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The relationship of urban design to human health and condition

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Abstract

The population of the United States of America is currently experiencing increased illness from dispersed and synergistic causes. Many of the acute insults of the past have receded due to centralized health care and regulatory action. However, chronic ailments including asthma and allergies, animal-transmitted diseases, obesity, diabetes, heart disease, and depression are on the rise. These diverse illnesses join with forest fragmentation, stream degradation, wetlands destruction, and the concomitant loss of native species to suggest detrimental contributions from the built environment.

This paper surveys the state of the science on the impacts of urban design on human health and well-being. Drawing primarily on recent peer-reviewed literature in a broad array of health, planning, and environmental fields, it outlines the influence of design at three spatial scales on aspects of physical and mental health, and social and cultural vibrancy. Selected ecological effects are also discussed to illustrate shared associations with urbanization. While causal chains are generally complex and not always completely understood, sufficient evidence exists to reveal urban design as a powerful tool for improving human condition.

Solutions are discussed at the personal and professional level, emphasizing cross-disciplinary collaboration in urban planning and design, and the participation of residents in shaping their living environment. At the parcel scale, greenery and access to it visually and physically are the principal keys to health. These elements must be incorporated into relatively high-density neighborhood designs that include public buildings, open space, mixed land use, and pedestrian walkways to increase physical exercise and enhance civic life. Finally, neighborhoods must be embedded in existing urban infrastructure to provide larger cultural and business opportunities and reduce reliance on the automobile. Further research is recommended to strengthen the associations between design and health. Increased communication on this subject is also necessary between design and health practitioners and their clients and colleagues.

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1. Introduction

Modern society is increasingly aware that humans and culture are components of the natural environ-

ment, and that human health is inextricably linked with environmental condition. Therefore, it is useful to explore methods and patterns of human settlement and landscape modification for their potential adverse effects on human as well as environmental health. The fields of landscape ecology and landscape architecture, among others, have generated a rich literature on the environmental consequences of urban land use. By comparison, research and discus-

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sion are highly limited on the related issue of human effects.

The population of the United States of America (USA) is currently experiencing illness and mortality from a broad range of insults that have not traditionally posed significant public health threats here. The epidemics of today include asthma and allergies, animal-transmitted diseases, obesity, diabetes, heart disease, depression and other mental illnesses, and suicide. It is true that scientific advances have alleviated morbidity and mortality from many infectious diseases and injuries. Historic efforts to regulate public sanitation, factory emissions, workplace safety, food production, and other centralized activities have reduced the health risks of industrial and municipal origin. Many of these controls have also benefited environmental condition. In the most well-known cases, reduction or elimination of toxins has restored river biota and top avian predators. However, the natural environment remains very much under siege, suffering habitat loss and fragmentation, invasion of aggressive exotic competitors, and continued pollution despite the regulatory framework. Meanwhile, the human population exhibits signs of malaise, sickness, and even death from what appear to be dispersed, synergistic ambient causes.

The public-health profession advocates personal involvement in wellness rather than a dependency on treatment and institutionalized solutions. Improvements to human and, by extension, ecological health will require modifications in countless individual lifestyle and professional choices. Personal decisions of consequence range all the way from small purchases, household waste disposal, and travel mode, to housing, community involvement, and family planning. Embedded in this vast array of personal choices are those that affect architecture, landscaping, and urban design. The built environment in post-industrial culture represents a tremendous unexamined resource for improving human and environmental health.

This paper explores the possibilities of design to benefit human condition, which encompasses physical and mental well-being, environmental quality, and overall quality of life. It documents the state of the science linking design to the human condition, and highlights methods for architects, planners and citizens to improve the living environment. Significant effort was made to capture current understanding

of this diffuse and surprisingly overlooked subject. Information sources included peer-reviewed literature and conference proceedings from the fields of public health, medicine, psychology, environmental health, natural resource management, transportation, and city planning, as well as books from the popular press, advocacy papers on the internet, and the print media. Findings are summarized in three sections that correspond to a spatial hierarchy of human settlement: buildings and grounds, neighborhoods, and towns/regions. While urban design issues do not always fall exclusively into one or another of these categories, they provide a useful method of organizing information, and represent a gradient of personal and professional control.

2. Buildings and grounds

Excepting the body of work on building materials, the majority of medical and social science research at this scale focuses on visual and physical access to the outdoors. Judging from the literature, the most healthful architecture exposes inhabitants to natural light and ventilation, views of greenery, and close proximity to outdoor green space. Landscape architecture appears to be the primary key at the finest scale to sound mind and body.

Frederick Law Olmsted observed in the 19th century that experiencing and simply viewing nature reduces the stress of daily urban life (Ulrich, 1979; Jackson, 2001). Parks and gardens have long been noted for their restorative effects on both mental and physical health (Kaplan, 1973; Frumkin, 2001; Hill, 2002). E.O. Wilson has coined the term “biophilia” to express the apparently innate human attraction to nature (Frumkin, 2001), citing a widely-shared evolutionary explanation that relates pleasing, park-like settings to prehistoric cues for water and shelter (e.g. Kaplan and Kaplan, 1989; Ulrich, 1983).

Research supports the beneficial effects of nature at the scale of the building parcel. Sullivan and Kuo (1996) demonstrated that the presence of trees near public housing is associated with decreased levels of domestic violence. Wells (2000) has associated window views onto green vegetation, rather than bare dirt or pavement, with increased cognitive function in low-income children. Ulrich (1984) provides the

off-cited results of recuperation from surgery, which was measurably faster for hospital patients with window views of greenery as opposed to those looking onto a brick wall. Adding to the importance of windows in building design are research findings on the adverse effects of artificial lighting (Lindheim and Syme, 1983). Perhaps most commonly known is that lack of adequate exposure to ultraviolet radiation impairs the body's use of calcium. Furthermore, radiation from televisions and fluorescent light causes nerve dysfunction, and fluorescent lighting is associated with increased melanoma.

Lindheim and Syme (1983), Evans et al. (2000), and Wells (2000) summarize findings that residence on the upper floors of high-rises is associated with lower physical activity, behavioral problems, and respiratory illnesses in children, and with neuroticism and social isolation in stay-at-home mothers and military wives. Wells speculates that restricted access to the outdoors is the key factor in these adverse health effects. Lindheim and Syme emphasize that mothers of children under 5 years of age, and these children, are affected the most negatively by high-rise living, while young adults and the elderly may find it preferable. Much of the research on window views and outdoor access involves captive populations with few opportunities for nature experience outside of the domestic setting. While researchers encourage broader studies, it appears all the more important that buildings designed for housebound urban residents in particular incorporate greenery and the means to access it visually and physically.

That being said, a word about lawns is in order. Most researchers advocating greenery to improve health and social welfare do not discuss the implications of landscaping alternatives. They report beneficial effects of greenery in general. However, the overwhelming choice of lawn cover for homes, schools, businesses, and public open space represents a staggering environmental cost in terms of water, energy, toxic exposures, and wildlife habitat. Ecologist and cancer survivor Sandra Steingraber (2002) reports that lawn-care pesticides can lead to cancer in wildlife and humans, exposing household members for prolonged periods when tracked indoors. Lyman (2000) finds that total emissions from lawn mowers (together with tractors) have surpassed those from cars in several pollutants that cause ozone formation.

These and other negative findings have led many to advocate native plantings in open space. Chosen wisely, indigenous vegetation absorbs rainwater and filters urban runoff, provides food and shelter for small wildlife, and serves as a source of nature education for city-bound residents. If designed and campaigned to appeal to the human aesthetic (Nassauer, 1997), native plantings can succeed as a healthful alternative to the homogeneous lawn.

3. Neighborhoods

The transition from building site to neighborhood introduces the critical issue of social capital. As a gregarious species, people benefit emotionally and physically from interpersonal relationships. Society at large also benefits from the participation of its members in political organizations, charitable activities, parent-teacher associations, even recreational leagues, as increased familiarity among individuals promotes mutual aid and empathy. Social capital is the subject of a recent book by Harvard University professor Robert Putnam (2000). In "Bowling Alone: The Collapse and Revival of American Community," Putnam presents 14 indicators of social capital, arranged in five categories: community organizational life, engagement in public affairs, community volunteerism, informal sociability, and social trust. Using existing survey data, he relates these measures to numerous aspects of human health and welfare. Putnam presents compelling evidence that many illnesses, including colds, heart attacks, strokes, cancer, and depression, and premature deaths are inversely related to social and family ties and religious and other group membership. His analyses demonstrate that poor social capital is as bad as or worse than smoking, obesity, elevated blood pressure, or physical inactivity for human health. Lindheim and Syme (1983) add suicide, accidents, tuberculosis, coronary disease, schizophrenia, pregnancy complications, and alcoholism to the list of adverse health effects associated with weak social ties.

Social capital begins in the neighborhood. According to Putnam, one of the first uses of this term is in Jane Jacobs' book, "The Death and Life of Great American Cities." Jacobs (1961) observed that, where neighborhoods are configured to maximize informal

contact among residents, street crime is reduced, children are better supervised, and people express greater happiness with their physical surroundings. [Kuo et al. \(1998\)](#) demonstrate that providing green space is a method to increase informal contact. Again studying low-income residents, they found that the presence of trees and grass in otherwise identical public housing is associated with the formation of strong social ties among neighbors. This study demonstrates that accessible green space is important to human welfare at the neighborhood scale as well as the individual parcel. In the area of neighbor relations within a single structure, [Lyle \(1994\)](#) reports that residents of a Berlin apartment complex with a wetland wastewater treatment plant displayed more social cohesion than other apartment dwellers. This is an example of design that builds social capital while also providing environmental benefits.

3.1. High densities and mixed use

Proponents of traditional and neo-traditional urban design advocate high residential densities, mixed land uses, and gridded street patterns to maximize not only social contact, but also physical exercise and open space (e.g. [Kunstler, 1996](#)). However, many of these claims are as yet unsubstantiated by formal research. [Berman \(1996\)](#) and [Cervero \(1996\)](#) do report studies finding that high densities and mixed use increase pedestrian and bicycle activity. Clearly, this confers health benefits upon participants while preserving open space by concentrating development. In addition, mixed use enables shared parking between daytime and evening drivers, further minimizing paved area. However, the evidence is unclear that the gains in non-motorized travel from these design features produce corresponding decreases in automobile trips. Issues related to cars and impervious surface are discussed in more detail in the next section.

On the negative side, Berman notes that the style of on-street housing sacrifices privacy. In Seaside, FL, the original neo-traditional development, residents have allowed shrubbery to obscure windows and porches so as to block views from the street. He also provides the results of one survey indicating that people prefer loop and cul-de-sac street designs to grids, even though grid residents report the highest sense of community, neighbor friendliness, and convenience to

shopping and schools. However, grids were rated the lowest on proximity to parks, and cul-de-sacs the highest on visiting with neighbors outside. Both Berman and Cervero suggest that the social and environmental goals of neo-traditional design are more likely to be met through infill and redevelopment of existing urban area, rather than through enforced mixed use in an otherwise isolated new neighborhood.

Some research exists to counter claims from detractors of typical inner city and neo-traditional design. Citing multiple studies, [Lindheim and Syme \(1983\)](#) state there is little evidence that high residential density (outside of prison) produces mental or physical illness. [Adams \(1992\)](#) reports that neither crowding nor demographic heterogeneity, often the result of high urban densities and a goal of neo-traditional design, is inherently stressful. Rather, [Putnam \(2000\)](#) finds that culturally integrated settings increase participation in the political process, a measure of social capital. However, Lindheim and Syme do note that ethnic enclaves promote family ties and neighbor reciprocity, other valued forms of social capital.

[Steingraber \(2002\)](#) weighs in on the subject of neighborhood industries such as automobile repair shops and dry cleaners. These encourage pedestrian activity when sited in residential areas, and increase local economic vitality. However, Steingraber warns against their toxic emissions. It could be argued that this category of small businesses is unsuitable for mixed land-use design, or should be phased out altogether and replaced with new technology.

3.2. Pattern, landmarks, and public buildings

Additional elements of neighborhood design that relate to human health and welfare are the presence of public buildings and other landmarks embedded in a logical pattern. Kaplan and Kaplan have written at length about the importance of orientation in the constructed environment (e.g. [Kaplan et al., 1998](#)). Visual landmarks and logical transit pathways assist people in reaching their destinations. Psychologically, these design elements provide a sense of ease and comfort. [Kaplan et al. \(1998\)](#) and [Berleant \(1992\)](#) discuss the importance also of mystery and exploration to the human intellect. In order to explore unfamiliar settings, it is essential that people feel safe. [Smith \(1977\)](#) reports that the presence of orienting landmarks is associ-

ated with decreased recidivism in de-institutionalized mental health patients. Decreased recidivism was also observed where former patients had access to public buildings such as libraries, churches, and community centers. These civic amenities serve as havens from urban noise and traffic, while providing a sense of belonging in society. Therefore, in addition to their psychological benefits, human-scale neighborhood design and the presence of public buildings are important ingredients in social capital (Kunstler, 1996).

3.3. Conducive walkways

A component of neighborhood design that is receiving intense scrutiny today is the pedestrian path. Richard Jackson, Director of the National Center for Environmental Health of the US. Centers for Disease Control and Prevention (CDC), has targeted the lack of physical exercise as a critical health issue resulting from urban sprawl. CDC (1998) reports that physical inactivity accounts for as much as 23% of all US deaths from major chronic diseases. Physical inactivity plays a critical role in obesity, which increases the risk of many illnesses including diabetes, itself often leading to kidney failure, heart disease, blindness, and amputations. The national financial burden of health care for obesity and physical inactivity is estimated to be more than USD\$ 100 billion annually. Current epidemics of obesity, heart disease, adult-onset diabetes (even in young children), depression, and other exercise-related illnesses prompted the Director of CDC to issue a national health objective in 2000 to reduce physical inactivity in the population (Jackson and Kochtitzky, 2001).

Urban residents (CDC, 1998) and low-income women in general (Brownson et al., 2001) report low participation in leisure-time exercise. Therefore, Jackson and Kochtitzky advocate providing neighborhood opportunities for walking to accomplish routine activities such as shopping and going to work. Andersen et al. (1999) report that these lifestyle activities are as effective as structured aerobic exercise in losing weight. Critical to this strategy is conducive neighborhood design.

Survey results indicate that the presence of sidewalks, busy streets, enjoyable scenery, and hills promote walking for exercise (Brownson et al., 2001). Berman (1996) notes that pedestrian paths separated

from the street and human activity are not used, but those adjacent to streets and winding through mixed land uses and small lot sizes are. Balfour and Kaplan (2002) report that poor lighting, excessive noise, heavy traffic, and lack of public transit are associated with loss of physical function in adults over 55 years of age. They suggest that these detrimental environmental features discourage neighborhood excursions.

While street activity engenders interest and feelings of safety, excessive traffic volume and street widths are health hazards. Children, the elderly, and the disabled are particularly affected by vehicular hazards to pedestrians, which have the effect of isolating these populations. During 1997–1998, the elderly comprised 13% of the US population. Yet they accounted for 22% of pedestrian traffic fatalities (Jackson and Kochtitzky, 2001). All pedestrian fatalities are most common in newer urban areas of the South and West, where sprawl is the predominant design (Kreyling, 2001).

Proponents of suburban-style development have not been silent in the face of the anti-sprawl campaign. The National Home Builders Association has accused Jackson and Kochtitzky of promoting a political agenda rather than sound science. The Association's president used CDC data to illustrate that suburban residents are actually healthier than people living in cities or rural areas. They are more likely to engage in leisure-time exercise, and suburban women in particular are the least likely to be obese. However, the CDC author of this information has responded that he did not control for neighborhood design in his study, and that his results reflected differences in income, education, insurance, and medical care. Also responding to the Association's accusations, Hugh Tilson, Professor of Epidemiology and Health Policy at the University of North Carolina's School of Public Health, states that suburban residents who are not motivated to use gymnasiums and trails also suffer from the lack of walkable destinations (Stradling, 2002).

Clearly, there is a multiplicity of factors that affect physical activity. Brownson et al. (2001) report that many people find opportunities in shopping malls, parks, trails, home and office treadmills, and indoor gyms. Low socio-economic status, lack of time, and high crime are important disincentives, which relate at best indirectly to neighborhood design. Nevertheless,

research shows that the provision of properly designed walkways through a mixed-use, human-scaled urban environment increases pedestrian activity. Neighborhood efforts in this direction will not only improve residents' health through unstructured exercise, but also integrate marginalized sectors into urban life, and enhance the sense of place and community (Kunstler, 1996).

4. Towns/regions

The discussion of pedestrian opportunity leads naturally to its antithesis—the culture of the automobile. The car is very much a design issue, as homes, businesses, and the entire road network have evolved in form to accommodate the car's operational and parking needs. Because cars both enable and force people to venture across the landscape in their daily activities, and because of their widespread environmental impacts, they are included in this section on towns and regions. Richard Jackson and other anti-sprawl proponents point to the culture of the car as the overarching cause of today's most pressing adverse human and environmental health effects. Kunstler (1996) writes that the primacy of the automobile shares responsibility for the dissolution of civic life. Putnam (2000) associates sprawl (made possible by the automobile) with measures of decreased social capital, but concludes that this style of urban design accounts for only about 10% of the observed decline.

One of the most frequently cited human physical health effects of widespread car usage is the increasing rate of asthma. This is a debilitating respiratory disease that affects children in particular, and is exacerbated by pollutants released by idling and moving cars. Jackson and Kochtitzky (2001) report that asthma rates in children more than doubled from 1980 to 1995, a period that also saw more cars on the road and increased urban congestion. In a serendipitous experiment during the 1996 Atlanta Olympic Games, driving decreased 22.5% as cars were restricted in the downtown area. At the same time, emergency room and hospital admissions for asthma decreased 41.6%, while the occurrence of other medical events was unchanged (Jackson and Kochtitzky, 2001).

Until very recently, research has associated automobile emissions only with the exacerbation of

existing asthma. However, McConnell et al. (2002) have just published the important finding that these pollutants are associated with asthma development in southern California children exercising outdoors. Another new publication on southern California reports the striking result that pregnant women exposed to high ambient levels of automobile emissions are up to three times as likely to give birth to infants with serious heart defects (Ritz et al., 2002). Car emissions are also associated with bronchitis and school absences in children (Polakovic, 2002), and increased susceptibility to various inhaled allergens (Jackson and Kochtitzky, 2001). Jackson and Kochtitzky also report that European scientists attribute 36,000 to 129,000 adult deaths per year to automobile pollution. Accelerating reports of significant morbidity and mortality are likely to influence transit policy, particularly because of effects on children. Society has been aware for decades of the adverse ecological impacts from automobile-generated air pollution, but these have not proven persuasive in changing transportation behavior.

4.1. *Commuting*

Cars permit greater distances between home and work. In addition to generating more air pollution, long commutes have been associated in a small body of literature with other adverse effects on human health and welfare. Costa et al. (1988) report that Europeans who commute long distances by car or transit experience higher absenteeism and accidents at work. Putnam (2000) claims that commuting time is more important than any other factor except education to social capital. He reports that each additional 10 min of commuting time reduces community involvement by 10%. Furthermore, long commutes create a negative externality in the community by decreasing participatory activities even in those who do not commute. Apparently, non-commuters are discouraged from community activities when many of their neighbors are absent.

Driving on congested roadways is now commonly known to cause stress, aggression, and even fatalities. Survey results show that 59% of nurses who use transit do so to avoid the stress of driving (STPP, 1999). Road rage, a term for aggressive driving, is the subject of a report by the non-governmental Surface Trans-

portation Policy Project (STPP, 1999). Using a conservative definition, this report finds that road rage is a factor in 56% of all fatal crashes. It is highest in areas with sprawl development, where transit is limited or non-existent and reliance on the automobile predominates. It is lowest in areas with gridded street patterns, sidewalks, and low amounts of driving per person. Road rage fatalities are directly proportional to traffic congestion, and are 61% more likely in urban areas with low transit use than in those with high transit use.

4.2. Impervious surface

Roadways and parking lots account for the majority of impervious area in the landscape. A large body of research documents the adverse effects of impervious surfaces on stream, wetland, and estuarine ecological condition (e.g. Booth and Reinelt, 1993; Schueler, 1994; Arnold and Gibbons, 1996). Paved surfaces impede rainwater infiltration and groundwater recharge, facilitate the movement of toxins into waterways, and increase erosion, sedimentation, water temperatures, flooding, and periods of low flow. These effects in turn eliminate cold-water fisheries, and degrade the natural community composition of fish and aquatic insect species. Studies suggest that watershed imperviousness should not exceed 10–15% in order to protect aquatic ecological condition (e.g. Schueler and Galli, 1992; Boward et al., 1999).

Urban development can attain and exceed these amounts of impervious cover fairly rapidly over its affected area. According to the USDA Natural Resources Conservation Service (formerly the Soil Conservation Service), the imperviousness of urban parcels typically ranges from 20% for 1 acre residential lots, to 95% for strip-malls (USDA Soil Conservation Service, 1975). Therefore, environmental guidelines have recommended various strategies such as vertical and cluster development to preserve open space, porous paving materials to allow infiltration, and vegetated stream buffers to filter runoff. Sacrificing selected watersheds to dense development has the beneficial effect of alleviating pressure on the surrounding landscape. However, mitigation techniques should still be employed in highly populated areas to reduce human illness from heat island effects and water-borne disease (Jackson and Kochtitzky, 2001).

4.3. Low-density development

Another component of sprawl, low-density development is the result of locational flexibility offered by the automobile and the associated road network. This development style is burgeoning across the US landscape, and has been associated with its own suite of adverse effects to human health, social welfare, and ecological condition. The Biodiversity Project (2000) states that ambulances and fire trucks take longer to reach homes on the fringes of service areas. Therefore, low-density housing can expose residents to greater risk from emergencies. Kunstler (1996) and Chen (2001) raise the issue that sprawl leads to social inequality, as wealthier residents move away from urban centers and abandon minority populations to weakened social services. Chen notes that the powerful USA workers union, the American Federation of Labor-Congress of Industrial Organizations (AFL-CIO), has become involved in the anti-sprawl campaign because of human health and welfare issues. Most of the problems already discussed concerning the lack of pedestrian activity are manifested in low-density development.

In addition to these effects, a new category of serious illness is on the rise and associated with low-density design. This is wildlife-transmitted disease, and includes new disease, the spread of previously localized diseases, and the resurgence of those thought to have been eradicated. Lyme disease, highly localized in the early 1980s to the northeastern US, is now the nation's most common vector-borne disease (CDC, 2001). Not entirely understood, its effects include joint pain and swelling, facial paralysis, severe headaches, and memory loss. In some patients, the illness becomes chronic and debilitating. Numerous researchers have associated cases with housing adjacent to forest tracts (e.g. Dister et al., 1993; Glass et al., 1995; Cromley et al., 1998). Findings strongly suggest that residential development that invades forest and creates edge habitat exposes residents to deer ticks (*Ixodes scapularis*), which transmit the disease to humans.

Hill (2002) claims that the spread of residential areas into previously isolated wildlife habitat may be responsible for the emergence of the Hanta virus in the US southwest, and even AIDS in Africa. The toll on ecological condition is substantial as well, since

this human activity results in habitat destruction, landscape fragmentation, and the extirpation of natural predators. The [Biodiversity Project \(2000\)](#) suggests that decreases in suitable habitat for fish, reptiles and bats have led to observed increases in mosquito-borne malaria and encephalitis.

The invasion of farmland for low-density development also carries human health risks in the form of pesticide exposure, inhalation of airborne particulates, and machinery noise. Since low-density development often requires septic systems, it also is a factor in groundwater pollution ([Jackson and Kochtitzky, 2001](#)).

5. Solutions

A growing body of evidence strongly identifies the design of living space and associated activity patterns as a public-health issue. While human health concerns do not currently drive urban design, they in fact were the original impetus in the 19th century for the profession of city planning. Poor sanitation and urban factory emissions are no longer leading health threats in the USA, yet urban design here remains very much under the influence of archaic planning practices. Several authors (e.g. [Lindheim and Syme, 1983](#); [Kunstler, 1996](#); [Jackson and Kochtitzky, 2001](#)) have called for designers and planners to address the pressing health problems of today—vehicle exhaust, physical inactivity, social and cultural isolation, and economic disparity. Health practitioners as well must increase their attention to the environment, mental illness, the elderly, and the disparity between wealthy and poor populations ([Jackson, 2001](#)). Underscoring these pleas is the recognition that collaboration across professions including urban design, planning, public health, environmental health, and veterinary medicine, is essential to preventative health care.

Citizens, too, will benefit by taking an active role in shaping their living environment. [Lindheim and Syme \(1983\)](#) and [Kuo et al. \(1998\)](#) point out that residents' participation in planning and design itself enhances health and happiness. Lindheim and Syme emphasize that there is no one template for a "healthy" living environment. Instead, the most healthful urban design may be one that provides structure for basic services

such as public buildings, parks, and the connectivity to access them, while providing a range of opportunities for citizens to select and shape their homes and neighborhoods according to their specific needs and preferences.

[Berman \(1996\)](#) and [Cervero \(1996\)](#) have observed that infill and redevelopment of existing urban areas are more likely to achieve reductions in automobile trips and miles traveled than neo-traditional neighborhoods sprung fully-formed in areas isolated from other urban services. Neighborhoods take time to develop, as small businesses emerge and change to meet residents' evolving needs. They also require the infrastructure of the surrounding town. Cervero suggests that high-density developments built on exurban sites are likely to meet transportation goals only if they are connected to mass transit. However, this option requires regional planning, government incentives such as congestion pricing and employer cash-back programs, and other transit incentives. While these large-scale actions are possible and desirable, more immediate solutions are necessary and more readily attainable by designers and planners at the scale of individual towns, their existing neighborhoods, and parcels.

6. Concluding remarks

There are strong public-health arguments for the incorporation of greenery, natural light, and visual and physical access to open space in homes and other buildings. Landscaping can and should support environmental functions as well, such as conserving water and providing wildlife habitat. However, for persuasive health, social, and environmental reasons, these design elements must increasingly be incorporated within traditional and neo-traditional urban settings. The extent of low-density development in the USA is environmentally unsustainable. The challenge is to offer options in urban living that appeal to a wide demographic. Proximity to civic and retail resources in the neighborhood, and access for all to larger cultural and business opportunities in town, will also preserve agricultural and natural areas nearby for respite and recreation. (True pricing for transportation and fuel costs would help tremendously to cast urban living in a more desirable light, but government policy changes are beyond the scope of this paper.)

These recommendations will go against the grain for many who seek household well-being solely in household solutions. It is essential, therefore, that designers and health practitioners speak to the physical, mental, social, and ecological health implications of urban design at multiple spatial scales. Continued research is critical to document changes in health parameters brought about by changes in design. New research is needed as well into amorphous yet likely important casualties of modern design such as the disruption of daily and seasonal natural rhythms, the loss of natural complexity, the disconnection from history and place, and the severance from the elderly and the processes of birth and death (Lindheim and Syme, 1983). Sufficient evidence exists to reveal urban design as a powerful tool for improving human condition. Solutions call for individuals to look beyond their personal and professional boundaries to shape the urban environment according to the overarching principles of ethics and ecological design.

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