(Re)Connecting land use planning and public health: supporting walkability initiatives from within a regional health authority

Sherrill Johnson, PhD, Population Health Consultant
Population Health – Capital Health

Contact Information:
Sherrill Johnson, PhD
Population Health Consultant
Population Health – Capital Health
Suite 300, 10216 – 124 Street
Edmonton, AB T5N 4A3
sherrill.johnson@capitalhealth.ca

Abstract
Health systems everywhere are currently struggling with the burden of 21st century public health problems, most notably chronic disease and injuries. In light of growing concerns about the sustainability of the health care system, interest has been growing in exploring how different types of urban design can promote health and influence the prevention of population-level factors that contribute to disease and injury. The evidence demonstrates that there is an association between land use planning and the health of populations.

The most researched area to date for connecting land use planning and public health is the impact of urban design on levels of physical activity. Low density suburban neighbourhoods contribute significantly to physical inactivity. The design of these neighbourhoods and their distance from daily destinations (groceries, services) typically requires a high degree of automobile dependence and decreases opportunities for active transportation, such as walking, cycling and use of public transit. The evidence shows that people who live in walkable communities (those that have mixed land uses, connected streets and higher population density) walk more and drive less than those who live in suburban communities.

This paper highlights the links between land use planning and public health and makes the case for public health input into land use decision-making processes.

Sherrill Johnson holds a Ph.D. in geography and environmental studies from Carleton University. She joined Population Health (Capital Health, Edmonton) in 2003, working on projects related to injury prevention. Her current work focuses on the impact of the built environment on public health, and on regional-level population health practice.

(Re)Connecting land use planning and public health: supporting walkability initiatives from within a regional health authority

Sherrill Johnson, PhD, Population Health Consultant
Population Health – Capital Health

Introduction

On the surface, land use planning and public health may seem like disparate fields of professional practice. Yet these two areas share a common history, and there are calls to reconnect professionals in these areas as one way of addressing pressing population health issues of the 21st century. Over the past few decades, urban planning has moved beyond thinking primarily about 'mains and drains' and public health has moved beyond thinking primarily about 'bugs and drugs'(Schechter 2003). These changes highlight common interest about the impact of built environments on health, and the role good urban design policies play in creating positive health outcomes at the population level (Knox 2003).

The desire for rebuilding a connection between public health and urban planning has been coming from many quarters, strengthened by recent evidence showing the myriad ways through which the design of built environments impacts the health of entire populations (Knox 2003). The purpose of this paper is to explore the linkages between public health and land use planning and examine the impacts of land use planning decisions on the health of populations.

Research on the connections between built environments and public health is expanding rapidly, with new studies emerging regularly. Given the rapid pace of growth in this area, a systematic review of this literature is outside the scope of this paper, as is a detailed analysis of particular studies. Rather, the emphasis is on identifying key research articles that highlight associations between land use planning and public health.

Land use planning and public health

Historical relationship

The 19th century practice of public health was strongly connected to land use planning in North America. As early industrialization brought about sharp demographic shifts, including increased urbanization and resultant crowding in urban areas, interest grew in the development of new regulatory measures to protect public health from the adverse effects of urbanization (Schilling 2005). While public health and land use planning are now viewed as separate fields of professional practice, originally public health, city planning and civil engineering in North America "…evolved together as a consequence of late 19th-century efforts to reduce the harmful effects of rapid industrialization and urbanization, particularly infectious diseases" (Coburn 2004). For instance, public health officials were instrumental in the introduction of infrastructure and technology to properly dispose of sewage and bring clean drinking water into people's homes.

These 19th century concerns about public health not only strongly influenced urban infrastructure planning, but also contributed to shaping the dominant view of health and cities. As Perdue et al. (2003) note that by the early 20th century, the belief that cities and urban concentrations were unhealthy had become established orthodoxy. Because of this, separation of land uses and deconcentration of population was viewed as an

effective means of improving "…public health, safety, morals, and general welfare" (Perdue 2003). Over time, beliefs about 'healthy' land use shaped during the industrial period became codified into zoning regulations as land use planning legislation developed. The impacts of these beliefs on planning and land use on population health are still being felt today.

For example, the 'urban sprawl' that is currently attracting a lot of attention in North America is one vestige of the 19th century focus on population deconcentration, and separation of industrial, commercial and residential land use. The creation of zoning practices emphasizing segregated land uses is in many ways a response to earlier conditions in urban North America. Current North American 'urban hygiene' conditions are generally much safer, and the most serious threats to public health are very different. For example, the root causes of the chronic disease 'epidemic' of the 21st century (e.g., physically inactive populations) stand in stark contrast to the factors implicated in the transmission of communicable diseases in the 19th and early 20th centuries (e.g., diseases spread via contaminated drinking water). The impact of land use planning on chronic disease will be discussed in greater detail later in this paper, but is noted here as an example of the residual impact of planning history on the health status of populations today.

Current context

There are many factors influencing the current calls for reconnecting public health with land use planning. To begin with, there is little doubt that the prevalence of chronic disease is one of the most significant public health issues of the 21st century. The Chronic Disease Prevention Alliance of Canada (CDPAC Online) asserts that heart disease now accounts for 38 per cent of all deaths among Canadians each year. The Public Health Agency of Canada (PHAC Online 2003) estimates that about one-half of the Canadian population lives with chronic disease and this accounts for approximately two-thirds of direct health care costs in Canada. Obesity and physical inactivity are two risk factors for chronic disease, and as demonstrated in the next section of this paper, there is evidence of an association between these risk factors and the design of the built environment.

There is also an association between land use patterns and injuries. Unintentional injuries, especially those involving motor vehicle collisions, are also a major source of hospitalizations and mortality. Design of transportation systems has a demonstrated impact on motor vehicle-related injuries, both for pedestrians and motorists (Pruss-Ustun 2005).

The impact of environmental design on chronic disease and injury is often discussed by comparing different types of urban design and assessing their differing health impacts. For the purposes of this paper, two particular types of design are referenced in the research literature. 'Traditional' or 'urban' design, typically found in older neighbourhoods, is characterized by relatively high population densities, the prevalence of mixed land use - incorporating both commercial and residential usage - and high street connectivity achieved through a grid layout. Recent planning trends towards incorporating the key tenets of this type of design are often referred to as 'new urbanist' approaches.

In contrast, 'suburban' design began to predominate as a form of land use planning just after World War II. During this period strong housing demand spurred rapid new

residential development. In addition, increasing availability of (and reliance on) automobiles for personal transport made it possible for suburban development to expand into areas previously outside the boundaries of accessibility via public and active forms of transit. Notable characteristics of suburban design include low population densities, an emphasis on curvilinear streets connected to major arterial roads providing entry and exits into the neighbourhoods, and zoning regulations favouring single-family residences. Suburban neighbourhoods, with their single-use zoning and low population densities, were originally developed as 'clean' and 'healthy' residential alternatives to crowded and dirty urban environments. Today, suburban development has resulted in many neighbourhoods with a large proportion of unconnected street networks (cul-de-sacs) and a reduced number of intersections replacing the traditional grid design. This type of suburban design is often referred to colloquially as 'urban sprawl' or 'suburban sprawl'.

Increasing concentration of the population in urban areas has contributed to concerns about land use planning, particularly in cases where city size is increasing, but population density is not. The development and proposed implementation of 'smart growth' principles, emerging largely from the planning profession, has been one response to suburban sprawl and the challenges of low population densities in large urban areas. Planning for sustainable, smart growth incorporates ten key principles, aimed at fostering sustainable land use planning that will foster both environmental and population health: 1. Create Range of Housing Opportunities and Choices; 2. Create Walkable Neighbourhoods; 3. Encourage Community and Stakeholder Collaboration; 4. Foster Distinctive, Attractive Communities with a Strong Sense of Place; 5. Make Development Decisions Predictable, Fair and Cost Effective; 6. Mix Land Uses; 7. Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas; 8. Provide a Variety of Transportation Choices; 9. Strengthen and Direct Development Towards Existing Communities; 10. Take Advantage of Compact Building Design. (Smart Growth Online)

Impact of land use planning on chronic disease and injury

There is growing evidence of the impact of the built environment on the prevalence of chronic disease and injury. While most types of disease have been understood primarily in terms of individual risk factors, there have been some well known attempts to contextualize disease within an environmental framework. For example, noted epidemiologist Leonard Syme argues that "changing individual behaviours in isolation may be more difficult than modifying the environment that facilitates and promotes them" (Diez Roux 2003).

Physical activity

The benefits of physical activity to health have been well known since the U.S. Surgeon General released his report on physical activity and health in 1996. Physical activity has been shown to reduce the risk of heart disease, stroke, and some cancers. It has also been shown to improve mental health, lower blood pressure, facilitate weight loss and prevent falls among the elderly (US Department of Health and Human Services 1996). The impact of land use planning on levels of physical activity is the most researched area of any public health impact and the evidence from recent literature is summarized below.

Gebel et al. (2005) summarize nine review papers examining the relationship between the built environment and physical activity. These nine reviews contained 81 source papers published between the mid 1990's and 2005. The authors conclude there are consistent associations between physical activity and high population density, mixed land use, and street and urban form connectivity. There is a reasonably consistent association between access to infrastructure that supports physical activity (e.g. bicycle paths) and increased rates of physical activity. There is less evidence of an association between accessibility to recreation facilities and physical activity rates. Gebel et al. (2005) conclude that the review provides some promising evidence that aspects of the urban form are likely to influence physical activity.

In the U.S., the Transportation Research Board and the Institute of Medicine published a review in 2005 examining the relationship between the built environment and physical activity (Transportation Research Board 2005). This analysis reviewed 50 studies from both the urban planning/travel behaviour fields and 28 studies from the public health/physical activity fields. The findings from this report are similar to that of Gebel et al. (2005), in that the greater the land use mix, and population and employment density, the greater the number of walking and non-motorized trips. Certain neighbourhood types (i.e., traditional urban design) are also positively correlated with walking and non-motorized travel. The main limitation found in studies covered in this review is that almost all studies were cross-sectional in nature, meaning that it is not possible to determine causal relationships, although associations can be inferred. The authors stress that socio-demographic variables must be included in any assessment of built environment relationship to physical activity because these variables undoubtedly affect physical activity.

Killoran et al. (2006) report on seven reviews of transportation interventions that promote physical activity. The reviews were published between 1996 and 2005. In their synthesis they found that urban form (both objective and perceived) influences levels of walking and cycling. The availability, accessibility and convenience of destinations and facilities are positively associated with levels of physical activity. However, the authors note that certain confounding factors such as vehicle ownership and attitudes of people in each neighbourhood need to be controlled before more definitive statements can be made about the relationship between urban form and physical activity.

Heart health and respiratory illness

While both heart health and respiratory illness tend to be understood in terms of individual risk factors, there is increasing evidence demonstrating a link between these forms of chronic disease and the design of urban environments, particularly with respect to the health impacts of suburban design. No systematic reviews were found on the relationship between built environments and heart health or respiratory illness, so the studies cited in this section come primarily from individual studies or literature reviews.

Savitch (2003) makes a compelling case about the chronic disease impact of suburban land use planning, noting that there are significant health costs paid for the privilege of sprawling, low-density neighbourhoods, and resultant smog created by the auto-dependent design of these communities. A host of chronic illnesses have been linked in some way to exposure to smog, including asthma, bronchitis, emphysema, pneumonia, and the exacerbation of heart ailments (Savitch 2003). These links are also emphasized by other researchers who note that while direct causal links are difficult to establish, there is evidence suggesting strong correlations between environmental toxins and poor

health (Perdue 2003, Bray 2005). For example, asthma, a chronic respiratory disease, can be triggered by exposure to respirable particulate matter produced by cars and factories. Recent research suggests that in addition to aggravating existing asthma, long-term exposure to pollution may also *cause* asthma (Bray 2005).

Frumkin (2002) sums up the nature of the relationship between 'urban sprawl' and these health issues: "Sprawl is associated with high levels of driving, driving contributes to air pollution, and air pollution causes morbidity and mortality."

The 1996 Olympics, held in the sprawling and auto-dependent city of Atlanta, provided a natural experiment and well-documented demonstration of the connection between respiratory health and air pollution. Atlanta temporarily ameliorated the effects of pollution from vehicular sources by closing the downtown sector to private automobile travel and encouraging use of mass transportation. The result was a 41.6 per cent reduction in asthma-related admissions to hospital emergency rooms for those up to age 16 years (Friedman 2001).

A similar link between urban design and heart health has been noted by other researchers. Diez Roux (2003) cites mounting evidence regarding possible effects of air pollution on the development of cardiovascular disease, and argues that although research is currently scant, it is possible that air pollution could contribute to regional differences in cardiovascular risk. Bray et al. (2005) cite evidence that exposure to air pollution contributes to heart related morbidity, hospitalization and mortality.

A recent review of research on public health and the built environment notes a chain of linkages between the design of the built environment, driving, vehicle emissions, air quality and public health, and concludes that "community design is one important factor in improving public health"(Ewing, Frank 2006). Similarly, Krzyzanowski (2005) concludes that while evidence on transport-related air pollution is still somewhat scant, a review of this evidence "…indicates that transport-related air pollution contributes to an increased risk of death, particularly from cardio-pulmonary causes, and increases the risk of non-allergic respiratory symptoms and disease."

Safety and injury prevention

In spite of all the recent interest in built environments and health outcomes, little attention has been paid to the health outcomes that could be achieved if safety and injury prevention were identified as leading priorities in the design of built environments (Stevenson 2006). Injuries are the leading cause of death for those between the ages of 1 and 44 years in Canada (Alberta Centre for Injury Control and Research 2004). The burden of injury in Canada is significant, as an estimated $8.7 billion is spent annually in Canada to treat nearly two million preventable injuries (Canadian Nurses Association 2005). Transportation related injury is central to discussions of the public health impacts of built environments, and individual transportation choices are determined, in large part, by land use patterns.

Killoran et al.'s (2006) overview summarizes results from two reviews that identify the link between transportation interventions and the promotion of safe bicycling and walking. The authors note that there is evidence to suggest that traffic calming (engineering countermeasures like crosswalks, rumble strips and roundabouts) and speed limits can reduce the number of road traffic injuries and deaths.

The World Health Organization recently published a review estimating the impact of environmental factors on the global burden of disease. Drawing on past research and expert opinion, the authors estimate that approximately 17 per cent of road traffic injuries in North America can be attributed to environmental factors such as poor or inappropriate road design. The authors of this review contend that changes to the built environment can have major implications on rates of traffic injuries (Pruss-Ustun, Corvalan 2006).

No other systematic reviews were located that specifically examined land use impacts on traffic safety. Other findings come only from individual studies. For instance, one study stated that automobile dependent suburban design has resulted in higher levels of congestion and increased motor and pedestrian injuries and deaths (Ewing 2003). According to U.S. data, while six per cent of societal trips are made on foot, pedestrians absorb 13 per cent of all fatalities caused by automobiles (Savitch 2003). In general, compact cities with more extensive public transit systems have lower automobile fatality rates (including drivers and passengers, but excluding pedestrians) than more sprawling cities (Frumkin 2002, Ewing 2003). A recent report on public health and the build environment notes that the incidence of fatal and non-fatal injuries as a result of traffic accidents is closely related to vehicle miles travelled, automobile speed and traffic volumes, all of which are characteristics of travel "linked in the research to the design of the roadway and street network and the distribution of land uses" (Ewing 2006).

Fear of crime is another factor related to the safety of built environments. In order for people to walk and cycle to destinations rather than driving, the environment must be safe, or perceived to be safe, for that activity. Therefore environmental factors such as good sightlines, safe path and surface design, and adequate signage and lighting are critical for fostering active living (Knox 2003). It is important to note that merely providing a walking path is only one factor in promoting increased physical activity levels. As Knox (2003) argues, "…a walking/cycling path of inappropriate width that is located at the rear of dwellings surrounded by high fences is quite often unsafe and unused." Critical elements of path design include ensuring safe locations and path connectivity, for instance, ensuring the path connects to other paths and/or leads to destinations rather than 'going nowhere' or ending abruptly. Brunson et al. (2001) note the role of the built environment in creating and fostering 'defensible space' which in turn contributes to neighbourhood safety and sense of community.

Other factors that influence trail and path safety include surface materials, adequate signage and facilities en route such as seats and drinking fountains. The latter are particularly important for keeping older adults active, as is the provision of public washrooms. Maintenance of the built environment is also a critical (but often ignored) issue with respect to injury prevention. For example, while an extensive sidewalk network can contribute to the walkability of neighbourhoods, poor sidewalk maintenance can result in the type of cracked and uneven surfaces likely to cause injuries, especially in frail or vulnerable populations.

There is also a small but provocative body of literature on the connection between built environments and injuries related to violence. Some studies have shown an association between a deteriorated physical environment and higher rates of crime, making neighbourhoods less safe for walking, and in some cases resulting in greater social isolation (Srinivasan 2003).

Social effects of built environments

The form of built environments also influences social environments. As Diez Roux (2003) remarks, features of street connectivity and urban design may enhance or detract from social interactions among neighbours and may influence social cohesion as well as levels of physical safety and violence. There is a related body of research focussing on individual perceptions of safety, rather than actual safety, within various types of built environments, but this literature was not reviewed for this paper.

Physical features of neighbourhoods may contribute to the development of (local) social norms regarding appropriate behaviours. For example, the presence of sidewalks may influence the likelihood of neighbourhood walking and jogging, and over time a culture of physical activity may influence the likelihood of others becoming more active. 'Walkable' neighbourhoods - those with high street connectivity and a variety of destinations to walk to - may foster greater social connectivity. Reciprocal associations between physical and social environments may also exist. For example, neighbourhoods filled with individuals who regularly cycle to work may foster advocacy efforts for changing physical environments in ways more conducive to cycling (e.g., creating bike lanes or instituting traffic calming measures).

Urban design that incorporates mixed land uses - creating residential, commercial and recreational activities within a community - are thought to enhance connections between residents, and may facilitate social interaction and feelings of social inclusion. For example, Nasar (1995) found that residents of a mixed use neighbourhood had a greater sense of community than residents of a nearby residential, single use neighbourhood. Conversely, non-driving individuals living in automobile dependent suburban environments may face increased social exclusion as many of these neighbourhoods offer only limited non-automobile transportation options.

Levels of social interaction affect health, with decreased levels of social interaction having a negative effect on both mental and physical health. Social support and depression are two psychosocial factors correlated to heart health, and there is evidence these may be affected by the physical design of neighbourhoods (Diez Roux 2003). In the end, as Frank et al. (2006) note, practices that decrease time spent driving likely increase pedestrian activity, and may contribute to increasing social interactions. Safe, inclusive communities can help to foster both mental and physical health.

Conclusion

As the discussion above demonstrates, there can be little doubt that the end results of land use planning affect the health of populations. Health systems everywhere are currently struggling with the burden of 21st century public health problems, most notably chronic disease and injuries. In light of growing concerns about the sustainability of the health care system, interest has been growing in exploring how different types of urban design can promote health and influence the prevention of population-level factors that contribute to disease and injury.

It is worth noting that governments at all levels are already involved in many aspects of built environments through direct intervention and regulation. As such, "…the political choice is not *whether* to plan the built environment, but *how* to plan it" (Perdue 2003) in ways that benefit populations. It is stressed that planning choices ought to be influenced

by evidence about the associations between land use and health as "…the issue is not whether government should have rules that impact behaviour, but what behaviour it should encourage or discourage" (Perdue 2003). Consequently, the case needs to be made for public health input into land use decision-making processes. Ensuring that interested public health professionals have opportunities to develop the capacity to participate effectively in this process will, ideally, contribute towards the development of built environments that prevent chronic disease and injury, and promote population health.

References

Alberta Centre for Injury Control and Research (ACICR). (2004). Injury control facts for Canada and Alberta. [Online]. Available from URL: http://www.acicr.ualberta.ca

Bray R, Vakil C, Elliott D. (2005).Report on Public Health and Urban Sprawl in Ontario: A Review of the Pertinent Literature. Environmental Health Committee, Ontario College of Family Physicians; January.

Brunson L, Kuo F, Sullivan W. (2001). Resident appropriation of defensible space in public housing. Environment and Behaviour. Sep;33(5):626-652.

Canadian Nurses Association. (2005).The Built Environment, Injury Prevention and Nursing: A Summary of the Issues. [Backgrounder]. Canadian Nurses Association.

Chronic Disease Prevention Alliance of Canada. The case for change. [Online]. Available from: URL: www.chronicdiseaseprevention.ca/content/case_for_change/case_for_change.asp

Coburn J. (2004). Confronting the Challenges in Reconnecting Urban Planning and Public Health. American Journal of Public Health. Apr;94(4):541-546.

Diez Roux AV. (2003). Residential Environments and Cardiovascular Risk. Journal of Urban Health: Bulletin of the New York Academy of Medicine. Dec;80(4):569-589.

Ewing R, Frank L, Kreutzer R. (May 2006). Understanding the Relationship between Public Health and the Built Environment. Report prepared for the LEED-ND Core Committee.. Available from URL: http://www.usgbc.org/

Frank L, Kavage S, Litman T. (2006). Promoting public health through smart growth: Building healthier communities through transportation and land use policies and practices. Vancouver, B.C.: SmartGrowth BC; 2006.

Friedman MS, Powell KE, Hutwagner L, Graham LM, Teague WG. (2001). Impact of changes in transportation and commuting behaviours during the 1996 summer Olympic Games in Atlanta on air quality and childhood asthma. JAMA;285(7):897-905.

Frumkin H. (2002). Urban Sprawl and Public Health. Public Health Reports. May-June;117:201-217.

Gebel K, King L, Bauman A, Vita P, Gill T, Rigby A, and Capon A. (2005). Creating healthy environments: A review of links between the physical environment, physical activity, and obesity. Sydney: NSW Health Department and NSW Centre for Overweight and Obesity.

Killoran A, Doyle N, Waller S, Wohlgemuth C, Crombie H. (2006). Transport interventions promoting safe cycling and walking. [Evidence briefing]. London: National Institute for Health and Clinical Excellence (NICE).

Knox S. (2003). Planning as a Public Health Issue. Urban Policy and Research ;21(4):317-319.

Krzyzanowski M. (2005). Health Effects of Transport-Related Air Pollution: summary for policy makers. World Health Organization, Regional Office for Europe.

Nasar J. (1995). The psychological sense of community in the neighbourhood. Journal of the American Planning Association;61(2):178-184.

Perdue W, Gostin L, Stone L. (2003). Public Health and the Built Environment: Historical, Empirical and Theoretical Foundations for an Expanded Role. Journal of Law, Medicine and Ethics;31:557-566.

Pruss-Ustun AP, Corvalan C. (2006). Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease. Geneva: World Health Organization.

Public Health Agency of Canada. (2003). Integrated approach to chronic disease. [Online]. Available from: URL: www.phac-aspc.gc.ca/ccdpc-cpcmc/topics/integrated_e.html

Savitch HV. (2003). How Suburban Sprawl Shapes Human Well-Being. Journal of Urban Health: Bulletin of the New York Academy of Medicine. Dec;80(4):590-607.

Schechter M, Virchow R. (2003). Public Health and the Built Environment. Journal of Urban Health: Bulletin of the New York Academy of Medicine. Dec;80(4):523-524.

Schilling J, Linton L. (2005). The Public Health Roots of Zoning: In Search of Active Living's Legal Genealogy. American Journal of Preventative Medicine;28(2S):96-104.

Smart Growth Online. Principles of Smart Growth. [Online]. Available at URL: http://www.smartgrowth.org/about/principles/default.asp

Srinivasan S, O'Fallon L, Dearry A. (2003). Creating Healthy Communities, Healthy Homes, and Healthy People: Initiating a Research Agenda on the Built Environment and Public Health. American Journal of Public Health. Sep;93(9):1446-1450.

Stevenson, M. (2006). Building Safer Environments: Injury, Safety and Our Surroundings. Injury Prevention;12:1-3.

Transportation Research Board. (2005). Does the built environment influence physical activity?: Examining the evidence. Washington, D.C.: Transportation Research Board & Institute of Medicine.

US Department of Health and Human Services. (1996). Physical activity and health: a report of the Surgeon General. Atlanta, Georgia: US Department of Health and Human Services, Public Health Service, CDC, National Center for Chronic Disease Prevention and Health Promotion.