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Environmental influences on physical activity levels in youth

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ABSTRACT

This study assessed the amount of physical activity engaged in by youth aged 11–13, in relation to: (1) the presence of neighborhood recreational opportunities, objectively measured within a geographic information system; and (2) parents' perceptions of recreation opportunities in their neighborhoods. Students in grade 7 and 8 ($n = 811$) in 21 elementary schools throughout London, Ontario completed the adapted Previous Day Physical Activity Recall and a questionnaire assessing environmental influences in the home and school neighborhoods. Parents/guardians of participants also completed a questionnaire eliciting demographic information and perceptions of the neighborhood environment. On average, students engaged in 159.9 min/day of physical activity. Both subjective and objective measures of recreational opportunities were associated positively with physical activity ($p < 0.05$). Greater access to recreational opportunities seem essential to facilitate youths' healthy levels of physical activity.

Introduction

Efforts to increase the physical activity and, therefore, energy expenditure of youth are likely to produce short-term improvements to health and quality of life, such as preventing and reducing overweight and obesity, increasing self-esteem and efficacy, and enhancing scholastic success, in addition to longer-term health gains, including preventing chronic diseases such as diabetes and cardiovascular disease (American College of Sports Medicine, 2000; Canadian Pediatric Society, 2002; Ritchie et al., 2001; Warburton et al., 2006). Moreover, researchers have identified a possible long-term relationship between current and future physical activity behaviors: physically active adolescents will more likely be active during adulthood (Conroy et al., 2005; Telama et al., 2005; Vanreusel et al., 2001). Given three out of five Canadian youth are not active enough to achieve health benefits, and since 26% of these youth are either overweight or obese, understanding the reasons for inactivity and engaging in activity-enhancing efforts are clearly required (Shields, 2005; Wharf-Higgins et al., 2003).

One recent line of research suggests that attributes of the built environment can influence behavior and facilitate or hinder physical activity (Giles-Corti et al., 2005; Heinrich et al., 2007; Kirby et al., 2007; Popkin et al., 2005). Most of these recent studies have taken an ecological approach to understanding physical activity behavior. Ecological models view physical activity behavior as being influenced by the interaction between the environmental setting in addition to biological and psychological factors at the level of the individual (Sallis et al., 2006; Spence and Lee, 2003).

Aspects of the built environment have been suggested to influence physical activity levels (Atkinson et al., 2005; Frank et al., 2005). Specifically, higher development densities, mixed land uses, connected street systems, and 'high quality' pedestrian environments are related to higher pedestrian trip rates (Boarnet and Sarmiento, 1998; Cerin et al., 2007; Crane and Crepeau, 1998; Ewing et al., 1994; Greenwald and Boarnet, 2001; Handy, 1996; Saelens et al., 2003). Recent studies from a population health perspective also suggest that features of the neighborhood environment such as sidewalks and bike paths are related to increased utilitarian and leisure non-motorized trips (Ainsworth et al., 2004; Greenwald and Boarnet, 2001; Huston et al., 2003; King et al., 2003; Saelens et al., 2003).

The importance of having access to suitable recreational facilities in the neighborhood, such as parks and recreation centers that support other types of physical activity besides walking has also been established (Frank et al., 2007; Gordon-Larsen et al., 2000; Huston et al., 2003; Kerr et al., 2007; Molnar et al., 2004; Motl et al., 2007; Norman et al., 2006; Sallis et al., 1997). Recent research by Tucker et al. (2007) found that

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accessibility was extremely important to parents in making decisions about where to bring their children to play; however, the functionality and overall "appeal" of a park was so important to parents that they would often travel past parks in their immediate neighborhood to reach more desirable ones. Also, Irwin et al. (2005) revealed that the location and characteristics of exercise facilities (i.e., walking distance, condition of equipment, perceived safety of neighborhood) were significant barriers to physical activity for parents of preschool-aged children, therefore suggesting that "accessibility" to leptogenic opportunities influences physical activity levels. Among adolescents, three recent studies identified the value of recreation facilities as a stimulant to increased activity (Frank et al., 2007; Gordon-Larsen et al., 2006; Norman et al., 2006). Popkin et al. (2005, p. 606) stated that "access to facilities and opportunities to exercise are consistent predictors of physical activity in children and adolescents." Outdoor play spaces and parks may also be particularly important because of the high correlation between physical activity and outdoor time among children (Tudor-Locke et al., 2001).

The specific layout of neighborhoods establishes the accessibility and safety of outdoor play (Powell, 2005). Therefore, changes to the built environment might foster increases in physical activity resulting in healthier lifestyles and serve as an effective population-based strategy for tackling inactivity (Powell, 2005). At a population level, even a small effect would produce dramatic changes in population activity rates (Gebel et al., 2007). Therefore, built environments designed to promote more physically active behaviors are necessary and require further attention (Mota et al., 2007).

Research in this area is growing exponentially; however, few of these studies have focused on youth, who do not make the decisions for the family about where they live (Frank et al., 2007; Gordon-Larsen et al., 2006; Norman et al., 2006). Compared to adult populations, it seems logical that youth are much more captive to the opportunity structures defined by their home and school neighborhoods. Based on our understanding of the prevailing literature, we are compelled to explore, in greater detail, the influence of the local environment on physical activity levels among youth with specific focus on 'recreationscapes' (i.e., neighborhood facilities that provide opportunities for formal or informal recreation such as parks, playing fields, recreation centers). Because parents are concerned about traffic, stranger danger, and consequently their child or youth's safety, the level of independence offered to adolescents might hinder their ability to use neighborhood parks and recreation facilities (Veitch et al., 2006). More specifically, parents might allow or restrict their child from using such facilities based on their opinion of the safety and quality of the neighborhood resource. Therefore, because parents play such an influential role in their child's use of these neighborhood amenities, it is important to gain parents' perceptions of these facilities (Sallis et al., 1997). To the best of our knowledge, no Canadian research has been conducted to assess the relationship between youth physical activity levels and the opportunity structures to which they have access.

Therefore, purpose of this study was to assess the amount of moderate vigorous physical activity (MVPA) in which grade 7 and 8 students in a mid-sized Canadian city, London, Ontario (population 350,000) engage in relation to: (1) the presence of neighborhood recreational opportunities, land use mix, and percentage park space objectively measured within a geographic information system (GIS); and (2) parents' perceptions of the presence of neighborhood recreation opportunities. The current study was part of a larger investigation into the environmental influences of physical activity and dietary habits of youth in London, Ontario.

Methods

Subjects

Prior to the start of participant recruitment, ethical approval was obtained from the Office of Research Ethics at the University of Western Ontario and by the research committees at both school boards. A purposeful sample of 51 geographically diverse schools located in the urbanized areas of London from both the London District Catholic School Board (LDCSB) and the Thames Valley District School Board (TVDSB) were invited to participate, and 11 from the LDCSB and 10 from the TVDSB agreed to partake (41% response rate). A total of 1666 grade 7 and 8 students, from both the LDCSB and the TVDSB were invited to participate with 811 students, aged 11–13 (average age of 12.7 years), receiving parent consent and present on the day of data collection, for a response rate of 49%. Students were recruited in class; letters of information and consent forms were sent home to parents/guardians and some teachers or principals also made announcements encouraging participation.

Procedure

Parents/guardians who provided consent for their child's participation were also asked to complete a demographic questionnaire (Table 1) and an inventory evaluating the child's home environment regarding presence of neighborhood recreation opportunities (see tools below).

Participating students completed the adapted Previous Day Physical Activity Recall (PD-PAR; Weston et al., 1997) during class time.

Tools

The parent tool was designed specifically for this study to ask the child's involvement in organized physical activity or sport; the presence of neighborhood recreation facilities as a dichotomous response of yes/no (i.e., Does your neighborhood have public recreation facilities, e.g., public swimming pools, parks, walking trails, bike paths, recreation centers, etc.?); the quality of these facilities on a five-point scale (i.e., In general, how would you rate the condition of these recreational facilities? Excellent–Poor); and the safety of their neighborhood on a five-point scale (i.e., How safe do you consider your neighborhood to be? Extremely–Not at all safe) (Table 2). Parents were also asked to complete demographic information on both their child and themselves (as per Table 1).

The adapted PD-PAR (Weston et al., 1997) was completed by students to assess their physical activity levels on the preceding day. This widely used self-report questionnaire has been previously validated against both a pedometer and a Caltrac© accelerometer and resulted in correlations of 0.88 and 0.77, respectively ($p<0.01$; Weston et al., 1997). This questionnaire was designed to assess activity type and relative intensity in 30-min blocks throughout the afternoon and evening of the previous day (3:00 p.m.–11:00 p.m.). To ensure all timeframes that offer opportunity for physical activity were captured, the tool was modified to include blocks of time for morning and afternoon recess, lunch time and physical education class (with 15-min blocks allocated for the morning and afternoon recess and 30-min blocks allotted for lunch hour and physical education class). The one day version of the tool was deemed appropriate because of previous research concluding that youth struggle to accurately recall their physical activity behavior over longer durations (Sallis, 1991; Saris, 1986).

Table 1
Descriptive characteristics of parents of grade 7 and 8 students

Demographics	*n*	%
Child's gender		
Male	399	48.6
Female	422	50.4
Grade		
7	345	43.5
8	449	56.5
Member of a physical activity of organized sport team		
Yes	546	66.6
No	274	33.4
Ethnicity		
White	618	75.3
Black	12	1.5
Latin-American	54	6.6
Asian	49	5.8
Other	72	8.8
Highest level of school—father		
High school		33.0
College/University		54.7
Graduate school		9.5
Highest level of school—mother		
High school		29.1
College/University		61.7
Graduate school		8.2
Currently employed—father		
Employed part-time	21	2.6
Employed full-time	655	80.3
Student	13	1.6
Currently employed—mother		
Employed part-time	156	18.6
Employed full-time	477	58.2
Student	26	3.2
At home with children	95	11.6
Family structure		
Single parent	136	16.2
Double parent	661	80.8
Household income		
<30,000	73	9.0
30,000–49,999	95	11.7
50,000–69,999	102	12.6
70,000+	262	32.3

Numbers in table may total less than total *n*'s because of non-reporting.

Table 2
Parent report regarding neighborhood recreation facilities

Characteristics	*n*	%
Neighborhood safety		
Extremely safe	143	17.4
Fairly safe	405	49.2
Safe	161	19.6
Somewhat safe	91	11.1
Not at all safe	13	1.6
Does your neighborhood have public recreation facilities?		
Yes	712	86.7
No	89	10.8
Don't know	20	2.4
Quality of recreation facilities		
Excellent	113	15.5
Good	419	57.6
Fair	162	22.3
Poor	15	2.1
Don't know	18	2.5
Frequency of facility use		
Never	25	3.4
Seldom	96	13.2
Sometimes	397	54.7
Often	179	24.7
Always	28	3.9

The PD-PAR provides a numbered list of activities in which youth are frequently involved. To improve recall, Weston et al. (1997) grouped these activities into categories for eating, sleeping/bathing, transportation, work/school, spare time, play/recreation and exercise/workout. The instrument requires respondents to enter the number corresponding to the primary activity completed during each block of time and the intensity at which that activity was performed: very light (e.g., slow breathing and little or no movement); light (e.g., normal breathing and movement); moderate (e.g., increased breathing and moderate movement); hard (e.g., hard breathing and quick movement; Weston et al.). Each intensity level offers both written and pictorial representation of activities characteristic of each intensity level.

PD-PAR data reduction

Consistent with previous researchers who have employed the PD-PAR, a metabolic equivalent task (MET) value was determined for each 30-min block based on that block's activity and the intensity level (very light, light, moderate, or hard). The Compendium of Physical Activities (Ainsworth et al., 1993) was used to assign a MET value for the recorded activity and intensity (with 1 $\mathrm{MET} = 1\ \mathrm{kcal\,kg^{-1}\,h^{-1}}$). An activity level of four METs or greater was considered to be moderate to vigorous in nature and the activity level necessary to gain health benefits (Weston et al., 1997). During school, after school and total activity level for each child was then calculated by adding all 30-min blocks that were four METs or above to convey activity level as number of minutes per day.

GIS analysis of neighborhood environment

Questionnaire data for the 792 of the 811 (97.7%) survey respondents which reported their home postal code were "geocoded" to the geographic center of the postal code using ArcGIS 9.2 (ESRI). Postal codes were used instead of exact home addresses to maintain the anonymity of each respondent. Previous research has suggested that postal codes are suitable proxies of home neighborhoods in urban environments (Bow et al., 2004).

Data on location of schools, parks, public recreational opportunities (e.g., soccer fields, baseball diamonds, playgrounds), as well as land use types were obtained from the City of London Planning Department (2006) and validated by researchers through field surveys and inspection of air photos. The location of our 21 sample schools were mapped as points and manually verified to the midpoint of building façade.

Before assessing the influence of certain neighborhood environmental characteristics (e.g., land use mix, density of recreation opportunities, and level of park coverage) on physical activity levels, we first delineated neighborhoods by creating buffers around both the school and the home postal code of each respondent. A distance of 1.6 km was used to define school neighborhoods as this is the cutoff distance local school boards use for providing bus service to students. School boards use straight line buffers to determine the bussing cutoff, and for this reason, straight line buffers were applied instead of street-network based service areas. In the home neighborhood, a straight

line distance of 500 m was analyzed as it is a common measure in accessibility studies (Bow et al., 2004), and in the urbanized area of London, it guarantees to encompass the respondent's actual home address.

Park coverage was calculated in ArcGIS as the percent of public parkland divided by the total area of all land within each buffer. Recreational opportunities were defined as all publicly funded recreational facilities, including soccer fields, baseball diamonds, basketball courts, community centers, arenas, pools, tennis courts, playgrounds and wading pools (see Gilliland et al., 2006). The number of recreational opportunities within each buffer was calculated using a spatial join in ArcGIS, to assess the total number of facilities within each school and home neighborhood.

To calculate land use mix, every land parcel within the City of London was classified into six broad classes: recreational; agricultural; residential; institutional; industrial; and commercial; and then we calculated the total area of each of the six land uses within each buffer. Following a methodology used in previous studies (Frank et al., 2004; Leslie et al., 2007), an entropy index was used to determine land use mix within home and school neighborhoods:

$$\mathrm{LUM} = -\frac{\sum_u (p_u \ln p_u)}{\ln n},$$

where u is the land use classification; p is the proportion of land area dedicated to a particular land use; and n is the total number of land use classifications (i.e., six). Land use mix scores range from 0 to 1; 0 represents a single land use (e.g., all residential), while a score of 1 represents even distribution of all six land use classifications.

Statistical analysis

All data were entered into SPSS, version 15.0 for statistical analysis. Means and standard deviations were calculated using descriptive statistics. Total minutes of MVPA were assessed and compared by gender and grade. Given the recruitment strategy used, it was necessary to analyze the data as a cluster sample. The SPSS Complex Samples Procedure was used for all descriptive and comparative analyses to account for sampling design effect. The SPSS Complex Samples option allows selections of a sample according to a complex design and incorporates the design specifications into the data analysis. Once completed, logistic regression analysis was conducted to assess the relationship between perceived (parent report) neighborhood recreation opportunities and after school physical activity levels. For the logistic model, being in the upper quartile for after school physical activity was the dependent variable. Covariates included: season, grade, gender, ethnicity, member of sports/physical activity team, family structure, mother's education, father's education, mother's work status, father's work status, number of people living in household, and family income.

A second logistic regression was conducted to assess the influence of objectively measured environmental variables on the physical activity behaviors of these students. The environmental variables, including land use mix, percentage of park coverage, and recreational opportunities were considered in relation to whether the youth were grouped in the upper or lower quartile for physical activity level. The above environmental factors were categorized into an upper and lower half (lower 50% and upper 50%) for consideration. Additionally, a linear regression assessing the above-mentioned environmental variables as predictors of after school physical activity were also completed. The linear regression analyses were conducted to assess after school physical activity as a continuous variable, but we also assessed the upper and lower quartile of after school physical activity to see the strength/magnitude of the association between activity and environmental indicators.

A number of outliers were excluded as we deemed their reported activity level to be inaccurate (i.e., cases were excluded if children reported total physical activity level at more than 5 h/day). Therefore, this left us with a sample of 694 students.

Results

Means and standard deviations of physical activity by grade and gender are shown in Table 3.

Subjective assessment of recreation opportunities

Eighty-seven percent of parents reported having neighborhood recreation facilities. This model identified that those children with recreation facilities in their neighborhood (as reported by parents) were 13.91 min more active after school than children without facilities ($p<0.05$) (Table 4). Moreover, children whose parents reported access to these amenities were 2.04 (95% CI 1.06–3.92, $p<0.05$) times more likely to fall within the upper quartile of after school physical activity (>180 min/day) than those in the bottom quartile (<60 min/day) (Table 5).

Objective assessment of recreation opportunities

The logistic regression analysis revealed that, when controlling for season and demographic factors (i.e., the covariates), having two or more objectively determined recreation facilities in the neighborhood was associated with youth being in the upper quartile of physical activity (Table 5). Those students who had two or more recreation facilities in their neighborhood were 1.7 times (95% CI 1.09–2.50, $p<0.05$) more likely to be categorized in the upper quartile for after school physical activity. Similarly, when controlling for the covariates, the linear regression analysis also identified recreation facilities as a factor associated with greater activity. Specifically, with regard to after school activity, children with more than two recreation opportunities engaged in 16.49 (standard error 4.97, $p<0.05$) more minutes of physical activity than those with fewer than two (Table 4).

In both the logistic and linear regression analysis, land use mix and percentage of park coverage were not significant factors influencing physical activity level among London, Ontario adolescents.

Discussion

Greater physical activity was associated with youth having two or more objectively measured and subjectively measured (parent

Table 3
Means (standard deviations) of physical activity levels by grade and gender (min)

	Mean (S.D.)		
	School-hour PA	After school PA	Total PA
Grade			
Grade 7	46.2 (28.9)	116.3 (72.9)	162.5 (79.6)
Grade 8	49.6 (31.7)	108.4 (73.9)	158.1 (81.6)
Gender			
Boys	47.4 (30.1)	107.6 (74.6)	154.9 (80.6)
Girls	48.3 (30.8)	114.8 (72.3)	163.1 (81.2)
Total	48.3 (30.6)	111.7 (73.5)	159.9 (80.7)

report) recreation facilities in their neighborhood. The findings are consistent with previous studies throughout the globe linking increased physical activity to the provision of public recreation opportunities (see Gomez et al., 2004; Hume et al., 2005; Motl et al., 2005; Norman et al., 2006; Gordon-Larsen et al., 2006; Leslie et al., 2007; Tucker et al., 2007). The findings are also similar to previous research that has identified a positive association between both subjective and objective assessments regarding proximity to and accessibility of parks, playgrounds, and recreation facilities and youths' physical activity (e.g., Gomez et al., 2004; Gordon-Larsen et al., 2006; Hume et al., 2005; Krahnstoever Davison and Lawson, 2006; Mota et al., 2005; Motl et al., 2005; Norman et al., 2006; Sallis et al., 1993; Timperio et al., 2004; Utter et al., 2006; Zakarian et al., 1994). The importance of *actual* accessibility to recreation facilities was stressed throughout many of the above-mentioned studies, but it is also important to acknowledge the key role that *perception* has in actually using these facilities. By way of explanation, Motl et al. (2005) proposed that the perception of accessible equipment, both in the home and the community, can promote adolescents' physical activity by fostering increased barrier self-efficacy (i.e., ability to overcome a barrier to physical activity participation).

With the exception of number of publicly funded recreation facilities, this study did not find any other significant association between activity levels and other characteristics of the local physical environment such as the percentage of park space and land use mix. A lack of association between park space and activity level is perhaps surprising given that previous research has suggested a relationship between the presence or accessibility of public parks and health-related outcomes and behaviors such as physical activity (Sallis et al., 2000; Huston et al., 2003; Coen and Ross, 2006). However, recent research using more direct forms of observing children/parents (through surveys) and measuring parks (through environmental audits), suggests that park *quality* may be a more important determinant of park use by children and parents, than the mere presence or size of a park (Gilliland et al., 2007; Loukaitou-Sideris, 2002; Tucker et al., 2007). Nevertheless, as our ongoing research indicates, London, Ontario is an extremely well-parked city; virtually every household has access to a public park within 400 m of home, and every neighborhood has at least one high-quality public park in which youth can play (Gilliland et al., 2006, 2007).

As for the apparent lack of influence of land use mix on physical activity levels, the findings are not overly surprising, as existing literature on this environmental determinant is poorly theorized and largely inconclusive from an empirical standpoint. While land use mix is often cited as a predictor of walking among adults for utilitarian trips (e.g., shopping), presumably due to the increased number of potential destinations near home, the findings in studies of children are mixed; Kerr et al. (2007) discovered a positive correlation between land use mix and non-motorized travel to school, and Ewing et al. (2004) found the opposite. More research needs to be done using more direct forms of observing the behaviors of younger populations before such environmental factors, largely borrowed from studies of adult populations, can be confirmed as predictors of physical activity participation among youth.

At approximately 2.5 h of daily MVPA, the activity levels of youth in this study are similar to those reported previously (e.g., Anderson et al., 2005; Trost et al., 1999). While not out-of-line with prior research, our findings are higher than anticipated and may be explained by a number of factors. First, the high education level among parents in this study may have influenced our findings, as parental education and child's physical activity have long been correlated (e.g., Gordon-Larsen et al., 2000; Guillaume et al., 1997). Second, it is possible that the 49% of students who volunteered to participate in the study were the most active and therefore, not representative of the entire student body. Additionally many respondents engage in organized activities, offering substantial time to achieve considerable MVPA.

Table 4
Estimated means for objective and subjective recreational opportunities as a predictor of after school physical activity among London, Ontario grade 7 and 8 students

	Model 1 (objective)				Model 2 (subjective)		
	β	S.E.	p-Value		β	S.E.	p-Value
% Park space ($\geqslant$6.8%)	−2.97	5.46	0.59				
Recreation facilities ($\geqslant$2)	16.49	4.97	0.004	Rec facilities	13.91	6.02	0.03
Land use mix ($\geqslant$0.52)	−8.26	9.38	0.39				
	$R^2 = 0.07$				$R^2 = 0.06$		

This model controlled for the following confounding covariates—season, gender, grade, ethnicity, family structure, number of people living in household, father's and mother's education, father's employment, household income, and participation in organized sport.

Table 5
Odds ratio for London, Ontario grade 7 and 8 students in the upper quartile of after school physical activity and objective and subjective report of recreational opportunities in their neighborhood

	95% Confidence interval (objective)					95% Confidence interval (subjective)			
	Odds ratio	Lower	Upper	p-Value		Odds ratio	Lower	Upper	p-Value
% Park space ($\geqslant$6.8%)									
PA upper quartile	0.92	0.58	1.45	0.70					
PA bottom quartile	1.00								
Recreation opportunities ($\geqslant$2)									
PA upper quartile	1.65	1.09	2.50	0.02	Rec facilities	2.04	1.06	3.92	0.03
PA bottom quartile	1.00								
Land use mix ($\geqslant$0.52)									
PA upper quartile	0.80	0.42	1.52	0.48					
PA bottom quartile	1.00								
	$R^2 = 0.09$								

This model controlled for the following confounding covariates—season, gender, grade, ethnicity, family structure, number of people living in household, father's and mother's employment, father's and mother's education, household income, and participation in organized sport.

Potential limitations

This study is unique in that it examined the effect of the environment, specifically neighborhood recreation opportunity structures, on the physical activity of youth in London, Ontario, Canada. Despite the interesting and valuable findings, a number of potential limitations need to be discussed.

First, the cross-sectional design of this study is a limitation as no causal inferences can be made from these findings. Second, we focused on the presence or absence (subjectively measured), and quantity (objectively measured) of neighborhood activity opportunity structures impacting physical activity, but the *quality* of these facilities was not objectively measured. We know from previous investigations that park quality is important in determining whether people will or will not use the facilities (Gilliland et al., 2007; Tucker et al., 2007). Had more detailed characteristics of neighborhood park space (beyond overall size) been assessed, our findings may have revealed that the easy accessibility of certain types of publicly provided park space in the local neighborhood plays an important role in overall physical activity levels among youth. Therefore, future research should both objectively and subjectively assess the quality of these facilities in relation to physical activity among youth.

Given the self-report nature of this study, the accuracy of the reported physical activity level should be considered with caution. It is clear from previous research that youth over-report vigorous physical activity levels (Ross et al., 1985; Ross and Gilbert, 1985). In addition to their predisposition for over-reporting their activity, the PD-PAR itself may have further inflated activity findings given the 30-min block structure of the instrument. That is, if students recorded MVPA within one block of time, he/she was given credit for 30-min of activity, which was then assigned a MET value from the Compendium of Physical Activities. However, if the MVPA activity in that block of time was not sustained for the entire half hour, the child would have been evaluated with an overestimation of MVPA (Anderson et al., 2005). Although more objective, and therefore valid, assessments of activity level would help increase the confidence we have in our findings, these tools were deemed inappropriate for this population-based study because of their high costs and logistical challenges (as suggested by Weston et al., 1997).

An additional challenge with the PD-PAR relating specifically to the purpose of our study was its inability to identify the location where physical activity occurred making it difficult to assess mode of active/passive transport because some students will include that in the 30-min block with the activity itself. Consequently, we are unable to identify whether the recreation facility itself or the transport to the facility is responsible for fostering physical activity within this population.

Lastly, our sample included a purposeful selection of schools from varying and diverse geographical areas within the city. As such our sample did not comprise a random sample of grade 7 and 8 students from London, Ontario.

Conclusions

Despite the above-mentioned limitations, it is important to note that the current study assessed the activity levels and neighborhood environmental features of a notably large number of London, Ontario youth in grades 7 and 8. To the best of our knowledge, this is the first Canadian study of its kind. Furthermore, it is one of the only studies set in a mid-sized North American city, as the literature is dominated by studies set in larger US cities. While the results are not necessarily generalizable to all settings, this study has important implications for city planners and other decision-makers involved in the construction and management of urban environments. This study adds to the literature on built environment and health and provides further support of this relationship among youth, as identified by previous research among other populations (Gordon-Larsen et al., 2006; Krahnstoever Davison and Lawson, 2006; Mota et al., 2005; Norman et al., 2006). This study offers insights into how physical activity levels of youth are associated with access to environmental features; we therefore submit that changes to the built environment of our cities which promote increased access to recreation facilities may be a key to promoting active lifestyles.

Given our current state of knowledge concerning childhood obesity, it seems imperative that further research be conducted into how environmental factors influence physical activity levels in youth, particularly if we are to develop youth-oriented interventions that promote life-long healthy behaviors. Moreover, given that environmental and policy changes are appropriate venues to modify physical activity behaviors of youth, and given the ability of these types of intervention to target a large population, it is critical that academics work with city officials, school boards and community stakeholders to consider enhancing both the quality and accessibility of neighborhood recreation facilities.

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