Smart Cities, Healthy Kids: The Association Between Neighbourhood Design and Children's Physical Activity and Time Spent Sedentary

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ABSTRACT

Objectives: To determine whether, and to what extent, a relation exists between neighbourhood design and children's physical activity and sedentary behaviours in Saskatoon.

Methods: Three neighbourhood designs were assessed: 1) core neighbourhoods developed before 1930 that follow a grid pattern, 2) fractured-grid pattern neighbourhoods that were developed between the 1930s and mid-1960s, and 3) curvilinear-pattern neighbourhoods that were developed between the mid-1960s through to 1998. Children aged 10-14 years (N=455; mean age 11.7 years), grouped by the neighbourhoods they resided in, had their physical activity and sedentary behaviour objectively measured by accelerometry for 7 days. ANCOVA and MANCOVA (multivariate analysis of covariance) models were used to assess group differences ($p < 0.05$).

Results: Group differences were apparent on weekdays but not on weekend days. When age, sex and family income had been controlled for, children living in fractured-grid neighbourhoods had, on average, 83 and 55 fewer accelerometer counts per minute on weekdays than the children in the core and curvilinear-pattern neighbourhoods, respectively. Further analyses showed that the children in the fractured-grid neighbourhoods accumulated 15 and 9 fewer minutes of moderate-to-vigorous physical activity per day and had a greater time spent in sedentary behaviour (23 and 17 minutes) than those in core and curvilinear-pattern neighbourhoods, respectively.

Conclusion: These data suggest that in Saskatoon there is a relation between neighbourhood design and children's physical activity and sedentary behaviours. Further work is needed to tease out which features of the built environments have the greatest impact on these important lifestyle behaviours. This information, offered in the context of ongoing development of neighbourhoods, as we see in Saskatoon, is critical to an evidence-informed approach to urban development and planning.

Key words: Urban; built environment; accelerometer; lifestyle; city planning

La traduction du résumé se trouve à la fin de l'article.

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The increased concern over escalating levels of chronic disease and the emergence of the smart growth movement has yielded a series of studies investigating how aspects of the built environment influence the physical activity and sedentary behaviours of children.¹⁻⁶ Studies show that improving the built environment to "make the healthy choice the easy choice" is essential to increasing children's physical activity levels.⁷⁻¹⁰ In a recent systematic review by Durand et al.,¹¹ five smart growth factors (diverse housing types, mixed land use, housing density, compact development patterns and levels of open space) were linked with increased levels of physical activity in children.

The burgeoning field of research related to physical activity and the built environment is starting to influence the work of city planners. For example, the City of Saskatoon, City Centre Plan Phase 1 (2011),¹² provides a policy framework that defines, directs and evaluates development of the city centre to ensure that it balances the environmental, social and economic needs of the community. Interestingly, since Saskatoon was incorporated as a city in 1906, its neighbourhoods have gradually developed into what today are three distinct design types: **core** neighbourhoods, **fractured-grid** pattern neighbourhoods and **curvilinear-pattern** neighbourhoods. The core neighbourhoods, developed before 1930, represent the oldest of the neighbourhood designs in Saskatoon, wherein the

road networks follow a grid pattern. These are typified by higher density (11.75 people/acre), mixed-use neighbourhoods connected by straight, intersecting streets. Surrounding the core neighbourhoods are the fractured-grid pattern neighbourhoods, or semi-suburban districts, which were developed between the 1930s and mid-1960s. The fractured-grid pattern neighbourhoods tend to be of lower density (9.25 people/acre), predominantly residential and increasingly car-oriented as they are located further away from the core. On the periphery are newer, curvilinear-pattern neighbourhoods that were developed from the mid-1960s through

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Table 1. Accelerometry Data Collection and Analytical Procedures: Smart Cities, Healthy Kids Study, Saskatoon, Canada

Information	Details
Accelerometer Model*	Actical (Philips Respironics, Bend, OR)
Piezo sensor orientation	Omnidirectional
Mode setup	Counts only
Epoch	15 seconds
Deployment method	Delivered and attached by researcher (on day 0)
Location worn	Right hip at mid clavicular line (via adjustable neoprene waist belt)
Requested days of wear	7 d (40,320 epochs) not including day 0
Initialization	Delayed until next day (i.e., day 1 at midnight 00:00 hrs)
Wear instructions	Wear during waking hours, remove for sleeping†
Analytical	
Non-wear appropriation	60 min (240 epochs) of consecutive 0s allowing for 2 min (8 epochs) of interruptions
Valid day criteria	10 h of wear
Valid file	At least 1 valid file
Missing data	No data modeling or imputation was performed
Cut-point reference(s)	From Colley and Tremblay ¹⁶ and Colley et al. ¹⁷
Sedentary	<100 counts per minute
MVPA	≥1500 counts per minute

* The Actical model has been validated in children.¹⁶

† We also asked that the accelerometer be removed for water-based activities where there was a chance of the device being fully submerged at a depth of ≥1 metre for ≥30 minutes (IEC Standard 60529 IPX7).

MVPA=moderate-to-vigorous physical activity.

to 1998 and are characterized by their moderate density (10.64 people/acre), and almost exclusively residential and highly car-oriented configurations. Although auto-centric, the curving streets, cul-de-sacs and intersections also contribute to lower through-traffic. These three distinct Saskatoon neighbourhood designs, which reflect the urban development approaches prevailing at the time of their construction and are commonly found in other large cities throughout Canada, can be used to assess whether particular urban designs create built environments that are conducive to children being more active and/or less sedentary.

At the same time that great strides are being made in our understanding of the built environment, our ability to measure physical activity is also evolving. Perhaps the most significant advance has been the increased use of objective measurements of physical activity (e.g., with accelerometers) in the place of self-report measures, which has greatly enhanced our ability to accurately capture short bouts of lifestyle-embedded physical activity that are difficult to recall.¹³ Advanced data-reduction software now enables more detailed information on physical activity and time spent in sedentary behaviour to be derived from accelerometer data and, thus, allows movement frequency, intensity, duration and temporality to be investigated more comprehensively.^{14,15}

Built environment policies are unfolding and evolving continually across the country, and are largely planned and funded by private, community, non-profit and/or public organizations both within and outside the health sector. However, these “natural experiments” often lack the embedded mechanisms needed for rigorous examination of how the multiple social, cultural, economic and/or environmental factors affect the outcomes. These natural experiments represent a rich but untapped data source that could benefit from researcher involvement and expertise. Therefore, the purpose of this study was to provide a detailed accelerometry-based profile of physical activity and sedentary time in children living in the three differing neighbourhood design types: 1) core, 2) fractured-grid and 3) curvilinear pattern. The overall objective was to determine whether, and to what extent, a relation exists between neighbourhood design, as classified here, and children’s physical activity and sedentary time in Saskatoon. While we recognize that the three neighbourhood design types represent a detailed and rich mix of various specific built environment characteristics, not all of

Figure 1. Saskatoon neighbourhood planning eras, Smart Cities, Healthy Kids study

which show a linear pattern with neighbourhood type, we hypothesize that, in the main, children’s physical activity level will fall and their sedentary behaviour will increase as we move from the core to the fractured-grid to the curvilinear neighbourhoods. A secondary hypothesis was that the pattern and timing of physical activity (i.e., weekdays vs. weekend days and time of day) of the children would differ depending on the design of the neighbourhood in which they live.

METHODS

The study uses data from Smart Cities, Healthy Kids, an ongoing mixed-method, multi-phase population health intervention study. Smart Cities recruited 1,610 children from grades 5 to 8 (10–14 years) from 40 elementary schools, and these children represented all the 60 residential neighbourhoods of Saskatoon as of 2010. Saskatoon is the largest city in the prairie province of Saskatchewan and has a metropolitan area population of 233,893 according to the 2006 census. The participants selected included a subsample of 455 children (52% female) from the larger study, who were requested to wear accelerometers for 7 days.

Table 2. Descriptive Characteristics of the Study Sample by Neighbourhood Design Type

Variable	Core	Fractured-Grid	Curvilinear-Pattern
Sampled schools, n	6	10	14
Family income, % in group 1-2*	70.2	71.5	81.9
Weekday compliance (n=432)	121	137	174
Weekend compliance (n=349)	97	107	145
Mean (SD) age, decimal years	11.6 (1.2)	11.6 (1.2)	11.8 (1.2)
Sex, % girls	54	51	52
Mean (SD) body mass index	20.1 (4.7)	20.4 (4.3)	20.0 (3.8)
Min; Max	14.1; 42.4	13.4; 34.3	13.2; 34.0
OW & OB, %	11.6	14.0	16.8
Mean (SD) weekday wear, minutes	797 (59)	801 (63)	808 (55)
Min; Max	612; 961	622; 947	667; 933
Mean (SD) weekend day wear, minutes	758 (87)	754 (90)	761 (90)
Min; Max	609; 1002	601; 1054	605; 1124
Mean (SD) counts per minute	460 (202)	403 (164)†	441 (169)
Min; Max	94; 1330	118; 1225	127; 1086
ICC weekday counts	0.656	0.766	0.760
ICC weekend day counts	0.540	0.605	0.509
Mean (SD) MVPA, min/day	77.5 (37.5)	67.7 (31.3)†	73.3 (29.2)
Min; Max	8.1; 232.5	13.3; 234.6	16.6; 182.0
Mean (SD) sedentary time, min/day	528 (73)	543 (72)	537 (63)
Min; Max	317; 683	344; 760	331; 798

* Family income groups: 1 – Wealthy, 2 – Average, 3 – Difficult, 4 – Poor.

† Indicates significant group difference ($p < 0.05$) compared with both core and curvilinear-pattern neighbourhood design types.

OW & OB=overweight and obesity combined, calculated using age-specific cut-offs;²¹ ICC=intra-class correlation; MVPA=moderate-to-vigorous physical activity.

Analytically, the children were grouped according to the design of the neighbourhood in which they lived (Figure 1): Era 1 – core (N=127), Era 2 – fractured-grid (N=146) and Era 3 – curvilinear-pattern (N=182). Each child gave written assent, and parental written informed consent was also obtained. All procedures were approved by the institutional research ethics board.

A portable stadiometer and weigh scale were used to measure height and weight. Body mass index (BMI) was calculated from height and weight (weight [kg]/height [m]²). Physical activity and sedentary time were objectively measured for seven consecutive days by means of an Actical accelerometer (Mini Mitter Co., Inc., Bend, OR, US). All pertinent data collection and analytical procedures related to the accelerometry portion of the study are described in Table 1. The raw data were analyzed using custom software KineSoft, version 3.3.63 (KineSoft, SK) to produce a series of standardized outcome variables following procedures similar to those described by Esliger et al.^{14,15} The main variables of interest were average counts per minute, minutes of moderate-to-vigorous physical activity (MVPA) and minutes spent sedentary. In an effort to understand the temporality of the physical activity and time spent sedentary, these variables were analyzed over the following time periods: weekday, weekend day and hourly.

Statistical analyses

Studies have shown a positive association between socio-economic status (SES) and MVPA^{18,19} and an inverse association between SES and time spent in sedentary behaviour among children.²⁰ It is therefore important to control for differences in SES at the individual level. Thus in all multivariate analyses, family income was controlled for in addition to age, sex and accelerometer wear time. Children were asked “Would you describe your family money situation as...” indicating one response in a 4-point Likert scale (1 – Wealthy, 2 – Average, 3 – Difficult, 4 – Poor). The responses to this question corresponded with the answers to the questions regarding the mother’s/father’s highest level of schooling, as was expected.

One-way ANOVA models were used to test for group differences in chronological age and accelerometer wear time. Subsequent analyses used multivariate analysis of covariance (MANCOVA)

models with chronological age, income and wear time as the covariates to determine group differences in physical activity and sedentary variables. Owing to the skewed distribution of the MVPA variables, these data were log transformed. All statistical tests were performed on the transformed data; however, the non-transformed means and standard deviations are presented. The influence of time of day on physical activity and sedentary time was described visually in 24 h x 7 d area plots for each group. Where appropriate, models used Fisher’s least significant difference for post-hoc comparisons, and alpha was set at $p < 0.05$. All analyses were performed using SPSS for Windows version 20.0 (SPSS Inc., Chicago, IL).

RESULTS

The characteristics of the study sample (N=455) are displayed by neighbourhood design in Table 2. No significant group differences were found for age, sex, BMI, prevalence of overweight and obesity combined, weekday or weekend day wear time. The sample size retained after removing those found to be noncompliant (i.e., not wearing the accelerometer for at least 10 hours/day on 1 or more days), as well as those with missing covariates, was 432 for the weekday analyses and 349 for the weekend day analyses (95% and 77%, respectively). In addition to the excellent compliance rates, the three groups greatly exceeded the minimum 10 hours/day wear-time requirement with an overall average of 13 hours, 11 minutes per day.

When age, sex and family income had been controlled for, ANCOVA models revealed that children living in fractured-grid neighbourhoods had fewer average accelerometer counts per minute on weekdays than the core and curvilinear-pattern neighbourhoods (83 and 55 minutes less, respectively) (Figure 2, top). Further analyses using MANCOVA models revealed that, after age, sex, family income and accelerometer wear time had been controlled for, children in the fractured-grid neighbourhoods accumulated significantly less MVPA (15 and 9 minutes) per weekday and spent a significantly greater time in sedentary behaviour (23 and 17 minutes) than those in core and curvilinear-pattern neighbourhoods, respectively (Figure 2, top). No significant group differences were evident for counts per minute, MVPA or sedentary time on the weekend days (Figure 2, bottom).

Figure 2. Average weekday physical activity and time spent sedentary (top) and weekend day physical activity and time spent sedentary (bottom) by neighbourhood eras

Means adjusted for sex, age, family income and wear-time covariates; FG=fractured-grid; CP=curvilinear-pattern; MVPA=moderate-to-vigorous physical activity; MVPA is scaled according to the secondary y axis. Analyses were performed on log-transformed physical activity variables; however, non-transformed data are presented. Error bars represent standard error.

*Fractured-grid group significantly different from both the core and curvilinear-pattern groups ($p < 0.05$).

In terms of temporality, Figure 3 shows the hourly physical activity behaviours by intensity and neighbourhood design. Focusing on school days (i.e., Monday to Friday from 0800 to 1500 h), it appears that the children living in different neighbourhoods had similar patterns of physical activity and sedentary time (i.e., they have the same physical activity intensity “hotspots”). Overall, on weekends, children spent 70% of their days being sedentary (528 minutes), whereas on weekdays sedentary time accounted for 67% of their day (540 minutes). Overall, on weekends, children spent 7% of their day (52 minutes) accumulating MVPA compared with 10% of the day (80 minutes) on weekdays. In terms of temporality, all three groups had a quadra-modal distribution (i.e., four pronounced peaks) of MVPA: during the morning commute (hour 8), morning recess (hour 10), lunch (hour 12) and afternoon commute (hour 15) (Figure 4, top). Comparison of the three peak sedentary hours of the school day (i.e., hour 9, hour 11 and hour 13)

Figure 3. Group differences (Top=Core, Middle=Fractured-grid, Bottom=Curvilinear-pattern) in intensity-specific physical activity profiles (7 d × 24 h)

Note: White areas of the figure (i.e., from approximately midnight to approximately 6 am) represent non-wear (sleep) time.

showed that children from the core, fractured-grid and curvilinear-pattern neighbourhoods were sedentary, on average, 44, 46 and 45 of every 60 minutes, respectively, during these three 1-hour blocks (Figure 4, bottom). Compared with the in-school time, the children's out-of-school sedentary time (i.e., Monday to Friday from 1500 to 2100 h) increased by 1 minute per hour, and their time spent in MVPA decreased by 1 minute per hour (Figure 4).

Although children in the fractured-grid neighbourhoods were significantly less active than children living in the core and the

Figure 4. Average minutes spent in MVPA (top) and sedentary behaviour (bottom) hour by hour on a weekday, by neighbourhood era

curvilinear neighbourhoods, visually the patterns of weekday physical activity are similar across the groups. The magnitude of this difference, per hour, may appear to be small (e.g., ~1 minute less MVPA per hour), but when accumulated over the entire day it results in a meaningful difference (Figure 4, top).

DISCUSSION

The purpose of this study was to determine whether, and to what extent, a relation exists between neighbourhood design (i.e., core, fractured-grid or curvilinear-pattern) and children's physical activity and time spent being sedentary, in Saskatoon. This observational study supports the hypothesis that children 10-14 years of age living in a fractured-grid neighbourhood are likely to be less active (fewer minutes in MVPA) and more sedentary than children in core or curvilinear neighbourhoods. The physical activity levels of the overall sample (i.e., 73 minutes of MVPA per day) is higher than in other, similarly analyzed population samples (e.g., Canadian Health Measures Survey (CHMS); 58 minutes MVPA per day in children 6 to 14 years¹⁷). The higher MVPA in the present sample may be due, among other things, to the fact that the data were collected during the fair weather months of April-June and did not include the typically less active winter months, as the CHMS did.

When minutes spent in sedentary, light and MVPA are presented for the full week (Figure 3), it is apparent that despite the lower MVPA and higher sedentary time in the fractured-grid neighbour-

hoods, the patterns of behaviours are markedly similar among all three neighbourhood designs. For example, children from each neighbourhood group were more active on weekdays compared with weekend days, a finding that is supported in the literature.^{22,23} Furthermore, on average, children from each neighbourhood type showed the same weekday activity "hotspots" before and after school, and during recess and lunch (Figure 4). These observations suggests that although the neighbourhood design has an appreciable impact on children's overall time spent in MVPA, the general physical activity pattern, hourly, on a typical weekday is not dramatically different across neighbourhood types. This shows the important contribution that schools make to patterning children's physical activity, whether it is related to school travel or activity levels during time in school.

Our research showed that children in the fractured-grid pattern neighbourhoods accumulated 15 and 9 minutes less MVPA per day than children in the core and curvilinear-pattern neighbourhoods, respectively. Emerging research has shown that modest differences in accelerometer-assessed MVPA, similar to the differences shown in this study, are associated with health benefits in youth. For example, data from a larger sample (N=5,500) of 12-year-olds showed that an increase of 15 minutes of daily MVPA was associated with lower odds of obesity – over 50% in boys and nearly 40% in girls.²⁴

Children living in the core neighbourhoods accumulated the greatest minutes of MVPA (although not significantly greater than the curvilinear-pattern neighbourhood). Core neighbourhoods are less car-oriented and have greater land-use mix (combining commercial, residential, institutional land uses). A recent systematic review⁶ revealed land-use mix to be a strong correlate of physical activity among children and adolescents. In addition, the grid-patterned road networks found in the core neighbourhoods with multiple intersections and interconnected streets increased the number of access and exit routes into a neighbourhood. This provides greater route choice and accessibility to destinations. Past research has shown that children from neighborhoods with greater street connectivity are more active outside their back/front yard when compared with children who live in curvilinear (cul-de-sac) neighbourhood designs.²⁵ However, it should be noted that increased connectivity of streets may also be coupled with increased traffic on local roads (because of vehicle use of short cuts).²⁶ Traffic speed/volume in neighbourhood streets is an important correlate of reduced physical activity in children (due to safety issues),⁶ thus street connectivity could also be a barrier to physical activity in the core neighbourhoods. This highlights the complexity of the association between neighbourhood design – as illustrated by street connectivity here, for example – and children's physical activity.

Children in the fractured-grid neighbourhood designs had significantly less MVPA and significantly greater sedentary time than children from the core and curvilinear-pattern neighbourhoods. Fractured-grid neighbourhoods are more reliant on car transport (i.e., auto-centric) and have lower density of destinations than the core neighbourhoods, which may contribute to the lower activity of the children residing in those neighbourhoods.²⁷ However, fractured-grid neighbourhoods include more residential land use than found in the core neighbourhoods, and residential density has been shown to be positively associated with self-reported physical activity in children.⁶ The fractured-grid neighbourhoods in Saskatoon

are usually bordered by busy, high-traffic arterial roads with little pedestrian access; this too could reduce the walkability of these neighbourhoods and likely the roaming distance of children.

Increasingly, Canadian cities, including Saskatoon, are adopting a newer neighbourhood design pattern called the Fused-Grid Model, which incorporates features from the core and the curvilinear-pattern neighbourhoods.²⁸ The Fused-Grid Model, similar to the core neighbourhoods, provides commercial destinations that can be easily accessed by foot but incorporates the traffic calming measures of curving streets, cul-de-sacs and intersections seen in the curvilinear-pattern neighbourhoods. The overall aim of the fused-grid design is to promote active transportation, increase the opportunities for social interaction within the neighbourhood and improve traffic safety.²⁸

A strength of this study was the use of objective measurements of physical activity.¹³ Another strength was the detailed analysis of the accelerometry data in terms of intensity and temporal patterns. However, there are limitations to accelerometry, most notably, its inability to assess lifting, carrying, cycling and water-based activities, and the general lack of contextual information relating to activity mode and/or location/domain.²⁹ For example, the fact that waist-mounted accelerometers do not measure cycling could have limited the true quantification of MVPA in neighbourhoods that are more “bike friendly”.

Although data across all neighbourhoods were collected during one season (April 28–June 11), data on extreme weather were not considered in these analyses. However, the likelihood that acute weather would have systematically affected the results is minimal. Another limitation was that selection bias could not be ruled out because of the non-random nature of the sample. The self-identifying process of school selection could have resulted in schools participating that were more supportive of physical activity. Last, the cross-sectional design of the study and the inability to control for self-selection or sorting into a residential area prevents comment on causation. A broad classification of neighbourhood design (i.e., core, fractured-grid, curvilinear-pattern) was chosen because these are the district neighbourhood designs present in Saskatoon and resonate with policy-makers, developers and city planners. Also, these design types typically reflect the era or the vintage of neighbourhoods and are commonly found in other cities across Canada.

Our research suggests that the neighbourhood design is associated with differences in MVPA and time spent being sedentary. However, we do not have information on the location of the activity, and therefore it is not known whether the activity took place in the neighbourhood in which the child resided or away from it. For example, a child residing in the core neighbourhoods may be driven to a fractured-grid neighbourhood for organized sports (e.g., soccer), as indicated by some participants in a qualitative substudy derived from this same sample (data not shown). Global positioning systems (GPS) provide time-stamped location information and would tell us in which neighbourhood the MVPA occurred.³⁰ Research has started to emerge that examines the associations between aspects of the built environment and physical activity in youth using both accelerometry and GPS;^{2–5} however, the accelerometer data are limited to day-level aggregate variables (such as daily minutes in MVPA) without any investigation as to *where* and *how* the activity and sedentary behaviour occur.^{14,15} Future

research is warranted that employs a detailed profiling of MVPA and sedentary behaviour by accelerometry, and research that couples it with GPS data collection.

In conclusion, the data presented in this paper show that in Saskatoon there is a relation between neighbourhood design and children’s physical activity and sedentary behaviours. Further work will need to be done to tease out which aspects of the built environments specifically have the greatest impact on these behaviours. This information, offered in the context of ongoing development of neighbourhoods, as we see in Saskatoon, is critical to an evidence-informed approach to modern urban development and planning.

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RÉSUMÉ

Objectifs : Déterminer s'il existe une relation, et si oui de quelle ampleur, entre, d'une part, la conception du quartier et, d'autre part, l'activité physique et les comportements sédentaires des enfants à Saskatoon.

Méthode : Trois types de quartiers ont été évalués : 1) les quartiers du centre-ville datant d'avant 1930, à l'agencement quadrillé, 2) les quartiers scindés à agencement quadrillé datant des années 1930 au milieu des années 1960 et 3) les quartiers à agencement curviligne datant du milieu des années 1960 à 1998. Nous avons mesuré objectivement par accélérométrie, pendant 7 jours, l'activité physique et les comportements sédentaires d'enfants de 10 à 14 ans (N=455; âge moyen 11,7 ans), regroupés selon leur quartier domiciliaire. Des modèles ANCOVA et MANCOVA (analyse multivariée de la covariance) ont servi à l'évaluation des différences entre les groupes ($p < 0,05$).

Résultats : Nous avons constaté des différences entre les groupes les jours de semaine, mais non les samedis et dimanches. Après ajustement selon l'âge, le sexe et le revenu familial, les enfants habitant des quartiers scindés à agencement quadrillé enregistraient en moyenne 83 et 55 points d'accéléromètre de moins par minute les jours de semaine que les enfants des quartiers du centre-ville et des quartiers à agencement curviligne, respectivement. Une analyse plus poussée a montré que les enfants des quartiers scindés à agencement quadrillé accumulaient 15 et 9 minutes de moins d'activité physique modérée à vigoureuse par jour et consacraient plus de temps à des comportements sédentaires (23 et 17 minutes) que ceux des quartiers du centre-ville et des quartiers à agencement curviligne, respectivement.

Conclusion : Ces données montrent qu'à Saskatoon, il y a une relation entre la conception des quartiers et l'activité physique et les comportements sédentaires des enfants. Il faudrait pousser la recherche pour « démêler » quelles caractéristiques des milieux bâtis ont le plus d'impact sur ces importants comportements liés au mode de vie. Cette information, présentée dans le contexte du développement en cours des quartiers, comme on le voit à Saskatoon, est essentielle à une démarche de planification et de développement urbain fondée sur des preuves.

Mots clés : urbain; milieu bâti; accéléromètre; mode de vie; urbanisme