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Associations between school-level environment and individual-level factors of walking and cycling to school in Canadian youth

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ABSTRACT

Identifying individual-level and school-level correlates of walking and cycling to school remains a public health priority as only one in four Canadian youth actively travels to school. This study aimed to estimate the prevalence of Canadian youth in grades 6 to 10 who walk, cycle, or use motorised transport to go to school, and to examine if school neighbourhood walkability, neighbourhood-level and individual-level correlates are associated with mode of transportation to school. Data come from the 2017/2018 Health Behaviour in School-aged Children study. The walkability of the schools' neighbourhood was measured using the Canadian Active Living Environments (Can-ALE) index. We observed that only 22.4% and 4.2% of youth walked and cycled to school, respectively. Most (73.4%) used motorised transport to school, including 53.2% of youth who lived less than 5 minutes from school. Schools located in neighbourhoods with higher Can-ALE classes (i.e., higher walkability) were positively associated with walking to school. No statistically significant association between school walkability and cycling to school was observed. Individual-level socioeconomic status (SES) was associated with walking, but not cycling, to school. Conversely, neighbourhood-level SES was associated with cycling, but not with walking, to school. Correlates of walking to school differed from those for cycling to school, suggesting that different approaches to promoting active transportation are needed.

1. Introduction

Physical activity is associated with a wide range of physical and psychosocial health benefits in children and adolescents (Dale et al., 2019; Poitras et al., 2016; Tremblay et al., 2016). Despite these benefits, only 44 % of Canadian children and youth meet the physical activity recommendation (Public Health Agency of Canada, 2023). Active transportation, which includes any form of human-powered travel —more commonly, walking and cycling—is associated with higher levels of physical activity and fitness in youth (Henriques-Neto et al., 2020; Larouche et al., 2012; Prince et al., 2022a; Ramírez-Vélez et al., 2017). Over the past few decades, the proportion of children and youth using active school transportation (AST) has declined dramatically, while the proportion of children being driven in cars to school has increased (Buliung et al., 2009; Gray et al., 2014; Mitra et al., 2014), with studies estimating that only about one in four students in Canada actively commute to school (Cottagiri et al., 2021; Gray et al., 2014).

In the last decade, there has been substantial attention on identifying correlates of AST in youth, with a focus on neighbourhood-level factors in addition to individual-level factors. Many features of the built environment have been shown to be associated with AST in children and youth, including proximity to school, presence of recreation facilities, sidewalks and cycle paths, street connectivity, dwelling density, green spaces and mixed land use (Fernández-Barrés et al., 2022; Larsen et al., 2012; Pont et al., 2009; Tewahade et al., 2019). In Canada, the Canadian Active Living Environment (Can-ALE) index was developed to measure the activity friendliness of communities, or walkability, and includes three features of the built environment: number of nearby destinations, intersection and dwelling density (Hermann et al., 2019). A few studies have examined the association between active transportation and walkability in Canadian youth using the Can-ALE index for home or school neighbourhood settings (Colley et al., 2019; Cottagiri et al., 2021). For example, Colley et al. (2019) observed a positive association between daily minutes of physical activity from active transportation and home-based Can-ALE classes. Cottagiri et al. (2021) observed that school neighbourhood Can-ALE was associated with active transportation, with youth who attended schools in the highest quartile score of the Can-ALE index twice as likely to be active commuters than those

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who attended schools in the lowest quartile. Studies often group walking and cycling into a single, broad category of AST. As a result, there is a lack of empirical knowledge on correlates that are specific to cycling to school and whether these differ from correlates of walking to school; this is an important limitation as evidence suggests that the correlates of cycling differ from those of walking (Aarts et al., 2013; Ton et al., 2019).

In addition, studies of children and youth actively commuting to school have largely relied on measures of the home built environment (Barnett et al., 2019; Bungum et al., 2009; Carlson et al., 2015), with fewer studies having examined the school built environment (Larsen et al., 2009; Wong et al., 2011). Moreover, studies have found that factors of the built environment associated with AST in children and adolescents are different for the school and home neighbourhood (Carlson et al., 2014; Larsen et al., 2009). For example, in a Canadian study (Larsen et al., 2009), intersection density in the home neighbourhood, but not dwelling density, influenced the mode of transportation to school while dwelling density in the school neighbourhood, but not intersection density, influenced the mode of transportation to school. Furthermore, as schools are a recurrent destination for youth, they are an ideal and frequently involved environment for interventions related to AST (Villa-González et al., 2018). A better understanding of schools' built environments could help inform future school-based interventions. Thus, the built environment around schools should be investigated further as their design and features could have a different effect on active transportation than the home built environment.

The objectives of this study are to 1) estimate the prevalence of youth in Canada who walk, cycle or use motorised transport as a primary mode of transportation to school, 2) examine if school neighbourhood walkability, as measured by the Can-ALE index, is associated with the primary mode of transportation to school in youth, and 3) identify potential neighbourhood-level and individual-level correlates of walking and cycling and determine whether these differ between modes.

2. Methods

Data for this study come from the 2017/2018 cycle of the Canadian Health Behaviour in School-aged Children (HBSC) study, an on-going, cross-sectional research study of youth aged 11 to 15 years old that collects data every four years. Details on the methodology for the HBSC study have been published elsewhere (Inchley et al., 2018). Briefly, schools were randomly selected from eligible and consenting school jurisdictions in Canada's 10 provinces and in two territories (Yukon and Northwest Territories). A stratified cluster sampling strategy was used, with classes nested within schools as the primary sampling unit. All students within selected classes were included, and self-completed questionnaires were administered in the classroom. Consent to participate was obtained from school boards, individual schools, parents or guardians, and from individual students. Approval for the conduct of the Canadian HBSC study was granted by the General Research Ethics Board of Queen's University and the Public Health Agency of Canada and Health Canada's Research Ethics Board. As the data collected are anonymous and because this is a secondary data analysis, the present study was exempt from research ethics board review.

2.1. Exposure variable

The Canadian Active Living Environments (Can-ALE) database contains Canada-wide estimates of the active living friendliness of neighbourhoods, based on 1000-metre circular buffers from the centroids of dissemination areas (Hermann et al., 2019). Three components are included in the Can-ALE index: intersection density (number ≥3-way intersections), points of interest (parks, schools, shops, landmarks, etc.) and dwelling density (number of dwellings per square kilometre) (Hermann et al., 2019). These measures are combined to create an index that characterizes the favourability of the active living environment into 5 classes, with values ranging from very low (class 1) to very high (class 5) (Hermann et al., 2019). Due to low sample sizes, Can-ALE classes 4 and 5 were aggregated into a single category. The Postal Code Conversion File Plus (PCCF+) Version 7D and the Postal Code^{OM} Conversion File were used to link the 2016 Can-ALE dataset to HBSC school postal codes.

2.2. Outcome

Main mode of transportation to get to school was self-reported with response options including "walking", "bicycle", "bus, train, streetcar, subway or boat/ferry", "car, motorcycle or moped" or "other". Responses were grouped into three categories: "walking", "cycling" and "motorised transport" (which included 'bus, train, streetcar, subway, or boat/ferry,' and 'car, motorcycle, or moped').

2.3. Individual-level correlates

Sex (female vs. male), race/ethnicity (White vs. non-White) and grade group (grades 6–8 vs. grades 9–10) were included in the analysis. Non-White youth include respondents who described themselves as being Black, Latin American, Indigenous, East and Southeast Asian, East Indian and South Asian, Arab and West Asian or having multiple race/ethnicities.

Participants first reported on usual time needed to travel to school ("less than 5 minutes", "5–15 minutes", "16–30 minutes", "31 minutes to 1 hour" and "more than 1 hour"), followed by their main mode of transportation to school. Both questions have been validated (Malnes et al., 2022). Due to the small number of responses for the last two categories, this variable was recoded into four categories: <5 minutes, 5–15 minutes, 16–30 minutes, and >30 minutes.

The Family Affluence Scale (FAS) was used as a proxy for individual-level socioeconomic status (SES). The FAS consists of six items reflecting family material resources (number of cars, having one's own bedroom, number of computers in the home, number of bathrooms, family holidays in the past year, and owning a dishwasher) and has been validated in children and adolescents (Corell et al., 2021; Hobza et al., 2017). The six items were summed to create a total score (0–13), that was then transformed and divided into three categories to identify youth in the lowest 20 % (low affluence), middle 60 % (average affluence) and highest 20 % (high affluence) (World Health Organization. Regional Office for Europe, 2016).

Perceived neighbourhood social capital was assessed using five items measuring neighbourhood trust, social cohesion and cooperation. Participants reported on: whether people say 'hello' and often stop to talk to each other on the street; how safe it is for younger children to play outside during the day; the perceived trustworthiness of people in their neighbourhood; the availability of places to spend one's free time; and whether they could ask for help or a favour from neighbours. Response options ranged from 1 (strongly agree) to 5 (strongly disagree). A total score was obtained from the sum of the items and further divided into three categories: high (5–11), average (12–18) and low (19–25) social capital.

Perceived neighbourhood safety was assessed by asking participants if people in their neighbourhood would take advantage of them if given the opportunity, on a scale from 1 (strongly disagree) to 5 (strongly agree). The variable was dichotomized into high (strongly disagree, disagree and neither agree nor disagree) and low (strongly agree and agree) neighbourhood safety.

2.4. School-neighbourhood-level correlates

Neighbourhood-level income, in deciles, was derived from the 2016 Census, and obtained from the PCCF+. Deciles were grouped into three categories representing the lowest 30 %, middle 40 % and highest 30 % neighbourhood income level.

2.5. Statistical analysis

A total of 21,745 Canadian students in grades 6 to 10 from 287 schools completed the 2017/2018 HBSC survey (73 % response rate). Three schools' postal codes were not available in the Can-ALE dataset, resulting in 68 students being excluded. Among the remaining 284 schools, 633 students who had missing data for the Can-ALE classes were also excluded. Participants with missing data for the main mode of transportation to school (n = 742) were excluded, as were those who answered "Other" (n = 298), in order to minimize misclassification. Furthermore, those who selected "neither term describes me" for sex (n = 321) or with missing data on any of the correlates (n = 4,223) were also excluded. The final analytical sample included 15,460 participants. Weighted proportions were calculated with 95 % confidence intervals (95 % CI) using the Wilson method (Franco et al., 2019) to describe the prevalence of each primary mode of transportation to school. The likelihood of the primary mode of transportation to school as a function of the school's Can-ALE was modeled using a multilevel multinomial logistic regression, with motorised transport as the reference category and the school identification as the level-2 variable. An empty model was run to calculate an intra-class correlation (ICC) to estimate how much of the variability for walking and cycling could be accounted for by the school level. As the outcome has three nominal categories, two ICC were estimated, one for each category versus the reference category (Hedeker, 2008). Overall, 29.4 % and 44.1 % of the total variation for walking and cycling to school respectively is accounted for by the school level, justifying the use of multilevel modeling.

The model was fitted as a multilevel generalized linear model using the SAS GLIMMIX procedure with a multinomial distribution and a logit link. To account for the clustered nature of the survey, we assumed random intercepts and fixed effects for the β coefficients. A Newton–Raphson with ridging technique was applied to optimize convergence (Schabenberger, 2008). No indication of collinearity was found between the correlates in the models. Results of the model are presented as adjusted odds ratios (aOR; adjusted for sex, grades, time to travel to school, race/ethnicity, perceived neighbourhood social capital and safety as well as neighbourhood-level income) with 95 % CI. All analyses were conducted using SAS Enterprise Guide software version 7.1.[1]

3. Results

3.1. Prevalence of active transportation to school in youth

The prevalence for each mode of transportation and correlates are presented in Table 1. The vast majority of youth used motorised transport to get to school (73.4 %, 95 % CI: 70.2–76.3), and only 22.4 % (95 % CI: 19.8–25.2) walked and 4.2 % (95 % CI: 3.3–5.5) cycled to school. The prevalence of motorised transport to school decreased with increasing classes of school Can-ALE, while the opposite was observed for walking. The prevalence of motorised transport to school was higher in girls (76.6 %, 95 % CI: 73.2–79.6) than boys (69.6 %, 95 % CI: 66.2–72.8), and increased with time to travel. Among youth who lived less than 5 minutes from school, a little more than half of them (53.2 % (95 % CI: 48.8–57.5)) relied on motorised transport. The prevalence of cycling to school was higher in boys (6.9 %, 95 % CI: 5.4–8.9) than in girls (2.0 %, 95 % CI: 1.4–2.8), in grades 6 to 8 (5.7 %, 95 % CI: 4.3–7.6) than in grades 9 and 10 (2.1 %, 95 % CI: 1.4–3.0), in youth living less than 5 minutes from school (7.3 %, 95 % CI: 5.3–10.0) than those living more than 15 minutes from school, and in youth attending schools in neighbourhoods with the highest income (6.6 %, 95 % CI: 4.4–9.9) than in the lowest (2.2 %, 95 % CI: 1.4–3.5).

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3.2. Multilevel multinomial logistic regression analysis

3.2.1. Individual-level correlates

Boys had higher odds of walking (aOR 1.3, 95 % CI: 1.1–1.4) or cycling (aOR 4.2, 95 % CI: 3.1–5.7) to school than girls (Table 2). Youth in grades 6 to 8 had higher odds of walking (aOR 1.2, 95 % CI: 1.0–1.4) or cycling (aOR 2.2, 95 % CI: 1.3–3.7) to school than those in grades 9 to 10. Youth with a travel distance of 30 minutes or less from school had higher odds of walking and higher odds of cycling compared to youth living more than 30 minutes away from school. Youth with a low or average score on the FAS had higher odds of walking to school than youth with a higher FAS score.

3.2.2. School neighbourhood-level correlates

The school's Can-ALE index was positively associated with walking to school in youth. Compared to youth in schools with the lowest walkability, youth going to school in higher Can-ALE classes had higher odds of walking to school. Finally, youth attending a school located in a high-income neighbourhood had higher odds of cycling to school (aOR 3.1, 95 % CI: 1.6–6.0) than those who attended school in a low-income neighbourhood.

4. Discussion

This study examined the prevalence of primary modes of transportation to school in Canadian youth in grades 6 to 10, and its association with the school's neighbourhood walkability, and other correlates of AST. Results show a low prevalence of AST, with 22.4 % of youth walking and 4.2 % cycling to school. Similar proportions were reported in other studies in Canada (Cottagiri et al., 2021; Gray et al., 2014). In this study, almost 3 out of 4 youth relied on motorised transport to get to school. Alarmingly, half (53.2 %) of the youth who live less than 5 minutes from school used motorised transport despite being a prime population to engage in AST.

Consistent with other studies looking at school (Giles-Corti et al., 2011) or both school and home (D'Haese et al., 2015) neighbourhoods, walkability was positively associated with walking to school; however, this association was not observed for cycling to school. It is possible that the components included in the Can-ALE are more relevant for youth who walk than for youth who cycle to school. Few studies have explored how components included in measures of walkability of the home's neighbourhood are associated with cycling in children and youth (Larouche, 2015), with even fewer studies having examined these components for the school's neighbourhood. One study did find an association between school neighbourhood street connectivity and cycling in boys (Trapp et al., 2011), however, other walkability components remain under investigated. Other features of the school's built environment not included in the Can-ALE index might have a greater impact on cycling in youth, such as traffic safety, the availability of cycling infrastructure and school cycling racks (Aarts et al., 2013; D'Haese et al., 2015; Ducheyne et al., 2012; Jones & Sliwa, 2016; Panter et al., 2010b). Alternatively, it is possible that school neighbourhoods with higher Can-ALE classes are more likely to have walking infrastructure that favour walking in youth, but that these neighbourhoods do not yet have sufficient cycling infrastructure to support cycling in youth.

Our results indicate that the correlates for cycling and walking to school differ. Indeed, individual-level SES, as measured by the FAS, was a statistically significant correlate of walking, but not cycling, to school. Specifically, youth whose family had a low to average score on the FAS had higher odds of walking to school, compared to those with the highest score. Studies examining walking to school found that children and youth from low-income families were more likely to walk to school than those from high-income families (McDonald, 2008; Pabayo & Gauvin, 2008). Possible explanations include that families with lower SES are less likely to own a car (Corell et al., 2021; Rothman et al., 2018), and more likely to live in neighbourhoods with greater

Table 1
Prevalence of modes of transportation to school in youth in Canada, HBSC 2017/2018 (n = 15,460).

	Total	Motorised transport	Walking	Cycling
	n	Weighted % (95 % CI)	Weighted % (95 % CI)	Weighted % (95 % CI)
Overall	15,460	73.4 (70.2–76.3)	22.4 (19.8–25.2)	4.2 (3.3–5.5)
Individual-level correlates				
Sex				
Female	8,202	76.6 (73.2–79.6)	21.5 (18.6–24.7)	2.0 (1.4–2.8)
Male	7,258	69.6 (66.2–72.8)	23.5 (20.8–26.4)	6.9 (5.4–8.9)
Grades				
Grades 6–8	9,137	69.6 (65.8–73.2)	24.7 (21.4–28.2)	5.7 (4.3–7.6)
Grades 9–10	6,323	78.9 (75.0–82.3)	19.1 (15.9–22.7)	2.1 (1.4–3.0)
Time to travel to school				
<5 minutes	2,639	53.2 (48.8–57.5)	39.5 (35.1–44.0)	7.3 (5.3–10.0)
5–15 minutes	7,003	67.2 (64.0–70.3)	27.6 (24.7–30.7)	5.2 (4.1–6.6)
16–30 minutes	3,501	81.1 (77.3–84.4)	15.6 (12.8–18.8)	3.3 (2.3–4.8)
>30 minutes	2,317	95.3 (93.6–96.6)	4.2 (3.0–5.8)	0.5 (0.3–1.0)
Race/ethnicity				
White	10,660	73.9 (70.8–76.9)	21.4 (18.9–24.1)	4.7 (3.6–6.2)
Non-White	4,800	71.9 (66.0–77.2)	24.9 (20.0–30.6)	3.2 (2.3–4.3)
Family Affluence Scale				
Low	3,186	69.4 (65.2–73.4)	26.8 (23.0–31.0)	3.8 (2.7–5.2)
Average	9,175	74.5 (71.1–77.6)	21.5 (18.9–24.4)	4.0 (3.0–5.3)
High	3,099	73.4 (69.7–76.8)	21.3 (18.3–24.7)	5.3 (3.9–7.1)
Perceived neighbourhood social capital				
Low	629	77.1 (71.4–82.0)	19.1 (14.9–24.2)	3.8 (2.3–6.1)
Average	6,344	73.5 (69.9–76.8)	22.9 (19.9–26.1)	3.7 (2.7–5.0)
High	8,487	73.0 (69.8–76.0)	22.3 (19.6–25.2)	4.7 (3.6–6.1)
Perceived neighbourhood safety				
Low	2,774	72.7 (68.7–76.3)	23.2 (19.8–27.0)	4.1 (2.9–5.7)
High	12,686	73.5 (70.2–76.5)	22.2 (19.6–25.1)	4.3 (3.3–5.5)
School neighbourhood-level correlates				
School neighbourhood Can-ALE classes				
1	6,990	78.3 (73.0–82.7)	16.4 (13.0–20.5)	5.3 (3.4–8.1)
2	5,477	72.8 (68.3–76.9)	23.3 (19.8–27.3)	3.9 (2.8–5.4)
3	2,788	67.5 (60.5–73.8)	29.4 (23.3–36.4)	3.1 (2.0–4.7)
4 and 5	205	50.6 (29.5–71.5)	46.4 (25.5–68.7)	3.0 (1.0–8.3)
Neighbourhood-level income				
Low	3,553	73.0 (67.5–78.0)	24.8 (19.9–30.4)	2.2 (1.4–3.5)
Average	6,838	76.7 (72.4–80.5)	19.4 (16.2–23.0)	3.9 (2.8–5.4)
High	5,069	69.4 (62.4–75.7)	23.9 (18.7–30.0)	6.6 (4.4–9.9)

Notes: Totals may not sum to 100% due to rounding.

walkability and closer proximity to schools (Zhu & Lee, 2008). In this study, no association was observed between the FAS and cycling to school, similarly to two European studies (Ducheyne et al., 2012; Ghekiere et al., 2016). With the low prevalence of youth cycling for AST in Canada, we may not have been able to detect an association between individual-level SES and cycling to school.

Contrary to what was observed for individual-level SES, the school's neighbourhood-level income was associated with cycling to school, but not with walking to school. Youth attending school in high-income neighbourhoods may be more likely to cycle to school as neighbourhoods in Canada with higher average incomes tend to have more supportive cycling-specific infrastructure than neighbourhoods with lower average income levels (Fuller & Winters, 2017). As cycling infrastructures are associated with higher perceived safety (Branion-Calles et al., 2019), parents and youths might be more inclined to cycle in these settings.

Unsurprisingly, boys have higher odds of walking and even greater odds of cycling to school than girls (Bungum et al., 2009; Larouche et al., 2014; McDonald, 2012; Mertens & Ghekiere, 2018; Nelson et al., 2008; Rothman et al., 2018; Schönbach et al., 2020). Social views on risk taking for boys and girls and parents being more protective toward girls than boys could account, in part, for this difference (McDonald, 2012; Mertens & Ghekiere, 2018). Younger youth, i.e. those in grades 6 to 8, were more likely to walk or cycle; a result that has been observed in multiple studies (Cottagiri et al., 2021; Gray et al., 2014; Mertens & Ghekiere, 2018; Pabayo et al., 2011; Rothman et al., 2018; Schönbach et al., 2020). This can be attributed to the normal development of youth as they transition from middle to high schools and the distance between the school and home increases (Cooper et al., 2012; Pabayo et al., 2011). In addition, as youth get older their use of public transit increases

Table 2
Multilevel multinomial logistic model: Associations between Can-ALE classes and mode of transportation to school in youth in Canada, 2017/2018 HBSC (n = 15,460).

	Walking			Cycling		
	Adjusted Odds Ratio	95 % CI	p-value	Adjusted Odds Ratio	95 % CI	p-value
Individual level						
Sex						
Female	Ref			Ref		
Male	1.3	1.1–1.4	0.002*	4.2	3.1–5.7	<0.001*
Grade						
Grades 6–8	1.2	1.0–1.4	0.028*	2.2	1.3–3.7	0.003*
Grades 9–10	Ref			Ref		
Time to travel to school						
<5 minutes	12.0	8.1–17.6	<0.001*	19.6	9.0–42.8	<0.001*
5–15 minutes	7.2	5.0–10.3	<0.001*	12.9	6.2–26.8	<0.001*
16–30 minutes	3.9	2.8–5.2	<0.001*	6.6	3.0–14.8	<0.001*
>30 minutes	Ref			Ref		
Race/ethnicity						
White	Ref			Ref		
Non-White	0.9	0.7–1.0	0.069	0.8	0.6–1.1	0.109
Family Affluence Scale						
Low	1.6	1.3–2.0	<0.001*	0.9	0.6–1.4	0.751
Average	1.2	1.0–1.3	0.043*	0.8	0.6–1.0	0.095
High	Ref			Ref		
Perceived neighbourhood social capital						
Low	Ref			Ref		
Average	1.2	0.8–1.6	0.362	0.9	0.5–1.8	0.875
High	1.2	0.9–1.7	0.212	0.9	0.4–1.8	0.726
Perceived neighbourhood safety						
Low	1.1	0.9–1.3	0.312	0.8	0.6–1.0	0.086
High	Ref			Ref		
School neighbourhood level						
School neighbourhood Can-ALE classes						
1	Ref			Ref		
2	1.8	1.4–2.5	<0.001*	1.0	0.6–1.8	0.912
3	3.0	2.0–4.4	<0.001*	1.9	0.9–3.7	0.076
4 and 5	8.1	3.2–20.4	<0.001*	2.2	0.5–10.4	0.317
Neighbourhood-level income						
Low	Ref			Ref		
Average	0.8	0.6–1.2	0.264	1.8	0.9–3.3	0.078
High	1.3	0.9–1.8	0.202	3.1	1.6–6.0	0.001*

Abbreviations: 95% CI, 95% confidence interval. Ref, reference category.
*p ≤ 0.05.

(Cooper et al., 2012; Pabayo & Gauvin, 2008). Our findings whereby greater home-to-school distance is negatively associated with AST are also similar to other studies (Macdonald et al., 2019; Nelson et al., 2008; Prince et al., 2022b; Schönbach et al., 2020; Wong et al., 2011) as distance has been identified as one of the most common barrier to AST (Nelson et al., 2008).

Contrasting with multiple studies who have found an association between AST and neighbourhood social capital (Aarts et al., 2013; McDonald, 2007; Panter et al., 2010a) and neighbourhood safety (Aarts et al., 2013; D'Haese et al., 2015; Gropp et al., 2012; Larouche et al., 2014; Panter et al., 2010a), we did not observe any associations with walking or cycling to school. This discrepancy observed for the neighbourhood social capital might be due to the survey questions being asked directly to the youth and youth's perception of their neighbourhood social capital might differ from parental perceptions. The lack of association observed between AST and neighbourhood safety could be because the survey question measured general distrust instead of road safety, which has been shown to be associated with AST in youth (Timperio et al., 2006). In addition, our study might have lacked the ability to detect an association due to the low sample size of youth with low social capital and low perceived neighbourhood safety.

This study has several limitations. As with all cross-sectional surveys, no causal link can be inferred between the Can-ALE classes and mode of transportation to school. Social desirability and recall bias may also introduce some bias in responses. Nunavut was not included in the survey, and results may not be representative of youth living in Nunavut. Our study relied on the journey *to* school to measure active transportation, since information on the main mode of transportation *from* school was not available in the 2017/2018 HBSC study. This may have resulted in an underestimation of the prevalence of youth who use active transportation by not accounting for those who use active transportation from school (Buliung et al., 2009). For example, it is possible that parents drive children to school in the morning, dropping them off on their way to work and that these children return home walking. Seasonality may have had an effect on AST, but this impact would have been minor as the data collection period was during the school year, with 70 % youth answering the survey between April and May, and only 6 % answering between December and February. As the HBSC study uses a school-based sampling design, information on the participants home postal code is not available and did not allow for examining the effect of home-based Can-ALE on active transportation to school. Additionally, not all youth reside in their school's neighbourhood and the choice to opt for active transportation to school may be simultaneously influenced by the features of multiple neighbourhoods on their route to school. Future studies are needed to examine the combined effect of both the home and school neighbourhoods on active transportation to school. In this study, we used a one-kilometer circular buffer, the only measure available in the Can-ALE index, around the school's dissemination areas to define school neighbourhood Can-ALE. A one-kilometer circular buffer represents 12–15 minutes of walking time (Hou et al., 2010) and has been demonstrated to be an appropriate walking distance for youth of this age (Nelson et al., 2008; Schlossberg et al., 2006). However, a one-kilometer circular buffer around schools' dissemination areas may not fully encompass the route of travel (Rinne et al., 2022). The low prevalence of cycling in the sample and the low prevalence of higher Can-ALE neighbourhoods may also have limited our ability to find statistically significant associations. Finally, as the outcome is multinomial, small cell numbers precluded us from performing stratified analyses or from examining associations in some population subgroups.

5. Conclusion

This study adds to the existing literature on individual and school-level factors associated with AST in Canadian youth and distinguishes between different modes of AST. School-level walkability, as measured by the Can-ALE index, was positively associated with walking, but not cycling to school. Other features of the built environment not captured by Can-ALE might better explain the association between cycling to school and the school's neighbourhood in youth. This study highlights the importance of disaggregating active transportation by mode to identify specific correlates for each. The school's environmental correlates for walking and cycling to school likely differ and, therefore, possibly warrant different interventional approaches. Moreover, promotion efforts could focus on these youth who, despite living close to their school, are not walking or cycling. As the Can-ALE index is composed of multiple features of the built environment, more research is needed to better understand which individual features of the built environment have a greater influence on promoting cycling and walking to school in Canadian youth.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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Disclaimer

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