Associations between familial affluence and obesity risk behaviours among children

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BACKGROUND: Results of studies examining associations between socioeconomic status and obesity among children are mixed.
OBJECTIVE: To examine whether physical activity, television viewing, computer use, and fruit, vegetable, soft drink and sweet consumption differed according to familial affluence of children attending schools in disadvantaged communities.
METHOD: A total of 218 children (seven to 11 years of age) recruited from three Calgary (Alberta) schools located in two adjacent socioeconomically disadvantaged neighbourhoods completed online surveys during the spring of 2005/2006. The number of days per week participating in vigorous physical activity for more than 20 min, and weekly frequency of fruit, vegetable, sweet and soft drink consumption were collected. Time spent watching television and using a computer during a normal school day was also captured. A family affluence scale was used to assess socioeconomic status (number of family holidays in the past year, ownership of motor vehicles and computers, and bedroom sharing). Associations between familial affluence and obesity risk behaviours were estimated using Pearson's correlation and demographic-adjusted logistic regression ORs.
RESULTS: Higher family affluence scale scores were significantly associated with weekly fruit consumption (r=0.14). Children with lower affluence were less likely to participate in vigorous physical activity five days/week or more (OR=0.39), and to use a computer for more than 2 h/day (OR=0.41) than children with higher affluence. Linear trends between familial affluence and the likelihood of participating in physical activity and using a computer were also found. However, no other behaviours were related to affluence.
CONCLUSIONS: Increasing opportunities for physical activity and accessibility to healthy food may be important for reducing obesity risk among less affluent children.

Key Words: *Diet; Obesity; Physical activity; Sedentary; Socioeconomic status*

Les associations entre l'aisance familiale et les comportements à risque de susciter l'obésité chez les enfants

HISTORIQUE : Les études portant sur les associations entre la situation socioéconomique et l'obésité chez les enfants donnent des résultats hétérogènes.
OBJECTIF : Examiner si l'activité physique, l'écoute de la télévision, l'utilisation de l'ordinateur et la consommation de fruits, de légumes, de boissons gazeuses et de sucreries diffèrent selon l'aisance familiale des enfants qui fréquentent les écoles de collectivités défavorisées.
MÉTHODOLOGIE : Au total, 218 enfants (de sept à 11 ans) recrutés dans trois écoles de Calgary, en Alberta, situées dans deux quartiers défavorisés sur le plan socioéconomique, ont rempli un sondage en ligne au printemps 2005-2006. Les chercheurs ont colligé le nombre de jours par semaine au cours desquels les enfants participaient à une activité physique vigoureuse de plus de 20 minutes et la fréquence hebdomadaire à laquelle ils consommaient des fruits, des légumes, des sucreries et des boissons gazeuses. Ils ont également colligé le temps consacré à écouter la télévision et à utiliser un ordinateur pendant les journées d'école. Ils ont utilisé une échelle d'aisance familiale pour évaluer leur situation socioéconomique (nombre de journées de vacances familiales depuis un an, possession de véhicules automobiles et d'ordinateurs et partage de la chambre). Ils ont évalué les associations entre l'aisance familiale et les comportements à risque de susciter l'obésité au moyen de la corrélation de Pearson et du rapport de risque relatif de régression logistique rajusté selon la démographie.
RÉSULTATS : Les indices plus élevés sur l'échelle d'aisance familiale s'associaient de manière significative à la consommation hebdomadaire de fruits (r=0,14). Les enfants moins fortunés étaient moins susceptibles de participer à une activité physique vigoureuse au moins cinq jours par semaine (RRR=0,39) et d'utiliser un ordinateur plus de deux heures par jour (RRR=0,41) que les enfants plus fortunés. Les chercheurs ont également déterminé les tendances linéaires entre l'aisance familiale et la probabilité de participer à une activité physique et d'utiliser un ordinateur. Cependant, aucun autre comportement n'était relié à l'aisance familiale.
CONCLUSIONS : Il pourrait être important d'accroître les possibilités d'activité physique et l'accessibilité aux aliments sains pour réduire le risque d'obésité chez les enfants moins fortunés.

Obesity is an independent risk factor for chronic health conditions including cardiovascular disease, musculoskeletal disorders, diabetes, stroke, hypertension and cancer (1,2). Obese children are more likely to become obese adults (3,4) and are at increased risk of developing chronic diseases that were once considered to be conditions that developed in adulthood (5-7). The immediate biological cause of obesity is energy imbalance, whereby calorie intake is higher than calorie expenditure; however, genetic, societal, cultural, environmental and lifestyle factors contribute to this imbalance (2). Specifically, lifestyle factors, including decreases in physical activity (8), increases in sedentary behaviour (8,9), overconsumption of calorie-dense foods (eg, sugar-sweetened drinks) and underconsumption of healthful foods (eg, fruits and vegetables) (10,11), have contributed to the rapid rise in obesity among children and adolescents in recent decades.

Evidence suggests that an association between socioeconomic status and obesity among adults exists (12,13). For children and adolescents, however, evidence for the association between socioeconomic status and obesity is mixed (13,14). Socioeconomic differences in obesity risk behaviours including physical activity (15,16), sedentariness (15,17), and the consumption of high-calorie foods and fruits and vegetables (18,19) among children and adolescents

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have been found. The mechanism by which socioeconomic status influences obesity risk behaviours and, consequently, positive energy balance is complex. Accessibility and affordability of calorie-dense food, reduced affordability of healthful food, reduced access to physical activity opportunities, and increased availability and affordability of sedentary pursuits may mediate the relationship between socioeconomic status and obesity (20).

Different measures of socioeconomic status have been used to investigate obesity among children and adolescents – parental income, education and occupation are the most commonly used (14). Specifically, the family affluence scale (FAS), which captures household material wealth (ie, computer and motor vehicle ownership, family vacations and bedroom sharing), has been used to measure socioeconomic status in children and adolescents (21-23). The FAS is a measure of socioeconomic status included in the Health Behaviour in School-aged Children (HBSC), a WHO Collaborative Cross-national Study (23) that is conducted in 41 countries including Canada. Relationships between the FAS and obesity risk behaviours including soft drink consumption, physical activity participation, television watching, fruit and vegetable intake, and breakfast consumption have been investigated (16,19,23-25). For example, increased soft drink and fruit consumption has been found among more affluent Scottish adolescents (24), while higher family affluence has been associated with increased intake of soft drinks, sweets and high-fat foods, and lower intake of fruits and vegetables among European adolescents (19). Associations among the FAS, physical activity and sedentary behaviour have also been reported among more affluent adolescents (16,23,25). Specifically, affluent Canadian adolescents were found to participate in more physical activity, watch less television, and were also less likely to be overweight or obese compared with less affluent adolescents (23).

Relationships between family affluence and obesity risk behaviours among Canadian adolescents have been reported (23). However, these associations are derived from data aggregated across regions and may be less generalizable to localized settings such as disadvantaged urban neighbourhoods. Moreover, most studies examining associations between the FAS and obesity risk behaviours (16,19,23-25) have relied on HBSC data, which include data only from adolescents 11 to 15 years of age. It is not known whether similar associations between family affluence and obesity risk factors exist when children of younger ages are considered. Thus, the objective of the present study was to determine whether obesity risk behaviours, including physical activity, sedentary behaviour and diet, differ according to familial affluence of children attending Calgary-based elementary schools located in socioeconomically disadvantaged neighbourhoods.

METHODS

Sampling

The present study was part of a larger body of research – Creating Opportunities for Resilience and Engagement (CORE) – aimed at increasing student connectiveness within schools as a means of improving mental health and well-being, and reducing risk behaviours among children and adolescents. A pilot study was conducted in three elementary schools (ie, kindergarten to grade 6) in Calgary, Alberta. The three schools were located in two adjacent low socioeconomic community districts (median annual household income in 2005 was $50,085 and $51,961; proportion of low-income households in 2005 was 32.3% and 17.4%; and proportion of individuals 15 years of age or older without a certificate, diploma or degree in 2006 was 31.1% and 26.6%, respectively) (26).

The pilot study involved a mixed methods (ie, qualitative and quantitative) design that included an intervention and baseline and follow-up measurement. The present analysis includes baseline data from students in grades 4 to 6 who participated only in the Attitude, Well-Being and Behaviour Survey (n=218). The Attitude, Well-Being and Behaviour Survey included two parts: the collection of data regarding school connections (ie, belonging, liking school, student voice, peer relations, teacher support and school safety) in the spring of 2005; and the collection of data on health behaviours (ie, physical activity, sedentary behaviour, tobacco and alcohol use, and dietary behaviour) in the spring of 2006. Data were collected inside school classrooms using an online survey. Data collection was facilitated by trained research staff and each survey required 20 min to 30 min to complete. Students were excluded from participating in the study if their parents did not provide active written consent. Student participation rates across the three elementary schools were 56.5%, 79.5% and 77.6%, respectively. The study was approved by the Calgary Board of Education, and the University of Calgary Health Research Ethics Board and Office of Medical Bioethics.

Data collection

Physical activity, screen-based activity and diet: Physical activity was measured by asking students to report the number of days (ie, zero to seven days) in the past week that they had participated in at least 20 min of vigorous, intense physical activity (ie, activity that made them sweat and breathe hard such as soccer, jogging, dancing, swimming, tennis or bicycling) (27). Physical activity was dichotomized to reflect participation on most days of the week (less than five days/week versus five or more days/week). Two items captured screen-based activities including watching television and the use of a computer for games, e-mailing, chatting and surfing the Internet on a normal school day (0 h/day, less than 1 h/day, 1 h/day, 2 h/day, 3 h/day, 4 h/day or at least 5 h/day). Both screen-based behaviour items were dichotomized (2 h/day or less versus more than 2 h/day). Weekly consumption of different foods, including fruits, vegetables, sweets and soft drinks, was also measured (never, once a week, two to four days/week, five to six days/week or at least once a day). All diet-related variables were dichotomized (some days versus consumed every day). Similar diet items have shown moderate reliability among children and adolescents (28).

Familial affluence: The FAS was used to capture socioeconomic status. Three items measured the number of family holidays in the past year (zero, one, two or at least three holidays), family owned vehicles including cars, trucks or vans (zero, one or at least two vehicles), and family owned computers (zero, one, two or at least three computers). A fourth item captured whether students had their own bedroom at home (ie, own bedroom versus shared bedroom). Responses to individual items were summed to derive a total FAS score and then categorized into three groups (low FAS score = 0 to 4; medium FAS score = 5 or 6; or high FAS score = 7 or 8). The FAS has acceptable reliability and validity among children and adolescents (29,30).

Demographic characteristics: Demographic characteristics included age (nine, 10, 11 or 12 years), sex, time spent living in Canada (10 years or less versus more than 10 years/all my life), family structure (residing with both parents in the same house including step parents versus residing with one parent/other arrangement), residential mobility (did not move, moved once or moved at least two times in the previous year) and school attended.

Statistical analysis: Descriptive statistics and frequencies were calculated for all independent and dependent variables. Kruskal-Wallis tests were used to compare total FAS scores within each demographic variable (ie, age, sex, time living in Canada,

family structure, residential mobility and school). Pearson's correlation coefficients were estimated to examine the linear associations between the total FAS score (ie, 0 to 8), physical activity, television watching, computer use, and fruit, vegetable, sweets and soft drink consumption. ORs and 95% CIs were calculated using binary logistic regression and adjusted for all demographic variables. In separate logistic regression models, physical activity, sedentary behaviours and diet were regressed onto familial affluence. FAS total and categorized scores were examined separately in the logistic regression analysis to test for linear and nonlinear associations between family affluence and the obesity risk behaviours. Analysis was undertaken using SPSS 16.0 (IBM Corporation, USA).

RESULTS

Complete physical activity, sedentary behaviour, dietary and demographic data were available for 200 students. The sample consisted mainly of boys (52.5%), children 10 years of age or younger (57%), and those residing in Canada for more than 10 years (83%) (Table 1). Moreover, 68% of students indicated that they had not relocated to a different house in the past year and 66% lived with two parents in the same household. The majority of students watched television for more than 2 h on a normal school day (68.5%), participated in vigorous physical activity fewer than five days/week (56%), and used a computer for 2 h or less on a normal school day (66.5%). Approximately one-third of students consumed fruits (39%) and vegetables (35%), while a small proportion reported consuming sweets (11.5%) and soft drinks (10.5%) daily (Table 1).

All FAS items were positively, albeit weakly, associated with the total FAS score (item-corrected correlations: family holidays = 0.22; family owned vehicles = 0.35; family owned computers = 0.21; own bedroom at home = 0.06) and the scale had moderate internal consistency (Cronbach's alpha = 0.37). The mean (± SD) and median FAS scores for students were 4.85±1.84 and 5.00, respectively. Results from the Kruskal-Wallis tests showed that mean total FAS scores did not significantly differ within age groups, sex, time living in Canada or residential mobility; however, differences were found for family structure (residing with both parents = 5.08±1.72; one parent/other arrangement = 4.40±1.99, P<0.05) and school (A = 3.48±2.29; B = 5.15±1.41; C = 5.01±1.82, P<0.001). Forty-one per cent of students reported low (FAS score of 0 to 4), 40.5% reported medium (FAS score of 5 or 6) and 18.5% reported high familial affluence (FAS score of 7 or 8) (Table 1).

The FAS score was positively correlated with weekly frequency of fruit consumption (r=0.14, P<0.05); however, correlations with other obesity risk behaviours were not found (Table 2). Statistically significant correlations were also found among the obesity risk behaviours. The frequency of weekly fruit and vegetable consumption (r=0.54, P<0.05) and frequency of weekly sweets and soft drink consumption (r=0.55, P<0.05) were positively correlated. Soft drink consumption was also associated with time spent watching television (r=0.30, P<0.05). The two sedentary behaviours were correlated (television watching and computer use: r=0.21, P<0.05). The frequency of vigorous physical activity was positively correlated with vegetable consumption (r=0.17, P<0.05) and computer use (r=0.19, P<0.05), but negatively associated with the consumption of sweets (r=–0.16, P<0.05) and soft drinks (r=–0.15, P<0.05) (Table 2).

Estimates from the logistic regression showed associations between familial affluence and vigorous physical activity and computer use (Table 3). Compared with students with the highest familial affluence, those with the lowest affluence were significantly less likely to participate in vigorous physical activity at least five days per week (OR=0.39, 95% CI 0.17 to 0.89). Those reporting the lowest familial affluence were also less likely to use a computer for more than 2 h on a normal school day (OR=0.41, 95% CI 0.17 to 0.99). Moreover, the likelihood of participating in vigorous physical activity at least five days/week and use of a computer for more than 2 h on a normal school day were linearly associated with familial affluence (Table 3). However, familial affluence, including both the total

TABLE 1
Frequencies for demographics, family affluence scale (FAS), diet, sedentary behaviours and physical activity among elementary school children (n=200)

	n (%)
Sex	
Female	95 (47.5)
Male	105 (52.5)
Age, years	
9	44 (22.0)
10	70 (35.0)
11	70 (35.0)
12	16 (8.0)
Residential mobility	
Did not move in the past year	136 (68.0)
Moved once in the past year	34 (17.0)
Moved ≥2 times in the past year	30 (15.0)
Time in Canada, years	
≤10	34 (17.0)
>10	166 (83.0)
Family structure	
Two parents in the same house (including step parents)	132 (66.0)
One parent or other arrangement	68 (34.0)
School attended	
School A	27 (13.5)
School B	67 (33.5)
School C	106 (53.0)
Time spent watching television, h/day	
≤2	63 (31.5)
>2	137 (68.5)
Time spent using a computer, h/day	
≤2	133 (66.5)
>2	67 (33.5)
Weekly consumption of fruit	
Not daily	122 (61.0)
Daily	78 (39.0)
Weekly consumption of vegetables	
Not daily	130 (65.0)
Daily	70 (35.0)
Weekly consumption of sweets	
Not daily	177 (88.5)
Daily	23 (11.5)
Weekly consumption of soft drinks	
Not daily	179 (89.5)
Daily	21 (10.5)
Weekly vigorous physical activity	
<5 days/week	112 (56.0)
≥5 days/week	88 (44.0)
Familial socioeconomic status (3 groups)	
Low (FAS score 0 to 4)	82 (41.0)
Medium (FAS score 5 or 6)	81 (40.5)
High (FAS score 7 or 8)	37 (18.5)

TABLE 2
Pearson's correlation coefficients of the associations between socioeconomic status (family affluence scale score) and obesity risk factors (diet, sedentary behaviours and physical activity) among elementary school children (n=200)

		Variable						
Variable	Mean ± SD	1	2	3	4	5	6	7
1. Family affluence scale score	4.85±1.84							
2. Times/week consuming fruits	3.94±1.04	0.14*						
3. Times/week consuming vegetables	3.82±1.11	0.13	0.54*					
4. Times/week consuming sweets	2.92±1.07	0.05	–0.06	–0.08				
5. Times/week consuming soft drinks	2.74±1.09	–0.05	–0.01	–0.01	0.55*			
6. Hours/day using a computer	1.34±0.47	0.12	0.00	0.08	–0.06	0.13		
7. Hours/day watching television	1.68±0.47	–0.01	–0.05	–0.02	0.10	0.30*	0.21*	
8. Days/week participating in vigorous physical activity	4.46±2.18	0.09	0.13	0.17*	–0.16*	–0.15*	0.19*	–0.03

**P<0.05*

TABLE 3
ORs* and 95% CIs for the associations between family affluence and obesity risk factors among elementary school children (n=200)

	Diet-related obesity risk factors							
	Fruits		Vegetables		Sweets		Soft drinks	
Familial socioeconomic status	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
High (FAS score 7 or 8)	1.00		1.00		1.00		1.00	
Medium (FAS score 5 or 6)	1.79	0.76–4.22	1.20	0.51–2.81	1.02	0.29–3.66	1.05	0.25–4.37
Low (FAS score 0 to 4)	0.61	0.25–1.45	0.79	0.34–1.86	0.85	0.24–3.01	1.35	0.34–5.26
Linear trend	NS		NS		NS		NS	

	Physical activity and sedentary behaviour-related obesity risk factors					
	Vigorous physical activity		Watching television		Using a computer	
Familial socioeconomic status	OR	95% CI	OR	95% CI	OR	95% CI
High (FAS score 7 or 8)	1.00		1.00		1.00	
Medium (FAS score 5 or 6)	0.50	0.22–1.16	0.73	0.29–1.84	0.67	0.28–1.58
Low (FAS score 0 to 4)	0.39	0.17–0.89†	0.95	0.37–2.40	0.41	0.17–0.99†
Linear trend	†		NS		†	

**Adjusted for sex, age, residential mobility, time residing in Canada, family structure and school; †P<0.05. FAS Family affluence scale; NS Nonsignificant*

and categorical scores, was not associated with television watching or any diet-related obesity risk behaviours.

DISCUSSION

The present study examined whether obesity risk behaviours differ according to familial affluence among children attending schools in socioeconomically disadvantaged neighbourhoods. Less affluent children were less likely to participate in vigorous physical activity at least five days/week and to use a computer for more than 2 h during a normal school day than more affluent children. Contrary to previous studies (19,23,24), we found limited associations between family affluence and diet-related behaviours.

For children, participation in regular physical activity can provide physical and mental health benefits (31). Of concern is that less than one-half of the children in our study, regardless of socioeconomic status, participated in regular vigorous physical activity and over two-thirds of children watched more than 2 h of television daily. Furthermore, the least affluent children were less likely to participate in regular vigorous physical activity than those who were more affluent – supporting findings among Canadian children in other studies (23,25). High familial affluence appears to positively influence physical activity behaviour, even among children residing in socioeconomically disadvantaged neighbourhoods. This is noteworthy given that socioeconomically disadvantaged neighbourhoods typically offer fewer physical activity opportunities for children (32,33), and that the availability and quality of recreational infrastructure influences children's physical activity levels (34). Furthermore, monetary costs of programs, using facilities and travel to facilities are barriers to participation in physical activity that may disproportionately affect low socioeconomic groups (35,36). Thus, families with high affluence residing in relatively socioeconomically disadvantaged neighbourhoods may be able to overcome restrictions of reduced access to physical activity opportunities offered in these neighbourhoods. It is necessary to provide local recreational opportunities (eg, neighbourhood parks) that are proximal, free or low cost, well maintained, and offer a wide variety of functions that are safe and attractive, particularly to children of low familial affluence.

Watching television was a popular sedentary activity among our sample; however, we did not find an association between family affluence and watching television. Associations between family affluence and watching television among Canadian adolescents have been found in other studies (23). Studies (17) have also found links between other socioeconomic indicators (ie, parental income and education) and television watching. The null association between familial affluence and television watching might reflect the younger respondents included in our study (ie, elementary students) and our focus on only socioeconomically disadvantaged neighbourhoods. Furthermore, television watching only during a normal school day was captured, excluding weekend viewing. Television watching is typically higher on weekends compared with weekdays (17), so an association might have been found if weekend television watching had been measured. It was noteworthy that less affluent children were less likely to use a computer for more than 2 h/day. Speculatively, this may reflect socioeconomic differences in access to a computer at home, with the most affluent families more likely

to own a computer. The modest correlation between computer ownership and the other FAS items provides some support for this notion. Although watching television and using a computer were moderately correlated (r=0.21), the differential association between these two sedentary screen-based activities and family affluence suggests that they should be considered independently when examining risk factors for childhood obesity (37).

Associations between diet-related behaviour and socioeconomic status, including family affluence, have been found (19,23,24). Socioeconomically disadvantaged neighbourhoods typically have increased accessibility to outlets offering unhealthy foods (38) and reduced accessibility to supermarkets (39). Correlations between the consumption of different foods were also evident in the current study, including between fruits and vegetables, and soft drinks and sweets. We also found few associations between diet behaviours and family affluence. Family affluence was positively correlated with fruit, but not vegetable, sweets or soft drink consumption. However, the association between fruit consumption and family affluence was not present after adjusting for demographic characteristics, although other studies (24) have found positive associations between fruit consumption and family affluence.

Of concern is that time spent watching television was positively correlated with frequency of consuming soft drinks. Positive associations between unhealthy eating and time spent watching television are reported among children elsewhere (37,40,41). Thus, watching television may contribute to the risk of obesity directly (ie, reduced calorie expenditure) and indirectly (ie, increased calorie intake through snacking during television viewing). In addition, frequency of vigorous physical activity was negatively associated with soft drink and sweet consumption, and positively associated with vegetable consumption in the current study. The associations among diet, physical activity and sedentary behaviours might suggest that they share an underlying cause or are interdependent, and that interventions that target one behaviour could influence other obesity risk behaviours. Regardless of these associations, our findings suggest that decreasing television time and increasing physical activity may influence energy balance directly via calorie expenditure, but also reduce calorie intake by decreasing the consumption of unhealthy foods such as soft drinks and sweets. Knowledge regarding the extent to which these associations are moderated by socioeconomic status is limited.

Several limitations should be considered when interpreting the findings of the present study. Physical activity, sedentary behaviour and diet data were collected via a child self report, which may be less accurate than objective measures (ie, accelerometers and direct observation) of these behaviours (42-44). The frequency, but not amount, of physical activity and foods eaten was captured, and not all domains of physical activity (eg, moderate-intensity activities) and diet (eg, consumption of fast food and meal skipping) were examined. Family affluence is only one type of socioeconomic indicator, and should not be interpreted as being analogous to parental income, education or occupation. Nevertheless, the FAS has been used to measure socioeconomic status in children because of its validity and low rates of missing responses (21-23). Moreover, children residing in two-parent families had higher family affluence compared with those in other family arrangements (ie, single parents) – providing validity for FAS as a socioeconomic indicator in the current study. Students from only three Calgary elementary schools in two socioeconomically disadvantaged urban neighbourhoods were examined; therefore, the results of the present study may not be generalizable to older children and adolescents, higher socioeconomic neighbourhoods or disadvantaged neighbourhoods in rural settings or other cities. Rather, the findings of the study are likely specific to students attending these three schools and could be used to inform interventions targeting physical activity and eating behaviours within these settings. Participation rates among the three schools were moderate; however, differences in characteristics and behaviours of children participating versus children not participating in the study cannot be ruled out. The present study focused on obesity risk behaviours, and not weight status as an outcome. Future studies should consider measuring body composition and examine the extent to which associations between socioeconomic status and weight status are explained by physical activity, diet and sedentary behaviour among children. Finally, associations found from the present cross-sectional study cannot be considered causal.

CONCLUSION

Socioeconomically disadvantaged children may be at increased risk of becoming overweight and obese (13,14). This higher risk may result from increased participation in unhealthy behaviours among children from low-affluence families (16,19,23-25). Increasing both local opportunities for physical activity and accessibility to healthful food may be important for reducing obesity risk among less affluent children residing in disadvantaged neighbourhoods.

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