

Creating A Healthy Environment:

The Impact of the Built Environment on Public Health

“In its broadest sense, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents, but also the effects on health of the broad physical and social environment, which includes housing, urban development, land-use and transportation, industry, and agriculture.”

*—Healthy People 2010,
U.S. Department of Health and Human Services ¹*



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About Sprawl Watch Clearinghouse

The Sprawl Watch Clearinghouse mission is to make the tools, techniques, and strategies developed to manage growth, accessible to citizens, grassroots organizations, environmentalists, public officials, planners, architects, the media and business leaders. At the Clearinghouse we identify, collect, compile, and disseminate information on the best land use practices, for those listed above.

Sprawl Watch Clearinghouse is a nonprofit organization based in Washington, DC
Allison Smiley, Executive Director

This report and many other sources of information on sprawl and smart growth are available on the World Wide Web at www.sprawlwatch.org

Preface

Here at the start of the 21st century our understanding of which factors promote health and which damage health has grown considerably. The diseases of the 21st century will be “chronic” diseases, those that steal vitality and productivity, and consume time and money. These diseases—heart disease, diabetes, obesity, asthma, and depression—are diseases that can be moderated by how we design and build our human environment. It is now accepted that, in addition to direct hazards from infectious diseases and environmental toxins, human behaviors play a critical role in determining human health. As we begin to include consideration of these factors into our health-related decision-making, we must additionally guard against using too narrow a definition of the environment. Every person has a stake in environmental public health, and as environments deteriorate, so does the physical and mental health of the people who live in them. There is a connection, for example, between the fact that the urban sprawl we live with daily makes no room for sidewalks or bike paths and the fact that we are an overweight, heart disease-ridden society.

Obesity can increase the risk of (adult-onset) type 2 diabetes by as much as 34 fold, and diabetes is a major risk factor for amputations, blindness, kidney failure, and heart disease. The most effective weight loss strategies are those that include an increase in overall physical activity. In a recent type 2 diabetes trial, weight loss and physical activity were more effective in controlling the disease than medication. In addition, for treatment of relatively mild cases of anxiety and depression, physical activity is as effective as the most commonly prescribed medications. It is dishonest to tell our citizens to walk, jog, or bicycle when there is no safe or welcoming place to pursue these “life-saving” activities.

Respiratory disease, especially asthma, is increasing yearly in the U.S. population. Bad air makes lung diseases, especially asthma, worse. The more hours in automobiles, driving over impervious highways that generate massive tree-removal, clearly degrade air quality. When the Atlanta Olympic Games in 1996 brought about a reduction in auto use by 22.5%, asthma admissions to ERs and hospitals also decreased by 41.6%. Less driving, better public transport, well designed landscape and residential density will improve air quality more than will additional roadways.

In order to address these critical health problems we must seize opportunities to form coalitions between doctors, nurses, and public health professionals and others such as architects, builders, planners and transportation officials, so that we are all “at the table” when environmental decisions are made. Such decisions include whether to install sidewalks in the next subdivision. It means thinking about what constitutes safe and affordable housing, safe neighborhoods, providing green space for people to enjoy where they live and work, and rethinking how we travel from one place to another.

Land-use decisions are just as much public health decisions as are decisions about food preparation. What, for example, are the implications for children with asthma of building yet another expressway? We must also question whether a fatality involving a pedestrian isn’t actually the result of poor urban planning, thoughtless land use, or inferior urban design rather than “simply” a motor vehicle crash. We must be alert to the health benefits, including less stress, lower blood pressure, and overall improved physical and mental health, that can result when people live and work in accessible, safe, well-designed, thoughtful structures and landscapes. We must measure the impact of environmental decisions on real people, and we must begin, in earnest, to frame those decisions in light of the well being of children, not only in this country but across the globe.

Richard J. Jackson, MD, MPH
Director, CDC’s National Center for Environmental Health

Introduction

When people consider factors adversely affecting their health, they generally focus on influences, such as poor diet or the need for more exercise. Rarely do they consider less traditional factors, such as housing characteristics, land-use patterns, transportation choices, or architectural or urban-design decisions, as potential health hazards. However, when these factors are ignored or poorly executed, the ecosystems in our communities collapse, people suffer the consequences. We have always known that a 2-hour commute to work each day on America's freeways is not a pleasant experience; it is also becoming clear that it is an unhealthy experience. We see evidence every day that Americans exercise less often and suffer higher levels of stress than they did in the past. Yet we often fail to make the connection between these all-too-common facets of everyday life and how unhealthy we are. As America increasingly becomes a nation that permits and even encourages thoughtless development and unmanaged growth, the impact of these factors grows clearer, and we ignore them at our peril.



Photo: USDA

Land-use planning and zoning have their roots in a desire to protect the public's health. As far back as 1926, the U.S. Supreme Court, in *Village of Euclid vs. Ambler Realty Co.*, cited public health protection as one of the basic responsibilities of local governments, thus giving them a legal mandate to restrict or control land-use decisions in a community.² In this monograph, we address some of these land-use decisions, discuss how they affect our health, and offer some suggestions on how public health professionals can collaborate with their colleagues in land-use planning and urban design to help ensure the health and quality of life of the people in their communities.

In recent years, public health organizations have emphasized that public health agencies and programs must not only control disease, but also work to prevent it. The World Health Organization (WHO) has defined health as "a state of complete physical, mental, and social well-being, not just the absence of disease or infirmity."³ The National Academy of Science's Institute of Medicine has asserted that the public health system should "fulfill society's interest in assuring conditions in which people can be healthy."⁴ Environmental public health initiatives have historically been among the most effective approaches for assuring healthy living conditions. In 1854, Dr. John Snow was credited with taking bold action when he suspected that contaminated water from a public pump on Broad Street was causing a deadly cholera outbreak in London. As a result of this discovery and Dr. Snow's actions to remove the handle on the pump, the cholera outbreak ended. Much of the improvement in disease death rates in the last century can be attributed to basic environmental public health actions such as Dr. Snow's that resulted in improved sanitation, cleaner air and water, injury prevention, and protection of citizens from dangers posed by industrial pollution in their communities.

We believe that applying public health criteria to land-use and urban design decisions could

substantially improve the health and quality of life of the American people. Therefore, in this monograph, we focus mainly on the following:

- ✿ The relation of land-use decisions to air quality and respiratory health;
- ✿ The built environment (including all man-made physical components of human settlements such as buildings, streets, open spaces, and infrastructure) in terms of whether it promotes or discourages physical activity;
- ✿ The impact of urban design on the number of pedestrian injuries and deaths, particularly among children;
- ✿ The choices communities make about the built environment that improve mobility and the quality of life for their elderly and disabled residents; and
- ✿ The ways that various land-use decisions affect community water quality, sanitation, and the incidence of disease outbreaks.

A brief summary of other health impacts of urban sprawl is also included, with a final section that describes some steps that both the planning community and the public health community can take to ensure that public health concerns figure prominently in decisions made about the built environment.

Land-use and Its Effects on Air Quality and Respiratory Health

Sprawl – uncontrolled, poorly planned, low-density, and single-use community growth – depends on individual motor vehicles to flourish. As people move farther and farther from cities, they inevitably will travel longer distances to work, shop, and play. From 1960 through 1990, the percentage of workers with jobs outside their counties of residence increased by 200 percent, while the proportion of workers commuting within their counties of residence declined.⁵ This trend contributed to an increase in the number of vehicle miles traveled in passenger cars – an increase of more than 250 percent (915 billion miles) from 1960 through 1997.⁶ This dependence on the automobile has only accelerated in recent years. For instance, according to the Sierra Club, the average American driver spends 443 hours each year behind the wheel – the equivalent of 55 nine-hour days or 11 work weeks.⁷ Residents of cities that have grown more over the last decade have also experienced a greater increase in the average time spent traveling in a car than residents of cities where growth has remained stable. From 1992 through 1996, the increase in the number of annual person-hours of delay spent in an automobile in Los Angeles was 9 percent; in Atlanta 44 percent; in Orlando 62 percent; and in Kansas City 81 percent.⁸

This increase in driving time results in an increase in air pollution and in the incidence of respiratory diseases. Despite tremendous progress in reducing U.S. air pollution since the passage of the Clean Air Act almost 30 years ago, cars and trucks are still a major source of pollution, because even though individual cars pollute less, the number of cars and trucks and the number of miles people drive increases.⁹ According to a recent report completed by the Congressional Research Service, in 1997, on-road

vehicles accounted for about 58 percent of carbon monoxide (CO) emissions in the United States, nearly 30 percent of nitrogen oxides (NO_x), roughly 27 percent of volatile organic compounds (VOCs), and about 9 percent of particulate matter (PM). NO_x and VOCs contribute to ground-level ozone pollution, which is known as smog.^{10, 11}

Research presented on the impact of automobiles and the transportation sector on human health at the Third Ministerial Conference on Environment and Health held in London in 1999 indicated the following:

- ☼ Motor vehicle traffic is the main source of ground-level urban concentrations of air pollutants with recognized hazardous properties. In Northern Europe, this traffic contributes practically all CO, 75 percent of NO_x, and about 40 percent of the particulate matter (PM10) concentrations.
- ☼ Approximately 36,000 to 129,000 adult deaths a year can be attributed to long-term exposure to air pollution generated by traffic in European cities.¹²

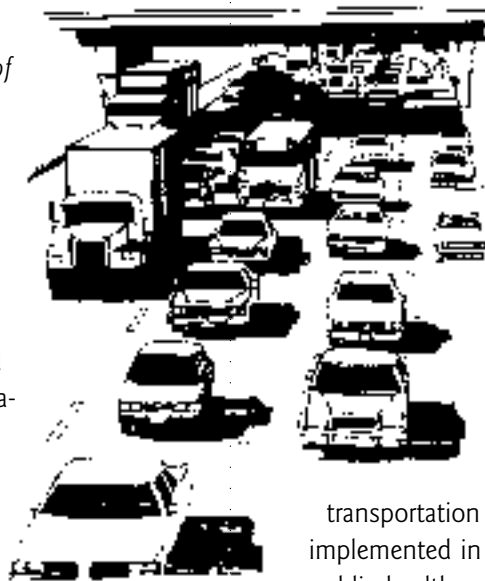
Also presented at the conference were results from a recent study of the health effects of air pollutants from traffic in Austria, France and Switzerland and their related costs. This study, using comparable methods, found that air pollution caused 6 percent of total mortality in the three countries, more than 40,000 deaths per year. About half of all mortality caused by air pollution was attributed to motorized traffic. This corresponds to about twice the number of deaths due to traffic accidents in these countries. When researchers analyzed the data from the study they found that automobile-related pollution was responsible for more deaths than traffic accidents. The economic burden of the health impact of automobile pollution was estimated at more than EUR 27 billion (approximately \$23.8 billion in U.S. dollars).¹²

Data from studies conducted in the United States strongly suggest significant links between

air pollution and negative health outcomes such as asthma. The President's Task Force on Environmental Health Risks and Safety Risks to Children reports that:

*"Many common air pollutants, such as ozone, sulfur dioxide, and particulate matter are respiratory irritants and can exacerbate asthma. Air pollution may also act synergistically with other environmental factors to worsen asthma. For example, some evidence suggests that exposure to ozone can enhance a person's responsiveness to other inhaled allergens. Whether long term exposure to these pollutants can actually contribute to the development of asthma is not yet known."*¹³

For instance, in the summer of 1997, smog pollution was responsible for more than 6 million asthma attacks, 159,000 visits to emergency rooms for treatment of asthma attacks, and 53,000 asthma-related hospitalizations.¹⁴ Results of a study conducted by the Centers for Disease Control and Prevention (CDC) during the 1996 Olympic Games in Atlanta, at which time vehicular traffic was kept at artificially low levels by city authorities, showed that the peak daily ozone concentrations decreased 27.9 percent and peak weekday morning traffic counts dropped 22.5 percent; at the same time the number of asthma emergency medical events dropped by 41.6 percent. Non-asthma medical events did not drop during the same time period.¹⁵ Results that support the Atlanta findings were found in a 1999 study of adverse health effects associated with ozone in the eastern United States. This study, conducted by ABT Associates, found that during a single ozone season, asthma attacks that were directly attributed to excessive ozone pollution numbered approximately 86,000 in Baltimore, 27,000 in Richmond, and 130,000 in Washington, D.C.¹⁶



Children with asthma are believed to be particularly sensitive to air pollution.¹³ As many as 25 percent of children in America live in areas that regularly exceed the U.S. Environmental Protection Agency's (EPA) limits for ozone, more than 25 percent of which comes from auto emissions.¹³ Asthma rates among children in the United States more than doubled from 1980 through 1995, from 2.3 million¹⁷ to 5.5 million.¹⁸ Reducing children's exposure to environmental pollutants such as ozone will reduce the frequency and severity of their asthma attacks,

will reduce their dependence on medication for asthma management, and will improve their overall lung function.¹³ The significant contribution of automobile use to the overall air pollution problem seems clear. As the American population drives longer distances, these problems will most likely only worsen. Therefore, it seems imperative that new

transportation options be developed and implemented in order to help alleviate the public health problems related to worsening air quality in the United States.

The Built Environment and Physical Activity

People who participate in regular physical activity reap substantial health benefits. According to the Surgeon General the most significant are as follows:

- ✿ Lower mortality rates for both older and younger adults. Even moderate increases in activity are helpful;
- ✿ Lower risk for heart disease and stroke;
- ✿ Prevention or delay of the onset of high blood pressure and actual lowering of blood pressure among people with hypertension;
- ✿ Decreased risk for colon cancer;
- ✿ Lowered risk for noninsulin-dependent diabetes;
- ✿ Weight loss and redistribution of body fat; increase in muscle mass;
- ✿ Relief of the symptoms of depression and anxiety and improvement of mood; and
- ✿ Apparent improvement in health-related quality of life by enhancing psychological well-being and by improving physical functioning among people with poor health.¹⁹

The built environment presents both opportunities for and barriers to participation in physical activity, thereby influencing whether or not we exercise. According to a recent survey about research studies,²⁰ one of the more important determinants of physical activity is a person's immediate environment (one's neighborhood). One study examined environmental variables, such as the presence or absence of sidewalks, heavy traffic, hills, street lights, unattended dogs, enjoyable scenery, frequent observations of others exercising, and high levels of crime. Positive environmental determinants of physical activity included enjoyable scenery (presence associated with more activity), whereas the greatest perceived barrier was the lack of a safe place to exercise.²⁰ Research by CDC and others^{21, 22} has also indicated that two of the main reasons given as reasons for not exercising are lack of structures or facilities (such as sidewalks



and parks) and fears about safety. Overall, CDC reports that higher levels of perceived neighborhood safety are associated with higher levels of physical activity, with the differences being greatest among racial or ethnic minorities and people older than 65 years of age.²¹ Thus, people are more likely to use parks, paths, and bikeways when they are easy to get to and are safe and well maintained.

Conversely, people tend to get less exercise as outlying suburbs are further developed and the distances between malls, schools, and places of employment and residence increases. Many theories have attempted to explain the radical changes in the health status of American society, but one of the strongest theories is the significant decline in activity levels among Americans today compared with levels from 50 or 100 years ago.²³ According to the U.S. Surgeon General's *Report on Physical Activity in America*,¹⁹ changes in our lifestyles and communities have played the greatest role in the decline of activity levels among Americans. Millions of Americans drive to and from work and use a car to run almost every errand. In 1977, children aged 5 to 15 years walked or biked for 15.8 percent of all their trips; by 1995, children made only 9.9 percent of their trips by foot or bicycle — a 37 percent decline.²⁴ Results of a study in South Carolina showed that students are four times more likely to walk to schools built before 1983 than to those built

more recently.²⁵ This would seem to point to some basic change in the “walkability” of newer schools, possibly because these schools aren’t as geographically close to the students they serve or because the school’s property and its environs were designed to meet the needs of automobiles rather than the needs of pedestrians and bicyclists.

In addition, many different types of urban design encourage sedentary living habits. For example, parking lots are built as close as possible to final destinations in order to increase convenience and safety for motorists. While older cities and towns were planned and built based on the practical idea that stores and services should be within walking distance of residences, the design of most new residential areas reflects the supposition that people will drive to most destinations. Work, home, school, and shopping are often separated by distances that not only discourage walking but may even necessitate the use of a car in order to reach any destination safely.

Sedentary living habits also contribute to poor health outcomes because they are a significant

factor in the incidence of overweight and obesity. From 1976 through 1994, the prevalence of U.S. adults who were overweight or obese rose from 47 percent to 56 percent, and by 1999 had risen to 61 percent.²⁶ More disturbing, however, was the fact that the prevalence of overweight children and adolescents almost doubled during this same period.²⁷ Some researchers have estimated that as many as 300,000 premature chronic disease deaths each year are due to obesity.²⁸

Figures 1-3 show the alarming increase in obesity prevalence among adults in the United States during a single decade.

Major health care costs are also associated with the lack of physical activity and concomitant rises in obesity rates. In 1995, the direct health care costs of obesity were estimated at \$70 billion.²⁹ Adding to that figure the estimated direct health care costs of physical inactivity (\$37 billion),²⁹ we can conservatively attribute an overall health care burden of more than \$100 billion to obesity and low levels of physical activity in the United States each year.

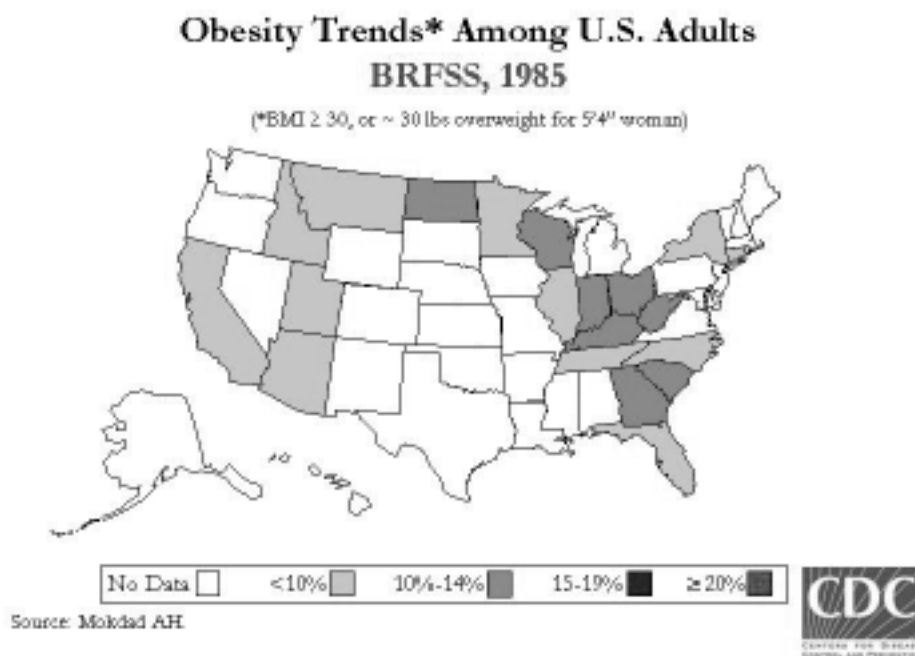
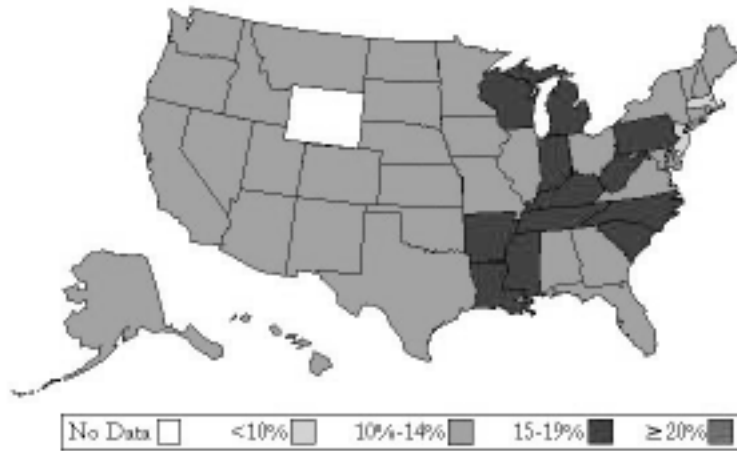


Figure 1

Obesity Trends* Among U.S. Adults BRFSS, 1993

(*BMI ≥ 30 , or ~ 30 lbs overweight for 5'4" woman)



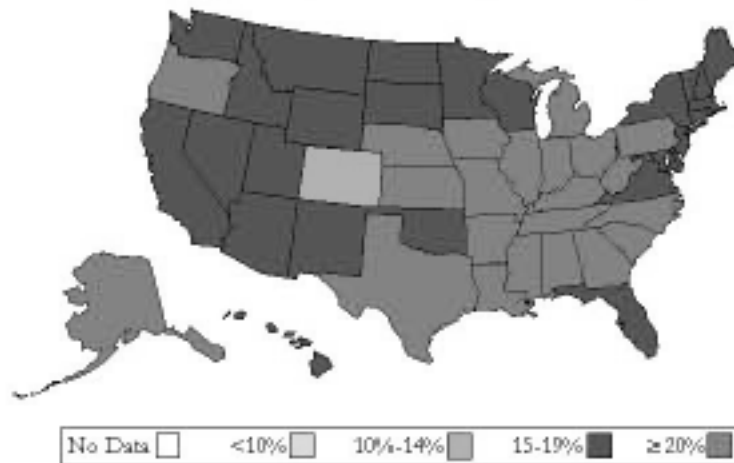
Source: Mokdad AH, et al. *J Am Med Assoc* 1999;282:16.



Figure 2

Obesity Trends* Among U.S. Adults BRFSS, 2000

(*BMI ≥ 30 , or ~ 30 lbs overweight for 5'4" woman)



Source: Mokdad AH, et al. *J Am Med Assoc* 2001;286:10



Figure 3

Urban Design and Pedestrian and Bicyclist Safety

Another important issue is the impact of urban design on a number of injuries involving pedestrians and bicyclists. According to a recent report by the Surface Transportation Policy Project, in 1997 and 1998, 13 percent of all traffic fatalities — 10,696 people — were pedestrians. Approximately 1,500 of these victims were children, while 22 percent were older than 65 years of age, even though only 13 percent of the population is elderly³⁰. Although Americans make fewer than 6 percent of their trips on foot, 13 percent of all traffic fatalities occur among pedestrians; of the pedestrian deaths for which information is recorded, almost 60 percent occurred in places where no crosswalk was available.³⁰ The report concluded that the most dangerous metropolitan areas for walkers were newer, sprawling, southern and western communities where transportation systems are more focused on the automobile at the expense of other transportation options.

A study conducted in New Zealand asserted that there are several potentially modifiable environmental risk factors for injury to child pedestrians. Particularly strong associations were found between the risk for pedestrian injuries and high traffic volume. The risk for injury to children living in neighborhoods with the highest traffic volumes was 13 times that of children living in the least-busy areas. Restricting curb parking at specific crossing points may be an effective approach to reducing children's injuries in this arena.³¹

Several regulatory and design strategies can be applied to make communities safer for both child and adult pedestrians and bicyclists. These strategies include (1) setting and enforcing lower speed limits in residential areas; (2) protecting pedestrians in crosswalks by using traffic signals; (3) instituting and enforcing “traffic-calming” measures, such as traffic circles or speed bumps; (4) providing sidewalks and pedestrian walkways; (5) providing crossing guards and bike paths in areas where most pedestrians are children, (e.g., near schools, parks, and playgrounds) and (6) providing overpasses, underpasses or tunnels for pedestrians and bicyclists to bypass particularly dangerous roads and intersections. Inherent in each strategy is a refocusing of design goals toward pedestrians and, to a degree, away from motorists.



Photo: Hugh Morris

Environmental Barriers for the Elderly and People with a Disability

Free and easy movement through public areas in the communities where we live is something most people take for granted and, if asked, would probably claim as a right. However, people with disabilities often find that they cannot move easily from place to place and that they have trouble gaining access to medical and other basic health care and social services. People with disabilities are even more vulnerable to “environmental barriers” than children or the elderly. Environmental barriers are defined as the “physical attributes of buildings, facilities, and communities which by their presence, absence, or design present unsafe conditions and/or deter access and free mobility for the physically handicapped.”³² These attributes can include the absence of ramps for wheelchairs, lack of depressed curbs (periodic breaks in curbs that act as ramps), narrow doorways that cannot accommodate various assistive devices (such as wheelchairs, motorized scooters, walkers, etc.), and lack access to mass transit routes or other public services.

Often, something as simple as the lack of a sidewalk or curb cut keeps people with disabilities from getting any physical activity at all. A study in Houston, Texas, for example, found that three out of five disabled and elderly people do not have sidewalks between their residences and the nearest bus stop.³³ An even greater percentage of these households lack depressed curbs in their neighborhoods (71 percent) and bus shelters by the nearest bus stops (76 percent). Although close to 50 percent of the elderly and disabled live within two blocks of a bus stop, the lack of sidewalks, curb cuts, and bus shelters actually makes use of the transportation system by these people impossible. Fewer than 10 percent of the disabled and elderly use public transportation in Houston. In addition, fear of crime prevents close to two-thirds of the elderly and disabled from walking to the bus stop at night.³³

For elderly citizens and people with disabilities, these issues are not simply about convenience or even quality of life; rather, they are critical health issues. Without access in the community, these groups cannot adequately participate in physical activity, establish a community of support, or get to or use health care facilities.

Thus, lack of physical access in a community becomes a factor leading to illness and even death.³³ Efforts to address these barriers through “universal design” have begun to show significant success. The concept of universal design maintains that — “...all products, environments and communications should be designed to consider the needs of the widest possible array of users. Universal design is a way of thinking about design that is based on the following premises: varying ability is not a special condition of the few but a common characteristic of being human, and we change physically and intellectually throughout our life. Usability and aesthetics are mutually compatible.”³⁴

As land-use and urban-design decisions are made, planners, architects, and engineers must keep in mind the needs of all community members. It is easy to see that if citizens in an urban setting such as Houston have encountered environmental barriers to mobility and accessibility, people living in suburban or rural settings may face even greater challenges. Residents of the urban areas of most major cities in the United States such as Houston have access to some type of mass transit and can also find residential housing that permits some amount of pedestrian access to needed shopping and service facilities. In suburban parts of these cities and certainly in more rural areas of the country, mass transit is nonexistent, and distances to commercial facilities make pedestrian access impossible. Such circumstances can therefore make life very difficult for anyone who cannot drive or does not have easy access to an automobile, with the pronounced hardships experienced by the elderly and disabled.

The Impact of Uncontrolled Growth on Water Quality

Uncontrolled growth and the loss of greenspace that often accompanies it can drastically affect both surface and groundwater quality. Between 1970 and 1990, central Puget Sound experienced a 38 percent increase in population, while the amount of land developed in that same period rose by 87 percent. This large-scale alteration of the natural landscape had profound effects on water resources and quality. Under natural conditions, rainfall is either intercepted by vegetation or percolates slowly through the soil to receiving waters. In urbanized areas, rainfall that once filtered slowly downhill becomes surface runoff. It flows across compacted earth and impervious man-made surfaces (e.g., asphalt, concrete, rooftops often covered with oil and other pollutants) and is channeled into storm drains. This disruption of the natural hydrologic cycle causes stormwater runoff to reach streams and rivers more quickly than these water bodies can absorb it and also before it has had an adequate chance for filtration of pollutants through the ground (the flush of auto contaminants from malls and other large parking areas that runs into surface water bodies during the initial period of a heavy rainfall contributes significantly to the non-point source loading of pollutants entering streams).³⁵ Undisturbed forested lands generally have the highest capacity to absorb water and subsequently the lowest rates of stormwater runoff. In contrast, impervious surfaces have the highest runoff rates. The volume of stormwater that washes off one-acre parking lots is about 16 times greater than that of a comparable size meadow.³⁶

According to research published in 2001 by Johns Hopkins University, more than 50 percent of waterborne disease outbreaks between 1948 and

1994 were preceded by extreme rainfall events. Outbreaks due to surface water contamination were most strongly and most immediately related, while outbreaks due to groundwater contamination were most often delayed by a month or two. These findings can, in some part, be attributed to the increase in impervious surfaces in areas of population concentration, thereby rendering the land incapable of absorbing and filtering the amount of water that falls during these extreme weather events.³⁷

An additional threat to water quality posed by sprawling uncontrolled growth is the overuse of septic systems in low-density suburban and rural residential development that results in groundwater contamination. For instance, according to the 1990 United States Census, approximately 26 percent of Florida's population was served by onsite sewage treatment and disposal systems (OSTDS). More than 1.8 million systems were estimated to be in use statewide. Since 1990, approximately 40,000 new systems have been installed each year. By comparison, in 1998, the Department of Health only issued 3,651 OSTDS abandonment permits where establishments were being connected to a central sewer system. It is estimated that OSTDS discharge 450 million gallons per day of partially treated, nondisinfected wastewater.³⁸



Photo: USDA

Other Potential Health Effects of Land-use Decisions

Land-use decisions and the built environment affect the way humans act and interact, with myriad impacts on public health. Sprawl and overdevelopment is closely correlated with a range of harmful public impacts:

- ✿ In a study of conflict and violence in and around public housing in Chicago, researchers found that the residents of buildings with surrounding greenspace had a stronger sense of community, had better relationships with their neighbors, and reported using less violent ways of dealing with domestic conflicts, particularly with their partners.³⁹
- ✿ Urban heat islands increase the demand for cooling energy, increase the health risks associated with heat-related illnesses and deaths, and accelerate the formation of smog. Heat islands are created when natural vegetation is replaced by heat-absorbing surfaces such as building roofs and walls, parking lots, and streets. This phenomenon can raise air temperature in a city by between 2-8°F.^{40, 41}
- ✿ Sprawl increases the risk of flooding. Development pressures lead to the destruction of wetlands, which are natural flood-absorbing sponges. In the last 8 years, floods in the United States killed more than 850 people and caused at least \$89 billion in property damage. Much of this flooding occurred in places where weak zoning laws allowed developers to drain wetlands and build on floodplains.⁴²
- ✿ Residential development next to farmland can pose unique health and quality-of-life concerns as well. In this “zone of conflict,” which might extend one-third of a mile from residential development, the spillover effects of agriculture, such as excess noise,

blowing dust, and pesticide overspray potentially can have negative health effects on the occupants of the residential development.⁴³

- ✿ As sprawl-type development pulls people and resources away from central cities, those left behind can experience many negative consequences. School districts pressed to save money are often enticed by donations of unknowingly contaminated property or seek out the cheapest land they can find. Some of these properties, called “brownfields,” are touted as the answer to all of the problems facing financially strapped school districts. Brownfields, defined by EPA as abandoned, idled, or underused industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination,⁴⁴ can, in some instances, be the only type of property a school district feels it can afford. The land is cheap, and in some cases EPA may enter into agreements with prospective purchasers of property, providing a covenant not to sue for existing contamination.⁴⁵ Some groups feel that the supposed community benefit of cleaning up and reusing an abandoned site is outweighed by the risks posed if, when these sites are redeveloped, they are only cleaned up to standards set for commercial or industrial property, rather than residential property standards which are more stringent.⁴⁶



Washington Post

School Case Study

Marion, OH Military Dump

River Valley High School and Middle School stand on the former site of the US Army's Marion Engineering Depot, part of which served as a dumping ground in the 1950s. In 1990, community members formed a group in response to alarming rates of leukemia and rare cancers among former students. Their efforts led to an investigation that revealed widespread campus contamination. Today, no one may exit back doors of the middle school or access several playing fields. Recently a bond issue passed to fund a new school, but students remain on the contaminated site until completion.⁴⁶

Planners, Architects, Engineers, and Public Health Professionals Can Make a Difference

The challenge facing those with responsibility for assuring the health and quality of life of Americans is clear. We must integrate our concepts of "public health issues" with "urban planning issues." Urban planners, engineers, and architects must begin to see that they have a critical role in public health. Similarly, public health professionals need to appreciate that the built environment influences public health as much as vaccines or water quality.

In a recently published list of the 10 most important public health challenges for the new century, CDC Director Jeffrey Koplan, MD, included at least four that are significantly linked to some of the land-use and urban design issues. They are: (1) integrating physical activity into our daily lives; (2) cleaning up and protecting the environment; (3) recognizing the contributions of mental health to overall health and well-being; and (4) reducing the toll of violence in society.²⁸

Specific actions from the public health sector to address these issues might include the following:

- ✿ Supporting research to determine the impact that changes in the built environment can have on public health, such as the addition of greenspace, sidewalks, and bike paths, and the reduction in impervious surfaces. Just as traffic studies are completed to ensure that road capacity can support new growth, so too should the public health community conduct research to determine the air quality impacts that increasing numbers of automobiles in use in a community have on its air quality. Just as engineers use data that have been collected over time in other places to determine the diameter of sewer pipe needed to serve a section of a

community, so too should public health officials use data on pedestrian injury patterns to create new urban design techniques.

- ✿ Participating in local planning processes, such as comprehensive planning meetings, zoning hearings, and urban planning workshops known as charrettes (intense, community-based, local planning and problem-solving workshops where local leaders and decision-makers develop consensus vision of the desired future of their community). Just as the developers, the neighbors, the school board, and the planners have their say in land-use decisions, so too should physicians and public health officials have the opportunity to provide input. It is their role to ask the questions such as “Why aren’t there any sidewalks in a new subdivision?” or “What is the air quality impact that is expected from a widening of the local highway?” and to press for evidence to substantiate any claims upon which any new growth and development are based.
- ✿ Working with planners and other land-use professionals to provide them with the strong public health arguments they need to support “smart-growth” designs and initiatives.

The public health and medical community must play an active role in the land-use and development decisions made in their community. It is their role to make policy makers and planners aware of the health impacts of the decisions they make. It is also critical that when they find that no data or analyses exist to answer the questions that they raise, they push researchers and policy makers to collect the information they need and conduct the research to ensure that all of the impacts of various land-use decisions are known before irrevocable actions are taken.

Just as there is an expanded role for health care workers and public health professionals in

making land-use planning decisions, so too is there an expanded role for urban designers and planners to begin to view themselves as a previously untapped force for public health. It is time for the planning community to remember its roots in public health protection – to remember that in the beginning many, if not most, land-use decisions were made to separate people from land-uses and industrial processes that posed a threat to their health or safety.

To reclaim their role as public health protectors, the planners and urban designers might take the following actions:

- ✿ Balancing the potential public health consequences of their choices with other considerations. “Smart growth” doesn’t mean “no growth,” but it does mean planned, controlled growth. The health impacts of land-use decisions need to receive at least as much consideration in development decision-making processes as economic impacts.
- ✿ Designing communities around people rather than around automobiles. Reviving the concept that the end result of urban design should be improved quality-of-life and that where people live as it relates to where they work, shop or go to school can have a dramatic impact on their health and quality of life.
- ✿ Changing existing zoning codes to encourage multiuse land-development patterns that make it possible to work, shop, and go to school within walking distance of people’s homes. The influence of last century’s community designers on our communities and on the behavior choices that we make everyday was seriously underestimated. The obesity epidemic in the United States was never imagined by those who made it difficult, if not impossible, to walk to the grocery store and to school and who also made it far easier to drive to the shopping mall or the movie theater across town than to walk to

such neighborhood establishments.

- ✿ Changing existing building codes to encourage building and site design that is accessible to people who have various degrees of mobility. It is a clear, if largely unrealized, fact that the more each member of society is able to participate and contribute, the better off society is. [Not only would those who were previously hampered by the inaccessibility feel better, but they also need less help to participate in society and be more able to contribute to their communities.] And all of this could be possible if appropriate design choices are made which, in most cases, would not cost appreciably more or negatively affect others.
- ✿ Encouraging greenspace development that promotes community, reduces violence, and improves mental health. The mental and physical health benefits of community parks and other green spaces have been demonstrated. The question that remains is whether communities want to spend money up front to create an environment that prevents violence and increases psychological well-being or whether they want to spend money after the fact to address the violence and stress which results from communities without parks and communal areas.

Public health professionals and those in architecture, urban design, and planning have much in common. The challenge now is for each profession to learn from each other how best to address the needs of the communities they serve, to determine what answers each has that the other needs, to create a common language, and to initiate the opportunities to use it.

To meet these challenges, we need a broader view of those factors influencing public health and a much better understanding of the interdisciplinary nature of the problem. We need a collaborative and concerted effort to influence both public health policy and other public policy on these issues in order for positive changes to take place that will improve the health and quality of life for all Americans.



Photo: Hugh Morris

References

1. Department of Health and Human Services (US). Healthy people 2010. Volume 1. Washington: DHHS; November 2000. p.8-3.
2. *Village of Euclid v. Ambler Realty Co.*, 272 U.S. 365 (1926) (USSC+).
3. World Health Organization. (No date). Definition of health [Online]. Available: <http://www.who.int/aboutwho/en/definition.html> [2001, August 6].
4. Institute of Medicine (US). The future of public health. Washington: National Academy of Sciences; 1988. p. 7.
5. Department of Transportation (US), Bureau of Transportation Statistics. (No date) Journey-to-work trends in the United States and its major metropolitan areas, 1960-1990. [Online]. Available: <http://ntl.bts.gov/DOCS/473.html> [2001, August 6].
6. Department of Transportation (US), Bureau of Transportation Statistics. (1999) The national transportation statistics report 1999. [Online]. Available: <http://www.bts.gov/ntda/nts/NTS99/data/Chapter4/4-11.html> [2001, August 6].
7. Pope, C. Solving sprawl. (1999) The Sierra Club rates the states [Online]. Available: <http://www.sierraclub.org/sprawl/report99/index.asp> [2001, August 6].
8. Texas Transportation Institute (1999). Urban roadway congestion annual report 1998. Table I-54 [Online] Available: <http://199.79.179.77/ntda/nts/NTS99/data/Chapter1/1-54.html> [2001, August 6].
9. Environmental Protection Agency (US). Emission facts. Washington: U.S. EPA, Air and Radiation Office, Office of Mobile Sources; EPA420-F-99-040. [1999, November].
10. National Council for Science and the Environment. (1999) Congressional Research Service Report for Congress. Air quality and motor vehicles: An analysis of current and proposed emission standards [Online]. Available: <http://www.cnie.org/nle/air-36.html> [2001, August 6].
11. Environmental Protection Agency (US). National air quality and trends report; Washington: US EPA, Office of Air and Radiation; EPA 454/R-98-016 [1997, December]
12. World Health Organization, European Region. (1999) Third ministerial conference on environment and health, London [Online]. Available: <http://www.who.dk/london99/transporte.htm> [2001; August 6].
13. The President's Task Force on Environmental Health Risks and Safety Risks to Children. Asthma and the environment: A strategy to protect children (2000) [Online]. Available: <http://www.epa.gov/children/whatwe/fin.pdf> [2001, August 6].
14. Clean Air Network and U.S. Public Interest Research Group Education Fund. (2000) Danger in the air: Smog days in 1999 [Online]. <http://www.pirg.org/reports/enviro/smog/index.html> [2001, August 6].
15. Friedman, MS, et al. Impact of changes in transportation and commuting behaviors during the 1996 summer Olympic games in Atlanta on air quality and childhood asthma. *JAMA* 2001;285:897-905.
16. ABT Associates. Adverse health effects associated with ozone in the eastern United States. Washington: (1999).
17. Centers for Disease Control and Prevention. Surveillance for asthma—United States, 1960–1995. *Mor Mortal Wkly Rep CDC Surveill Summ* 1998;47(No.SS-1):1-28.
18. Massey JT, Moore TF, Parsons VL, Tadros W. Design and estimation for the National Health Interview Survey, 1985-1994. Hyattsville: Department of Health and Human Services (US), National Center for Health Statistics; 1989. (PHS)89-1384. (Vital and health statistics; series 2; no. 110).
19. Department of Health and Human Services (US). Physical activity and health: A report of the surgeon general. Washington: (1996).
20. King AC, et al. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women; *Health Psych* 2000;19(4):354-64.
21. Centers for Disease Control and Prevention. Neighborhood safety and the prevalence of physical inactivity—selected states, 1996. *Mor Mortal Wkly Rep* 1999;48(7):143-6.
22. Pate RR, et al. Physical Activity and Public Health: A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 1995;273(5):402-7.
23. Nestle M, Jacobson MF. Halting the obesity epidemic: A public health policy approach. *Public Health Rep* 2000;115(1):12-24.

24. Corless J, Ohland G. Caught in the crosswalk: Pedestrian safety in California [Online]. Available: <http://www.transact.org/ca/caught99/caught.htm> [2001, August 6].
25. Kouri C. Wait for the bus [Online]. Available: <http://www.scccl.org/nletter/2000summer/schools.htm> [2001, August 6].
26. Centers for Disease Control and Prevention. (No date). Prevalence of overweight and obesity among adults: United States, 1999 [Online]. Available: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/obese/obse99.htm> [2001, August 6].
27. Centers for Disease Control and Prevention. (No date). Prevalence of overweight among children and adolescents: United States, 1999 [Online]. Available: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overwght99.htm> [2001, August 6].
28. Koplan JP, Fleming, DW. Current and future public health challenges. *JAMA* 2000;284(13):1697.
29. Colditz, GA. Economic costs of obesity and inactivity. *Med Sci Sports Exerc* 1999; 31:664-5.
30. Surface Transportation Policy Project (2000). Mean streets 2000: A transportation and quality of life campaign report [Online]. Available: [2001, August 6].
31. Roberts I, et al. Effect of environmental factors on risk of injury of child pedestrians by motor vehicles: A case-control study. *BMJ* 1995;310(6972):91-4.
32. Crum S, Foote KE (1996). Environmental and architectural barriers: How accessible is the urban environment? (1996) [Online]. Available: <http://www.colorado.edu/geography/gcraft/warmup/barriers/barriers.html> [2001, August 6].
33. Gilderbloom JJ, Markham JP. Housing quality among the elderly: A decade of changes. *Int J Aging Hum Dev* 1998; 46(1). Also available at http://www.louisville.edu/org/sun/housing/cd_v2/Bookarticles/Ch1.htm [2001, August 6].
34. Adaptive Environments Center. Adaptive Environments & Universal Design (No date) [Online]. Available: <http://www.adaptenv.org/universal/default.asp> [2001, August 6].
35. State of Pennsylvania, 21st Century Environment Commission (No date). Redefining progress: recommendations from the 21st century environment commission to Governor Tom Ridge [Online]. Available: http://www.21stcentury.state.pa.us/2001/redefining_progress.htm [2001, August 6].
36. 1000 Friends of Washington. Sprawl (No date) [Online]. Available: <http://www.1000friends.org/sprawl.htm> [2001, August 6].
37. Curriero FC, Patz JA, Rose JB, Lele S. The association between extreme precipitation and waterborne disease outbreaks in the United States. *Am J Public Health* 2001;91(8):1194-9.
38. Florida Department of Health. Departments of Community Affairs and Department of Environmental Protection. (1999) Onsite sewage treatment and disposal in Florida: Draft background paper for the Governor's study of onsite sewage treatment and disposal systems [Online]. Available: [2001, August 6].
39. Sullivan WC, Kuo FE. Do trees strengthen urban communities, reduce domestic violence? In U.S. Department of Agriculture, Forest Service, Southern Region. Forestry Report RB-FR 56, January 1996 [Online]. Available: http://www.urbanforestrysouth.org/pubs/Tech_bulletin/tb4.htm [2001 August 6].
40. Gorsevski V, Taha H., Quattrochi D, Luval J (No date) Air pollution prevention through urban heat island mitigation: An update on the urban heat island pilot project [Online]. Available: http://www.ghcc.msfc.nasa.gov/uhipp/epa_doc.pdf [2001, August 6].
41. Blum LN, et al. Heat-related illness during extreme weather emergencies. *JAMA* 1998;279(19):1514.
42. The Sierra Club (No date). Sprawl fact sheet [Online]. Available: <http://www.sierraclub.org/sprawl/factsheet.asp> [2001, August 6].
43. American Farmland Trust (No date). Alternatives for future urban growth in California's Central Valley: The bottom line for agriculture and taxpayers [Online]. Available: <http://www.farmlandinfo.org/fic/ft/cv/cv-intro.html> [2001, August 6].
44. USEPA Office of Solid Waste and Emergency Response Glossary of Terms. [Online] Available: <http://www.epa.gov/swerosps/bf/glossary.htm#brow> [1997, September 30].
45. United States Environmental Protection Agency, Office Solid Waste and Emergency Response. Brownfields Economic Redevelopment Initiative Quick Reference Fact Sheet. EPA 500-F-00-241 [Online] Available: <http://www.epa.gov/swerosps/bf/html-doc/econinit.htm> [2000, October].
46. Child Proofing Our Communities: Poisoned School Campaign. Poisoned schools: invisible threats, visible actions (2001) [Online]. [2001, August 6].

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