vary based on societal structure, cultural norms, and socioeconomic position (Table 2-1). For example, why are some groups more likely to suffer from cardiovascular disease, human immunodeficiency virus (HIV) infection, or cancer? Why are some patients more or less likely to adhere to various treatment regimens? What factors buffer some groups from harm or increase access to and effectiveness of pharmacologic interventions?

Social epidemiologists argue that we are not all created equal. On the contrary, economic, political, social, and other processes and structures determine the different and unequal distribution of resources and services that promote health, buffer against illness, and cure disease. Throughout the world, the highest socioeconomic classes have the highest-quality shelter, health care, and schools, whereas the lowest classes often struggle with reduced access to affordable food, adequate housing, health care, and protection from environmental hazards. Modern social epidemiologists argue that throughout history, social elites have inequitably organized societies through laws, policies, and cultural norms in order to protect or benefit their position. As a result, persisting inequalities based on gender, class, age, sexual orientation, race and ethnicity, and other characteristics are the rule, rather than the exception.

TABLE 2-1   Various Factors at Different Levels That Interact to Influence Health Status

Structural	Social	Individual
Legal Structures	**Social Capital**	**Individual Characteristics**
Laws	Trust	Sex
Law enforcement	Norms	Age
		Race/ethnicity
Policy Environment	**Community**	Disability
Economic policy	Access to health care	Psychosocial
Health and education policy	Community groups	Biology
Social policy	Schools and workplaces	Heredity
Agricultural, transportation,	Institutions	
trade, etc., policies	Risks and protections	**Behaviors**
		Hygiene
Demographic Change	**Cultural Context**	Sexual activity
Urbanization	Beliefs, patterns of behavior	Diet and exercise
Migration	Traditions	Care practices
Aging of population	Gender roles	
		Socioeconomic Position
Institutions	**Social Networks**	Income
Government	Social influence	Education
Legislative system	Engagement	Occupation
Judicial system	Access to resources	
Regional and international	Support	
bodies and laws		
	Physical Environment	
	Weather	
	Natural resources	
	Hazards	

Our bodies are directly and indirectly influenced by where we live, our parents' (and their parents') economic status, our mothers' prenatal care, our education, the stressors we face, the resources we can access, and the support we enjoy or lack within our communities. In addition, government policies and laws that regulate taxes, pollution, trade, drug prices, welfare support, food supplies, the economy, employment, access to and quality of health insurance, and other important factors also affect health and disease. Morbidity and mortality are not random, but geographically and socially patterned to render some people winners and others losers.

Social epidemiology can be conceptualized along a scale of biological organization, in which molecular biology focuses on the level of molecular particles; cell biology concentrates on the cellular level; physiology focuses on the organ level; clinical research occurs at the individual level; and finally, epidemiology occurs at the level of the individual, family, community, and society.[1] Social epidemiologic inquiry occurs at the levels of the individual and the society simultaneously, without overlooking genetics and biomedical causation.[2]

HISTORY

For centuries, physicians, scientists, activists, philosophers, and laypeople have sought to understand the causes of disease in populations. This has always been a political process, largely led by elite social classes and dominant global powers. Thus, including social causes of disease in the public discourse has been a difficult, arduous journey transcending centuries and continents.

In the 17th century, efforts to understand and predict disease motivated the documentation of disease symptoms, outbreak patterns, and patient outcomes. For example, in the 1600s, the first Bills of Mortality were compiled, creating what is now a modern-day death registry, listing characteristics of individuals and providing details on who died of what. In London, John Graunt (1620–1674), an early statistician, set out to understand who was dying during outbreaks of the bubonic plague in order to set up an early warning system and prevent death. He noted differences in death rates based on sex and residency and completed a seminal work in vital statistics called the *Natural and Political Observations Upon the Bills of Mortality*.

By the 1700s, there was a greater understanding of the specific causes of disease. A French physician, Louis René Villerme (1782–1863), recognized elevated levels of illness that appeared work related, thus identifying social class and work conditions as crucial determinants of health or disease. Villerme found that wealth was inversely associated with risk of mortality, short stature, illness, and deformities, leading him to argue that longevity is not fixed, but based on economic conditions that can be influenced by government policy. Villerme's findings were not well received, however, because he called for regulation within the workplace and protection for the poor—perhaps at the expense of businesses.

By the mid-1800s, physicians and others argued that miasma, or bad air and emanations from decaying matter, caused outbreaks of cholera. Observing that deaths were commonly clustered among the poor, proponents of the theory of miasma argued that the lower classes had terrible hygiene, which poisoned the air. Reducing death required people to be less filthy. This theory contrasted with the work of John

Snow (1813–1858), who methodically covered the streets of London collecting statistics documenting the location of outbreaks. Snow identified contaminated water from communal pumps as the source of cholera. Contaminated water was more common in poorer neighborhoods, where infrastructure was of lower quality.

In 1844, Friedrich Engels (1820–1895), a German social scientist, further described the working conditions of factory workers in England. Through direct observation, Engels witnessed horrible working conditions and identified the relationship between these conditions and disease, motivating him to write *The Condition of the Working Class in England in 1844*. Engels described long hours without breaks, dingy facilities, repetitive duties, and environmental hazards, writing:

> All of these adverse factors combine to undermine the health of the workers. Very few strong, well-built, healthy people are to be found among them. . . . They are for the most part, weak, thin and pale. . . . Their weakened bodies are in no condition to withstand illness and whenever infection is abroad they fall victims to it. Consequently they age prematurely and die young. This is proved by the available statistics of death rates.[3]

The documentation of and attention to the impact of society on the body lost traction as the concept of *germ theory* became popular in the 1860s. Germ theory identifies single causal agents, such as *Salmonella typhi*, as the cause of disease—in this case, typhoid fever. Whereas many scientists, physicians, and funding agents rallied around germ theory, early social epidemiologists argued that lifestyle, behaviors, hygiene, and socioeconomic status, which affect nutrition and shelter, were more important than exposure to germs. They noted that once exposed, susceptibility to disease and mortality from the specific virus was dependent on social status, noting that the poor were less able to fight off even minor infections.

The causal model connecting the combined influence of host, environment, and agent emerged in the 1920s to 1930s. This model asserts that the human host is constantly besieged by viral, bacterial, or other disease-causing agents that are repelled by an uncompromised immune system. Therefore, unhealthy environmental characteristics can compromise this natural protection and allow the entry of the agent into the host. This theory gave rise to the disciplines of genetics and cellular biology. Although the causal model furthered our understanding of the influence of environmental agents on the body, the lines of scientific inquiry it prompted ignored the role of social environment on disease.

In the early 1940s, Salvador Allende, who would later go on to become the president of Chile, wrote *The Structure of National Health*, linking illness and socioeco-

nomic status. Allende argued that social change and efforts toward creating a more egalitarian society are the only effective approach to solving health problems. "It is impossible," he wrote, "to give health and knowledge to a people who are malnourished, who wear rags, and who work at a level of unmerciful exploitation."[4] Allende urged wage and land reform, rent control, reorganization within the Chilean Ministry of Health, and control of pharmaceutical production to allow generic drugs. Allende was one of the first socialist presidents in Latin America and was at odds with the capitalist societies of the West. He identified national development as a critical determinant of health, a theory that laid the early groundwork for the creation of the Human Development Index in 1990 by Amartya Sen and Mahbub ul Haq (Fig. 2-1).[5]

By the 1950s and 1960s, chronic diseases such as cancer and heart disease were becoming more frequent, particularly in more developed countries where infectious diseases were better controlled. Over the last 60 years, clinicians and epidemiologists treating and monitoring these conditions gradually came to understand that chronic diseases are caused by a combination of biological, social, and behavioral exposures leading to the creation of differential risk patterns for various populations.

This new branch of epidemiology, focused on the health impact of social conditions and social status as key determinants of morbidity and mortality, emerged in the 1960s and 1970s using statistics and classic epidemiology to investigate the relationship between social structure and disease vulnerability. By the end of the 20th century, the concept of social causation of disease gained traction, leading to increased funding for research and new journals such as *Social Science and Medicine*. Today, social epidemiology integrates concepts and methods from anthropology, biology, biostatistics, medicine, political science, public health, psychology, sociology, and other disciplines.

KEY CONCEPTS IN SOCIAL EPIDEMIOLOGY

The World Health Organization published the projected number of deaths from various causes for 2030 (Fig. 2-2). According to these projections, nearly 11 million people will die of cancer per year globally, more than 9 million from heart disease, and about 6 million per year from HIV/AIDS. To reduce disease-specific mortality, complementary strategies for prevention, management, and treatment of diseases linked to the geographic distribution of disease, risk levels of diverse populations, and the proximal, distal, and fundamental causes of disease are needed.

If we envision disease as a river, proximal causes are downstream, or the end results, of the more upstream, distal, or fundamental causes. We know that, for example, the proximal or immediate causes of heart disease include elevated blood
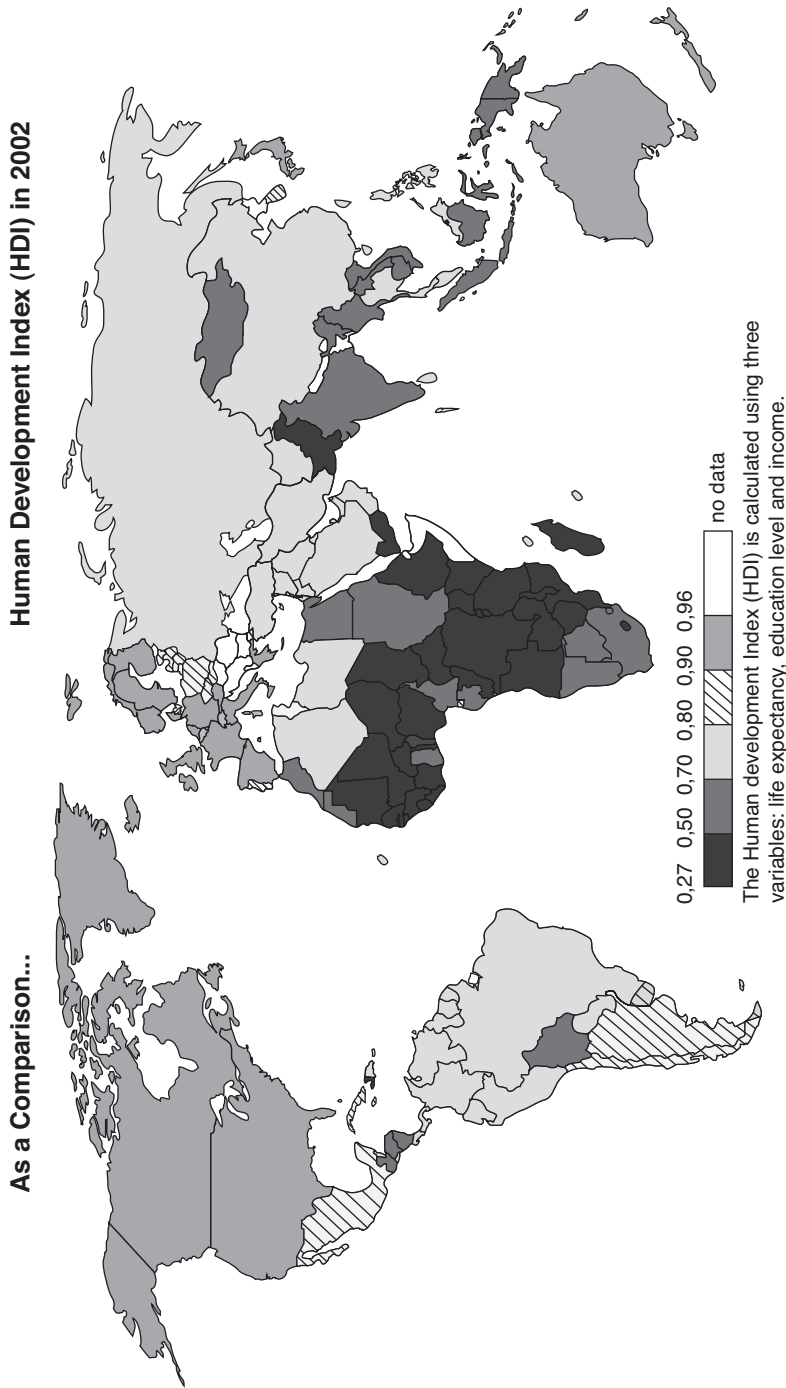
FIGURE 2-1   Human Development Index in 2002

Source: Human Development Index (HDI) in 2002. (2004). In UNEP/GRID-Arendal Maps and Graphics Library. Retrieved 21:15, Philippe Rekacewicz, August 6, 2007 http://maps.grida.no/go/graphic/human-development-index-hdi-i n-2002; Courtesy of UNEP/GRID - Arendal Maps and Graphics Library, http://www.grida.no
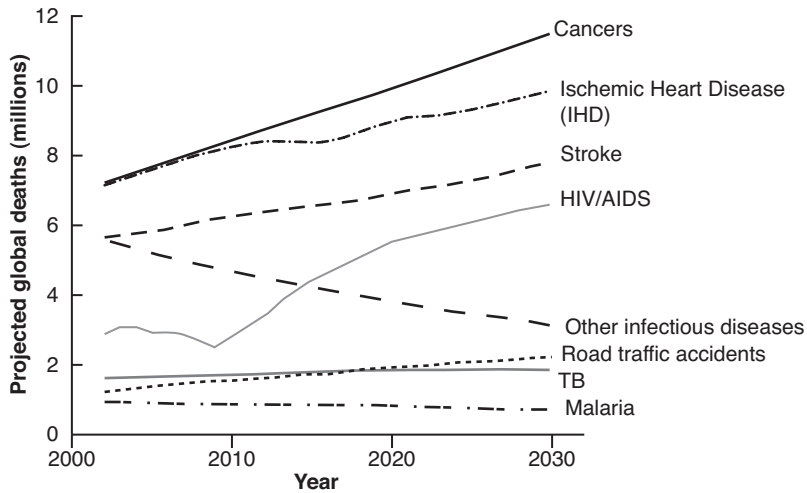
FIGURE 2-2   Projected global deaths for selected causes of death, 2002–2030
Source: Mathers CD and Loncar D. Updated projections of global morality and burden of disease, 2002–2030: data source, methods and results. http://www.who.int/healthinfo/statistics/bodprojectionspaper.pdf

cholesterol levels, high blood pressure, and diabetes mellitus. High blood cholesterol levels can lead to narrowing of the arteries, which may cause blockages, heart attacks, and other complications that can be irreversible.

We also know that genetics and a person's family history are important to health status and that complicated interactions between downstream and fundamental factors determine risk of disease. Although geneticists have not yet found ways to manipulate genes to reduce heart disease, cholesterol, and diabetes, all these conditions are manageable through behavioral, surgical, and pharmaceutical interventions. Lack of availability and lack of affordability of such interventions in this example are tied to fundamental causes, such as poverty and lack of access to preventive health care, which lie even further upstream.

Behavioral factors lie mid-river, between the far upstream fundamental causes (poverty, social marginalization, etc.) and downstream disease diagnosis. These factors include tobacco and alcohol use, poor nutrition, and physical inactivity. In fact, behavioral factors are causally related to elevated cholesterol levels, high blood pressure, and diabetes. But what determines behavioral factors? For example, what determines who smokes and how much they smoke? Surveillance data find different rates of smoking based on age, gender, education, income, occupation, social norms, and

geographic location (i.e., where there are differences in tobacco taxes, advertising reg-ulations, and laws regarding who can smoke and where it is acceptable). Behaviors can be influenced directly, such as by raising tobacco taxes; or indirectly, such as by restricting tobacco advertising aimed at children.

Socioeconomic factors such as income, education, and occupation are fundamental causes that influence tobacco use or other behaviors related to heart disease and may be more difficult to influence. According to demographic World Health Surveys from 2003, smoking is most common in the lowest-income households in developing coun-tries. Tobacco-related mortality is also higher where elevated rates of smoking exist in a context with poorer health services and insufficient tobacco cessation programs.[6] These risk factors, along with low literacy or poor working conditions, in places where tobacco regulation does not exist, partly explain the fundamental causes of tobacco use and rates of heart disease in the developing world.

In the developed world, physical inactivity and obesity are most common in poorer socioeconomic classes among people who lack the resources to purchase healthier foods and who live in neighborhoods where fresh vegetables and fruits are not sold, cheap fast food outlets are plentiful, and there is no access to a physical environment conducive to exercise. The people most likely to die prematurely from heart disease are generally least likely to access health screenings or have adequate health insurance coverage and quality health care, and must often pay out of pocket for medications.

Thus, fundamental causes occur at the societal level through social structures that determine the pathways and mechanisms by which health is negatively affected. Returning to the metaphor of disease as a river, fundamental causes occur at the mouth of the river; upstream factors determine the level of risk, and downstream factors become health consequences leading to morbidity or mortality. Although social epidemiologists do not discount that individual choice can affect health and behavior, they recognize that human agency, in the form of choices, alternatives, and resources, is largely determined by the society in which an individual lives and his or her socioeconomic position.

Undoubtedly, categorizing the causes of disease as fundamental is controversial. Identification of fundamental causes challenges the status quo, power bases, and the very way in which societies are organized. Fundamental disparities can expose powerful elites and inequitable decision-making processes that may be partly responsible for deprivation and highlight the lack of rights or equity experienced by vulnerable groups and minorities. Moreover, reform is often undesirable to those who profit from or feel that their needs are satisfactorily met within the existing social hierarchy. Change may deeply conflict with commerce and trade or may require urban renewal, rural develop-ment, or more equitable regulation regarding wages, industry, and markets.

PROCESSES IN SOCIETY: HOW DOES SOCIETY ACTUALLY "GET INTO THE BODY"?

Over the lifespan, the human body moves through various processes as it develops. Professor Nancy Krieger of Harvard University describes "bodies in society" as biological species that grow and reproduce.[7] Our bodies begin life in utero and progress into old age, experiencing the constraints or opportunities of our age or stage. Bodies are built to develop and grow physically, intellectually, emotionally, and sexually. We are born with a set of characteristics, such as genetic makeup, physical features, gender, and intellectual aptitude, but we are also biological organisms who evolve as new traits emerge, adaptations occur, or as the body is manipulated. We are able to and do interact with others and with the physical environment.

Our bodies also belong to and are products of the society in which we live. We are born at a certain time or historical period and, as we age, experience life according to our temporal context. Each historical period is marked by its economy, political and legal system, and existing technology. Of course, smaller economies and political systems exist as microcosms within and interacting with larger systems. Thus, we may be overtly excluded from interacting with certain systems (because of social hierarchy or geographic proximity) or choose to boycott certain systems. Still, we cannot divorce our development from the systems into which we are born and interact with or reject during our lifespan and the long history upon which particular contexts are founded.

We are born in a distinct place, but we move across geography, now with greater speed than ever before. Nevertheless, each place or space has advantages and disadvantages, rights and responsibilities, resources, relationships, and institutions.

We are also born, raised, and enter adulthood within a certain social position. We may move up and down the social ladder, but the various ages and stages of our lives are shaped by the social positions we live within and are determined by our class, gender, race/ethnicity, sexual preference, or other divisions based on power or property.[7] As social beings, shaped and developed by the circumstances of our lives and environments, we partake in relationships and processes of production, consumption, and reproduction. As defined by Krieger, social production includes the transactions related to the market economy and culture where goods, services, ideas, and information are produced, shared, traded or sold, and otherwise distributed. We consume ideas, information, advertising, and goods and services that meet our various needs and desires.

Society "enters" the body through our immunologic responses to bacteria, susceptibility to infection, protection from viruses, lifestyle behaviors, knowledge of

risks, exposure to harm, attitudes toward health, actions to protect health, and resources for prevention and treatment of disease. We may be exposed to infectious diseases such as malaria, tuberculosis, influenza, HIV/AIDS, hepatitis, schistosomiasis, and other illnesses. We may also develop chronic diseases such as heart disease, arthritis, cancer, diabetes, depression, and drug addiction. Social epidemiologists argue that whether or not we suffer from and survive the infectious or chronic disease is heavily dependent on our place in society.

Social epidemiologists refer to lifecourse theory to help explain the phenomenon by which multiple factors interact to increase susceptibility to disease. For example, there may be disadvantages that accumulate throughout the life cycle so that, by middle age, some populations are highly susceptible to cancer or heart disease. Childhood illness, adverse environmental exposure, accumulated stress, and risky lifestyle behaviors may all interact to cause and worsen heart disease. In the developing world, maternal morbidity and mortality may be largely determined by events that occur throughout the life course. For example, a young girl living in poverty from childhood onward may be more likely to have an early sexual debut leading to an unplanned pregnancy. When childbirth occurs before the reproductive organs are fully formed, there is higher risk of complications, including an obstructed delivery. Persistent deprivation and inadequate nutrition may cause increased mortality among AIDS patients with very low CD4 counts in their first months of receiving antiretroviral treatment in the poorest countries.

Critical periods, during which assaults to the body or exposures destroy or undermine healthy processes or interventions support healthy growth and development, are also important. These critical periods may occur in utero, at birth, during infancy and childhood, at sexual debut, at childbirth, or during other stages and processes. For example, adequate nutrition in early childhood is essential for children to grow to their optimal physical stature, whereas exposure to lead prevents children from reaching their full intellectual potential in adulthood. In addition, prenatal care for mothers affects a child's birth weight, which has long-term health consequences over the lifespan, and exposure to pollution in early years may attack lung function, eventually causing asthma.

SOCIOECONOMIC POSITION

> Life expectancy is shorter and most diseases are more common further down the social ladder in each society. Health policy must tackle the social and economic determinants of health.[8]

Socioeconomic position refers to the indicators that signify a person's status in society. Status is most frequently gained through the ownership of resources, power,

and skills that can be used to accumulate wealth or exert influence. In every society, political, cultural, and institutional factors determine the ways in which socioeconomic status influences health, with the steepest gradients found in the most unequal societies and the flattest gradients in the most egalitarian.[9] Although complex patterns of disease distribution exist globally, studies have consistently found that socioeconomic position is robustly related to most health outcomes in nearly all populations.[9] Whereas sociologists seek to explore this social stratification, social epidemiologists aim to explain its influence on health.

As a discipline, social epidemiology is founded on the hypothesis that although the direction and strength of relationships between morbidity and mortality and socioeconomic position vary, the underlying relationship persists. For example, in the United States, socioeconomic status affects low birth weight, injuries, asthma, diabetes, depression, cancer, stroke, and other diseases. In addition, a gradient occurs whereby children from families of lower socioeconomic status have been found to be markedly more likely to suffer from injuries, ear infections, or chronic illness and to be less physically active than children from families of higher socioeconomic status. In fact, children from families in the top third of the socioeconomic status hierarchy have a 50% lower risk of asthma than children from the bottom third. And children in the lowest income quintile are nearly three times as likely to suffer an injury as those from the highest quintile.[9] These socioeconomic influences persist throughout the life course, increasing susceptibility to disease, shaping coping behaviors, and reducing the body's ability to heal itself when confronted by multiple stressors.

MEASUREMENT

Measures of socioeconomic position include indicators of "life chances" such as income, education, and occupation, as well as assets or wealth. In essence, income, education, and occupation are the links between the individual and social stratification that determine life chances as well as market and cultural value.[10] An individual's "value" affects job prospects and opportunities in life. In addition, our income, education, and occupation determine where we live, the groups we belong to and interact with, the resources we can access, the environments in which we live, and the stressors we experience.

Income is a key indicator that captures the resources used to meet basic needs and determines an individual's material conditions, which have direct implications for health. In the United States, for example, a family with high income can afford both health insurance and a physician's copayment and will seek care immediately if a child

has an asthma attack. A low-income family without insurance must pay full price for medical attention, which may cause them to delay seeking help until the child is much sicker. Income is often difficult to measure in health research because some people are reluctant to report household income, regarding it as a private matter or a cause of shame.

Education is an easily measured indicator of socioeconomic status that most people freely reveal to health researchers. Education is a marker of socioeconomic status even when individuals are not in the labor force. Education is also rather stable over the lifespan, whereas income may fluctuate based on current employment status. However, indicators of the highest level of achieved education do not capture any information about the quality of schooling, which often determines an individual's value in the marketplace. Educational indicators may also not be sensitive enough to measure inequalities, which are closely linked to the resources used to purchase goods and services. Also, the link between higher levels of education and health is not necessarily obvious, so it is not always clear why education is health promoting or creates protection against illness. Furthermore, the links between health and education can be confusing. For example, research in Nigeria and other developing countries suggests that level of education is positively associated with appropriate prevention and treatment practices for malaria.[11] However, level of education is not consistently associated with patient adherence to medication regimens in either developing or developed country contexts.

Occupation is an important indicator of socioeconomic position because it is the obvious and stable link between individuals and economic processes. Occupation also forms the link between the measures of education and income. Unfortunately, occupational classification systems may not capture important nuances such as formal and informal roles, which may relate directly to benefits and security and the workplace environment. Given the large number of occupations in every society, type of work may also be hard to organize into meaningful categories.

Finally, earned wealth or assets are important indicators of socioeconomic position. Ownership of stocks, real estate, or valuable assets can sustain households and economic activities during unemployment or other household shocks when income declines. Wealth can be readily measured in the developing world, where assets tend to be durable goods (livestock, radios, bicycles, automobiles, indoor plumbing) that are easy to observe (rather than assets such as stocks or investments). Still, it may be difficult to place value on different assets, whose value may decline over time or vary according to culture, geography, and infrastructure.

Researchers seeking to quantify the extent to which socioeconomic factors affect morbidity or explain varying levels of disease in populations must be intentional as

they choose the indicators of socioeconomic status. These various measures may have different meanings and levels of sensitivity. For example, a single measure of education used as an indicator of socioeconomic status in a study may not fully capture the differences between populations that would be captured using measures of income or occupational classifications. Social epidemiologists are charged with identifying risk factors for disease, and they must also identify the mechanisms or describe how these factors affect disease. If the occupation of a group of people places them at higher risk of asthma, social epidemiologists must explain how this happens. What occurs within the workplace, or as a result of that occupation, to increase risk of asthma?

INCOME INEQUALITY AND HEALTH

Whereas poverty is an important determinant of health globally, an individual's *relative* position within the social hierarchy is also critical to health outcomes. Evidence from developed countries suggests that unequal access to resources, power, or services appears to affect satisfaction with life, participation in society, and ultimately morbidity and mortality. Although controversial, the evidence suggests that societies with higher levels of inequality have worse measures of health and that income inequality undermines health through various processes and mechanisms. In fact, a 2005 review of 168 analyses of income inequality and population health found that three of four studies associated worse health outcomes with societies with greater inequality, or in which the majority of wealth is heavily concentrated among a small elite.[12] Income inequality in the United States is such that the top 1% of households owns between 40% to 50% of the nation's wealth, whereas the bottom 20% owns just 3.7% of the nation's wealth.[12]

Kawachi argues that inequality leads to underinvestment in human capital, and provides compelling evidence at the state level.[13] For example, he found that states in the United States with greater income inequality devote fewer resources toward education, which results in higher school dropout rates and greater percentages of youth with no high school education and lower reading and math scores.[13] In addition, Kawachi argues that inequality undermines social ties that bind families and community members, compromising social networks during economic or other hardships. He makes the case that strong social ties promote health, but that these bonds are undermined by inequality, leading to mistrust and a focus on the individual over social relationships, although this hypothesis has not been proven.[13]

Finally, Kawachi argues that income inequality undermines health through the psychological effects of relative deprivation, so that those higher up on the economic ladder experience significant and steady advances, while the lower-status groups watch

this progression with frustration.[13] The end of apartheid in South Africa has not led to improved socioeconomic conditions for all citizens. Although upward social mobility and wealth are now theoretically available to all, regardless of race or family background, the wide gap between the rich and poor continues. In 2001, 57% of the population lived below the poverty line—unchanged from 1996 (two years after apartheid ended)[14]—and in 2006 the unemployment rate was 25.5%.[15] In this example, frustration or the stressful psychological experience of inequality for 40% of the population who live on less than one U.S. dollar a day actually undermines health.[16]

Income inequalities are further exploited in comparing out-of-pocket expenditures for medicines within and across countries. Inevitably, people living in poorer developing and transitional countries are responsible for paying a great portion of their healthcare and medicine costs compared with those living in transitional and developed countries. In developed countries, social, public, and private insurance protects residents from excessive medicine costs, whereas residents in low-resource countries often encounter catastrophic financial circumstances after encountering unexpected and unaffordable expenditures on medicines.[17] In the Republic of Georgia (formerly part of the Soviet Union), for example, a household study revealed that 19% of respondents had to sell personal property in order to pay for health expenses, and 16% of respondents could not afford to purchase medicines prescribed by doctors.[18]

Social epidemiologists continue to study the ways in which inequality "gets into the body" and undermines population health. The mechanisms and processes most likely operate at various levels, such as through exclusionary laws and policies, the pricing of goods and services, and psychological processes, but more evidence is needed to explain how these processes affect health.

DISCRIMINATION AND HEALTH

The ways in which discrimination is embodied among individuals in society are complex and multifaceted. Anyone who has ever been discriminated against because of age, accent, skin color, gender, sexual preference, or other characteristics can describe the anger or frustration that the experience generates. Beyond anger however, the evidence that discrimination affects health is compelling: in the United States, people of color (including blacks, Latinos, Native Americans, and others) die younger and have higher infant mortality rates and age-adjusted mortality rates.[19] Although women live longer than men, women have higher rates of disability and illness and therefore fewer years of disability-free life. Gay men, bisexuals, and lesbians have higher rates of smoking, suicide, and substance abuse. But how does discrimination harm health?

First, understanding the parameters of discrimination is important. Discrimination can take many forms and occur throughout the life course, determining prenatal care, early childhood education, schooling options, and job prospects. Episodes of discrimination may vary by frequency, intensity, and duration, creating differential impacts on health even with the same population.[19] Discrimination may occur at the individual level, in neighborhoods, states, or countries and can occur in one or more domains, such as at home, in school, or at the workplace. Discrimination may also occur in the marketplace, as people attempt to purchase goods and services such as housing or health care. Public agencies such as police and social workers may discriminate. Discrimination may be overt or covert and be expressed verbally or even through aggressive force. Discrimination is sometimes legislated, allowing individuals and institutions to discriminate against individuals and entire racial/ethnic or other targeted groups. In the United States, the Americans with Disabilities Act of 1990 made barring access to persons with disabilities to public services and employment illegal. In South Africa, apartheid, or the legal discrimination against black South Africans, was not abolished until 1994.

In addition to socioeconomic status and race/ethnicity, societal value is frequently determined by age, gender, and sexuality. Throughout history, the elite in society have often placed a higher value on working-aged adults (who are favored over the very young or old), on men over women, on heterosexuals over homosexuals or bisexuals, and on whites over blacks and others. This value determines life chances and opportunities for work and education and may afford social and economic protection from harm. Thus, discrimination may affect health through economic and social deprivation, increased exposure to hazardous conditions, the often cumulative experience of socially inflicted trauma, targeted marketing, and inadequate health care and resources for health.[7] In healthcare settings, discrimination by physicians may delay patient care or the type of treatment and/or medications prescribed.

Gender roles related to health are complex and varied among different cultures. Gender norms and values influence whether an individual in a household will ultimately seek care, including the purchase and use of medicines, for a given illness or condition. In some regions where gender inequality exists for women, girls and women carry a disproportionate burden of disease and are less likely to seek care and purchase medicines compared with boys and men. In low-resource settings, decisions about whether to seek care for a condition in contexts of gender inequality for women are typically made by men, specifically the husband or father. A community-based study in Benin revealed that decisions regarding use of resources for health services are commonly made without involving women.[20]

Compared with men, Nepalese women delay seeking medical care for the treatment of tuberculosis, instead choosing to seek care from traditional healers prior to seeking treatment from Western medicine practitioners.[21] Other research on household decision making on child health care in Nepal suggests that boys are more likely to be identified as sick than girls, but once deemed sick, there is no difference in care seeking among boys and girls.[22] On the other hand, in areas such as Central Asia, adult men account for less than 25% of all healthcare visits, compared with 50% for adult women.[23] In this region, men assume a much greater burden of disease compared with women. In these examples, a social epidemiologic approach can be used to identify how gender relates to disease distribution and the role gender plays in decision making and care seeking for the treatment of illness, including decisions to purchase and use medicines.

The evidence quantifying racial disparities in health is robust and complex. For example, in the United States, racial and ethnic health disparities, caused in part by discrimination occurring through different mechanisms, are not fully explained by race alone. In fact, a large body of science describes how race, ethnicity, and socioeconomic status combine to undermine health and increase mortality. Consequently, for example, poor black infants have the lowest birth weights in the United States, a condition that sets children up for increased morbidity and mortality throughout the life course. Numerous studies in the United States have revealed disparities in medicine use among African Americans. A study of subjects receiving treatment for schizophrenia revealed that African Americans were less likely to receive newer and more tolerable antipsychotic medicines, such as clozapine and risperidone, than white subjects, but African American subjects were more likely to receive less desirable, deep intramuscular injections of antipsychotic medicines.[24] A study of subjects with elevated serum cholesterol revealed that African Americans and Mexican Americans were less likely than whites to undergo cholesterol screening and less likely to take cholesterol-lowering medicines once diagnosed with elevated cholesterol.[25] In a study evaluating appropriate treatment of asthma, white, non-Hispanic subjects were more likely to have used appropriate inhaled corticosteroid therapy to control asthma compared with minority subjects.[26]

SOCIAL INTEGRATION, SOCIAL NETWORKS, AND SOCIAL SUPPORT AND HEALTH

Social ties and connectedness to family and friends affect all causes of mortality. Studies from many parts of the world have found that people who do not have social ties are at higher risk of dying of heart disease, cancers, and other causes of death.[27]

Thus, the social support gained from relationships is health promoting, and having someone to rely on increases longevity. Support may be financial, informational, emotional, or functional.

Although having someone who can lend a helping hand is important, an individual's social relationships also affect knowledge, behaviors, attitudes, and disease outcomes in both positive and negative ways. For example, a nonsmoking teenager who hangs out with a group of kids who smoke cigarettes may also begin smoking. Parents of a newly diagnosed diabetic child who join a support group might learn how to manage the child's diabetes and insulin shots with ease. Research on adherence to antiretroviral therapy (ART) consistently reveals associations between the need for social support and long-term adherence to ART for the treatment of HIV/AIDS; however, stigma and discrimination within a society may impede the ability of an individual to seek social support concerning treatment for HIV/AIDS. So, whereas an HIV-positive person living in the United States or sub-Saharan Africa may benefit from programs that utilize buddies or community health workers to provide social support to promote ART adherence, an HIV-positive person living in the former Soviet Union may choose nondisclosure of HIV status and forgo such support systems for fear of the discrimination he or she might face if the individual's HIV status were known to his or her community. Social epidemiologists aim to look beyond traditional predictors of adherence such as regimen complexity, pill burden, and side effects to understand the societal factors that prevent or promote adherence to medicines. Social constructs and relationships can also affect acceptability of treatment modality. One U.S. study on depression found that African Americans and Hispanics were less likely to find antidepressant medicine treatment acceptable compared with whites; however, Hispanics were more likely to find counseling methods acceptable than whites.[28]

People belong to social networks at home, in their neighborhoods, at school or work, in communities, at churches, in clubs, and even online. Although these memberships in social organizations may be health or disease promoting, belonging to multiple networks creates complexity in understanding how behaviors are affected by various memberships.

SUMMARY

The great public health challenges of the early 21st century include poverty, malnutrition (food insecurity and obesity), chronic disease (in both developed and developing countries), pandemic infectious diseases (HIV/AIDS, malaria, tuberculosis, influenza), and the threat of drug-resistant "superbugs." The discipline of social epidemiology is

founded on the assumption that all of these health outcomes are inextricably tied to social context. This chapter offered two metaphors by which to envision this relationship: the porous human body, absorbing every influence of its external social and physical environment, and the fast-moving river current of fundamental sociocultural influences carrying populations of human bodies downstream from health to disease, through distal risk behaviors, to the accumulating silt of proximal symptoms, eventually ending in disease diagnosis. Whereas clinicians screen, diagnose, and treat individuals, often taking into account socioeconomic background, genetic predisposition, domestic environment, and more, social epidemiologists track complex patterns of morbidity and mortality across populations with the objective of recognizing risk dynamics. Armed with a wealth of details and data about cultural norms, economic determinants, and environmental dangers and protections, social epidemiology is integral to designing, implementing, and evaluating public health interventions to improve access and use of medicines in communities and societies.

REFERENCES

1. Stallones RA. To advance epidemiology. Ann Rev Publ Health 1980;1:69-82.
2. Krieger N. Epidemiology and the web of causation: has anyone seen the spider? Soc Sci Med 1994;39(7):887-903.
3. Engels F. The condition of the working class in England in 1844. New York: J.W. Lovell, 1887:118-9.
4. Allende S. La realidad médico-social Chilena [The structure of national health]. Santiago, Chile: Ministerio de Salubridad, 1939.
5. UNEP/GRID-Arendal Maps and Graphics Library. Human Development Index (HDI) in 2002. 2004. (Accessed August 6, 2007, at http://maps.grida.no/go/graphic/as_a_comparision_human_development_index_hdi_in_2002.)
6. Mathers CD, Loncar D. Updated projections of global morality and burden of disease, 2002–2030: data source, methods and results. Geneva: World Health Organization, 2005. (Accessed at http://www.who.int/healthinfo/statistics/bodprojectionspaper.pdf.)
7. Krieger N. Bodies count and body counts: social epidemiology and embodying inequality. Epidemiol Rev 2004;26:92-103.
8. Marmot M, Wilkinson R, eds. Social determinants of health: the solid facts. 2nd ed. Geneva: World Health Organization, 2003. (Accessed at http://www.euro.who.int/document/e81384.pdf.)
9. Chen E, Matthews KA, Boyce T. Socioeconomic differences in children's health: how and why do these relationships change with age? Psychol Bull 2002;128:295-329.
10. Lynch J, Kaplan G. Socioeconomic position. In: Berkman L, Kawachi I, eds. Social epidemiology. New York: Oxford University Press, 2000:13-35.
11. Dike N, Onwujekwe O, Ojukwu J, et al. Influence of education and knowledge on perception and practices to control malaria in Southeast Nigeria. Soc Sci Med 2006;63(1):103-6.

12. Wilkinson R, Pickett K. Income inequality and population health: a review and explanation of the evidence. Soc Sci Med 2006;62(7):1768-84.
13. Kawachi K. Income inequality and health. In: Berkman L, Kawachi I, eds. Social epidemiology. New York: Oxford University Press, 2000:76-94.
14. Schwabe C. Fact sheet: poverty in South Africa. Human Sciences Research Council, 2004. (Accessed at http://www.sarpn.org.za/documents/d0000990/index.php.)
15. Statistics South Africa. Statistics South Africa, Pretoria. 2007. (Accessed at http://www.statssa.gov.za/PublicationsHTML/P0318July2006/html/P0318July2006.html.)
16. South African Regional Poverty Network. The annual poverty report for the SADC region, 2007. (Accessed at http://www.sarpn.org.za/publications/annual.php.)
17. Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CLJ. Household catastrophic health expenditure: a multicountry analysis. Lancet 2003;362:111-7.
18. Skarbinski J, Walker K, Baker LC, Kobaladze A, Kirtava Z, Raffin TA. The burden of out-of-pocket payments for health care in Tbilisi, Republic of Georgia. JAMA 2002;287:1043-9.
19. Krieger N. Discrimination and health. In: Berkman L, Kawachi I, eds. Social epidemiology. New York: Oxford University Press, 2000:36-75.
20. Ngom P, Wawire S, Gandaho T, et al. Intra-household decision-making on health and resources allocation in Borgou, Benin. Report for United States Agency for International Development. November 2000. (Accessed at http://www.popcouncil.org/pdfs/frontiers/FR_FinalReports/Benin_Decision_Making.pdf.)
21. Yamasaki-Nakagawa M, Ozasa K, Yamada N, et al. Gender difference in delays to diagnosis and health care-seeking behaviour in a rural area of Nepal. Int J Tuberc Lung Dis 2001;51(1):224-31.
22. Pokhrel S, Sauerborn R. Household decision-making on child health care in developing countries—the case of Nepal. Health Policy Planning 2004;19(4):218-33.
23. Cashin CE, Borowitz M, Zuess O. The gender gap in primary health care utilization in Central Asia. Health Policy Planning 2002;17(3):264-72.
24. Kuno E, Rothbard AB. Racial disparities in antipsychotic prescription patterns for patients with schizophrenia. Am J Psychiatry 2002;159(4):567-72.
25. Nelson K, Norris K, Mangione CM. Disparities in the diagnosis and pharmacologic treatment of high serum cholesterol by race and ethnicity. Arch Intern Med 2002;162:929-35.
26. Adams RJ, Fuhlbrigge A, Guilberrt T, Lozano P, Martinez F. Inadequate use of asthma medication in the United States: results of the Asthma in America national population survey. J Allergy Clin Immun 2002;116(1):58-64.
27. Kawachi I, Berkman L. Social cohesion, social capital and health. In: Berkman L, Kawachi I, eds. Social epidemiology. New York: Oxford University Press, 2000:36-75.
28. Cooper LA, Gonzales JJ, Rost KM, et al. The acceptability of treatment for depression among African-American, Hispanic, and white primary care patients. Med Care 2003;41(4):479-89.