

Chapter 2

What Is Health, and How Do We Measure It?

When we think about health, we often consider the very small and the very large, ranging from microscopic infectious organisms and toxic molecules to global climate change and the pandemic effects of war. Yet the major concern for human beings has been to be free from the tyranny of infectious disease.

Because infectious diseases, such as plague or tuberculosis, were so lethal throughout most of human history, their presence or absence has been a primary metric of health. Despite this importance, humankind was ignorant of the root causes of most infectious disease until the widespread acceptance of the findings of microbiology in the late nineteenth century, which resulted in what is generally known as *germ theory*.

As long as cities have existed on Earth, they have generally been squalid and dangerous places. Cities were frequently swept with epidemics of plague, smallpox, cholera, dysentery, tuberculosis, typhoid fever, influenza, yellow fever, and malaria. Rodents and insects thrived in these old cities and were the primary instruments that carried these diseases over the generations. These

epidemics were accelerated by unsanitary practices such as the accumulation of waste, overcrowding, and a lack of clean water, food, and air.

For most people at most times, the leading overall causes of death were infectious and easily transmitted diseases. More than 30 percent of all deaths were among children under age five, with pneumonia, tuberculosis, and gastrointestinal infections the main causes of mortality.¹

Figure 2.1 shows the ten leading causes of death expressed as a percentage of all deaths in 1900; Figure 2.2 shows the ten leading causes in 2006. The major causes of the decline in the diseases that were leading causes of death in 1900 were immunizations and better built environments. The discovery of penicillin in 1928, followed by other antibiotics, helped to bring down infectious disease death rates as well. Smallpox, a scourge for generations and a disease that decimated the American Indian population, has now been eradicated, thanks to worldwide "search and contain" immunization programs led by the World Health Organization

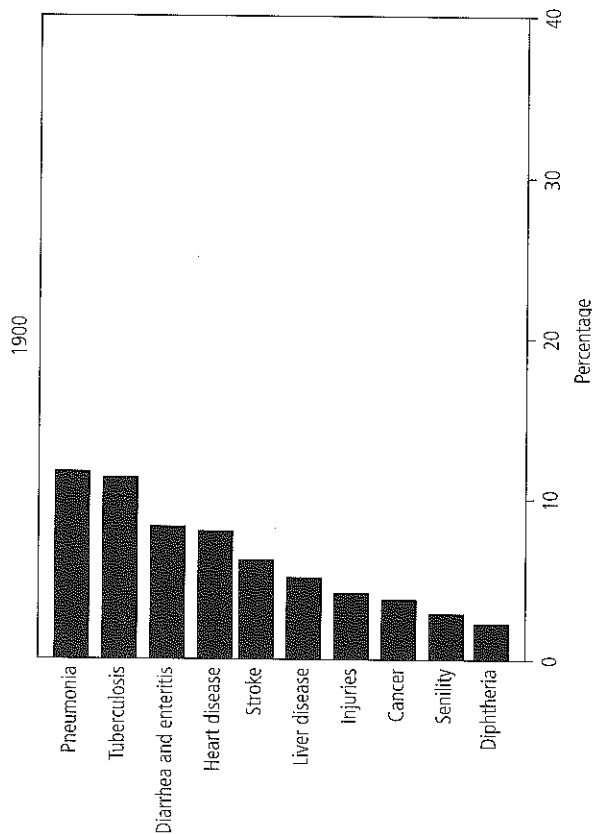


Figure 2.1 The ten leading causes of death as a percentage of all deaths—United States, 1900.

Source: Centers for Disease Control and Prevention, "Achievements in Public Health, 1900–1999—Control of Infectious Disease," *Morbidity and Mortality Weekly Report* (July 30, 1999), 48(29), 621–629, fig. 2.

(WHO), with essential support from the Centers for Disease Control and Prevention (CDC) and national programs. Polio, the reason that every year's class in my grammar school had a child with leg braces, and the disease that killed my young father, is close to eradication thanks to powerful CDC, WHO, and national immunization programs and astonishingly generous support from Rotary International.

In response to the advances in biological sciences during the nineteenth and twentieth centuries, death rates due to preventable infectious diseases dropped to a

fraction of their previous toll. Child mortality decreased and average life span increased by over thirty years.

Beginning in the year 1860, the average life span of a woman in the United States increased three months every year going forward, though this trend stopped about twenty years ago. Infectious diseases are in abeyance, but I and most other doctors anticipate their return, in part because of wasteful and indiscriminate use of antibiotics leading to resistant infectious organisms. When I was a young pediatrician, a resident once joked that penicillin was so effective at killing the *pneumococcus*, a common cause of pneumonia, that you could uncork the container on the other side of the room and the bacteria would be gone. Sadly, those days are long gone, and now powerful fourth-generation antibiotics requiring large-dose, in-hospital intravenous treatment are often required, and many physicians worry that it will not be long before even these powerful meds will become ineffective.

Of course there will always be a leading cause of death, as we all must die of some cause. The duty of scientists and physicians is to prevent *premature* death due to disease, because that has been the immediate challenge facing the human race since prehistory. Currently, infectious diseases have been replaced as leading causes of death by chronic and often environmentally induced causes—and I tend to think about environment writ large. This means that even though we have long, by and large, defined health as the absence of infectious or acute chronic disease, we must now revise and expand the definition of health to combat the causes of the causes of

saw in Figure 2.2, seven of the leading causes of death in 2006 were heart disease, cancer, stroke, chronic lung disease, unintentional injury, diabetes, and pneumonia and influenza. The common thread in this list of maladies is their relationship to the environment in which we live and the lifestyles we choose to follow.

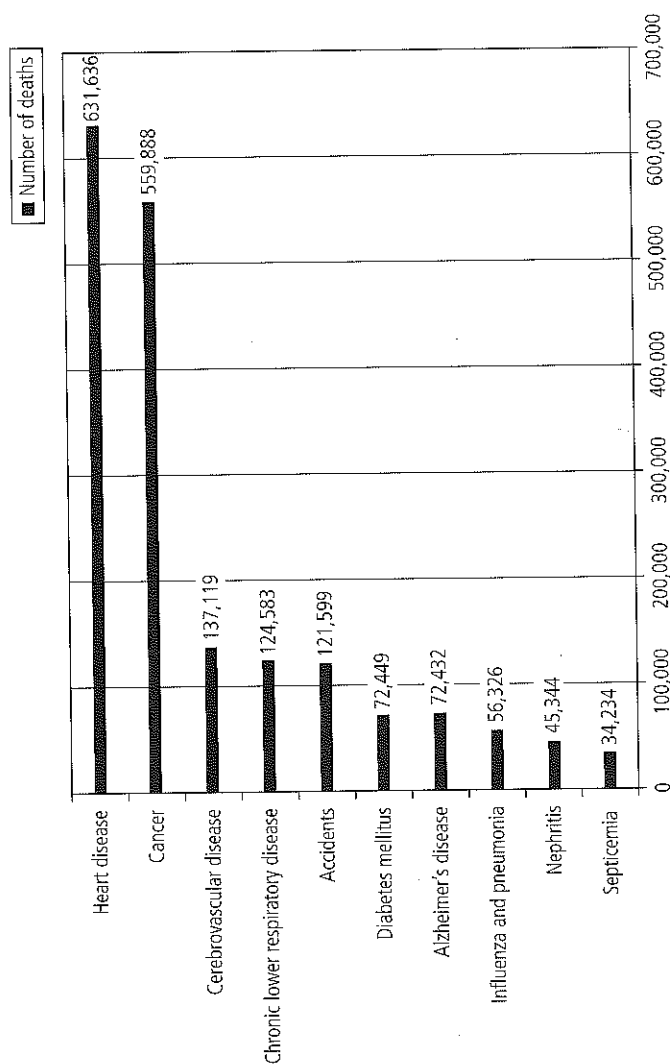


Figure 2.2 The ten leading causes of death as a percentage of all deaths—United States, 2006.

Source: Data from M. Heron, D. Hoyert, H. Murphy, and J. Xu, "Deaths: Final Data for 2006," *National Vital Statistics Reports* (April 17, 2009), 57(14).

death—causes that take lives prematurely today and that diminish the quality of life for millions of other people.

PERSONAL HEALTH

Today the primary enemies of good health are those that we as a society inflict on ourselves—an unhealthy environment, lack of exercise, and bad nutrition. As we

10,000 Steps

In 1965, the Japanese introduced a pedometer called the *Manpo Kei*, which translates as "10,000 Steps Meter." This name is derived from the belief that taking 10,000 steps each day greatly enhances one's personal health through exercise. In studies of over 3,000 people with pre-diabetes in the United States, those who walked or exercised five times a week for at least thirty minutes reduced their body weight by 5 to 7 percent and reduced their risk of diabetes by 58 percent.²

Walkable neighborhoods encourage a 10,000-step lifestyle. A 2003 article in the *American Journal of Health Promotion* noted that "older women who live within walking distance of trails, parks, or stores recorded significantly higher pedometer readings than women who did not. The more destinations that were close by, the more they walked."³

There are billions of people alive today, including the millions in the United States, who are living in the midst of pollution, poisons, and sources of infection at a very personal level. This is not only the situation of the impoverished. The immediate environments of home and work, even for middle- and high-income individuals across the United States, are taking a toll on personal health.

The Residential Microenvironment

The immediate built environment in which we live and work has a profound effect on our personal health. Most of us recognize a threat instantly when we smell smoke or gasoline in our home or workplace, but other health factors are more subtle and harder to pin down yet just as dangerous over time. For example, at least 70 percent of cancers are due to the environment.⁴ As those in environmental health say, "The genes load the gun. The environment pulls the trigger." The physical location or positioning of our homes, schools, or workplaces can expose us to the harmful effects of natural phenomena. For example, radon, a radioactive gas that forms through the natural decay of uranium, is the leading cause of lung cancer among nonsmokers and is the second leading cause of lung cancer in the United States. The U.S. Environmental Protection Agency (EPA) estimates that radon is the cause for 20,000 lung cancer deaths annually. Granite contains uranium that leads to the release of radon, an odorless gas that our bodily senses cannot

detect. Radon released from soil containing granite can enter a structure, like a home, through cracks in basement floors and walls or via gaps around underground pipes as they enter the building. Sealing these cracks and openings and maintaining air circulation can mitigate many potential problems.

The construction of homes, schools, or workplaces can be a source of chronic allergies and asthma or irritations caused by volatile organic compounds (VOCs) or natural agents such as dust mites, cockroach feces, and spores from fungi. Balance in an ecosystem depends upon the decomposing of organic material by fungi and molds so that nutrients can be reused. Although molds, such as black mold, reproduce naturally in areas with high humidity, a building that is excessively wet during construction or is not sealed properly can become a long-term mold incubator. Unattended leaks and water intrusion after construction are not just cosmetic and economic problems; they are health challenges as well.

Choices made in home construction materials and furnishings can also affect our health over time. Many houses built before 1978 and those furnished with old furniture likely contain lead-based paint. If this paint peels, chips, or cracks, it can be hazardous. In such dwellings the dust around windowsills and on friction surfaces like doorjamb can contain highly bioavailable lead. The soils around older houses can retain lead deposited from the flaking and "chalking" of exterior lead-based paint or from leaded-gas car exhaust. Lead can enter drinking water through old lead pipes and from lead-based

solder. Lead poisoning has been linked to many growth, reproduction, movement, and nervous system operation impairments. A child eating a single lead paint chip can become lead poisoned.

When I was growing up, paint was 50 percent lead; in fact the weight of a paint can was largely that of its lead content. In those days the definition of lead poisoning was a blood-lead level greater than 60 micrograms (mcg) per deciliter. Mine was about average, about 22 mcg per deciliter. Now we know that no level of lead is healthy in the body, especially in the brain. But lead was everywhere not too long ago: in our water, paint, canned food (from the metal solder on the top of a food can), and very important, in gasoline.

Lead was used in printing for hundreds of years, and back in the 1750s Benjamin Franklin described printers developing the "dangles," that is, a *wrist drop*, and losing the ability to move their hands properly because of lead toxicity.⁵ One hundred and fifty years ago workers in lead foundries were known to develop serious illnesses, including one called Saturnine gout, after the ancient association of the planet Saturn with lead. It was well known that women who worked in lead foundries were much more likely than other women to have miscarriages, babies with birth defects, and babies that did not grow properly.

It was not until the late 1970s, thanks to the work of a heroic pediatrician and psychiatrist, Herbert Needleman, that we began to realize that lead had effects far longer lasting than immediate toxicity. In a remarkable study, he collected the shed baby teeth of six- and seven-year-olds

(he paid for them). At the same time, he collected psychological measures and performance assessments by the children's teachers. The teeth were important because they reflected each child's lead level before age two, back when the teeth were being formed and about the same time that the brain was undergoing very rapid growth. Dr. Needleman showed that the higher a child's lead level, the more likely the child was to be hyperactive and distractible and to have learning problems and poor academic performance. This and subsequent studies had major influences on our thinking about low-dose exposures to chemicals, particularly in susceptible populations such as young children.

Reducing blood lead levels by 10 mcg per deciliter raises average IQ in a population by an average of 2.6 points (1.9 to 3.2).⁶ We can debate the value of IQ tests, but they are pretty good predictors of lifetime income. In economic terms, the value of an IQ point is estimated to be about \$14,500 (in year 2000 dollars) of lifetime income. An article I coauthored for *Environmental Health Perspectives* in 2002 discussed these findings and calculated that the substantial reductions in lead exposure among the children of the United States has saved each year's cohort of children between \$110 billion and \$318 billion per year in lost economic potential and increased health costs.⁷ When I was at the Centers for Disease Control and Prevention we had a goal of eradicating lead poisoning by the year 2000. We weren't completely successful, but now average blood-lead levels in this country are less than 2 mcg per deciliter.⁸

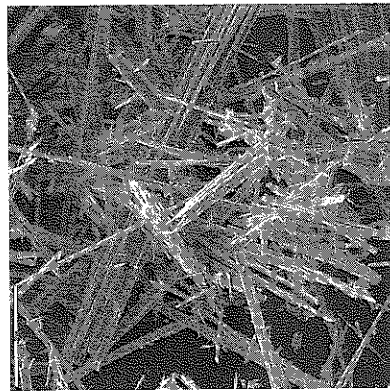


Figure 2.3 Asbestos fibers.

Source: Photograph from the U.S. Geological Survey.

Asbestos is a fire-resistant fiber used in construction materials including roofing shingles and ceiling and floor tiles (Figure 2.3). When the asbestos is in an undisturbed condition, it causes no threat, but when fibers of asbestos become airborne, exposure to them can cause lung cancer and *mesothelioma*, the dreadful cancer of the linings of the lung and abdomen. These cancers kill thousands of people per year. I, and many of my colleagues in environmental public health, feel the use of asbestos should be banned worldwide.

Carpeting can be the cause of chronic respiratory illness, headaches, fatigue, and skin irritations, either through the off-gassing of VOCs from new carpet or from the decaying material, dusts, and allergens that accumulate in carpeting and the padding below it.⁹ When working in an allergy clinic, I was taught that carpeting supports one thousand times the allergens that a bare or tile floor does. Doctors routinely recommend to families of children with asthma that the carpets be removed from the house where possible, and that the floors be kept bare. Additionally, carpet is currently 1 to 2 percent of all the solid waste in our landfills. There are companies that are now picking up old carpets and recycling the plastic fibers. This is a model for the future.

When we look at our built environments, our goal should be to put a solution in place that mitigates multiple problems, yet we cannot legislate people's choices in personal health. For ourselves, although we may not know the original construction of our homes, schools, and workplaces, we can choose or advocate for wall and

floor coverings not associated with health problems, as well as choose whether to open a window for fresh air, and select appropriate plants when landscaping.

When we make places, we are making health or disease. The greatest impacts on health do not come from medical care but from *upstream determinants*. This is

Walk to School Like Grandpa Did

In 1974, 66 percent of all children walked or rode a bicycle to school. By 2000, that number had dropped to 13 percent, and childhood obesity had skyrocketed. By 2004, just 25 percent of California's fifth graders passed the annual fitness tests and the cost of transporting California's children to school by diesel bus had climbed to more than \$1 billion per year.

Studies have shown that walking or bicycling to school increases children's concentration, improves mood and alertness, and enhances memory, creativity, and overall learning. Programs that promote safe routes to school for children result in improvements in both academics and physical fitness. When infrastructure and social programs create and support those safe routes, schools in areas with initially low levels of walking or biking to school show increases in these healthy behaviors by 20 to 200 percent.¹⁰

where we get the most change for good or ill with the fewest costs. A major upstream determinant is how we build where we live. This affects how much we eat, walk, and socialize; the safety of our home and community; and the quality of the air we breathe and the water we drink.

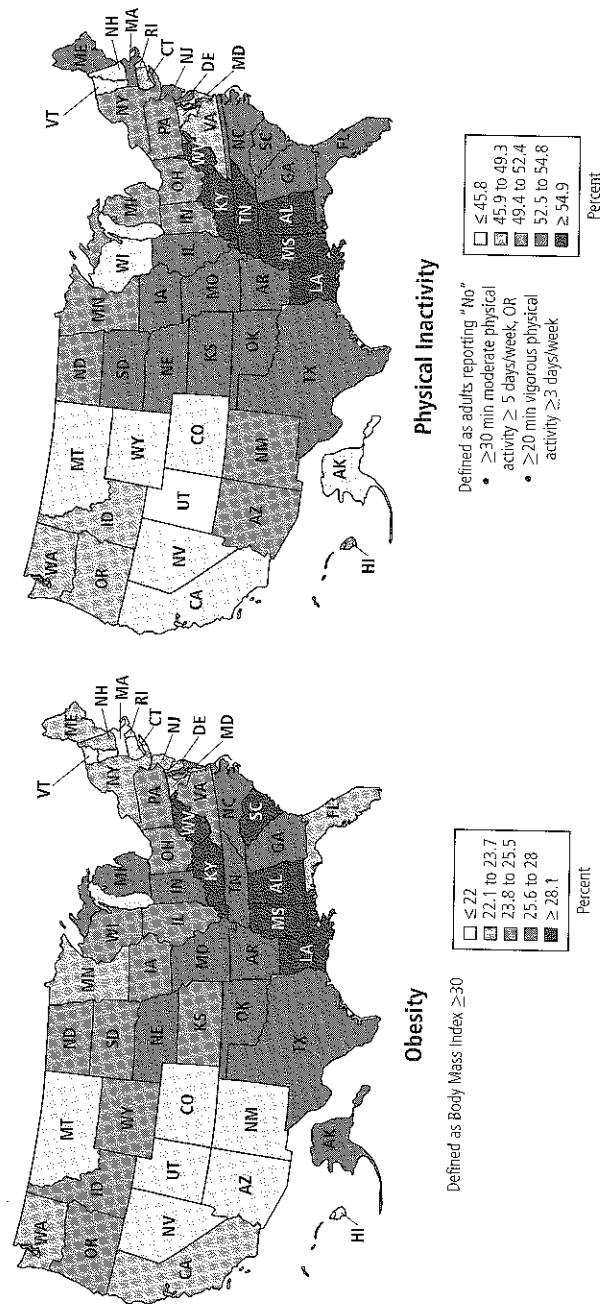
The Obesity Challenge

Many unhealthy factors actually stem from our habits and not from any deficiency in our environment. How many

homes in the United States have exercise equipment that sits unused while the occupants lounge in front of the television?

In generations past, physical activity was woven into all the activities of daily life. Few in the United States were obese and most would never imagine joining a fitness club just to go out and exercise on machines. Fitness was taken somewhat for granted, and many working people longed to be free of backbreaking labor. As a nation, we got our wish in the second half of the twentieth century, but the unintended consequences have been devastating (see Figure 2.4).

Figure 2.4 Obesity and physical inactivity in the United States, 2005.
Source: Self-reported data from the Behavioral Risk Factor Surveillance System, Centers for Disease Control and Prevention, <http://apps.nccd.cdc.gov/gisbrfss/default.aspx>.



Children have gained a dozen pounds in less than a generation. Three-quarters of high school students cannot run or walk a twelve-minute mile. Obesity was recently named the leading chronic disease health threat in the United States. Since 1980, the number of obese children in the United States has tripled, and among adults, obesity now rivals smoking as the largest cause of preventable death and disease. (See Plate 1 for the state-by-state prevalence of obesity.) The cost of obesity-related illness has been estimated at between \$147 billion per year¹¹ and \$215 billion per year when direct medical, productivity, transportation, and human capital costs are examined,¹² far exceeding all the costs for cancer.

In response to the increasing epidemic of obesity in the United States, First Lady Michelle Obama recently launched a campaign called "Let's Move: America's Move to Raise a Healthier Generation of Kids." The campaign aims to foster collaboration among the leaders in government, medicine, athletics, science, business, and education to encourage, support, and pursue solutions tailored to those children and families facing a wide range of challenges and life experiences. This includes empowering consumers with health-related information, encouraging people to monitor their weight and understand healthy parameters, providing more nutritious school lunch choices to build healthy eating habits, opening farmers' markets with fresh and locally grown foods in communities that lack ready access to fresh produce, and championing physical activity and fitness.

The built environment drives driving, and driving leads to drive obesity. Areas that have higher densities of fast-food stores have higher rates of obesity. Children whose schools are close to fast-food stores are more likely to eat high-calorie and low-nutrient foods, which promote obesity. According to a 2004 article in the *American Journal of Preventive Medicine*, predominantly African American and low-income neighborhoods average 2.4 fast-food outlets per square mile, whereas more affluent neighborhoods average just 1.5 fast-food stores per square mile.

Those who live in low-density suburban and rural areas are more likely than inhabitants of higher-density areas to drive cars everywhere they go.¹⁴ Both children and adults who live in areas without good walking or bicycling amenities are virtually forced to use cars by the design of the built environment around them.

Conversely, changes in the built environment can positively affect the rate of obesity. People who live in more dense areas use mass transit more often and are more physically active than those in suburban environments. Those who live near parks and destinations are more likely to walk or bicycle. Children who live close to schools are more likely to bicycle or walk to school. Persons who live near green space and more attractive environments are more likely to use physically active transportation.¹⁵ Those who live near a neighborhood farmers' market are more likely to eat fresh fruits and vegetables.

One proof of the potential beneficial effect of the built environment is this: living in areas with walkable green spaces positively influences the longevity of

urban senior citizens independent of their age, sex, marital status, baseline functional status, and socioeconomic status.¹⁶

Consider two average suburban men. Both are fifty-two years old, work in standard office jobs, and complain of low energy and general lethargy. This is not an uncommon medical scenario.

One of these men commutes twenty-five miles each way to work, spending three hours a day in his car. A physical examination comes up mostly normal, except that he's twenty-eight pounds overweight. His blood pressure is 155/95, and his blood sugars are elevated. He's starting to show signs of depression. His doctor treats him in the usual American way by scheduling a meeting with a nutritionist and recommending a weight loss program. The man buys a membership to a fitness center and generally tries to "get more in control of work and life commitments." As anyone might guess, within several months the exercise program has gone nowhere because he has no time to get to the fitness center and no good place to walk in his community or at work. He is now on blood pressure, blood sugar, and cholesterol medications and an antidepressant. His prescription medication costs run approximately \$385 per month.

The second man has about the same physical profile, but after his checkup he changes his habits. He now bicycles just thirty minutes to and from the transit center three days a week. Each thirty-minute bicycle trip burns 250 calories in his 190-pound body, which amounts to 1,500 calories a week, and 78,000 calories per year. That

works out to twenty-two pounds of body fat lost if he changes nothing else in his lifestyle. After one year, he has reduced his weight to 168 pounds, his blood pressure is 130/78, his blood sugars and cholesterol are normal, and he finds his energy and mood are both much improved.

So, what's the difference? Part of the story is the environment. The first man has a long commute and no place to easily get physical activity. The second man has an environment that supports healthier choices.

Our behaviors are not only affected by our physical culture but influenced by our social culture as well. When our neighbors are healthier, we are healthier. That said, the healthiest environment does not guarantee that we will be healthy. We have to decide to step up and take advantage of what is around us. Good neighbors can even help.

PUBLIC HEALTH POLICY

Another driving force of change is the influence of policy. The purpose of public health is to ensure the conditions where people can be healthy.

Diseases spring from the environment when the conditions are optimal. For example, plague has been present throughout recorded history and still exists. In the middle ages, more than a third of Europe's population died from the plague bacterium, spread by infected fleas and rats.

Even now, there are plague outbreaks in North America, Africa, Asia, and South America, claiming 1,000 to 3,000 lives each year.¹⁷

The movement of people can hasten the spread of disease. Consider the U.S. Civil War. Recruits often came from farms and small towns where they were in close contact with perhaps ten to fifty neighbors. They joined the armed forces and arrived in squalid camps with hundreds or thousands of fellow soldiers. These young men were in unfamiliar and cramped settings where they were exposed to germs for which they lacked immunity. Many never made it out of those camps to fight, as they got sick and died from infections that spread from soldier to soldier. During the Civil War, battlefield deaths amounted to over 200,000. During the same period there were 400,000 deaths from disease.

As I recounted in the Prologue, Frederick Law Olmsted was not only the architect of New York City's Central Park but also Abraham Lincoln's appointee to head the U.S. Sanitary Commission during the Civil War. The work of the commission doubled the survival rate of injured Union soldiers. Rather than worry about specific diseases, Olmsted oversaw changes that made sure that the hospitals—the dressings, food, and water—were clean. He made sure that sick soldiers received sunlight and fresh air. He put sanitation into hospitals before the widespread acceptance of the germ theory of disease.

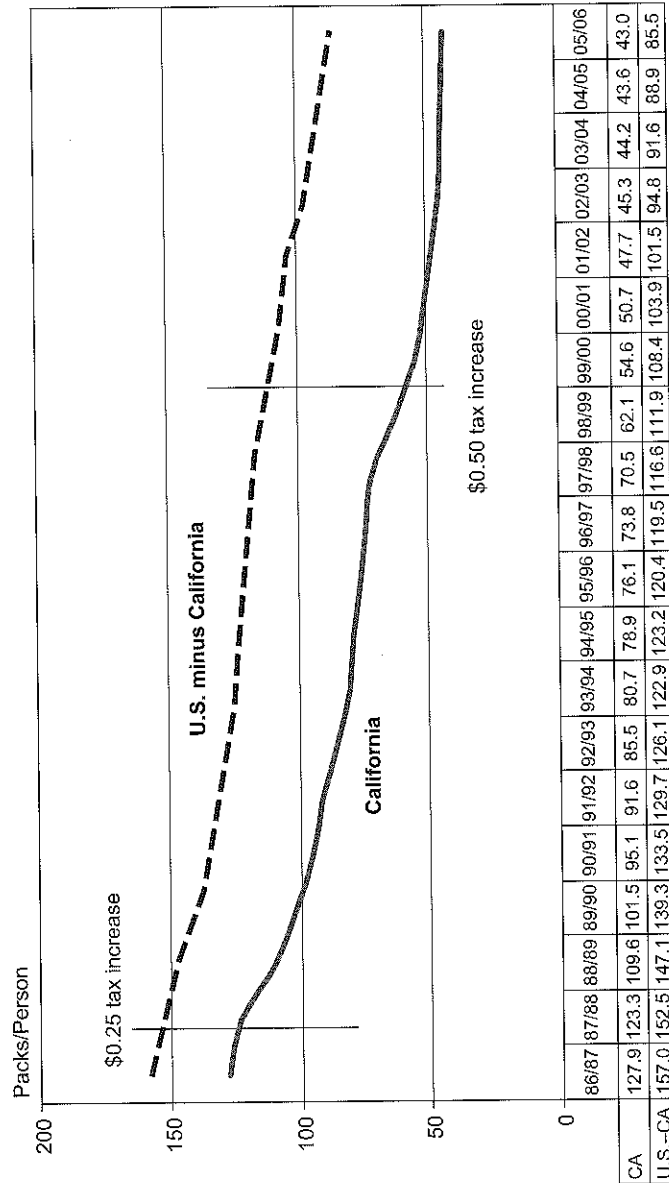
What Olmsted understood at a very fundamental level is that science can tell us what to do to inhibit the spread of disease, but all three prongs of public health

must be put in place to effectively change the environment: *science, finances, and marketing*. Science tells us what the problem is, the budget tells us how to fund the changes needed, and marketing uses communication tools to influence public behaviors. Public health must be interdisciplinary. It must also have critical links to the medical care world to understand what causes infectious disease.

When I was California State Health Officer, the hardest battle I fought was not over obesity or disasters. It was over tobacco and particularly antitobacco advertising. Every time the state would raise the tax on tobacco, the tobacco industry wanted to use the money from that tax to fund care for those with lung diseases. What the tobacco industry did not want was for money to be spent on preventing people from smoking.

California has done better than the rest of the country at reducing smoking rates, going from 123.3 packs per capita per year in 1987 down to 43 packs in 2006 (Figure 2.5). The rest of the country still smokes about 90 packs per capita.¹⁸ The interventions that were put in place in California included taxes on tobacco, used in part to fund the antitobacco program, antitobacco advertising, and environmental tobacco smoke laws. Messages were and continue to be communicated through public education, including public television. Then the PBS station in San Diego focused media messages on the dangers and consequences of smoking, and that worked. Twenty years ago, California's lung cancer death rate was somewhat higher than the rate for the rest of the

Figure 2.5 California and United States minus California adult per capita cigarette pack consumption, 1986/1987–2005/2006.
 Note: Dates are fiscal years (July 1 to June 30).
 Source: Prepared from state and federal data by the California Department of Health Services, Tobacco Control Section, Mar. 2007.



California also had to create conditions that made people want to be healthy. If I want to change behavior, it is most effective to change the environment and let that environment influence behavior. It was very important that California put in place environmental tobacco smoke laws that reduced and mostly eliminated smoking in buildings. Public health policy does not only react to outbreaks of disease; it must also forecast epidemics and act

country—today it is more than 20 percent lower. When we want to change people's behavior, simply telling people what to do or not to do does not work well. The California antitobacco ads had to find a message that made people angry. The most effective ad was the one with tobacco executives laughing about how many kids they had addicted that day. This "I am being exploited" message resonated with young people.

proactively to protect the population. Through regulation and implementation of new technologies, people are relatively confident that they can go into a building, eat at a restaurant, drink water from a tap, or go to work without being exposed to life-threatening diseases.

Nevertheless, sometimes there are surprises. In 1976, American Legionnaires attending a convention in Philadelphia developed an unexplained and often lethal pneumonia. I was a CDC Epidemic Intelligence Service officer at the time and had the opportunity to assist in this outbreak. It took months of investigation, physical examinations of the sick and well legionnaires, and sampling from the environment before the cause was identified. Dr. Joseph McDade of the CDC identified some novel organisms in the lung tissue of legionnaires who had died. Further investigation discovered that the water in the air-handling system had become extensively contaminated with what was later called the *Legionella* organism, while the disease became known as Legionnaires' disease. As a result of these findings, substantial changes were required in the design and inspection of air-handling systems, with particular attention to preventing water from infiltrating the system.

Coincidentally, when I returned to the CDC in 1994, almost twenty years later, one of the outbreaks being wrapped up at the time was a *Legionella* epidemic associated with cruise ships. The CDC eventually traced the illnesses to whirlpool spas on the ships' decks. When the environmental specialists examined the filters for these hot tubs, they discovered that the filters had not

been maintained or cleaned. As a result, regulations and design changes were put in place to both enable better record keeping and to require easy and regular changing of filters.

There is a larger lesson to be gained from these responses to outbreaks of illness: we can learn a great deal from such *natural experiments*, including things we need to do elsewhere to protect people. Additionally, they remind us that every new technology, even when it is thought to bring a basketful of benefits, is always accompanied by impacts on health.

We are also surprised when people get sick from food; we expect our food to be safe. Recall the *E. coli* outbreak linked to spinach that killed three people and left over two hundred sick in February 2009, or the outbreak of illness across the Northeastern states from romaine lettuce in May 2010. It is remarkable how much more common and visible, as well as genuinely immense, outbreaks of illness caused by unsafe food have become. Over the recent decades, food production has become substantially centralized and profoundly intermingled. This means, for example, that even if a relatively small plant is supplying peanuts that turn out to be contaminated with *Salmonella*, those peanuts can, over a short period of time, contaminate hundreds of food products, ranging from peanut butter to candy bars, and can cause illness in thousands of people and in nearly every state.

One day in 1999, I was driving along Buford Highway in Atlanta to CDC headquarters for a meeting. The road (it is really not a highway) is seven lanes wide—three in

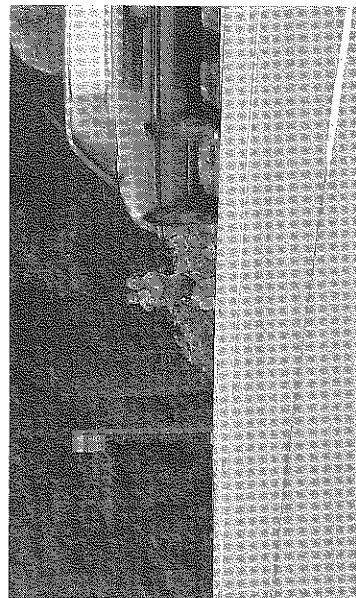


Figure 2.6 The dangers faced in crossing Buford Highway point to upstream issues.

Source: Photograph from the Media Policy Center.

each direction and a lane for right or left turns (a "suicide lane") down the middle (Figure 2.6). The temperature was 95 degrees, and the humidity was 95 percent. I looked to the right side of the road and saw an elderly woman struggling along with plastic shopping bags in each hand. She was bent over with osteoporosis. She had red hair and looked like my mother.

I went to the meeting to discuss national and global health issues including causes of death, but all I could really think of was that poor woman. If she were to collapse, the cause of death would be listed as heat stroke, and there would be no mention of the upstream causes—the absence of trees, a black tar road, too many cars, too much air pollution, and lack of public transportation. If she were killed by a truck, the cause

of death would be listed as motor vehicle trauma, and again, the real causes of death, the lack of sidewalks, lack of public transportation, poor urban planning, and failed political leadership, would be misdiagnosed or, worse, ignored.

Part of the work of public health is to examine the causes of death. When I and others in public health look upstream at the real causes of morbidity and mortality, we can make discoveries. First, we can recognize that health professionals have very little involvement with or effect on the real causes of death, even though I think they should. Second, we can see that these real causes of death are being driven by social, ideological, and economic realities. And third, we are likely to learn that when public health doctors begin to focus on upstream causes, it can generate a powerful and unwanted political backlash.

Nevertheless, public health policy needs to look at these macro-issues affecting the health of the population, and it also needs to consider micro-issues, problems that can grow undetected long enough to infect our food, water, air, and mechanical systems. At this microlevel, public health policy needs to consider how what happens to individuals influences the greater community. Poverty, lack of education, inadequate mass transit, crowding, and a variety of other negative factors affect not only the individuals directly involved but also the surrounding community. Communities can look at their local environment in terms of the potential for health concerns, and can come to understand that public health is about providing the conditions necessary for people to live a healthy life.

Buford Highway, for example, where I saw the woman with the shopping bags, is less than a mile from and parallel to Interstate 85. It absolutely does not need to be seven lanes wide or to have a mile or more between crosswalks. A concerned community must examine why this woman must carry heavy packages alone and such a far distance. It needs to examine how public transportation can support her needs. And what is in those packages? Has she purchased healthy food or highly processed meals that are easy to prepare? It should examine those services that can help provide nutritious, low-salt, and low-fat meals to the elderly. Public health becomes very personal when we center our thinking on an individual and how we can bring resources to bear to make it possible for that person to lead a healthier life.

ENVIRONMENTAL HEALTH

Our built environment is so pervasive and we human beings are so adaptable that we hardly notice it. In fact, the profession of environmental health scarcely paid attention to the built environment until the second half of the twentieth century. *What* we build and *how* we build it affects our overall environment and thus also affects the viability of our children's future.

In the nineteenth century the United States improved the built environment by removing biological and

industrial waste and by supplying clean water, safe food, home heat and lighting, and mass and personal transit. Construction reduced crowding, and developed healthy cities and trolley car suburbs. In the twentieth century, thanks to cheap and abundant fossil fuel and unparalleled prosperity, the United States was rebuilt for automobiles. As populations grew, small towns became cities, and farmlands and forests were turned into subdivisions, industrial parks, and highways. Public transit systems like trolley cars were abandoned; schools became larger and more distant from towns, commutes longer, and traffic congestion overwhelming. Fresh water became increasingly more precious, and the atmosphere hotter and more polluted. We are only now beginning to understand the toll of these choices on our bodies.

Deep in the American psyche there is a feeling that when we have destroyed the place where we are, we can always go someplace else, yet the reality is that there are scarcely any *someplace elses* left. We have to take care of where we are.

Through travel and technology we can now transit the globe in days rather than months or years. What happens halfway around the world can affect us just as acutely as events that occur close to home. Witness the radiation scare resulting from earthquake damage in Japan that we are experiencing as this book is being written. Due to the natural movement of air in the Earth's atmosphere, particulates can move globally. What happens in Europe or Asia can affect air quality in the United States, and vice versa.

Recently, an international consortium of scientists used satellite data and computer modeling to determine the impact of the Asian monsoon season on global air circulation. Examining the upward flow of air from Asia, they learned that this air, carrying a variety of pollutants, ascended into the stratosphere, where the pollutants traveled the globe for several years, eventually descending back to the lower atmosphere or breaking apart. It is suggested that the level of pollutants entering the stratosphere will grow with the increase in industrial activity in rapidly developing nations, such as China. Why is this important? The compounds in the pollutants become an aerosol that is known to affect the ozone layer in ways that reduce our planet's protection from ultraviolet radiation, which causes skin cancer. Hydrogen cyanide, produced largely from burning trees and other vegetation, is recorded at low levels over the tropical ocean but at high levels over areas in Asia where land has been recently cleared for agriculture. This and other pollutants in the stratosphere have been linked to an effect on levels of water vapor that in turn increases the capture of solar heat on the Earth, affecting the global climate.¹⁹

Precipitation is naturally a little acidic due to chemical reactions in the atmosphere, but this natural acidity can be increased by human-induced activities. In the United States, nearly two-thirds of sulfur dioxide (SO_2) emissions and about one-fifth of nitrogen oxide (NO_x) emissions are produced by the burning of fossil fuels by electricity plants. Nearly one-half of NO_x emissions are from sources of transportation.

Prevailing winds transport these gases over long distances, crossing state, national, and international borders. Eventually they combine with moisture to fall as acid rain, which accumulates in ponds and lakes, and on soil. In time the slightly acidic water can dissolve and carry along metals from the soil into water sources, ultimately causing chronic stress in animals in the area.

What does acid rain have to do with the built environment? Plenty—one-third of all the fossil fuel we consume goes to the heating and lighting of buildings and another third goes to our vehicles, to move us to and from the built environments we construct. The air pollutants that produce acid rain also affect us directly. As we interact with the atmosphere, fine sulfate and nitrate particles are inhaled deep into our lungs, increasing illness and premature death from heart disease and lung disorders, including bronchitis and asthma.

The question is not whether there will be pollution, but what we are going to do about it. It is up to us to change how we approach pollution. In the United States we have the Clean Water Act and the Clean Air Act, two important pieces of legislation that have made significant changes in how we do business. Through the 1960s, there were few if any pollution controls. The original passage of the Clean Air Act in 1970 enacted a major shift, authorizing comprehensive federal and state regulations to limit emissions from both stationary (industrial) sources and mobile sources. There have also been amendments to the original legislation (in 1977 and 1990), each authorizing tighter

regulation of emissions and setting higher safety standards.

The greatest intervention for reducing levels of atmospheric lead in the United States occurred in Los Angeles. The federal government gave California a special dispensation for stricter emission controls than those then mandated for the nation. The tighter regulations sparked technological breakthroughs. Beginning in the 1970s, cars became equipped with exhaust gas recirculation pumps and catalytic converters, positive crankcase ventilation, and evaporative emissions canisters for fuel tank fumes. Leaded gasoline destroys a car's catalytic converter. Today our cars have computerized engine management, better catalysts, and use unleaded gas. The engines in the latest generation of diesel cars consume about 30 percent less fuel than gasoline engines of equivalent power. Using ammonia-based acid injection into the exhaust stream, these diesel cars emit about 25 percent less carbon dioxide and 90 percent less nitrous oxide than gasoline-powered automobiles. Particulate emissions have been reduced by 98 percent compared to the diesels of the 1970s. So, have these changes had an impact on the quality of our air?

According to the EPA, "today's cars emit 75 to 90 percent less pollution (for each mile driven) than their 1970 counterparts,"²⁰ owing to improvements in vehicle and fuel technology and increasingly stringent standards for tailpipe emissions. Yet even though emissions from cars have dramatically decreased, our air quality overall has improved only incrementally and not nearly as dramatically

as the reduction in emissions. Why? One reason could be that midsize and larger sport utility vehicles (SUVs) are classified as trucks, not cars, so they do not have to follow the most stringent emissions and fuel economy standards. With the increased popularity of SUVs, there are more vehicles on the road with lower standards for emissions, reducing the potential benefit emission regulations hoped for. Heavy trucks, jets, and other large vehicles also contribute to air pollution. As of April 2010, tighter emissions standards for new cars and trucks were approved for fleets of vehicles, beginning in model year 2016.²¹

Another reason could be that even though emissions per car have decreased by more than 70 percent since I got my driver's license, the number of drivers has increased three- to fourfold. All the benefits we could have had have been washed away by not investing in public transit and quality density. So the net effect of emission controls on passenger cars is less than it should be. What we can see from this example is that where regulations are in place, change happens, but other factors often come into play, so evaluating improvements is essential—midcourse adjustments are nearly always required.

MENTAL AND SOCIAL HEALTH

People underestimate how extraordinarily important mental health is. Health is about our mental, physical, and spiritual well-being, not just the absence of disease. This

isn't a novel idea, but one proposed in the constitution of the World Health Organization, dating from 1948, which states that "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."²²

Mental health is inherently biochemical and can affect our physical health by influencing how we feel about ourselves and the condition of our life. The immediate status of our mental health affects the choices we make every day and can be influenced by neurological imbalances, congenital disorders, or diseases that require medical care; by uncontrollable events that affect or change our life circumstance; and by our connection to others and the space in which we live. Our mental health status is something we feel personally, but this status also affects those around us at work and at home. In time, our personal mental health can affect our community, and the community can, in turn, affect our personal mental health.

Our health stems from the interrelationship of our personal, family, work, and community factors and our mental health. It can be influenced by world events, the weather, personal trauma, interactions with others, and nature. These are influences enough, but the one influence that we have a good chance of doing something about is our built environment.

When I was in Elgin, Illinois, preparing for this book and the video series, I heard high-schooler Ashley Lundgren talk about attention deficit disorder (ADD) and attention deficit/hyperactive disorder (ADHD). Her

research showed that up to 10 percent of students are being diagnosed with ADD or ADHD and approximately 35 percent of high school dropouts are students with ADD or ADHD. She found studies that say students are better able to concentrate when they are in contact with nature. So, what about bringing nature to the city? Community gardens bring people together where they can interact with their neighbors, breaking down social isolation. Isolation and alienation are big factors to address in depression and stress management.

In 2003, researchers found that American children were twice as likely to be prescribed antidepressants at that time than they were five years before.²³ The highest increase (66 percent) was in preschool children. Why would a preschooler need an antidepressant? Mental health and stability are influenced by nature and green spaces. People are happy when they are outside. They're happy when they're in nature.

When you look at the happiness of a country or groups of people, people are happy when they make more money, up to the point where their needs are met. Once their needs are met, having more money does not make them measurably more happy. Data from the National Opinion Research Center's General Social Survey, when analyzed by researchers at Harvard University, revealed that people who feel connected to others, and who trust those they spend time with, actually live longer.²⁴

This is not a new idea. In the 1970s, the Prince of Bhutan rejected the assumption that a country's gross

domestic product is the appropriate indicator of a country's well-being. King Jigme Singye Wangchuck decided to make his country's priority *gross national happiness*.²⁵ His focus was to ensure that prosperity was shared across society and that there was a balance among preserving cultural traditions, protecting the environment, and maintaining a responsive government. The government of Bhutan has made big decisions based on this philosophy.

In September 2009, the president of France, Nicolas Sarkozy, suggested the development of a "happiness index," as the "dogma of economic growth is no longer sustainable. It has to be broadened into a new measure of political success and national achievement that takes account of the quality of ordinary lives and our professed desire to save the planet from environmental disaster."²⁶ This *net national product* indicator is still in development. Even our Declaration of Independence includes the "pursuit of happiness" as an "unalienable right," so why don't we measure it? Measuring a society only by dollars and not by other kinds of capital is a mistake.

So, in a book about the built environment, why is mental health an important topic? As a society, we all pay the price for those with poor mental health. Mental illness takes a deep toll on the immediate family, and on society when communities must provide services and manage care when situations rise to the level of crisis. When people are stressed because they cannot find work or are unhappy in their relationships, they are unable to contribute to the community as a whole and sometimes

they vent their frustrations in violent or self-destructive ways. As James Howard Kunstler has written:

We drive up and down the gruesome, tragic suburban boulevards of commerce, and we are overwhelmed at the fantastic, awesome, stupefying ugliness of absolutely everything in sight—the fry pits, the big-box stores, the office units, the lube joints, the carpet warehouses, the parking lagoons, the jive plastic townhouse clusters, the uproar of signs, the highway itself clogged with cars—as though the whole thing had been designed by some diabolical force bent on making human beings miserable. And naturally this experience can make us feel glum about the nature and future of civilization.²⁷

When we think about the concept of the built environment and how it can promote our mental health, we need to consider how the design of our communities can effectively, safely, and inexpensively promote healthy choices. At the core of this idea is motivating change through planned environmental conditions. Those who work in public health know quite a bit about changing people's behavior. For example, they have instituted programs that have reduced smoking and increased the use of seat belts.

There is a set of techniques called *social marketing* that help to induce cultural change, making the change popular, convenient, easy, and fun. Communities and whole societies can bring about change by basing it on values and by framing the issues well. If we make a healthy

the natural environment, so some spaces will need to be indoors in communities where there is snow for 80 percent of the year, and some communities will need bandstands in the park and shady trees to capture warm summer breezes. Our social health comes from the interchange that begins between the individual and others within the community and expands to a sense of the greater community.

We currently plan our communities to protect us from things we think we do not want to see (Figure 2.7). Our adult communities, for example, admit only people over fifty-five years of age. There are no schools so there are no young families. This monoculture is attractive to many who do not want to be bothered by the loud noises of a teenager next door or the nuisance of dogs barking from homes empty all day as families are at work and school. Yet there is another side to this picture. The couple who move in at fifty-five watch as their neighbors, and they themselves, become less active, then begin using canes, walkers, and wheelchairs. They have to begin checking on who in the neighborhood still drives a car so everyone can get groceries. The neighborhood sounds change from chatting across the porch to the rumble of the ambulance taking another neighbor to the hospital or the morgue. As residents rotate in a home, those who have been in the community longest may refrain from building close friendships. After all, the ambulance will be on its way again.

Social health goes beyond the quality of your neighborhood and the provision of services for the poor or underrepresented. When we segregate ourselves by where and how we live, we lose our understanding of

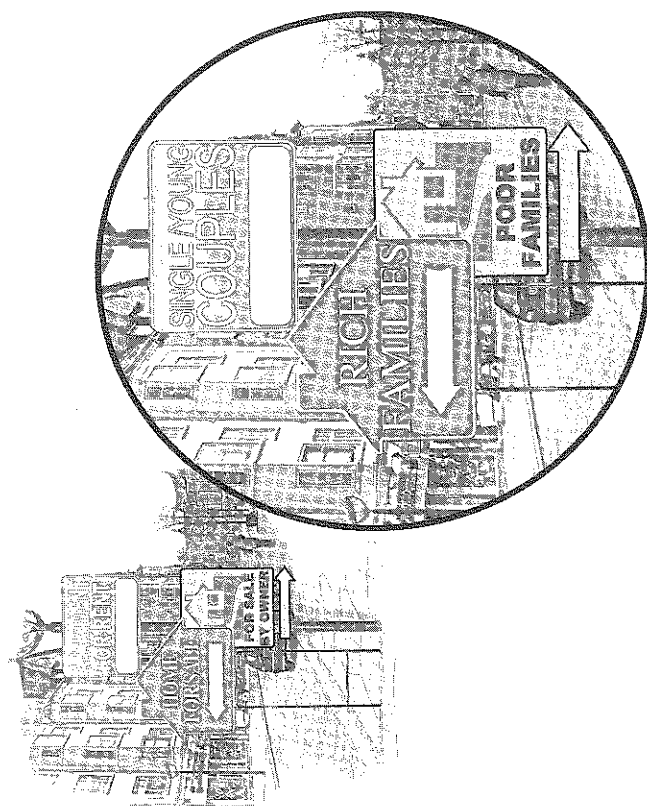


Figure 2.7 Communities can be segregated by pricing as well as location.
Source: Graphic by Scott Izen for the Media Policy Center.

choice cool, then people are more likely to adopt it. In addition, through planning our communities we can make it easy for ourselves to do cool, healthy things by putting workplaces, recreational sites, restaurants, and stores near where we live. We can make exercise convenient by putting in attractive sidewalks that make us want to walk.

As we create our built environment we need to adapt to

each other. This vacuum of understanding is filled by assumptions. When people do not know or understand, they become fearful. What are the social health implications of violence and hate in the United States? The media capitalize on our inherent fears through their selection of news stories and the types of entertainment programs they create. Fear and hate are social health problems with tangible effects.

What does it mean to have a healthy society? What are the value judgments inherent in this concept? Building a healthy city requires a clear vision of health, living and a narrative that can communicate that vision to others. This vision must address the cause-and-effect nature of our built environment and that environment's impact on the people who live, work, and play in it.