Socioeconomic Discrepancies in Children's Access to Physical Activity Facilities: An Activity Space Analysis

Corresponding author: Léa Ravensbergen

University of Toronto at Mississauga

Room 3211 Davis Building, 3359 Mississauga Rd. N.

Mississauga, On., L5L 1C6

Tel: 647.762.1307 Fax: 905.828.5273

lea.ravensbergen@mail.utoronto.ca

Ron Buliung

University of Toronto at Mississauga Room 3264 Davis Building, 3359 Mississauga Rd. N., Mississauga, On., L5L 1C6

Tel: 905.569.4419 Fax: 905.828.5273 ron.buliung@utoronto.ca

Kathi Wilson

University of Toronto at Mississauga Room 3283 Davis Building, 3359 Mississauga Rd. N., Mississauga, On., L5L 1C6

Tel: 905.828.3864 Fax: 905.828.5273 kathi.wilson@utoronto.ca

Guy Faulkner

University of Toronto Room 2080 55 Harbord St., Toronto, On., M5S 2W6 Tel: 416.946.7949 Fax: 416.971.2118

guy.faulkner@utoronto.ca

Total number of words in title, authors, abstract,

headings and text: 4and 35 references

Number of figures and tables: 5

ABSTRACT

Few Canadian children meet current physical activity (PA) recommendations, especially children from households having lower socioeconomic status (SES). Previous work suggests that accessibility to, quality of, and cost of physical activity promoting facilities influences PA levels. Disparities in accessibility to PA resources may contribute to neighborhood health and social inequalities. Many studies examine geographic accessibility to health-promoting facilities in residential neighborhoods, ignoring individual mobility and other barriers to access such as cost and quality. This study examines SES differences in accessibility to PA facilities for schoolchildren as they move throughout the day. It does so using activity spaces measured using a modified version of a road network buffer and a shortest path network estimation method. SES based differences in use and quality of visited physical activity resources are also considered. Results indicate that the high SES sample has greater accessibility to PA facilities and uses them more frequently. Used facilities are of higher quality than those used by children living in low SES neighborhoods. Cost is identified as a potential barrier to facility access for the low SES group. To combat neighbourhood health inequalities cities should aim to provide high quality, affordable, and accessible resources across all neighborhoods.

INTRODUCTION

National statistics indicate that 93% of Canadian children do not meet the Canadian Physical Activity Guidelines of at least one hour of moderate to vigorous intensity physical activity daily (1). Regular physical activity is not only associated with physical fitness, but also with motor skill development, coordination, better bone health, greater academic achievement and cognitive functioning, greater self-esteem, less risk of depression and anxiety, better health-related quality of life, and better psychological health (2). Furthermore, Canadian children of higher socioeconomic status (SES) tend to be more physically active than those of lower SES (2).

There is growing evidence that environmental factors partly determine physical activity levels. Consider, for example, how geographic accessibility to physical activity resources such as parks, community centres, and playgrounds in residential neighborhoods is associated with children's physical activity levels (3, 4, 5) and lower rates of obesity (6). Two literature reviews found that children's accessibility to recreational programs and facilities is consistently associated with physical activity (7, 8). In East Harlem, New York, the presence of one or more playgrounds on a child's block was positively associated with unscheduled physical activity levels (3). Indeed, levels of unscheduled physical activity increased as the number of physical activity resources on a child's block increased. Using activity diaries and accelerometer data, another study found that children's accessibility to other recreational facilities (playgrounds, recreational centres, basketball courts) is also associated with high rates of physical activity (5). Evidence also suggests that the prevalence of obesity declines with residential accessibility to greenspace (6). Simply put, living near physical activity facilities such as parks, community centres, and fitness clubs, may encourage physical activity.

Further research has found that disparities in body weight and physical activity levels found in low SES neighborhoods may be due, in part, to an inequitable distribution of physical activity resources (3, 13, 14). Take, for example, how children from low-income families were more likely to have no physical activity resources on their block in one study, while another found that higher SES neighborhoods were more likely to have accessibility to a variety of physical activity resources (3, 13). Interestingly, even public facilities that we would expect to be found in equal proportions across neighborhoods such as schools, parks, youth organizations and YMCAs appear to be unevenly scattered around cities (13). Finally, low-income neighborhoods have been found to not only have fewer physical activity facilities, but also higher levels of incivilities (e.g. trash, graffiti, etc.) at these resources than those found in the high-income neighborhoods (14). Taken together, the literature demonstrates how disparities in body weight and physical activity levels found in low SES neighborhoods may be due, in part, to the inequitable distribution and declining condition of some physical activity resources.

Accessibility is most frequently measured at the neighborhood level where the number or density of facilities within residents' census tracts, postal code areas, or buffers around households may be used to represent how accessible health promoting resources are. This common practice has recently been criticized in the food environment literature because individuals often leave their residential address over the course of their daily lives and are therefore exposed to determinants of health within and beyond their residential neighborhoods (15, 16, 17, 18). A promising method to capture residential and non-residential individual exposure to environmental determinants of health is the use of activity spaces. Activity spaces are the "locations with which the individual has direct contact as the result of day-to-day

activities" (19). Activity spaces are a spatial representation of individuals' activity and mobility patterns.

Looking beyond geographic accessibility, which does not guarantee use, there are other barriers to access including: lack of financial resources, limited supply of transport options, crime/safety, and quality of facilities (10, 11, 12). In a study of children's park use and physical activity, social (i.e., presence of other active children, presence of a parent or supervisor), contextual (i.e., formality of play), and design features (i.e., picnic areas, courts, number of recreational facilities) were found to influence physical activity levels (10). Using an audit tool, another study compared two contrasting neighborhoods, one with residents exhibiting higher levels of physical activity than the other, and found that in the high physical activity neighborhood, parks were not only more common, but were also of superior quality (i.e., equipment and low levels of physical disorder) (11). In another study, the total number of physical activity facilities available to youth from low-income neighborhoods did not affect their physical activity behaviours (12). Instead, cost and the perception that nearby facilities were of poor quality were identified as PA barriers. Clearly, beyond accessibility, quality and cost are integral parts of use.

This study uses children's activity-travel data and an activity space approach to examine SES inequality with regard to accessibility to, use of, and quality of physical activity resources in bordering neighbourhoods in the city of Toronto, Canada. Given that children of lower socioeconomic standing tend to be less physically active, this research aims to understand if such children have poorer accessibility to physical activity resources or use them differently, or use facilities of poorer quality than higher SES children.

METHODS

Data and Study Area

This study builds on project BEAT (Built Environment Active Transportation), an ongoing, large scale, multidisciplinary and mixed methods study of the association between school transportation modes, activity levels of Toronto schoolchildren aged 10-11 years and the built environment. Among other data collection activities, participants were asked to complete an activity-travel diary. The activity-travel diary provided individual characteristics of children and caregivers of the study and an activity log in which caregivers were asked to document the type, to/from travel mode, duration, and location of every activity in which their child participated in over the course of four consecutive days (2 weekdays, and 2 weekend days). Many studies have used an activity or travel log tool to analyze spatial mobility and activity engagement (20,21).

The sample used here includes children attending schools located in socioeconomically contrasting bordering urban neighborhoods that were built during the same era and are similar with regard to street design, public transport services, and design of commercial strips. Triangulation of data at three different scales, the neighborhood, school, and household, was performed in order to select a socially contrasting sample. The triangulation process included examination of city-wide indicators of SES by neighborhood, indicators of a school's SES, and indicators of household SES provided by the activity diaries from project BEAT (22).

To satisfy research ethics requirements and preserve confidentiality and anonymity, the three participating schools are coded as low SES school # 1, low SES school # 2, and high SES school. The sample size of the high SES school (n=56) is similar to that of the two low SES schools combined (n=48) due to poorer survey return rate in the low SES schools. One hundred and thirty-one children from the three schools sampled for this study completed and returned an activity diary. To ensure data quality, children that documented activities on all four days under question (2 week days and 2 weekend days) were considered to have adequate data and were selected for this research producing a final sample of n=104 children.

Activity Space Estimation

Of the many activity space measurements that exist, this study uses two methods to estimate children's activity spaces: the Road Network Buffer (see: 23 and 24) and the Activity Location Buffer. The Road Network Buffer consists of the area around the shortest path children might take as they moved by foot, bicycle, public transit, or car from one activity to the next throughout the four days they participated in this research. The Activity Location Buffer consists the area around each location the children indicated visiting. Both methods consider non-residential accessibility to physical activity resources by incorporating children's activities at non-residential destinations (22).

Accessibility to Physical Activity Facilities

Children's accessibility to physical activity resources was measured as the number and density of physical activity facilities in children's activity spaces. A geospatial database of physical activity promoting resources in Toronto was created. Physical activity facilities were extracted from multiple data sources and classified by facility type. The inclusion of facility types was based on those identified in the Physical Activity Resource Assessment (see *14*) to study how neighborhood factors influence physical activity. Categories included: fitness clubs, parks and/or trails, sport facilities, community centers, religious institutions, and schools.

Multiple data sources were used to create the Toronto Physical Activity Facilities database (Figure 1). Parks and trails were taken from a 2014 Parks and Green Space dataset from Parks, Forestry and Recreation that provides the boundaries and names of all Green Spaces in Toronto (25). The Toronto Police Service's school dataset was used to represent all Toronto District School Board (TDSB) and non-Toronto District School Board schools (26). Community Centres were extracted from the pre-determined Community Centre and Assembly Hall category from the City of Toronto's 2015 address points (27), and religious institutions were extracted from the pre-determined Religious Institution category from DMTI's 2012 Enhanced Points of Interest database (28).

Fitness Clubs and Sports Facilities were extracted from Pitney Bowes Mapinfo's (2010) Canada Business data (29). Fitness Clubs included gyms and health clubs, yoga and dance studios, indoor playgrounds, and rock climbing gyms. Sports Facilities included stadiums, arenas, athletic fields, outdoor bocce courts, tennis, golf, and squash facilities, skateboard parks, and bowling alleys. Pre-determined categories existed for gyms and health clubs, yoga and dance studios, stadiums, arenas & athletic fields, and bowling alleys in the Pitney Bowes Mapinfo's

Canada Business dataset. All other fitness clubs and sports facilities were identified manually by name from the list of businesses. All potentially relevant categories from the list of 130,037 Toronto businesses were extracted. Data quality checks were performed to verify location data and facility functions producing a final database of 2,944 unique facilities.

Once the physical activity facilities database was created, the number and density of all physical activity facilities, as well as all different types of facilities, within each child's activity space was estimated. For parks and trails, both the number and total area were measured. Difference of means t-tests were performed on log transformed (normalized) values of facility metrics. The physical activity database only existed for the city of Toronto while many activity spaces surpassed this boundary, particularly for children attending the higher SES school. To ensure that the results were not misleading, the activity space areas within the Toronto boundaries were used for this part of the analysis.

Use of Physical Activity Facilities

In the activity diaries, the caretakers, the children themselves, or adult caregivers in combination with the children described every activity their child participated in as well as its location. This enabled an assessment of the accessibly facilities actual used by the children. The number and type of facilities used by the children was determined and the existence of SESrelated discrepancies in use was investigated. Actual activities performed at recorded locations as well as the monetary costs of performing these activities were considered. Documenting how much children or their households paid to access facilities proved to be a difficult task as many resources, and particularly community centres, sports facilities, and fitness centres, provide many services, all of which incur varying user costs. For example, most hockey arenas were surrounded by a public park and had free or inexpensive skating nights, but also had high registration fees for those using the facility to play hockey as part of a club. To produce the most accurate representation of user cost(s), the activity that each child participated in at each resource was examined and assigned as either free (e.g., playing in a park, going to school, etc.), pay at the door (e.g., entrance fee to play basketball, drop in yoga, etc.), membership or class-based activities (e.g., being part of a hockey club or dance class, etc.) or unknown (e.g., when the child indicates skating as an activity and both free and costly skating programs exist).

Quality of Physical Activity Facilities

Site audits were performed to shed light on the quality of visited facilities using the Physical Activity Resource Assessment (PARA) instrument (14). PARA is a commonly used validated audit (see 30, 31, 32, 33) used to rate facilities on 6 dimensions: type, cost, features, amenities, quality, and incivilities. The audit compromised 13 features items (e.g. basketball courts, soccer fields, baseball diamonds, etc.), 12 amenity items (e.g. trash containers, benches, water fountains, etc.) and 9 incivility elements known to make facilities less pleasant to use (e.g. litter, overgrown grass, graffiti, etc.). The count of all facilities and amenities was assigned a score. For facilities, this score was calculated by summing the number of courts present for hockey, volleyball, tennis, soccer, basketball, and tennis and giving a point if all other features were present (e.g. bicycle racks, playground, etc.) and no points if they were not. For amenities,

each item was assigned 0 if none were present, 1 if inadequate numbers were present, 2 if acceptable numbers were present, and 3 if ample numbers were present. Features and amenities were also rated for quality (1 for poor, 2 for mediocre and 3 for good) using objective standards provided in the tool's instruction manual. Each of the 9 incivilities measures was scored out of 3 (0 = Not Present, 1 = Poor, 2 = Mediocre, 3 = Good). The PARA instrument was modified for supplemental data collection to better situate the analysis in the study area. For example, the presence and quality of hockey rinks was added to the feature section (making this section out of 14 items). The audit's official operational definitions were used to rate all features, amenities, and incivilities. Pictures of all sides of each facility were taken by the researcher to give a general impression of each facility and its situation. Pictures were also taken of items of potential relevance given the research questions (e.g., litter, graffiti, an impressive playground, beautiful landscaping, etc.). This was done in order to compliment the audit and to help with the analysis post site visit.

In thirteen instances the diaries did not indicate an exact address or place name for an activity. Respondents opted to give the nearest intersections instead. When this was the case, the closest facility to the named intersection was chosen. In 14 instances there was inadequate location information to identify the facility in use. A total of 3,360 activities were documented in the 104 participants' diaries. Of these, 501 activities (14.91% of total) took place in or at physical activity facilities (as defined by *14*) within the City of Toronto boundary. Forty-seven identifiable facilities were audited between August and September 2014 on clear, sunny days between 10am and 3:30pm. This time of day was chosen to control for changes in traffic that might be observed into the commute travel peak hours.

RESULTS

Accessibility of Physical Activity Facilities

Results indicate that the high SES sample had a greater total number of physical activity resources (p=0.01) accessible to them than the low SES sample. However, no significant difference existed between the two groups in terms of facility density (Table 1). While the high SES sample had a greater total number of facilities in their activity spaces, this was not the case for all types of facilities. The low SES sample had a greater number of and a higher average density of community centres regardless method used. This greater access to community centres was statistically significant using the activity location buffer method for both the number (p<0.01) and density (p<0.05) of facilities and using the road network buffer for density (p<0.01) only. The high SES sample had greater numbers (p<0.01) and densities (p<0.1) of religious institutions in their activity spaces using both methods. They also had a greater number (p<0.01) of accessible schools. Whether group wise differences existed in the accessibility of parks depended the method used: the high SES group had greater numbers of parks accessible to them (p<0.01) using the road network buffer, but the low SES group had greater densities of parks accessible (p<0.01) using the activity location buffer method. The high SES sample consistently had more park area accessible – regardless of method used (p<0.01).

Use of Physical Activity Facilities

Of the many physical activity resources accessible to the children, fifty-three different facilities were visited according to the activity diaries. Overall, the high SES sample accessed more physical activity resources (35 vs. 23) and used them more frequently (5.36 times per child vs. 4.35) (Table 2). The type of facility most frequently visited by all children was sports facilities (13 facilities used), followed by religious institutions (11 facilities used), parks/ trails (10 facilities used), schools (8 facilities used), fitness clubs (6 facilities used), and community centres (5 facilities used). SES discrepancies were identified in the facility types. The high SES children used sports facilities, schools, and fitness clubs far more frequently than the low SES group. Specifically regarding sports facilities, the high SES group visited more than twice as many facilities (10 vs. 4) and visited them approximately four times more frequently than the low SES sample. The low SES sample did, however, use religious institutions more frequently than the high SES sample. Regarding the use of parks/trails, while both the high and low SES sample visited six different parks during the study period, the low SES sample used these parks far more frequently (0.54 times per child vs. 0.27).

SES-based separation in the individual facilities used was also identified, indicating potentially limited social-mixing within the physical activity context. Of the fifty-three facilities used, only five were frequented by children from both samples despite the geographical proximity of their neighborhoods. Furthermore, two of these five facilities also exhibited socioeconomic discrepancies in use (i.e., one was visited eighteen times by the high SES sample and only once by the low SES sample, while the other was used twenty-seven times by the low SES sample and only once by the high SES sample). Therefore, only three facilities were used as frequently by both the high and low SES sample. In all other cases, regardless of school proximity, facilities were used almost exclusively by children from the high or low SES; rarely by both.

Socioeconomic discrepancies exist in the way these physical activity resources are used as well (Table 3). For example, the most common use of community centres was to play in the park - a free of cost use of the centre - for the low SES group and to play hockey - an expensive sport – for the high SES group. The high SES group also used sports facilities predominately for playing hockey while the low SES groups' main use of this type of facility was to go bowling. Only the high SES group visited fitness clubs that were audited, all of which had user fees. Overall, the high SES group played hockey and volleyball and attended choir more frequently than the low SES group who played in parks more often. The low SES group also swam, worshiped, and attended language/ cultural classes more frequently while the high SES group skated, played music and basketball, went rock climbing, watched hockey, attended daycare and walked more often. Both groups played soccer with similar frequencies. Overall, the high SES group participated in organized sports such as soccer, swimming, skating, dance, and hockey, far more frequently than the low SES group (85 times vs. 29 for all organized sports). In terms of user costs or fees, the facilities used varied from public parks to community centres with subsidized programming to health clubs with monthly fees to an exclusive yacht club with a \$15,000.00 entrance fee. While the majority of activities for both the high and low SES group were free of cost, the high SES group paid for a far larger proportion of activities at physical activity facilities (19.19% vs. 10.31%).

Quality of Physical Activity Facilities

Given that so few facilities were used by both children from the high and low SES sample, the facilities were categorized into three groups, those used by the high SES sample, those used by low SES sample, and those used by both samples. Facilities used by the high SES group received higher average quality scores on the audit when compared to the low SES group (p<0.01). The average facilities and amenities count scores were also higher (p< 0.01) while the average incivilities score was lower for facilities visited by the high SES group than those visited by the low SES group (Table 4). Both groups had similar proportions of medium sized facilities, but there were far more large-sized facilities frequented by the high SES group (46% vs. 31%). The three facilities sought out equitably by children in both groups received by far the highest features and amenity scores on the PARA audit.

Some of these facilities were used more frequently than others: only seven of the fifty-three facilities were used more than ten times during the study period. Not surprisingly, three of these seven institutions were the children's schools. Two are community centres and the remaining two are a park used by the low SES group and a hockey arena that the high SES sample used frequently. Overall, the frequently used high SES facilities had greater average numbers of facilities (26 vs. 20), higher quality features (52 vs. 39) and amenities (68 vs. 65), and fewer incivilities (10 vs. 40) than those used frequently by the low SES group. Facilities frequently used by the low SES school did, however, receive a higher average score for amenity count (33 vs. 31) (22).

DISCUSSION

With regard to accessibility to physical activity facilities, this study contributes some insight into how mobility shapes children's accessibility. Consistent with previous work, results indicate that the high SES group had more physical activity facilities in their activity spaces than the low SES group (3, 13, 14). However, no difference was found when it came to facility density. These results raise questions regarding how accessibility is measured, and how facilities and their various amenities are located, from a process or institutional perspective, across the city. Specifically, whether it is the number or density of facilities accessible that influences resource use. Group wise differences in accessibility to such possibly health-promoting resources also varied by facility type. Given that children of high SES tend to be more active (2), as was the case in a separate piece of research on the same sample where the high SES group exhibited higher levels of moderate to vigorous physical activity (22), perhaps greater accessibility to numbers of physical activity resources influenced their use and children's levels of physical activity.

SES discrepancies in access to physical activity resources exist beyond geographic accessibility. The types of facilities visited and activities performed at these facilities also varied by group. The high SES group used more physical activity resources, and used them more frequently. Children from higher SES households participated in organized sports more frequently in this study, a trend identified across Canada (34). In 2005, the annual cost of Canadian children's sports and athletic equipment averaged \$579 (34). Furthermore, this average does not include time and monetary costs associated with transportation to practice and sporting events, competition entry fees, and club memberships (34). Given that the median after tax household income for families living in the two low SES census tracts in this research is \$34,476 and \$41,268, this represents a heavy financial burden. Furthermore, results indicate that the high

SES group paid more frequently to access physical activity resources – regardless of whether it was to participate in organized sport or not - than the low SES sample. These results signify that cost may be a barrier to access physical activity facilities for low SES families. This is congruent with previous work (12): rather than being deterred by distance to physical activity resources, youth residing in low-income neighborhoods found cost to be a major barrier.

Several steps can be taken to reduce financial barriers to accessing physical activity facilities. At the municipal scale, public programs aimed at reducing facility entry fees at publically funded community centres should be expanded. Some non-publically funded physical activity facilities also provide financial assistance to low-income families. Following these examples, the machinery of organized sport for the privileged should aim to include options for higher income families to donate fees partially or in their entirety to support participation from across the broader socioeconomic spectrum. Bursary programs offer another possibility to encourage social inclusion in play and sport, although the impact may be limited in terms of the number of individuals affected. Steps can be taken to broaden the reach of such initiatives.

In the public policy realm, it is commonly believed that neighborhoods with mixed social classes build social capital, the expected economic or collective benefits derived from social networks (35). While most research focuses on social mixing *in neighborhoods* to combat inequality (35), children attending schools in socioeconomically contrasting neighborhoods demonstrated a lack of social mixing in terms of *activity participation* in this study. Regardless of geographic proximity to one another, the children very rarely frequented the same physical activity facilities and therefore have low likelihood of social mixing. This observation should be further examined in future research.

Results illustrate that the actual facilities used by the high SES group were of higher quality than those used by the low SES group: they scored higher points on the Physical Activity Resources Audit when it came to features (e.g. basketball courts, baseball fields, etc.) and amenities (e.g. benches, lights, etc.) (p < 0.01) and lower points when it came to incivilities (e.g. litter, graffiti, etc.). This was also the case for facilities that were used frequently (10 or more times): the ones used by the high SES group tend to score higher on the Physical Activity Resource Audit than those used by the low SES group. Finally, the high SES group also frequented more large resources than the low SES group. These results imply that SES inequalities exist for more than just accessibility: inequalities in quality of physical activity facilities also exist. These results are congruent with previous work showing that geographic accessibility does not guarantee use; quality is also important (9, 10, 11, 12).

CONCLUSION

This study sheds light on the complex relationship between social factors, accessibility to physical activity resources such as parks, community centres, fitness clubs, and sports complexes, use of these facilities, and quality of these resources. The results indicated that SES discrepancies exist in the accessibility, use, and quality of physical activity facilities. The high SES group had a greater number of physical activity facilities accessible to them. However, no difference was found regarding the density of facilities. The high SES group also used physical activity facilities more frequently and visited facilities of higher quality than those used by the

low SES sample. This research also indicates that cost is likely a barrier to participation in physical activities, specifically organized sport, amongst low SES groups. Indeed, results indicated that the high SES group paid more frequently than the low SES group to access physical activity resources and participated more frequently in organized sports. This research also demonstrates the utility of expanding the use of transportation data and concepts to the study of neighborhood health inequalities. The results also further our understandings of health inequalities: children from low SES households may be less active due to their poorer accessibility to and use of physical activity facilities. Furthermore, these children often visit facilities of lower quality and likely face financial barriers to accessing resources. Specifically, this work demonstrates the need for municipal governments to ensure geographical accessibility to facilities, as well as ensuring these resources are affordable and of high quality for the entire population – irrespective of class.

ACKNOWLEDGEMENTS

The first author received the Canadian Institute of Health Research Canadian Graduate Scholarship – Masters Award (CIHR CGS M). The second author acknowledges funding support from the Built Environment, Obesity and Health Strategic Initiative of the Heart and Stroke Foundation and the Canadian Institutes of Health Research (CIHR).

Works cited

- (1) Statistics Canada. *Physical Activity Levels of Canadian Children and youth, 2007 to 2009.* 2011. http://www.statcan.gc.ca/pub/82-625-x/2011001/article/11553-eng.htm. Accessed September 14th, 2014
- (2) Active Healthy Kids Canada. Are We Driving Our Kids to Unhealthy Habits? The Active Healthy Kids Canada 2013 Report Card on Physical Activity for Children and Youth. Toronto: Active Healthy Kids Canada, 2013.
- (3) Galvez, M. P., K. McGovern, C. Knuff, S. Resnick, B. Brenner, S. L. Teitelbaum, and M.S. Wolff. Associations Between Neighborhood Resources and Physical Activity in Inner-City Minority Children. *Academic Pediatrics*, Vol. 13(1), 2013, pp. 20-26.
- (4) Roemmich, J. N., L. H. Epstein, S. Raja, L. Yin, J. Robinson, and D. Winiewicz. Association of Access to Parks and Recreational Facilities with the Physical Activity of Young Children. *Preventative Medicine*, Vol. 43, 2006, pp. 437–441.
- (5) Maslow, A. L., and N. Colabianchi, N. Youth Physical Activity Resource Use and Activity Measured by Accelerometry. *American Journal of Health Behaviour*, Vol. 35(2), 2011, pp. 219-297.
- (6) Bell J. F., J. S. Wilson, and G. C. Liu. Neighborhood Greenness and 2-Year Changes in Body Mass Index of Children and Youth. *American Journal of Preventative Medicine*, Vol. 35(6), 2008, pp. 547–53.
- (7) Ding, D., J. F. Sallis, J. Kerr, S. Lee, and D. E. Rosenberg. Neighborhood Environment and Physical Activity Among Youth: A Review. *American Journal of Preventative Medicine*, Vol. 41(4), 2011, pp. 442-455.
- (8) Sallis, J. F., J. J. Prochaska, and W. C. Taylor. A Review of Correlates of Physical Activity of Children and Adolescents. *Medicine Science Sports Exercise*, Vol. 32(5), 2000, pp. 963, 975.
- (9) Weiss, C. C., M. Purciel, M. Bader, J. W. Quinn, G. Lovasi, K. M. Neckerman, and A. G. Rundle. Reconsidering Access: Park Facilities and Neighborhood Disamenities in New York City. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, Vol. 88, No. 2, 2011, doi:10.1007/s11524-011-9551-z
- (10) Floyd, M. F., J. N. Bocarro, W. R. Smith, P. K. Baran, R. C. Moore, N. G. Cosco, M. B. Edwards, L. J. Suau, and K. Fang. Park-Based Physical Activity Among Children and Adolescents. *American Journal of Preventative Medicine*, Vol. 41(3), 2011, pp. 258 –265.
- (11) Baker, E. A., M. Schootman, C. Kelly, and E. Barnidge. Do Recreational Resources Contribute to Physical Activity? *Journal of Physical Activity and Health*, Vol. 5(2), 2008, pp. 252 261.

- (12) Romero, A. J. Low-Income Neighborhood Barriers and Resources for Adolescents' Physical Activity. *Journal of Adolescent Health*, Vol. 36, 2005, pp. 253–259.
- (13) Gordon-Larsen, P., M. C. Nelson, P. Page, and B. M. Popkin. Inequality in the Built Environment Underlies Key Health Disparities in Physical Activity and Obesity. *Pediatrics*, Vol. 117(2), 2006, pp. 417- 424.
- (14) Lee, R. E., K. M. Booth, J. Y. Reese-Smith, G. Regan, and H. H. Howard, H.H. The Physical Activity Resource Assessment (PARA) Instrument: Evaluating Features, Amenities and Incivilities of Physical Activity Resources in Urban Neighborhoods. *International Journal of Behavioural Nutrition and Physical Activity*, Vol. 14, 2005, pp. 2-13.
- (15) Chaix, B. Geographic Life Environments and Coronary Heart Disease: a Literature Review, Theoretical Contributions, Methodological Updates, and a Research Agenda. *Annual Review of Public Health*, Vol. 30, 2009, pp. 81-105.
- (16) Cummins, S. Commentary: Investigating Neighbourhood Effects on Health—Avoiding the 'Local Trap'. *International Journal of Epidemiology*, Vol. 36, 2007, pp. 355–357.
- (17) Diez Roux, A. V. Estimating Neighborhood Health Effects: the Challenges of Causal Inference in a Complex World. *Social Science & Medicine*, Vol. 58, 2004, pp. 1953–1960.
- (18) Kwan, M. P. The Uncertain Geographic Context Problem. Annals of the Association of American Geographers. Vol. 102 (5), 2012, pp. 958-968.
- (19) Horton, F. E., and D. R. Reynolds. Effects of Urban Spatial Structure on Individual Behavior. *Economic Geography*, Vol. 47(1), 1971, pp. 36–48.
- (20) Kwan, M. P. Space-Time and Integral Measures of Individual Accessibility: A Comparative Analysis Using a Point-Based Framework. *Geographical Analysis*, Vol. 30, 1998, pp. 191-217.
- (21) Schonfelder, S., and K. W. Axhausen. Activity Spaces: Measures of Social Exclusion? *Transport Policy*, Vol. 10, 2003, pp. 273-286
- (22) Ravensbergen, L. (2015). Socioeconomic Discrepancies in Children's Accessibility to Health Promoting Resources: An Activity Space Analysis (Masters Thesis). Retrieved from ProQuest Dissertations and Theses. (Accession Order No. 13108)
- (23) Sherman, J. E., J. Spencer, J. S. Preisser, W. M. Gesler, and T. A. Arcury. A Suite of Methods for Representing Activity Space in a Healthcare Accessibility Study. *International Journal of Health Geographics*, Vol. 4(1), 2005, DOI: 10.1186/1476-072X-4-24.
- (24) Horner, M. W., and Wood, B. S. Capturing Individuals' Food Environments Using Flexible Space-time Accessibility Measures. *Applied Geography*, Vol. 51, 2014, pp. 99-107.

- (25) Parks, Forestry and Recreation. *Parks and Green Space (WGS84)*, 2014. http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=da6389fe9c18b210VgnVCM100000 3dd60f89RCRD&vgnextchannel=1a66e03bb8d1e310VgnVCM10000071d60f89RCRD. Accessed April 18, 2015
- (26) Toronto Police Service. School Locations All Types, 2014. http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=16a91e22fe370410VgnVCM100000 71d60f89RCRD&vgnextchannel=1a66e03bb8d1e310VgnVCM10000071d60f89RCRD. Accessed April 18, 2015.
- Repository, 2015. http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=91415f9cd70bb210VgnVCM100000 3dd60f89RCRD&vgnextchannel=1a66e03bb8d1e310VgnVCM10000071d60f89RCRD. Accessed April 19, 2015.

(27) Geospatial Competency Centre. Address Points (Municipal) - Toronto One Address

- (28) DMTI Spatial. *Enhanced Points of Interest* v2012.3, 2014. http://maps.library.utoronto.ca/cgi-bin/datainventory.pl?idnum=1415&display=full&title=Enhanced+Points+of+Interest+v2012.3&edition=2012. Accessed April 19, 2015.
- (29) Pitney Bowes Mapinfo. *Canada Business Data*, 2010 http://maps.library.utoronto.ca/cgibin/files.pl?idnum=1037&title=Canada+Business+Data. Accessed May 6, 2015.
- (30) Castelli, D., C. Hillman, S. Buck, and H. Erwin. Physical Fitness and Academic Achievement in Third-and Fifth-Grade Students. *Journal of Sport and Exercise Psychology*, Vol. 29(2), 2007, pp. 239-252.
- (31) DeBate, R. D., E. J. Koby, T. E. Loonet, J. K. Trainor, M. L. Zwald, C. A. Bryant, and R. J. McDermott. Utility of the Physical Activity Resource Assessment for Childcentric Physical Activity Intervention Planning in Two Urban Neighborhoods. *Journal of Community Health*, Vol. 36, 2011, pp. 132–140.
- (32) Heinrich, K., R. Lee, R. Suminski, et al. Associations Between the Built Environment and Physical Activity in Public Housing Residents. *International Journal of Behavioral Nutrition and Physical Activity*, Vol. 4(1), 2007, DOI: 10.1186/1479-5868-4-56.
- (33) Trent, M., J. Jennings, G. Waterfield, L. Lyman, and H. Thomas. Finding Targets for Obesity Intervention in Urban Communities: School-Based Health Centers and the Interface with Affected Youth. *Journal of Urban Health*, Vol. 86(4), 2009, pp.571–583.
- (34) Warren, C. Canadian Social Trend: Kid's sports. Component of Statistics Canada catalogue no. 11-008-X, 2008.
- (35) Nast, J., and T. Blokland, T. Social Mix Revisited: Neighbourhood Institutions as Setting for Boundary Work and Social Capital. *Sociology*, Vol. 48(3),2014, pp. 482-499.

List of Tables and Figures

- Figure 1 Toronto physical activity promoting facilities database.
- Table 1 Physical Activity Resource Accessibility
- Table 2 Physical Activity Resources Used by Type and Frequency
- Table 3 Costs and Activities Performed at Physical Activity Facilities
- Table 4 Physical Activity Resources Quality

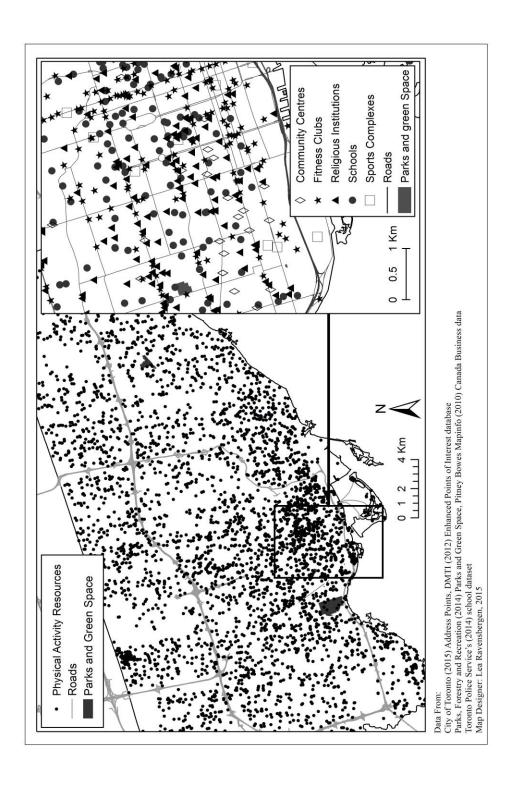


FIGURE 1 Toronto physical activity promoting facilities database.¹

¹ 1 km = 0.621371 Miles

TABLE 1 Physical Activity Resource Accessibility

		High SES	Low SES	High SES	Low SES	
		Road Netv	work Buffer	Activity Location Buffer		
Total Facilities		302.43***	239.52	69.32***	53.31	
Community Centres	L	11.82	14.29	1.59	2.4***	
Fitness Centres	nbe	53.75**	50.13	14.32**	11.62	
Religious Institutions	Nur	74.05***	48.17	19.82***	10.17	
Schools	age	48.66***	35.35	10.23***	7.51	
Sports Facilities	Average Number	3.82	4	0.91	0.96	
Parks/ Trails	A	110.32***	87.58	22.45	21.06	
Area of Parks/ Trails		3.48***	2.37	1.17***	0.39	
Total Facilities		23.96	24.84	19.2	20.59	
Community Centres		1	1.67***	0.45	0.96**	
Fitness Centres	ısity	4.41	5.63	3.9	4.31	
Religious Institutions	Der	6.37*	5.09	5.83***	3.82	
Schools	age	3.83	3.45	2.87	2.94	
Sports Facilities	Average Density	0.25	0.4***	0.22	0.36	
Parks/ Trails	A	8.09	8.6	5.93	8.31***	
Area of Parks/ Trails		0.27***	0.15	0.35***	0.14	
*** = p-value < 0.01. *	** = n-	value < 0.05 *	=p-value<0.1			

^{*** =} p-value < 0.01, ** = p-value < 0.05, *=p-value < 0.1

Table 2 Physical Activity Resources Used by Type and Frequency

	Total (n=104)			High SES (n=56)			Low SES (n=48)		
	No. Visited	No. Visited /Child	Times Visited/ Child	No. Visited	No. Visited /Child	Times Visited /Child	No. Visited	No. Visited /Child	Times Visited /Child
Community Centres	5	0.05	0.52	4	0.07	0.45	3	0.06	0.6
Fitness Clubs	6	0.06	0.15	5	0.09	0.27	1	0.02	0.02
Parks /Trails	10	0.1	0.39	6	0.11	0.27	6	0.13	0.54
Religious Institutions	11	0.11	0.18	4	0.07	0.13	7	0.15	0.25
Schools	8	0.08	3.36	6	0.11	3.82	2	0.04	2.81
Sports Facilities	13	0.13	0.29	10	0.18	0.43	4	0.08	0.13
Total	53	0.51	4.89	35	0.63	5.36	23	0.48	4.35

TABLE 3 Costs and Activities Performed at Physical Activity Facilities

		High SES		Low SES		
		n	%	n	%	
	% Free of charge	170	57.24%	172	88.66%	
Total	% Pay at door	11	3.70%	5	2.58%	
	% Classes/ membership	46	15.49%	15	7.73%	
	% Unknown	70	23.57%	7	3.61%	
Community Centres (3), watching hoc		ting (5), swimming ekey game (2), ball e class (1), playing occer (1)	Park (9), swimming (7), soccer (7), badminton (1), gymnastics (1), hockey (1), tag (1), walk (1), unknown (1)			
Fitnes	ss Clubs	Rock climbing (7 swimming (2), da taekwondo (1), Y	ance class (1),	_		
Park/	Trail		parding (3), jog (2), , festive event (1),	Park (10), picnic (2), festive event (2), dodge ball (1), jogging (1), kickball (1), soccer (1), swimming (1), walk (1)		
Relig	ious Institution	Worship (4), cho	ir (2), cubs (1)	Worship (11)		
Schoo		School (143), choir (19), volleyball (17), daycare (8), basketball practice (7), band practice/ music (6), organized soccer (6), walk (3), book fair (1), park (1), track & field (1)		School (113), park (11), language/ cultural classes (5), swim (2), walk (2), gymnastics (1), track & field (1)		
Sports Facilities			tching hockey game skateboarding (1)	Bowling (2), basketball (1), hockey (1)		

^{— =} No Documented Activities

TABLE 4 Physical Activity Resources Quality

	High SES Facilities	Low SES Facilities	Facilities Used by Both Samples		
No. Audited	28	16	3		
% Large	46%	31%	100%		
% Medium	43%	44%	0%		
% Small	11%	25%	0%		
Mean Features Count	6.68***	3.19	12.67		
Mean Quality of Features	13.11***	6.38	24.33		
Mean Count of Amenities	10.93***	7.69	19.00		
Mean Quality of Amenities	20.79***	15.34	30.33		
Mean Incivilities Score	4.46	5.91	4.67		
*** - p voluo < 0.01 ** - p voluo < 0.05 *-p voluo < 0.1					

^{*** =} p-value < 0.01, ** = p-value < 0.05, *=p-value<0.1