CHAPTER 23

The Built Environment and Obesity: Trimming Waistlines through Neighbourhood Design

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Introduction

Obesity is a burgeoning public health problem in Canada. One in four Canadian children aged 2–17 and nearly six out of 10 adults (18 years and older) are overweight or obese (Shields and Tjepkema, 2006). Childhood obesity rates in Canada have nearly tripled over the past 25 years (Shields, 2005). Similar increases in obesity rates have been identified in the United Kingdom, the United States, and other developed nations. The increased prevalence of obesity has been linked to the concurrent rise of many socio-psychological and physical health problems. Not surprisingly, policy-makers are struggling to find effective and cost-efficient methods for obesity prevention.

It is understood that obesity results from an imbalance between energy intake and energy expenditure, in other words, by eating too much and exercising too little. While health researchers have focused traditionally on individual-level factors, such as genetic predisposition, recent work suggests that environmental factors also may influence body weights and overall well-being through the opportunities they provide for promoting or hindering healthy behaviours. Recent literature suggests that the ways in which cities have been designed and constructed over the past half-century or so, with increasing automobile dependence and limited opportunities to walk for utilitarian purposes, may be at least partly to blame for the rise in obesity rates in North America (see Bunting and Filion, Chapter 2; Filion and Bunting, Chapter 3; Perl and Kenworthy, Chapter 11). Furthermore, since dietary intake and energy expenditure are modifiable behaviours, it is crucial to understand how environments influence behaviour, as environmental interventions may be among the most effective strategies at mitigating the obesity epidemic that now plagues many developed nations. Unfortunately, the paucity of Canadian data on environmental determinants of physical activity and food consumption patterns limits the development of evidence-based recommendations for policy and practice. But this is a very new and exciting area of research and there is every reason to believe that policy-related measures might see implementation within the next few years.

Following a brief overview of the obesity problem in Canada, this chapter examines the evidence on the environment–obesity link and then discusses potential interventions for building healthier communities.

The Problem: Obesity 'Epidemic' in Canada

Obesity is an important risk factor for a number of chronic diseases, and it entails substantial financial burden on Canada's health-care system. The

percentage of Canadian adults considered obese increased from 10 per cent in 1970 to 23 per cent in 2004—from 8 to 23 per cent in men and from 13 to 22 per cent in women (Luo et al., 2007).[1]

Obesity has been linked to many physical health problems, including type-2 diabetes, hypertension, heart disease, sleep apnea, pulmonary diseases, and certain cancers (Marcus et al., 1996; Fagot-Campagna, 2000; Figueroa-Colon et al., 1997; Figueroa-Munoz et al., 2001). Obesity has also been linked to increased prevalence of socio-psychological problems such as discrimination, behavioural problems, negative self-esteem, anxiety, and depression (Strauss and Pollack, 2003). Furthermore, recent estimates show that obesity places a significant financial burden on the Canadian health-care system, responsible for about $4.3 billion per year in direct and indirect costs (Katzmarzyk and Janssen, 2004).

Distinct regional variations in obesity exist across Canada. In 2004, 34 per cent of adults in Newfoundland and Labrador were considered obese, compared to only 19 per cent of adults in British Columbia (Shields and Tjepkema, 2006). Perhaps even more dramatic are the variations with respect to degree of urbanization. In general, Canadian adults who reside in census metropolitan areas are much less likely to be obese than those living outside of CMAs (20 per cent versus 29 per cent). Furthermore, in CMAs with 2 million or more people, only 17 per cent of adults were obese. Adult obesity prevalence was 24 per cent in CMAs with a population of 100,000 to 2 million, and 30 per cent in urban centres with a population of 10,000 to 100,000. A closer look at individual cities indicates that St John's has the highest rates of adult obesity at 36.4 per cent, and Vancouver the lowest at 11.7 per cent. If we consider adults who are also overweight, then Hamilton takes the title as Canada's 'fattest city', with 74.3 per cent of adults obese or overweight, and Halifax has the lowest levels of obese/overweight adults at 47.8 per cent (see Table 23.1). A simple analysis of available data suggests that there may be a negative relationship between city size and levels of obesity ($r = -0.53$) and overweight ($r = -0.42$). Such correlations have led some researchers in the US and Canada to argue that differences in obesity prevalence may be due to the respective level of 'urban sprawl' (see also Donald and Hall, Chapter 16).

Exploring the Link between the Built Environment and Obesity

Although it is widely accepted that today's obesity epidemic is due to changing behaviours associated with energy intake and energy expenditure, the underlying determinants of those obesity-related behaviours are not as straightforward. Public health promoters and researchers have long argued that people's abilities to lead healthy lives depend on characteristics of the environments in which they live, work, learn, and play. In one of the earliest studies to propose an ecologic paradigm for understanding obesity, Egger and Swinburn (1997) posited that increasing rates of obesity should be considered as a normal response to an abnormal environment. Following this argument, an increasing amount of research over the past decade has been aimed at exploring if, what, and how obesity-related, or 'obesogenic', behaviours are related to the built environment. Simply defined, the built environment refers to those components of our physical surroundings constructed by humans, such as buildings, parks, and transportation networks; its design can have a significant effect on many lifestyle decisions and behaviours related to obesity, as conceptualized in Figure 23.1.

The Role of the Built Environment on Energy Intake

Eating behaviours have a significant impact on the overall health of an individual. Four of the 10 leading causes of death in the United States are diseases directly related to diet (Zenk et al., 2005).

Table 23.1 Proportion of Adults Who Are Overweight or Obese, Canadian CMAs, 2004

CMA	Population (000s)	Overweight (BMI >25)*	Obese (BMI >30)
Hamilton	452	74.3	34.6
Kingston	81	70.1	28.9
St John's	159	70.0	36.4
St Catharines–Niagara	346	69.3	23.1
Saint John	124	68.9	34.7
Saskatoon	147	64.5	27.0
Gatineau	199	63.6	n/a
Oshawa	208	63.5	29.6
Victoria	251	62.6	19.0
Kitchener	450	62.3	30.7
Edmonton	946	62.2	20.1
Greater Sudbury	72	62.1	26.1
Ottawa	636	62.0	19.7
London	470	61.6	26.6
Thunder Bay	185	60.0	32.6
Abbotsford	110	58.3	25.0
Winnipeg	525	58.2	25.2
Regina	151	58.1	31.8
Quebec	552	56.8	17.3
Trois-Rivières	139	56.6	n/a
Windsor	99	56.5	33.2
Calgary	765	53.8	25.7
Sherbrooke	97	52.4	n/a
Saguenay	141	52.3	18.9
Vancouver	1,720	51.8	11.7
Montreal	2,577	51.6	21.2
Toronto	3,772	50.9	15.6
Halifax	284	47.8	18.4

*Includes obese

Source: Statistics Canada, 2004 Canadian Community Health Survey.

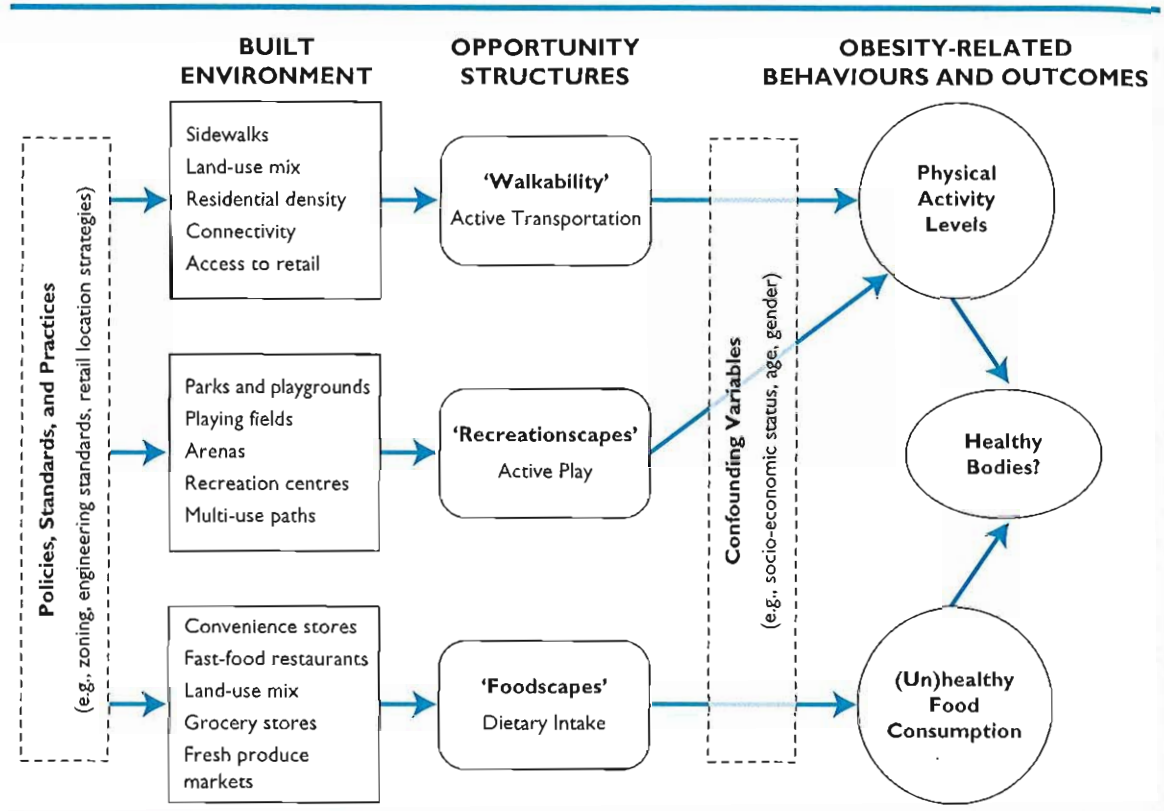

Figure 23.1 Conceptual diagram illustrating the potential influence of the built environment on obesity

The majority of obesity-related health problems are caused by a diet with low fruit and vegetable consumption and high fat and sugar content (WHO, 2003). Dietary habits have changed significantly in recent decades, as a greater proportion of food consumption is taking place outside of the home (Cummins and Macintyre, 2006; Nielsen et al., 2002; Blay-Palmer, Chapter 24). The growing belief among planning and health researchers is that the changing dietary habits of North Americans are associated with major shifts in the food retail environment, which has limited the access to healthy food retailers such as supermarkets and increased the availability of unhealthy foods through the proliferation of 'junk-food' outlets.

The Potential Influence of 'Food Deserts' on Diet and Health

The recent emergence of '**food deserts**', or areas of cities with relatively poor access to healthy and affordable food, has been attributed to the ongoing suburbanization of food retailers in North America and the United Kingdom. In many US cities, low-income, minority-dominated urban neighbourhoods are often considered food deserts, as grocers have vacated these communities in recent decades (Eisenhauer, 2001; Weinberg, 2000; Zenk et al., 2005). Several studies in the UK have also identified food deserts in socially deprived areas, typically local authority housing estates in suburban rather than inner-city locations (Clarke et al., 2002;

Sooman et al., 1993; Wrigley, 2002). Canadian findings are mixed. In London, Ontario, Larsen and Gilliland (2008) identified low-income, inner-city neighbourhoods as 'food deserts' using a variety of GIS-based techniques of network analysis to assess supermarket accessibility within a 10–15-minute walk or public transit ride. Moreover, they showed how spatial inequalities in access to supermarkets in London had increased over time: in 1961, more than 75 per cent of London's inner-city population lived within a kilometre of a supermarket; by 2005, that number was less than 20 per cent (see Figure 23.2). On the other hand, Apparicio and colleagues (2007) found that food deserts are 'missing' in Montreal and access to healthy food is not a major issue for Montreal residents. Furthermore, Smoyer-Tomic and colleagues (2006) found that, on average, low-income neighbourhoods near Edmonton's city centre actually had the best supermarket access in the city; however, certain high-needs neighbourhoods still had poor access.

Grocery retailing practices in North American cities have changed repeatedly over the past century; small independent food markets gave way to small chain food stores, which were then superseded by larger supermarkets. Since the early 1990s, the trend has been to erect giant superstores on suburban lands that 'offer more land for parking,

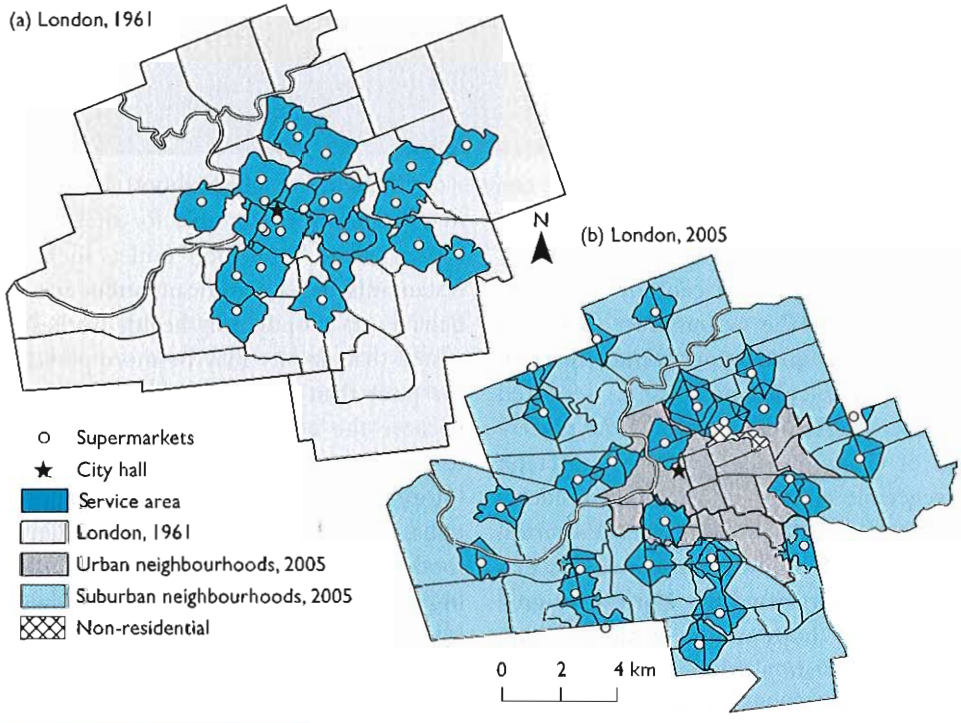

Figure 23.2 The evolution of food deserts in London, Ontario, 1961–2005

The location of supermarkets and 500-metre network service areas reveals retail migration out of the urban core.

Source: Larsen and Gilliland (2008).

easier loading and unloading for trucks, convenient access to highways, and a development context for much larger stores' (Pothukuchi, 2005: 232). These superstores have created new challenges for urban planners and engineers around traffic, parking, public transit, and other issues that occur in the planning review process. The abandonment of smaller inner-city supermarkets has also presented challenges for public health policy-makers due to the uneven distribution of healthy, affordable food opportunities.

Recent empirical studies have identified high rates of obesity and individuals who are overweight among residents living in neighbourhoods without a supermarket (Morland et al., 2006). Since supermarkets are the primary source of healthy and affordable food for most people, poor access to a supermarket makes it harder to maintain a healthy diet. A large US study involving over 10,000 respondents across four states (Maryland, North Carolina, Mississippi, and Minnesota) discovered that white Americans' fruit and vegetable consumption increased by 11 per cent with the presence of one or more supermarkets in their census tract, and black Americans' fruit and vegetable intake increased by 32 per cent for each additional supermarket in the census tract (Morland et al., 2002). Using a 'quasi-experimental' research design, Wrigley and colleagues (2002) reported that improved retail food access in an underserved area of Glasgow had a positive impact on fruit and vegetable consumption among residents who shopped at the new supermarket. Empirical research in the UK, US, and Canada indicates that residents of food deserts pay higher prices for groceries at small food shops and convenience stores where healthy foods are also scarcer (Chung and Myers, 1999; Kayani, 1998; Larsen and Gilliland, 2008). In addition, Bertrand and colleagues (2008) found that 40 per cent of Montreal residents without an automobile had poor access to fresh fruits and vegetables. Such findings remind us that 'access' to healthy food is not only a geographic issue but is fundamentally economic, as food prices and transportation costs also influence healthy food choices.

In North American cities today, the reality is that most new grocery superstores are found, along with other 'big-box' outlets, in expansive retail centres, which are almost always built in areas beyond walking distance from residential land uses, which essentially makes them accessible only to consumers with automobiles (see Figure 23.3).

The Built Environment and 'Junk-Food' Consumption

It is commonly believed that fast food is contributing to an overall increase in childhood obesity. The average American adolescent has been reported to frequent fast-food restaurants twice a week (about 100 times per year), accounting for approximately one-third of his or her away-from-home meals (Guthrie et al., 2002). Children are now consuming more fat in their diets than ever before, and this rate continues to rise as children enter adolescence (Crownfield, 2004).

Changing neighbourhood food environments may be partly responsible for the rise in obesity; easy access to 'junk-food' outlets such as fast-food restaurants has a significant influence on dietary behaviours. Population health studies have suggested that obesity may be more prevalent among the poor than the rich in industrialized countries because the poor are more likely to be exposed to—or constricted in their choice to—fast food (Story et al., 2002). One study in Melbourne, Australia, for example, showed that the density of fast-food restaurants is 2.5 times higher in low- versus high-status neighbourhoods (Reidpath, 2002). Likewise, in Edmonton the odds of being exposed to fast-food outlets are greater in socially disadvantaged areas with more Aboriginal residents (Peters, Chapter 22), lone parents (Townshend and Walker, Chapter 8), renters (Walker and Carter, Chapter 20), and low-income households (Walks, Chapter 10) (Smoyer-Tomic et al., 2008). Positive associations have also been identified between the density

Figure 23.3 A 'club' format food retailer: automobile-oriented development on the rural fringe of London, Ontario. (J. Gilliland)

of fast-food restaurants and adult obesity rates at the state level (Chou et al., 2004; Maddock, 2004).

For children and youth, the food environment around their schools has a significant impact on diet, and in turn, may influence obesity levels (French et al., 2001; see also Rosenberg and Wilson, Chapter 21). Ongoing research in London, Ontario, indicates that fast-food restaurants and convenience stores are significantly clustered around elementary schools, particularly those in low-income neighbourhoods (see Figure 23.4); furthermore, increased proximity and density of junk-food opportunities within walking distance (500 metres) around the school and/or home were linked with increased purchasing of junk food (Gilliland and Tang, 2007). These findings support the call for additional research and policy interventions to address the proliferation of junk food in youth-oriented neighbourhoods.

Role of the Built Environment on Energy Expenditure

It is well known that a physically active lifestyle is supportive of overall health. For older adults, physical activity can reduce the risk of heart disease and high blood pressure, and can improve musculoskeletal health and overall quality of life (Brandon et al., 2009; Greenberg and Renne, 2005). Physical activity can also improve independence and functional ability, which can reduce hospitalization, morbidity, and mortality (Ackermann et al., 2008; Berke et al., 2007; Takano et al., 2002). Higher physical activity levels among children and

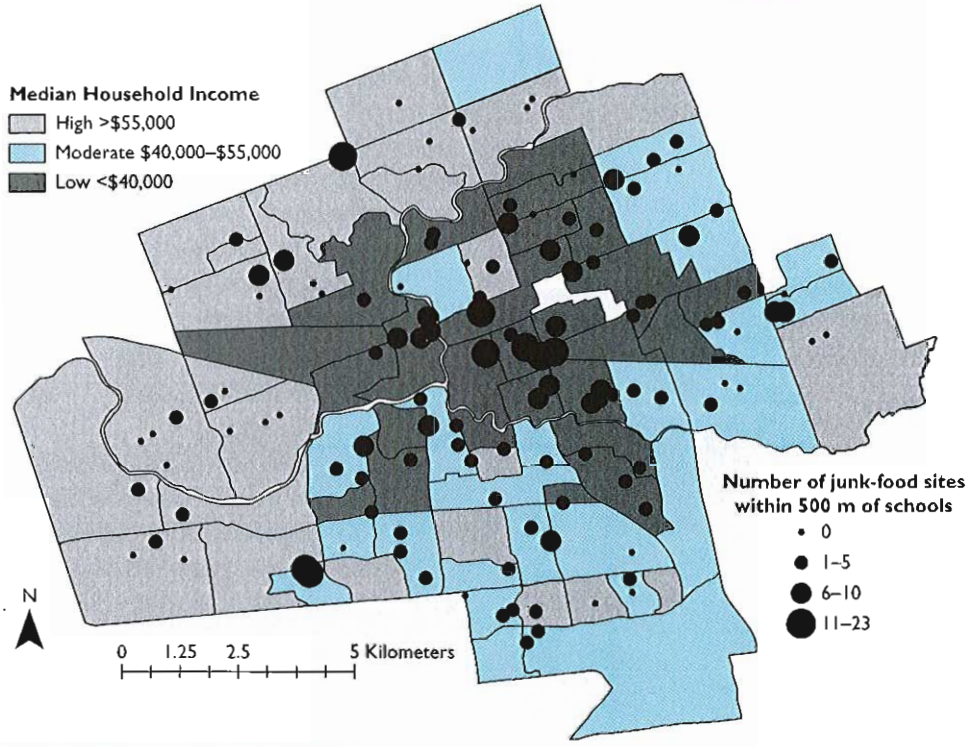

Figure 23.4 Junk food targeted to poor kids?

Elementary schools in low-income areas of London, Ontario, are exposed to three times more junk-food outlets than are high-income schools.

youth have been correlated with academic achievement, healthy body weight promotion, positive self-esteem, and positive attitudes and behaviours (Canadian Paediatric Society, 2002). Unfortunately, the majority of Canadians, both young and old, are not physically active enough to reap the health benefits (Allison et al., 2007).

An increasing number of planning and public health researchers are recognizing that prevailing patterns of land use and development (see also Grant and Filion, Chapter 18) in North American cities negatively impact physical activity levels in that they discourage active modes of travel such as walking and restrict opportunities for physical recreation. Evidence for these arguments is explored below.

Built Environments for Physical Activity: 'Recreationscapes'

Opportunities for recreation within neighbourhood environments obviously are important for facilitating physical activity. Numerous studies in the US, Australia, and Canada have found that convenient access to publicly provided recreational opportunities such as parks, playgrounds, and other recreation facilities is consistently associated with higher rates of physical activity and decreased overweight, especially among children and adolescents (Gordon-Larsen et al., 2006; Maziak et al., 2007; Norman et al., 2006; Sallis et al., 2000). As early as 1990, James Sallis, the pioneer of 'active living research', and his colleagues showed that the

frequency of exercise among San Diego residents was related to the distance between their homes and available exercise facilities. In a recent study in London, Ontario, it was discovered that children who had two or more public recreation facilities within 500 metres of their home were active for 16 additional minutes after school per day than were those who had fewer amenities (Tucker et al., 2009). Opportunities located within walking distance of home may be doubly important for stimulating active behaviours as both the route and the destination contribute to overall activity levels.

A few recent studies have adopted an 'environmental justice' approach to exploring parks, as access to affordable, quality recreation facilities and programs may not be equitably distributed across neighbourhoods (Gilliland et al., 2006; Taylor et al., 2006). Children from low-income households may have fewer opportunities for health-promoting activity due to reduced access to high-quality parks, a reduced ability to afford fee-based recreation programs and/or transportation to free facilities outside their own neighbourhood, as well as parental concerns regarding neighbourhood safety (Gilliland et al., 2006, 2007; Tucker et al., 2007; see also Cowen, Siciliano, and Smith, Chapter 17). Numerous US studies have indicated that parks are less likely to be available, and more likely to be of poorer quality, in low-income neighbourhoods and/or those with high proportions of visible minorities (Loukaitou-Sideris, 2002; Wolch, 2005). Contrary to US studies, Smoyer-Tomic and colleagues (2004) found in Edmonton that low-income, high-social-need neighbourhoods had equitable spatial access to playgrounds; however, the condition of playgrounds in these neighbourhoods was often poorer than those in higher-income neighbourhoods. In their evaluation of a small sample of 28 parks selected from six urban neighbourhoods in Montreal, Coen and Ross (2006) discovered that parks in poor neighbourhoods were of significantly lower quality than those in high-income neighbourhoods. Based on detailed field audits of every public park (n = 208) in London, Ontario, Gilliland and colleagues found no distinct socio-spatial inequity with respect to the availability and quality of public parks in that city, but did identify the existence of 'recreational deserts', or areas where children did not have easy access to a good place to play (Gilliland et al., 2006, 2007).

The perception of poorer-quality facilities has been associated with lower levels of physical activity among adolescents (Romero, 2005). In London, Ontario, it was found that high-quality parks were heavily frequented in all neighbourhoods, whereas poor-quality parks were virtually abandoned in all but the lowest-income neighbourhoods (Gilliland et al., 2007). Recent interviews with parents in London revealed that their perceptions of poor neighbourhood safety and the perceived long distances to activity facilities were significant barriers to physical activity for young children (Tucker et al., 2007). Similarly, speaking with elementary school students in London, Tucker and colleagues (2008) learned that youth *want* to use parks, yet often avoid them because of their undesirable qualities, such as garbage, safety issues, or lack of lighting. These findings highlight the need for city planners to better understand and address both children's and parents' perceptions of features of the built environment that support or hinder physical activity and restorative play.

Built Environments for Physical Activity: Walkability and Active Travel

The most common form of physical activity for people of all ages is walking. Even moderate increases in walking have been linked to numerous health benefits among adults, such as better body weight and overall fitness, as well as protection from high blood pressure, diabetes, cancer, cardiovascular disease, osteoarthritis and hip fractures, stress, and depression (Demers, 2006; Frank et al., 2003). Both walking and biking are common forms of recreational physical activity, but they are also utilitarian forms of physical activity, as they

are a both a practical mode of transport to work, school, or shop. For many adults, the journey to work represents the most convenient opportunity to be physically active on a regular basis; however, recent data on the commuting patterns of Canadian adults from the 2006 census indicate that only a small percentage of the employed population take an active mode of travel such as walking or biking to their job sites. Furthermore, as seen in Figure 23.5, the data suggest that cities with the highest proportions of their working population commuting via a private vehicle also have the highest percentage of overweight citizens.

For children and youth, the journey to school represents a significant opportunity to increase daily levels of physical activity. Research suggests that children who walk or bike to school also tend to be more physically active during other parts of the day (Cooper et al., 2005). Nevertheless, the proportion of students who use active transportation modes (e.g., walking, cycling, skating) to and from school has decreased dramatically in recent years; a nationwide survey of children in the US revealed a decline from 41 per cent to 13 per cent over the last 25 years (McDonald, 2007). Clearly, some of this change is related to the growth in

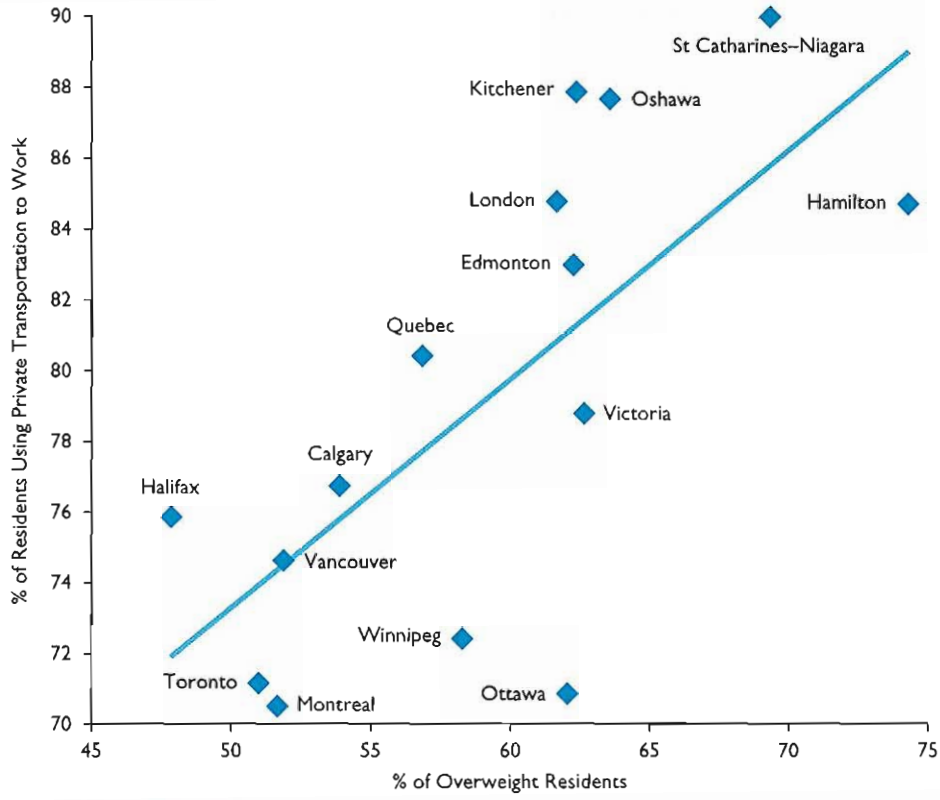

Figure 23.5 The relationship between driving and obesity

Cities with a high proportion of workers commuting by private automobile also tend to have a high proportion of overweight or obese residents ($r^2 = 0.5$).

Source: Data on 15 largest CMAs from 2006 census.

private schools, charter schools, and amalgamations that make it difficult if not impossible for children to transport themselves to school as well as to parental fear of predators, unsafe neighbourhoods, etc. (see Cowen, Siciliano, and Smith, Chapter 17). Further research will be needed to sort out the strength of the effect of the environment when these other factors are controlled for.

Either way, a growing body of research indicates that environmental features such as the presence of sidewalks, multi-use pathways, and retail shops, as well as the configuration of streets and the mix of land uses, have a significant influence on walking behaviours (Frank et al., 2003, 2006; Owen et al., 2004) (see Table 23.2). The majority of this research has focused on the environmental factors that influence utilitarian travel (i.e., to work, to shop, to school) rather than walking for pleasure, exercise, or overall health. Indeed, the earliest studies on this subject were performed mostly by urban planners rather than health scientists, and more specifically by transportation planners, whose pioneers include Susan Handy (Handy et al., 2002), Robert Cervero (Cervero and Duncan, 2003), and Lawrence Frank (Frank and Kavage, 2008). Because much of this work has focused on commuting, subjects have typically been adults of traditional 'working age', between 18 and 65 years old. The current popularity of 'new urbanist' communities (Grant and Filion, Chapter 18) as an alternative to the traditional suburb owes its popularity, at least implicitly if not explicitly, to a dawning societal recognition that the way we produce communities has a great impact on individual health and well-being; indeed on our social construction of ourselves as a society.

Much less is known about environmental factors influencing active travel behaviours among youth, despite the fact that they are typically less mobile and the group most likely to benefit from increasing **walkability** in local neighbourhoods. Research on active travel among youth, which has largely drawn its variables from studies of adults, has suggested that neighbourhood factors such as distance to school, land-use mix, and various characteristics of urban design such as the presence/absence of sidewalks influence decisions regarding a child's mode of travel to school (Kerr et al., 2007; McMillan, 2005, 2007). Current evidence from US and Canadian studies indicates that distance

Table 23.2 Established Environmental Factors Correlated with Increased Walking

Environmental Support	Selected References
Population density	Cervero, 1996; Frank and Pivo, 1995
Employment/office density	Lee and Moudon, 2006; Frank and Pivo, 1995; Kockelman, 1997
Retail/commercial density	Lee and Moudon, 2006; Cervero and Duncan, 2003; Cervero, 1996
Land-use mix	Larsen et al., 2009; Cervero and Duncan, 2003; Frank and Pivo, 1994
Sidewalks, paths, and trails	Kitamura et al., 1997; Hess et al., 1999; Troped et al., 2001
Intersection density	Cervero and Duncan, 2003
Street lighting	Cervero and Kockelman, 1997
Street trees	Larsen et al., 2009
Shorter trip distance	Larsen et al., 2009; Kockelman, 1997

Source: Gilliland, Jason and Kristian Larsen, 2010. 'Planning Pathways to Health: Assessing the Impact of the Built Environment on Walking Behaviours', in Pathways to the Future: Proceedings of the International Planning Conference (Christchurch, NZ: New Zealand Planning Institute).

between home and school is the most important barrier to choosing to walk to school (Larsen et al., 2009; Schlossberg et al., 2006). A recent study of the journey-to-school among over 800 children aged 11–13 in London, Ontario, revealed that 52 per cent took an active mode of travel to school (48 per cent walked and 4 per cent used bike, scooter, or rollerblades); however, that figure rose to 62 per cent for those who lived within 1.6 km of school and to 93 per cent for those who lived within 500 metres of school (Larsen et al., 2009).

Research also suggests that the layout or design of certain features of the built environment plays an important role in choice of travel mode, although the evidence is somewhat mixed regarding exactly how this occurs. The density of street intersections, for example, is related to route options and 'connectivity' in the local neighbourhood, and it has been shown to have positive associations with rates of active travel (Braza et al., 2004; Kerr et al., 2007) (see Figure 23.6). Intersection density is also related to increased number of roadway crossings, however, which raises safety concerns that may negatively affect rates of active travel, particularly among school-aged children and the elderly. Likewise, a few studies have indicated that higher residential densities are an important factor towards increasing active travel among adolescents (Frank et al., 2007; Kerr et al., 2007), but other studies have found no relationship between residential density and walking to school (Larsen and Gilliland, 2009). The presence of sidewalks, which arguably can increase pedestrian safety, has been linked to increased walking and bicycling to school in the US (Fulton et al., 2005; Kerr et al., 2006), but the variable has not appeared to be significant in Canadian studies (Larsen et al., 2009). In addition, a recent Canadian study has indicated that increased tree coverage

A. Typical urban school neighbourhood

B. Typical suburban school neighbourhood

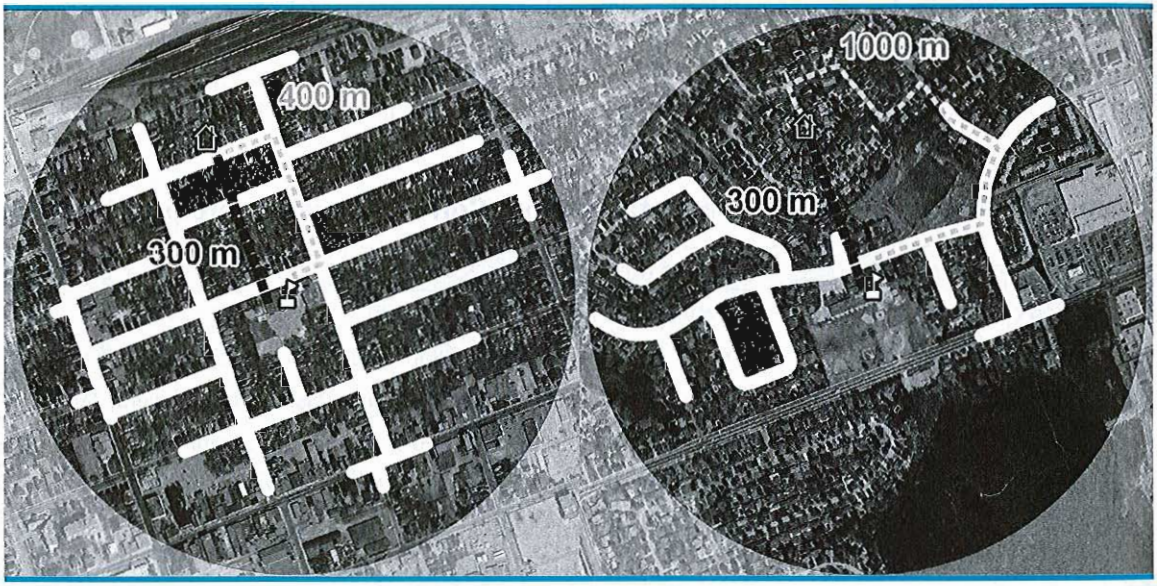

Figure 23.6 Street network patterns and neighbourhood walkability

In school neighbourhood B, the student must travel 2.5 times farther from home to school than in A, even though they are the same distance apart (300 metres) 'as the crow flies'.

Source: Gilliland, J. 2010. 'Healthy by Design: Planning for Children's Well-Being', Designing Auckland: A Mayoral Conversation, City of Auckland, New Zealand.

along streets is positively associated with likelihood of walking to school (Larsen et al., 2009).

Finally, higher density and mix of land uses have been linked to increased rates of walking and physical activity in adults for utilitarian travel, as such factors increase the number of potential nearby walking destinations (Frank et al., 2004; Owen et al., 2004; Saelens et al., 2003;). The relationship between the density or mix of land uses and children's travel is less clear: it may be that neighbourhoods of high density and land-use mix provide a more interesting walk to school than uniformly zoned residential neighbourhoods; on the other hand, highly dense and highly mixed areas may be perceived by parents as being unsafe. Recent work in London, Ontario, by Larsen and colleagues (2009) indicates that rates of walking or cycling to school among adolescents were higher in areas with greater land-use mix, after controlling for other key factors. In a US setting, Kerr and colleagues (2006) also found a positive correlation between land-use mix and non-motorized travel to school, but Ewing and colleagues (2004) found the opposite. Although some results are mixed, research on younger populations is scant but growing, and current findings suggest that both community design and geographical factors influence levels of active transportation among youth, and possible environmental interventions may exist for making neighbourhoods more walkable.

Discussion and Conclusions: Where Do We Go from Here?

Given the growing body of evidence linking the built environment to dietary behaviours, physical activity patterns, and expanding waistlines, it can be argued that the way we have built our communities in Canada in recent decades has been a major cause of the recent obesity epidemic. The remainder of this chapter presents a road map for future work on building healthy communities, beginning with avenues for future research and concluding with suggestions for (re)designing environments for health.

How Can We Build Healthier Communities?

What can policy-makers, city planners, engineers, developers, builders, and other agents of change in the built environment learn from this growing body of research? How do we modify current and future development to alter critical obesity-related behaviours? What suggestions can be put forward for retrofitting, or should we say 'retrofitnessing', cities for improving the body weights and overall health of Canadians?

Cultivating healthier community food environments is critical for improving dietary habits and promoting healthy body weights. To attract supermarkets back to underserved, inner-city food deserts, municipalities could introduce financial incentives, such as building restoration initiatives or land 'swaps', or change zoning or parking regulations. Any municipal strategy for inner-city redevelopment must recognize the positive correlation between supermarkets and population density. The existence of a local supermarket makes a neighbourhood more attractive to (potential) residents; likewise, the existence of a large number of residents (potential customers) makes a neighbourhood more attractive to a potential supermarket owner.

In locations that cannot attract or support a supermarket, alternative strategies, such as farmers' markets, are available for improving access to fresh, healthy, and affordable food. Using a 'pre-test/post-test' research design, Larsen and Gilliland (2009) identified how the opening of a farmers' market greatly improved the price and availability of fresh and healthy food in one disadvantaged neighbourhood of London, Ontario, that previously had been considered a food desert. Furthermore, they estimated that the annual savings to the household grocery budget due to improved access associated with the market was equivalent to the average monthly rent in that city; thus, they further argued that the particular disadvantaged neighbourhood

under surveillance could no longer be considered a food desert. Farmers' markets have long been fixtures in many of Canada's larger cities. The St Lawrence Market in downtown Toronto, for example, has fed local residents and visitors for over two centuries. Likewise, the Atwater and Jean Talon markets in Montreal are embedded in the fabric of their low-income neighbourhoods, but each one also serves a larger clientele, being easily reached via public transit. It is possible that many older, inner-city neighbourhoods in other Canadian cities have a stock of underutilized warehouse buildings that could support a permanent indoor market; where buildings are not available, outdoor markets can occupy sections of underutilized parking lots (particularly on weekends) or space on retail-oriented streets that are temporarily closed to automobiles during the hours of market operation. Furthermore, outdoor markets can be moved throughout the city, serving different neighbourhoods on different days of the week.

Planning and policy interventions are necessary to limit the concentration of junk-food retailers within a certain distance of schools and to restrict junk-food sales and advertising targeted to children and youth. Some US cities, including Los Angeles and New York City, have introduced zoning restrictions to ban the sale of trans fats; to date, no Canadian city has enacted similar strategies. Given Canada's government-funded universal health-care system, where all taxpayers ultimately bear the burden of the costs associated with obesity, it is reasonable to believe that Canadians would be even more accepting of a legislative approach than US citizens.

Designing, building, and retrofitting neighbourhoods to encourage physical activity is critical. Creating high-quality public places to play for different populations in all neighbourhoods is critical for increasing levels of physical activity. Given the scarcity of large parcels of open space in older (already developed) areas of the city, in order to rectify current inequities city planners need to adopt innovative strategies for providing new recreation spaces in older neighbourhoods, such as the acquisition and redevelopment of vacant lots and underutilized schoolyards, as well as any available **'brownfield' sites** (i.e., former industrial land) and **'greyfield' sites** (e.g., former commercial plazas). In addition, future investments of increasingly scarce municipal resources should be aimed at creating multi-purpose recreation spaces that appeal to multiple demographic groups.

Besides improving neighbourhood 'recreationscapes' for participation in sports, a more effective method to get Canadians moving will be to build or retrofit our cities so that they are more supportive of active modes of travel, such as walking or biking. Increasing reliance on the automobile over the past half-century has led to increasingly sedentary lifestyles. The first step in promoting walkable urban forms is to rework or remove obsolete zoning laws and engineering standards. Numerous studies confirm that children and adults in neighbourhoods with a high mix of land uses walk much more often than their counterparts in more homogeneous residential neighbourhoods; the former have more destinations easily reachable on foot. Therefore, zoning laws that still serve to segregate land uses should be rewritten to promote walking and support public health. It is also time to critically review long-standing engineering standards focused on outdated 'minimums' (e.g., minimum parking requirements or road widths), which have long served to prioritize the automobile. A number of strategies have been proposed for 'taming' city streets to make them more pedestrian-friendly: reduce street widths; build or widen sidewalks; install clearly marked bike paths; redesign crosswalks; make pedestrian lights longer; plant trees along streets; and reduce speed limits on streets of potentially high pedestrian traffic. While the specific impacts of these planning and design strategies on walking and physical activity are still being empirically validated, these suggestions should be relatively easy to introduce and

will undoubtedly enhance the pedestrian experience in Canadian cities.

Many researchers also suggest that walking levels can be increased by improving neighbourhood 'connectivity', which essentially refers to how directly or efficiently a person can move from one location to another using existing circulation networks. The majority of previous studies have identified neighbourhoods of high connectivity as those having a high density of street intersections, and by extension they have shorter blocks, more direct routes, and a greater variety of route options; such ideas were first popularized by Jane Jacobs in 1961, in her now classic text, *The Death and Life of Great American Cities*. But connectivity is about more than just street intersections; to lessen dependency on the private automobile, planners must carefully plan the courses of bike trails, multi-use pathways, and bus routes, and also (re)think links between transport modes to ensure direct and efficient routes to significant places (e.g., universities, shopping centres, and workplaces). A new bicycle path, for example, will have little impact on encouraging active commuting if it is constructed in low-density areas far away from residences and/or workplaces. On the other hand, residents in a 'food desert' neighbourhood could potentially experience a great improvement in dietary choices if an existing bus route was redrawn to directly and efficiently connect them with an affordable grocery store in a nearby neighbourhood.

While talking about the weather is a popular Canadian pastime, very few physical activity researchers discuss climate (Tucker and Gilliland, 2007). Physical activity levels of Canadians decrease significantly in winter (Brandon et al., 2007; Stephens et al., 1986). A logical explanation for seasonal fluctuations in physical activity is the fact that most major cities in Canada are covered in snow for up to four months of the year (Environment Canada, 2009). Unfortunately, urban parks tend to be abandoned with the first snow and most municipalities do little to encourage physical activity during wintertime, besides building outdoor skating rinks or expensive indoor hockey arenas, which appeal to only a small proportion of the population. Unlike Nordic cities (e.g., Copenhagen), few Canadian cities maintain their bicycle and walking paths in winter. Winterizing bike and pedestrian pathways is just one relatively simple solution to promoting active travel and keeping some people out of their cars year-round.

The walkability of a neighbourhood is also greatly impacted by school-siting decisions. Throughout Canada and the United States, inner-city schools are being closed, or threatened with closure, while new ones are being opened up on the rural fringe. Such decisions are typically a response to bureaucratic calculations such as 'floor space per student' ratios, without a holistic vision regarding the potential broader, long-term economic, social, and health impacts of a school closing. This is a short-sighted, narrow-focused approach, as closing neighbourhood schools leads to longer commutes for youth and ultimately more children have to be bused, or chauffeured by parents, between home and school. School location decisions should be made with the goal of encouraging physically active travel.

The weight of evidence clearly indicates that prevailing forms of development in North American cities are 'obesogenic' in that they deter walking and recreation, while promoting the consumption of unhealthy foods. Unlike motivational programs or educational campaigns, which have had limited, short-term impacts, any changes in behaviour due to changes in the built environment should have more lasting effects on the battle against obesity. Breakthroughs in our understanding of how the built environment impacts obesity, and what we can do about it, have come from combining expertise from multiple disciplines and arenas. Future studies and interventions require strong collaborations among researchers of various disciplines, between health and social scientists

(e.g., epidemiologists, health promoters, psychologists, economists, human/urban geographers) and those who study, plan, and construct the built environment, such as city planners and engineers, as well as property developers and builders. Furthermore, with growing co-operation and exchange among researchers, planners, policy-makers, health professionals, advocacy groups, and citizens, we will soon see how this exciting field of research will lead to effective policy and interventions aimed at creating healthier built environments for all.

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Review Questions

1. What reasons are suggested for increasing the walkability of our cities? Are you able to suggest others?
2. How can we build healthier communities?

Note

1. Overweight and obesity are typically assessed using the body mass index (kg/m^2). For adults, a BMI of >25 is considered overweight, and a BMI of >30 is considered obese.

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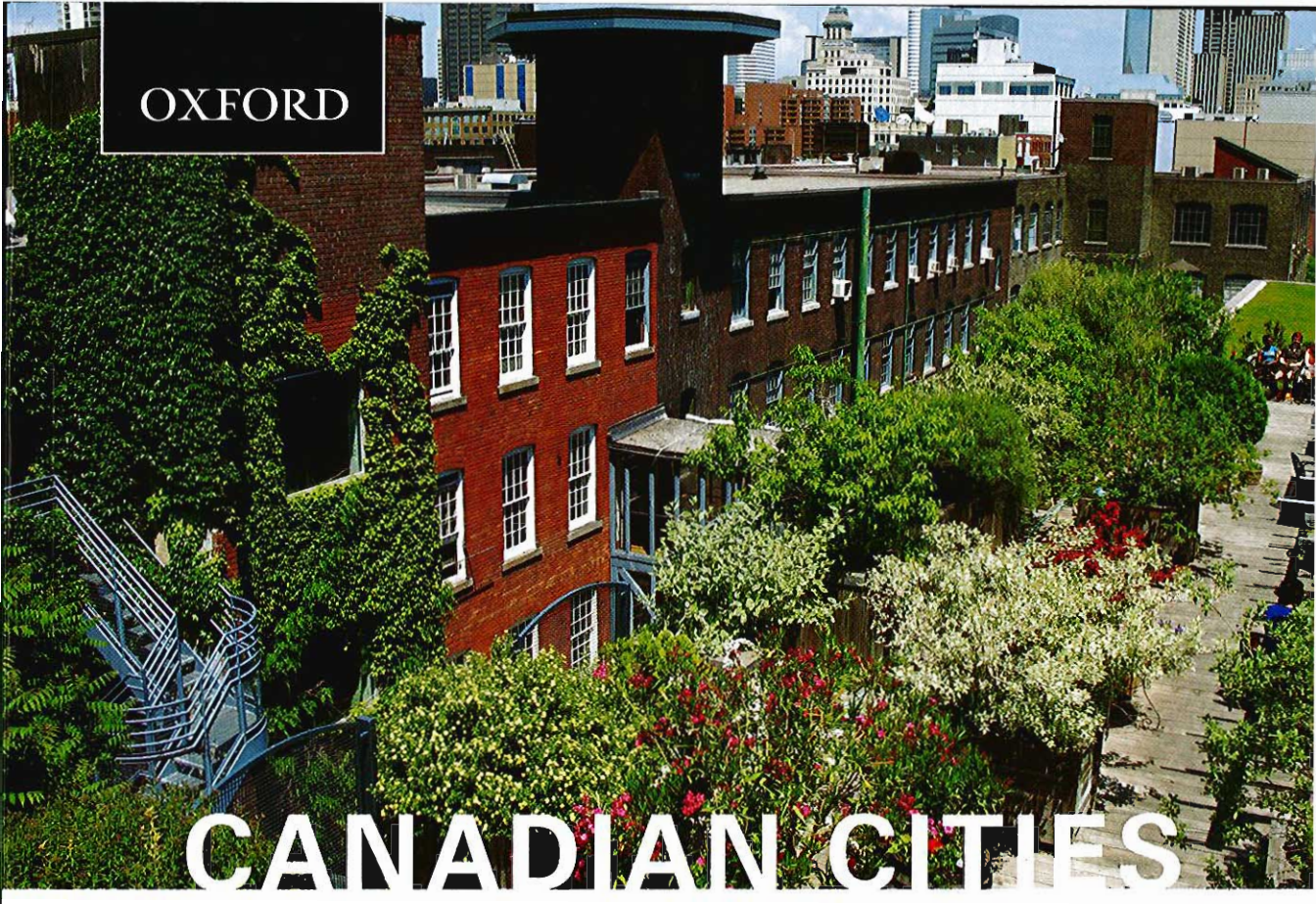

OXFORD

CANADIAN CITIES IN TRANSITION

NEW DIRECTIONS IN THE TWENTY-FIRST CENTURY

FOURTH EDITION

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