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Abstract

Background
Urban sprawl is a potential environmental influence on youth overweight/obesity. However, little is known about the association between urban sprawl and behaviours that influence obesity such as active transportation and physical activity.

Methods
The study population consisted of 7,017 respondents aged 12 to 19 to the 2007/2008 Canadian Community Health Survey, living in Canada's 33 census metropolitan areas (CMAs). Factor analysis was used to obtain an urban sprawl score for each CMA, incorporating dwelling density, percentage of single or detached dwelling units, and percentage of the population living in the urban core. Multi-level logistic regression examined whether urban sprawl was associated with frequent active transportation (30 or more minutes a day), moderate-to-vigorous physical activity (MVPA) (60 or more minutes a day), and overweight/obesity.

Results
Urban sprawl was associated with active transportation among 12- to 15-year-olds, with the relative odds of engaging in at least 30 minutes of active transportation per day increasing by 24% (95% CI: 10-39%) for each standard deviation (SD) increase in the urban sprawl score. For the entire sample aged 12 to 19, higher urban sprawl was associated with MVPA (odds ratio per SD increase = 1.10, 95% CI: 1.01-1.20), but not with overweight/obesity (odds ratio per SD increase = 1.06, 95% CI: 0.94-1.18).

Interpretation
Urban sprawl was associated with active transportation and MVPA in Canadian youth, although in the opposite direction to what has been reported in the literature for adults.

Keywords
adolescent behaviour, body mass index, built environment, exercise, residence characteristics, urban planning

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Over the past 30 years, the prevalence of overweight and obesity has nearly tripled among Canadian youth aged 12 to 17,[1] thereby potentially increasing the physical, mental and social problems associated with obesity in young people.[2-6] Furthermore, obesity tends to persist, with 60% to 90% of obese adolescents remaining obese into adulthood.[7] To develop effective public health strategies, an understanding of the determinants of obesity is important. Because lack of moderate-to-vigorous physical activity (MVPA) is acknowledged to be one of those determinants,[8-11] researchers are interested in features of the surrounding environment that promote or inhibit physical activity.[12]

Urban sprawl is a pattern of development whereby metropolitan areas extend over a large geographic region.[13] This can make it difficult to walk or cycle between destinations, and can result in more driving, longer commute times, and less physical activity.[14,15] Evidence from two American studies suggests an association between urban sprawl and obesity and its behavioural determinants among adolescents. Ewing et al.[16] found that 12- to 17- year-olds in counties with greater-than-average urban sprawl were more likely to be overweight or obese than were those in counties with less-than-average urban sprawl. In a study of Grade 8 and 10 students, Slater et al.[17] found a lower prevalence of obesity among those in areas with less-than-average urban sprawl, but no association with MVPA.

Because reliance on automobiles may influence obesity, it is important to consider the role of driving on the association between urban sprawl and the behavioural determinants of obesity. Trowbridge et al.[18] reported that, in the United States, the likelihood of driving more than 32 km per day was twice as great among youth in sprawling counties, compared with those in compact counties. This supports the possibility of an association between urban sprawl and driving patterns. However, the influence may not be the same for youth who lack a driver's license, and therefore, depend on active transportation such as cycling and walking. Few studies of urban sprawl and obesity-related behaviours among young people have examined the potential moderating role of driving age.

Studies of the association between urban sprawl and obesity in youth are not extensive and have typically been limited to the United States. The inclusion of active transportation as an outcome may help gain a better understanding of whether urban sprawl affects the use of physically active means of transportation, which, in turn, may also influence MVPA and youth obesity.

The primary objective of this analysis was to examine associations between urban sprawl and (1) active transportation, (2) MVPA, and (3) obesity in a large sample of Canadian youth residing in Census Metropolitan Areas (CMAs). A secondary objective was to consider driving age as a possible moderator of these associations. As well as interventions aimed at changing an individual's behaviour,[19-21] the possibility of modifying surrounding environments to facilitate healthy behaviour should be recognized. Two-thirds (68%) of Canadians live in CMAs[22] (urban centres with a population of 100,000 or more). Therefore, even small changes in features of the built environment in CMAs have the potential to affect many people.

Methods

Study design

The study consisted of a multi-level cross-sectional analysis and examined associations between urban sprawl, obesity-related behaviours, and obesity among 12- to 19-year-olds in Canada's 33 CMAs. Individual-level data on active transportation, MVPA, obesity, and socio-demographic characteristics were obtained from a general health survey. Area-level data—urban sprawl scores and climate averages—were obtained for each CMA from the 2006 Census and from Environment Canada, respectively. The individual- and area-level data were linked based on the CMA identifier for each survey respondent.

Study sample

The study sample was from the 2007/2008 Canadian Community Health Survey (CCHS), a large, nationally representative cross-sectional survey that collects information about the health of Canadians aged 12 or older.[23] A complex sampling strategy ensured that the sample was representative of the health regions in all provinces and territories.

The present analysis was restricted to respondents aged 12 to 19. Because urban sprawl primarily applies to larger urban areas,[12] only CMA residents were included .

Outcomes

CCHS respondents were asked to report the number of times they participated in common physical activities in the past three months (90 days) and the appropriate duration category. The midpoint of the duration category was used to estimate the number of minutes of physical activity.[24] The average daily duration of the activity was calculated by multiplying the frequency and duration and dividing this by 90.

Total MVPA was comprised of all activities, whereas active transportation was limited to walking, cycling and rollerblading to work or to school or for leisure. Respondents were placed in two groups, based on whether they met the current guideline of 60 minutes of MVPA a day.[25] In the absence of guidelines for the duration of active transportation, a 30-minute-a-day cut-point was used to place participants into two groups. This cut-point corresponded to the top quartile of active transportation, and the percentage of study participants who met this active transportation threshold was similar to the percentage who met the 60-minute-a-day MVPA cut-point. Because vehicle use may moderate the association between urban sprawl and physical activity, an interaction term between urban sprawl and age group was introduced into the analysis, distinguishing those who were of driving age (16 to 19) from those who were not (12 to 15).

Self-reported height and weight were used to calculate the body mass index (BMI) (weight in kg / height in m^2) of each respondent. The weight status of 18- and 19-year-olds was based on adult BMI thresholds of less than 25 kg/m^2 (non-overweight), 25 to 29.9 kg/m^2 (overweight), and 30 or more kg/m^2 (obese); for 12- to 17-year-olds, the age- and sex-specific International Obesity Task Force pediatric BMI thresholds[26] were used. Overweight and obese categories were combined for regression analyses.

Exposure

Urban sprawl was measured for each CMA, using an adaptation of the Canadian urban sprawl index developed by Ross et al.[27] that incorporated total dwelling density, percentage of single or detached dwellings, and percentage of the population living in the urban core of each CMA. Total dwelling density and density of single or detached dwelling units in each CMA were obtained using PCensus (2006 Census of Canada Profile Data; Tetrad Computer Applications Inc., Vancouver BC) The percentage of the population in the urban core was obtained from Statistics Canada.[28] Instead of weighting the three urban sprawl components equally to create a summary urban sprawl score (as is done by Ross et al.[27]), a principal components factor analysis was performed. Results showed that the three components comprised a single factor, and Cronbach's alpha for this factor was 0.89. The factor loadings were 0.95 for dwelling density, 0.96 for density of single or detached dwellings, and 0.82 for percentage of the population in the urban core of the CMAs. The three components were used to create a standardized urban sprawl score, with a mean of 0 and a standard deviation of 1.

Confounders

Potential individual-level confounders obtained from the CCHS were age,[7,29,30] sex,[31] socio-economic status,[32] and the season[33] in which the interview was conducted. Household education categories ranged from less than secondary graduation to postsecondary graduation. Household income was determined by a ratio of the income to a low-income threshold for a given household and community size.[24]

Area-level confounders, specifically, climate averages,[34] were also considered. They comprised daily temperature, annual rainfall and annual snowfall. The climate data for each CMA were obtained from Environment Canada, and were based on averages from 1972 to 2000 at the international airport or the municipal airport in each CMA.[35]

Statistical analysis

All analyses were conducted using SAS software version 9.2 (SAS Institute, Cary, NC). The complex sampling procedures for the CCHS resulted in individuals in the target population having unequal probabilities of being sampled. To account for this, 500 bootstrap replications were performed using Statistics Canada's bootstrap weights for the descriptive and regression analyses.[36,37] Multi-level logistic regressions were carried out using *proc glimmix* and used a multi-step process to estimate the odds ratio (OR) of reporting: (1) 30 minutes of active transportation a day; (2) 60 minutes of MVPA a day; and (3) an overweight/obese BMI, in association with estimated levels of urban sprawl.

An empty model was used to determine the intra-class correlation (ICC) statistic for logistic regression. The ICC value indicates the percentage of the total variation in the outcomes that was due to differences across CMAs. Bivariate associations between the outcomes and each potential confounder were then examined. The multivariate model-building process began with the introduction of the individual-level variables and the interaction term (driving age), and proceeded using a backwards elimination approach. The urban sprawl variable was forced into all models. The interaction term was included at the beginning of the model-building process to test the *a priori* hypothesis that driving age modified the association between urban sprawl and the outcome variables. For active transportation and MVPA, the CMA climate variables were entered into the model using backwards elimination. Season and climate variables were not included for overweight/obesity, because no evidence suggests an association. To account for the possibility that the relationship between urban sprawl and the outcomes may be heavily influenced by respondents in the three largest CMAs (Montreal, Toronto and Vancouver), the analysis was repeated with these respondents removed.

Table 1
Distribution of selected demographic and health characteristics, household population aged 12 to 19 in Census Metropolitan Areas, Canada, 2007/2008

Characteristic	Unweighted number	Weighted %	95% confidence interval from	95% confidence interval to
Total	**7,017**	**100.0**	**...**	**...**
Sex				
Male	3,587	51.3	50.9	51.8
Female	3,430	48.7	48.3	49.1
Age group				
12 to 15	3,522	51.0	49.4	52.6
16 to 19	3,495	49.0	47.4	50.6
Highest household education				
Less than secondary graduation	180	2.8	2.3	3.4
Secondary graduation	659	9.0	8.0	10.0
Postsecondary graduation	4,666	68.6	67.1	70.1
Not stated	1,512	19.6	18.4	20.8
Household income decile				
1 to 3	1,729	27.4	25.9	28.9
4 to 6	1,747	24.3	22.9	25.6
7 to 10	1,890	23.7	22.4	25.0
Not stated	1,651	24.6	23.3	26.0
Season of survey interview				
Winter (December to February)	1,527	23.2	21.9	24.5
Spring (March to May)	1,955	27.4	25.9	28.9
Summer (June to August)	1,489	22.4	21.1	23.8
Fall (September to November)	2,046	27.0	25.6	28.4
Active transportation (30 or more minutes a day)				
Yes	1,669	22.2	20.9	23.5
No	4,715	68.6	67.1	70.1
Not stated	633	9.2	8.3	10.2
Moderate-to-vigorous physical activity (60 or more minutes a day)				
Yes	2,402	32.8	31.3	34.3
No	3,812	56.2	54.6	57.7
Not stated	803	11.0	10.0	12.0
Weight				
Not overweight	4,975	71.7	70.3	73.2
Overweight	933	12.1	11.2	13.0
Obese	307	4.2	3.5	4.9
Not stated	802	11.9	10.9	13.0

... not applicable
Source: 2007/2008 Canadian Community Health Survey.

Results

A total of 7,017 respondents to the 2007/2008 CCHS met the inclusion criteria for the study. Respondents were equally distributed between the two age groups (12 to 15 and 16 to 19) (Table 1). One in four respondents engaged in active transportation for at least 30 minutes day. One in three met the MVPA guidelines. Of those who reported their height and weight, one in four were overweight or obese.

Table 2 provides the urban sprawl scores and the climate characteristics for each CMA. Positive scores indicate higher levels of urban sprawl. Toronto, Montreal and Vancouver—the three largest CMAs—had the lowest scores.

The ICC value for active transportation (30 or more minutes a day) indicated that only 0.21% of the variation in this outcome was explained at the CMA level. In the bivariate analysis, no association was apparent between urban sprawl and active transportation in the total sample (Table 3). However, because the interaction term between age and urban sprawl was statistically significant (β= -0.20, p<0.01), separate odds ratios were calculated for the two age groups. When adjustments for the individual- and area-level confounders were made, urban sprawl was related to an increased likelihood of active transportation among 12- to 15-year-olds (OR per SD increase = 1.24, 95% CI: 1.10-1.39), but not among 16- to 19-year-olds (OR per SD increase = 1.02, 95% CI: 0.88-1.17).

The ICC value for MVPA (60 or more minutes a day) indicated that only 0.28% of the variation in this outcome was explained at the CMA level. Because the interaction term between the urban sprawl score and MVPA was not significant (β= -0.01, p-value=0.90), the odds ratio was calculated for the entire study population, rather than by age group (Table 4). The bivariate analysis suggested no statistically significant association between urban sprawl and MVPA. However, when the individual- and area-level confounders were added to the model, a positive association emerged between urban sprawl and MVPA (OR per SD increase = 1.10, 95%: 1.01-1.20). Sex, the season when the interview was conducted, and average daily temperature were also significantly related to MVPA.

The ICC value for overweight/obesity was 0.90%. The bivariate analyses revealed no association between urban sprawl and overweight/obesity (Table 5). Addition of the confounders to the model did not change this result. The age interaction term was not statistically significant (β= -0.02, p-value=0.81).

When respondents in the three largest CMAs (Montreal, Toronto and Vancouver) were removed from the analysis, the interaction term was no longer statistically significant for active transportation (β= 0.16, p-value=0.13), suggesting that there was no difference in relationships for the two age groups (data not shown). Furthermore, the association between urban sprawl and active transportation changed directions (OR per SD increase = 0.93, 95% CI: 0.82-1.05). For MVPA, the relationship was no longer statistically significant (OR per SD increase = 0.98, 95% CI: 0.88-1.09). However, removal of these respondents did not substantially affect the relationship with overweight/obesity (OR per SD increase = 0.97, 95% CI: 0.86-1.11).

Table 2
Urban sprawl scores and climate characteristics, by Census Metropolitan Area

Census Metropolitan Area	Standardized urban sprawl score	1972-to-2000 average Daily temperature (ºC)	Annual rainfall (mm)	Annual snowfall (cm)
Montreal, QC	-2.28	6.2	764	216
Toronto, ON	-2.15	7.5	685	115
Vancouver, BC	-1.65	10.1	1,155	48
Kitchener-Cambridge-Waterloo, ON	-1.51	6.7	765	160
Hamilton, ON	-1.43	7.6	765	162
Victoria, BC	-1.21	9.7	841	44
Windsor, ON	-0.73	9.4	805	127
Guelph, ON	-0.65	6.5	771	161
Oshawa, ON	-0.45	7.7	760	118
Calgary, AB	-0.35	4.1	321	127
St. Catharines-Niagara, ON	-0.31	8.8	746	137
Quebec City, QC	-0.21	4.0	924	316
Barrie, ON	-0.09	6.7	700	238
Abbotsford-Mission, BC	-0.04	10.0	1,508	64
Winnipeg, MB	0.05	2.6	416	111
London, ON	0.05	7.5	818	202
St. John's, NF	0.07	4.7	1,191	322
Trois-Rivières, QC	0.20	4.9	859	241
Regina, SK	0.37	2.8	304	106
Edmonton, AB	0.38	2.4	375	121
Sherbrooke, QC	0.41	4.1	874	294
Ottawa ON-Gatineau QC	0.51	6.0	732	236
Saskatoon, SK	0.65	2.2	265	97
Thunder Bay, ON	0.70	2.5	559	188
Brantford, ON	0.86	8.0	780	113
Kelowna, BC	0.93	7.7	298	102
Halifax, NS	0.96	6.3	1,239	231
Moncton, NB	0.98	5.1	865	350
Kingston, ON	1.05	6.7	795	181
Saguenay, QC	1.11	2.3	661	342
Saint John, NB	1.17	5.0	1,148	257
Peterborough, ON	1.24	5.9	682	162
Greater Sudbury, ON	1.35	3.7	657	274

Source: 2006 Census of Canada; Environment Canada.

Table 3
Unadjusted and adjusted odds ratios relating selected characteristics to active transportation, household population aged 12 to 19 in Census Metropolitan Areas, Canada, 2007/2008

	Bivariate model			Individual-level model			Area-level model		
	Unadjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
		from	to		from	to		from	to
Urban sprawl									
1 standard deviation in sprawl score	1.03	0.94	1.12	....	...	...	....	...	...
12- to 15-year-olds	....	...	...	1.15*	1.03	1.27	1.24*	1.10	1.39
16- to 19-year-olds	....	...	...	0.94	0.77	1.15	1.02	0.88	1.17
Individual-level variables									
Sex									
Male†	1.00	...	...	1.00	...	...	1.00	...	...
Female	0.74*	0.64	0.87	0.73*	0.63	0.86	0.73*	0.63	0.86
Age group									
12 to 15†	1.00	...	...	1.00	...	...	1.00	...	...
16 to 19	1.03	0.88	1.19	0.84	0.70	1.00	0.84	0.70	1.00
Highest household education									
Less than secondary graduation†	1.00	...	...	....	...	...	....	...	...
Secondary graduation	1.62	0.94	2.80	....	...	...	....	...	...
Postsecondary graduation	1.32	0.80	2.20	....	...	...	....	...	...
Not stated	1.80*	1.10	2.97	....	...	...	....	...	...
Household income decile									
1 to 3†	1.00	...	...	1.00	...	...	1.00	...	...
4 to 6	0.80*	0.65	0.99	0.77*	0.62	0.95	0.77*	0.62	0.95
7 to 10	0.72*	0.58	0.90	0.69*	0.56	0.86	0.69*	0.56	0.86
Not stated	0.94	0.76	1.17	0.90	0.72	1.13	0.90	0.72	1.13
Season of survey interview									
Winter (December to February)†	1.00	...	...	1.00	...	...	1.00	...	...
Spring (March to May)	0.92	0.72	1.17	0.92	0.72	1.17	0.92	0.72	1.17
Summer (June to August)	1.39*	1.10	1.74	1.40*	1.11	1.76	1.40*	1.11	1.76
Fall (September to November)	1.16	0.94	1.44	1.16	0.94	1.45	1.16	0.94	1.45
Area-level variables									
Average temperature (1 standard deviation increase)	1.12*	1.02	1.23	....	...	...	1.18*	1.06	1.32
Average rainfall (1 standard deviation increase)	1.07	0.97	1.17	....	...	...	....	...	...
Average snowfall (1 standard deviation increase)	0.97	0.88	1.06	....	...	...	....	...	...

N = 6,384
† reference category
* significantly different from reference category (p<0.05)
... not applicable
Note: Active transportation is 30 or more minutes a day.
Source: 2007/2008 Canadian Community Health Survey.

Discussion

Adolescents aged 12 to 15 in CMAs with a high degree of urban sprawl were more likely than those in relatively compact CMAs to engage in active transportation. And for the 12-to-19 age group overall, high urban sprawl was associated with elevated odds of MVPA. Although the strength of these associations was relatively modest, the impact on the physical activity levels of young people may still be meaningful for the population as a whole. The CMAs with the lowest sprawl scores—Toronto, Montreal and Vancouver—were also the most populated. Therefore, alterations of the surrounding environment aimed at increasing active transportation could potentially affect a large number of young people.

The lack of a relationship between urban sprawl and overweight/obesity in this analysis differs from the results of Ewing et al.[16] and Slater et al.[17] who found that increased urban sprawl was associated with a higher prevalence of overweight/obesity in American youth. A possible reason for the difference may be that the sprawl index used by those researchers pertained to counties, whereas the measure in this analysis pertained to CMAs. The large size of CMAs may have masked differences in the prevalence of overweight/obesity.

Table 4
Unadjusted and adjusted odds ratios relating selected characteristics to moderate-to-vigorous physical activity, household population aged 12 to 19 in Census Metropolitan Areas, Canada, 2007/2008

	Bivariate model			Individual-level model			Area-level model		
	Unadjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
		from	to		from	to		from	to
Urban sprawl									
1 standard deviation in sprawl score	1.01	0.94	1.09	1.02	0.94	1.10	1.10*	1.01	1.20
Individual-level variables									
Sex									
Male†	1.00	...	...	...	...	...	1.00	...	...
Female	0.56*	0.49	0.64	0.56*	0.49	0.64	0.56*	0.49	0.64
Age group									
12 to 15†	1.00	...	...	...	...	...	...	...	...
16 to 19	0.93	0.81	1.71	...	...	...	...	...	...
Highest household education									
Less than secondary graduation†	1.00	...	...	...	...	...	...	...	...
Secondary graduation	1.32	0.74	2.35	...	...	...	...	...	...
Postsecondary graduation	1.46	0.87	2.46	...	...	...	...	...	...
Not stated	1.63	0.97	2.73	...	...	...	...	...	...
Household income decile									
1 to 3†	1.00	...	...	...	...	...	...	...	...
4 to 6	0.99	0.81	1.22	...	...	...	...	...	...
7 to 10	1.26*	1.04	1.52	...	...	...	...	...	...
Not stated	1.05	0.85	1.29	...	...	...	...	...	...
Season of survey interview									
Winter (December to February)†	1.00	...	...	1.00	...	...	1.00	...	...
Spring (March to May)	0.89	0.73	1.10	0.89	0.73	1.10	0.89	0.73	1.10
Summer (June to August)	1.34*	1.09	1.65	1.33*	1.08	1.64	1.33*	1.08	1.64
Fall (September to November)	1.10	0.90	1.35	1.09	0.89	1.33	1.09	0.89	1.33
Area-level variables									
Average temperature (1 standard deviation increase)	1.13*	1.05	1.23	...	...	...	1.18*	1.08	1.30
Average rainfall (1 standard deviation increase)	1.11*	1.02	1.20	...	...	...	...	...	...
Average snowfall (1 standard deviation increase)	1.00	0.91	1.10	...	...	...	...	...	...

N = 6,384
† reference category
* significantly different from reference category (p<0.05)
... not applicable
Note: Moderate-to-vigorous physical activity is 60 or more minutes a day.
Source: 2007/2008 Canadian Community Health Survey.

Another possibility is that information about neighbourhood and traffic safety was included in the earlier studies, [16,17] but was not available from the CCHS. Concerns about traffic and crime tend to have a dampening effect on active transportation among young people.[38,39] In the present study, the three largest CMAs, where traffic concerns may be more common, had the least urban sprawl. In fact, when respondents in these three CMAs were removed from the analysis, the strength of the relationships was diminished. As well, the interaction term for active transportation was no longer significant, and the direction of the relationship changed. This suggests that the positive association between active transportation and urban sprawl primarily affected residents of large cities. Therefore, it is possible that traffic safety concerns may have deterred younger adolescents in the largest CMAs from engaging in active transportation.

In contrast to its influence on adults,[27,40-42] urban sprawl may encourage physical activity in young people. Slater et al.[17] found that adolescents in sprawling counties had higher rates of sports participation. And according to Mecredy et al.,[43] Canadian youth exposed to less densely connected streets were more likely to be active outside of school for at least four hours a week, compared with young people exposed to more densely connected streets.

Initiatives to reduce urban sprawl in Canadian cities[44,45] and worldwide[46] are based, in part, on evidence demonstrating

Table 5
Unadjusted and adjusted odds ratios relating selected characteristics to overweight/obesity, household population aged 12 to 19 in Census Metropolitan Areas, Canada, 2007/2008

	Bivariate model			Individual-level model		
	Unadjusted odds ratio	95% confidence interval from	95% confidence interval to	Adjusted odds ratio	95% confidence interval from	95% confidence interval to
Urban sprawl						
1 standard deviation in sprawl score	1.04	0.94	1.16	1.06	0.94	1.18
Individual-level variables						
Sex						
Male†	1.00	...	...	1.00	...	...
Female	0.52*	0.44	0.62	0.51*	0.43	0.61
Age group						
12 to 15†	1.00	...	...	1.00	...	...
16 to 19	1.23*	1.04	1.46	1.25*	1.05	1.49
Highest household education						
Less than secondary graduation†	1.00	...	...	...	...	...
Secondary graduation	0.54*	0.31	0.95	...	...	...
Postsecondary graduation	0.42*	0.25	0.71	...	...	...
Not stated	0.48*	0.28	0.83	...	...	...
Household income decile						
1 to 3†	1.00	...	...	1.00	...	...
4 to 6	0.88	0.69	1.12	0.85	0.66	1.08
7 to 10	0.70*	0.55	0.89	0.67*	0.52	0.85
Not stated	0.93	0.72	1.19	0.88	0.68	1.14

N = 6,215
† reference category
* significantly different from reference category (p<0.05)
... not applicable
Source: 2007/2008 Canadian Community Health Survey.

What is already known on this subject?

- Given the rapidly increasing obesity prevalence among young people, researchers are interested in how aspects of the surrounding environment may contribute to obesity-related outcomes.
- American studies have demonstrated that urban sprawl, a component of the surrounding environment, is related to higher levels of obesity in young people.

What does this study add?

- A positive association emerged between urban sprawl and active transportation and moderate-to-vigorous physical activity, which contradicts other findings for youth and adult populations.
- The association between urban sprawl and active transportation prevailed only among 12- to 15-year-olds, indicating that driving age was a potential modifier. This highlighted the importance of considering associations among younger and older adolescents separately.
- Small variations in the outcomes across CMAs suggest that refinements of the current measure of urban sprawl might capture more variability across geographic areas.

negative effects, such as increased time spent in cars[47] and greater air pollution.[48] Among adults, urban sprawl has been negatively associated with physical activity and active transportation.[40,42,49] However, some urban planners recognize advantages of a suburban lifestyle, including more affordable housing,[50] aesthetically pleasing green space,[51] and lower crime rates.[52]

Limitations

A limitation of this study was that the ICC values for the outcomes were small, possibly because the large geographic area covered by the CMAs resulted in little variation in outcomes among them.

A small percentage of the CMAs consisted of rural land. Because it was not possible to exclude these areas, some study participants were not influenced by the patterns of development associated with urban sprawl.

An additional limitation was that the BMI and physical activity measures were based on self-reports, which likely resulted in an underestimate of BMI values[53] and an overestimate of physical activity levels,[54] which may have influenced the strength of the observed associations.

Finally, information on potentially important confounders was unavailable. For example, although it was possible to determine if participants were of driving age, whether they had a driver's license and access to a vehicle was not known.

Conclusion

Clearly, urban sprawl is a complex public health issue, with both positive and negative outcomes. This study contributes to the evidence of positive health outcomes associated with urban sprawl among Canadian youth. Urban sprawl was not related to overweight/obesity per se, but it was related to moderate-to-vigorous physical activity, and among 12- to 15-year-olds, to active transportation. These findings differed from those for adults.[43,48] Therefore, age should be considered when developing strategies relating to the built environment that are intended to increase physical activity, and ultimately, reduce obesity among Canadians. ■

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