Journal of Transport & Health 3 (2016) 377–385

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

“I'd rather bike to school!”: Profiling children who would prefer to cycle to school

Richard Larouche [a,*], Michelle Stone [b], Ron N. Buliung [c], Guy Faulkner [d]

[a] Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute, Room R242, 401 Smyth Road, Ottawa, ON, Canada K1H 8L1
[b] School of Health and Human Performance, Dalhousie University, 6230 South Street PO Box 15000, Halifax, NS, Canada B3H 4R2
[c] Department of Geography, University of Toronto Mississauga, Room SB3104, 3359 Mississauga Road N., Mississauga, ON, Canada L5L 1C6
[d] School of Kinesiology, University of British Columbia, 2146 Health Sciences Mall, Room 4606, Vancouver, BC, Canada V6T 1Z3

ARTICLE INFO

Article history:
Received 10 February 2016
Received in revised form
24 May 2016
Accepted 30 June 2016
Available online 3 August 2016

Keywords:
Children
Bicycling
Active transportation
Physical activity

ABSTRACT

Introduction: Cycling to/from school can increase physical activity and physical fitness, but it is uncommon among North American children. Few studies have examined the correlates of cycling to/from school. We examined the concordance between children's preferred and actual school travel mode, and compared children who are driven to or from school but who would prefer to cycle (“potential school cyclists”) with those who prefer to be driven (“non-school cyclists”).
Methods: 988 children aged 9–12 years were recruited in neighborhoods that differed in built environment and area-level socio-economic status within the City of Toronto. Each child wore an Actigraph accelerometer for 7 consecutive days and reported preferred and actual school travel modes. Objective measures of height and weight were obtained. Parent surveys provided household socio-demographic information. Binary logistic regression analyses compared potential school cyclists and non-school cyclists for morning and afternoon trips.
Results: Although only 2–3% of children cycled to or from school, about 40% indicated a preference to do so, including about 50% of children who traveled by motorized vehicle. For the morning trip, children who participated in the study in the spring and those who had a lower body mass index were more likely to indicate a preference for cycling. For the afternoon trip, higher PA, greater independent mobility, and having at least one parent working part-time were associated with children's stated preference for cycling. Conversely, children who spoke a language other than English at home were less likely to indicate a preference for cycling.
Conclusion: Many children in Toronto would prefer to cycle rather than being driven to/from school. Exploring how to harness such preferences in future advocacy and intervention work is needed. Future studies should examine the potential mediating role of parents between children's preference/intention to cycle and cycling behavior.

1. Introduction

The majority of children and youth worldwide do not meet current physical activity (PA) guidelines of 60 min of daily moderate-to-vigorous PA (Hallal et al., 2012; Tremblay et al., 2014). Previous research indicates that children and youth who use non-motorized modes such as walking and cycling to travel to/from school (e.g., active school transport; AST) are significantly more active (Larouche et al., 2014b; Schoeppe et al., 2013). Unlike other forms of PA, AST may also provide environmental co-benefits such as reduced traffic congestion, and emissions of fine particulate matter, nitric oxide, and greenhouse gases (Litman, 2013; Marshall et al., 2010). Furthermore, prospective studies have shown that cycling to/from school improves cardiovascular fitness and reduces cardiovascular disease risk factors among youth (Andersen et al., 2011; Østergaard et al., 2012).

* Corresponding author.
E-mail addresses: rlarouche@cheo.on.ca (R. Larouche), Michelle.Stone@dal.ca (M. Stone), ron.buliung@utoronto.ca (R.N. Buliung), guy.faulkner@ubc.ca (G. Faulkner).

http://dx.doi.org/10.1016/j.jth.2016.06.010
2214-1405/

From a public health perspective, encouraging cycling early in life may be judicious because: 1) physical activity tracks from childhood to adult age (Malina, 1996; Telama et al., 2005); 2) children generally have more positive attitudes toward active travel than adolescents and adults (Lorenc et al., 2008); and 3) travel behavior is known to be habitual (Faulkner et al., 2010; Gardner and Abraham, 2008). However, cycling to/from school is uncommon in most North American cities (McDonald, 2012). For example, data from the 2006 Transportation Tomorrow Survey in Toronto shows that only 2% of 11–13 year olds and 1% of 14–15 year olds regularly cycle to/from school (Buliung et al., 2009). In the United States, only 1% of 5–14 year olds regularly do so (McDonald et al., 2011). Another study found that 12–16 year olds in two regions of the US cycled only 1.4 min/day on average (Carlson et al., 2015). Encouraging and supporting cycling to school may have a spillover effect by increasing cycling to other destinations.

A recent review identified few studies that have specifically examined the correlates of cycling in North American children and youth (Larouche et al., 2015). Nevertheless, some included studies have shown that the odds of cycling decrease as distance between locations increases (Emond and Handy, 2012; Tal and Handy, 2008). In addition, Carlson et al. (2015) observed that time spent cycling was positively associated with intersection density and neighborhood walkability, but they found no relationship with measures of residential density, retail density and entertainment density. While many other North American studies have investigated the correlates of AST (walking and cycling together), such findings cannot be interpreted as correlates of cycling per se because the latter accounts for a very small percentage of active trips in most studies (Buliung et al., 2009; Larouche, 2015). Moreover, the cost, tacit knowledge, infrastructure, and politics and planning surrounding cycling, not to mention the set of laws established to govern the operation of bicycles in traffic, are largely different when compared with walking.

As a strategy to identify adults who may be more receptive to cycling interventions, many authors have developed cyclist typologies (Bergstrom and Magnusson, 2003; Damant-Sirois et al., 2014; Dill and McNeil, 2013; Geller, 2006; Winters and Teschke, 2010). Some of these typologies are top-down (i.e., authors established categories and assigned cyclists to them), while others are bottom-up and data-driven (such as the typology of Damant-Sirois et al., 2014). To our knowledge, no previous study has used cyclist typologies among 9–12 year olds. This age group is characterized by increasing independent mobility (Shaw et al., 2015) and as such, children may gradually have more input in travel mode decisions. Understanding what distinguishes "potential school cyclists" (i.e., children who use motorized travel modes, but who would prefer to bike) from "non-school cyclists" (i.e., those who travel by car and prefer to do so) may provide new insights for future cycling interventions.

The purpose of our study was twofold: to examine the concordance between children's actual and preferred school travel mode and to explore differences between potential school cyclists and non-school cyclists. For the second objective, we examined differences in personal, behavioral, socio-economic (SES) and built environment characteristics between potential school cyclists and non-school cyclists.

2. Methods

2.1. Setting

This study used data from Project BEAT (Built Environment and Active Transport; www.beat.utoronto.ca), a large mixed methods study examining how the built environment influences school travel behaviors and PA among grade 5 and 6 students in the City of Toronto, Canada. There are marked differences in built environment features across Toronto: the older central city neighborhoods (e.g., pre-World War II) are characterized by grid-based street networks, mixed land uses, and short block lengths (with the exception of superblocks in the financial district) while the newer inner-suburbs are characterized by curvilinear street networks, segregated land uses and lower housing density (Stone et al., 2012). All elementary and intermediate schools within the Toronto District School Board ($n=469$) were invited to participate in the study. A pool of interested schools was generated from which 16 schools were purposefully selected to provide variability in neighborhood type and area-level socio-economic status. Specifically, neighborhood type was categorized as old versus new based on the period of neighborhood development, and area-level SES was categorized as low versus high based on the median household income reported in the 2006 Canadian Census.

2.2. Participants

The University of Toronto Research Ethics Board, and the Toronto District School Board granted ethics approval. Informed consent was obtained from individual school administrators and parents, and assent was obtained from students. Student participation was voluntary. A total of 1027 parents or guardians provided informed consent for their child to participate, a response rate of 60.3%. Of these children, 1001 completed the child questionnaire and were subsequently asked to wear an Actigraph GT1M accelerometer (ActiGraph LLC, Pensacola, Florida) for seven consecutive days.

2.3. Procedures

Among a range of school transport and PA questions, children were asked to report their usual travel modes to/from school and their preferred modes if given the choice. Response options included: (1) walk; (2) ride a bicycle; (3) school bus; (4) public transit (subway, streetcar or city bus); and (5) driven in vehicle (car, truck, or van). 988 children (53.9% girls) provided valid data for their actual and preferred mode for the morning and afternoon trips.

With the help of their parents, children were asked to draw their route to/from school on a custom map provided by the research staff. The drawn routes were then geocoded using ArcGIS version 9.3 (Environmental Systems Research Institute, Redlands, CA), and the distance between home and school (in kilometers) was determined by measuring respondent reported digitized route data. Further details about the mapping process are available elsewhere (Buliung et al., 2013).

Detailed accelerometry procedures are described by Stone et al. (2013). Data were collected in 5 second epochs to capture the rapid transitions in activity that are typical of children (Stone et al., 2009b) and treated using published cut-points (Stone et al., 2009a). PA data for children who wore the accelerometer for at least 10 hours per day on at least 3 weekdays and one weekend day were included in analyses ($n=856$; 389 boys and 467 girls). Participants' height was measured to the nearest 0.1 cm with a Seca stadiometer, and weight was recorded to the nearest 0.1 kg using a Seca electronic weighing scale. Measurements were taken twice with children wearing no shoes, and the average of the two measures was calculated. Body mass index (BMI) in kg/m^2 was then computed.

A parent or guardian completed a survey, which provided information on their child's school transport, independent mobility, household SES and transport resources (e.g., availability of an automobile, licensing, etc.). Independent mobility was assessed via parental report. Parents were asked the following question: "In general, how often do you allow your child to go out on their own or with friends without an adult?" Response options were "never", "sometimes", "often" and "always" (Page et al., 2010). Parents reported the age and gender of their child, whether their child has access to a bicycle, and the language that they speak at home. They also reported on several other compositional and contextual factors: mother's education and employment, father's education and employment, family type, car ownership, and driver license ownership.

Please cite this article as: Larouche, R., et al., "I'd rather bike to school!": Profiling children who would prefer to cycle to school. Journal of Transport & Health (2016), http://dx.doi.org/10.1016/j.jth.2016.06.010

2.4. Data treatment

Independent mobility was dichotomized as "never" vs. "sometimes, often or always", following the approach of Stone et al. (2014). Data collection season was categorized as "spring" and "fall". SES indicators were re-categorized based on the observed distributions. Language spoken at home was dichotomized as English vs. others. Household car ownership and licensing and the number of adults employed full-time were categorized as "1 or less" or "2 or more" while the number of part-time workers was dichotomized as "0" or "1 or more". Parental education was classified as "college or less" or "university" and occupation was dichotomized as "full-time" versus "other". Family type was classified as two-parent vs. others. Finally, based on the sampling strategy, neighborhood type was categorized in four quadrants "older built environment/lower SES", "older built environment/higher SES", "newer built environment/lower SES" and "newer built environment/higher SES".

2.5. Statistical analyses

Cohen's kappa (κ) statistic was used to assess the agreement between children's preferred and actual school travel modes for the morning and afternoon trips. Landis and Koch's (1977) recommendations were used to qualify agreement as slight ($\kappa < 0.20$), fair (0.20–0.40), moderate (0.41–0.60), substantial (0.61–0.80) or almost perfect (0.81–1.00). These trips were examined separately because previous research has shown that more children engage in active travel in the afternoon (Buliung et al., 2009; Wong et al., 2011b; Yarlagadda and Srinivasan, 2008) and that the correlates of school travel mode choice differ between the morning and afternoon trip (Mitra et al., 2010; Yarlagadda and Srinivasan, 2008). Changes in preferred and actual school travel mode between the morning and afternoon trip were examined using McNemar tests.

Because we were interested in exploring characteristics distinguishing children who are driven by car to or from school who indicated a preference for biking (i.e., "potential school cyclists") to those who indicated a preference for being driven ("non-school cyclists"), participants who did not travel by car or who indicated that they would prefer to walk were excluded from further analyses. Univariate binary logistic regression models were used to compare the characteristics of potential school cyclists and non-school cyclists. Subsequently, all variables that were associated with cycling type (i.e., potential school cyclists vs. non-school cyclists) at $p < 0.20$ in univariate analyses were entered in a multi-variable binary logistic regression model. This threshold was used given the exploratory nature of the analyses and to minimize the risk of excluding variables that could achieve significance, but only after controlling for other covariates (Gropp et al., 2012). A backward selection approach was used to remove variables that were no longer significant ($p > 0.05$) starting from the highest p value. Gender and distance between home and school were mandatory variables in the models. Nagelkerke's R^2 was used as a measure of effect size for the final models. All analyses were conducted with IBM SPSS version 23 (Armonk, NY).

3. Results

Descriptive characteristics of the participants are shown in Table 1. On average, participants accumulated 29.3 min of daily moderate-to-vigorous PA, and 28.2% of participants were overweight or obese. 92% of participants had access to a bicycle and the majority of participants lived close to their school (average distance $= 1.0 \pm 1.6$ km). Tables 2 and 3 indicate children's preferred and actual school travel mode for the morning and afternoon trips respectively. There was only slight agreement between children's preferred and actual travel mode to school ($\kappa = 0.19$; $p < .001$). Only 2.6% of children cycled to school although cycling was the preferred mode reported by 41.3% of children (Table 2). Most children who were driven to school expressed preference for biking or walking. Findings were similar for the trip home from school ($\kappa = 0.18$; $p < .001$; see Table 3).

Table 4 illustrates the differences in actual and preferred school travel modes between the morning and afternoon trips. The proportion of trips made by walking (i.e., mode share) was 6.4% higher for the afternoon trip while the car mode share was 6.4% lower (both $p < .001$). The proportion of participants expressing preference for cycling was 2.0% higher in the morning while the proportion expressing preference for walking was 2.1% higher in the afternoon, but neither of these differences achieved statistical significance ($p = 0.050$ and 0.071 respectively). No other differences in actual or preferred travel mode were noted between the morning and afternoon trip.

After restricting our sample to children who were driven to or from school by car and who stated that they would prefer to travel by bike or by motor vehicle, the analytical sample for the trip to school included 176 children of whom 122 were potential school cyclists (48 boys and 74 girls) and 54 were non-school cyclists (16 boys and 38 girls). The analytical sample for the trip to home included 121 children of whom 84 were potential school cyclists (29 boys and 55 girls) and 37 were non-school cyclists (9 boys and 28 girls). Univariate and multi-variable models of the likelihood of being classified as a potential school cyclist relative to a non-school cyclist are shown in Tables 5 and 6 respectively. For the trip to school, the multi-variable model explained 12.9% of the variance. Children who participated in the study in the spring season were more likely to indicate a preference for cycling than those who participated in the fall (OR = 2.83; 95% CI = 1.39–5.76). For each unit increase in BMI, children were 11% less likely to express a preference for cycling (OR = 0.89; 95% CI = 0.81–0.98).

In the model for the trip to home, moderate-to-vigorous PA and accelerometer counts per minute were both associated with the likelihood of being classified as a potential school cyclist in the univariate models (Table 5), and they were strongly correlated ($r = 0.768$).

Table 1
Descriptive characteristics of the sample.

Characteristics	Percentage or mean ± SD
Gender (female)	53.9%
Age (years)	10.5 ± 0.7
Body mass index (kg/m^2)	18.9 ± 3.6
Prevalence of overweight/obesity[a]	28.2%
MVPA (min/day)	29.3 ± 13.7
Accelerometer counts/min	427.8 ± 144.8
Access to a bicycle (yes vs. no)	92.0%
Low area-level SES (vs. high)	50.9%
New built environment (vs. old)	48.9%
Distance to school (km)	1.0 ± 1.6
Spring season (vs. fall)	55.4%

[a] The prevalence of overweight/obesity was assessed based on the International Obesity Task Force cut-points (Cole et al., 2000). MVPA: moderate-to-vigorous physical activity; SES: socio-economic status.

Please cite this article as: Larouche, R., et al., "I'd rather bike to school!": Profiling children who would prefer to cycle to school. Journal of Transport & Health (2016), http://dx.doi.org/10.1016/j.jth.2016.06.010

Only the latter was retained for the multi-variable models because it was more strongly associated with the outcome. In the multi-variable model (Table 6), children were about twice as likely to be classified as potential school cyclists with each additional 100 accelerometer average counts/minute (OR=2.31; 95% CI=1.34–3.96). Other correlates of being classified as a potential school cyclist included being granted some independent mobility (OR=9.75; 95% CI=2.60–36.63), having at least one parent employed part-time (OR=6.11; 95% CI=1.41–26.52), and speaking a language other than English at home (OR=0.28; 95% CI=0.09–0.92). This model explained 42.1% of the variance. Gender and distance were not associated with stated preference for cycling either for the morning or afternoon trip.

4. Discussion

This study examined the concordance between children's preferred and actual school travel mode in a large sample of children living in Toronto and explored the factors that distinguish potential school cyclists from non-school cyclists for the trips to and from school. Our results suggest that while only about 2–3% of participants cycled to or from school, approximately 40% indicated a preference to do so. Of greater relevance from a public health perspective, about half of the children who were driven to or from school would prefer to bike. These results are consistent with previous research indicating that children generally have positive attitudes toward active travel (Lorenc et al., 2008). Furthermore, a 16-country report on children's independent mobility also indicated that a large proportion of 11 year-olds would prefer to cycle to school (Shaw et al., 2015).

Table 2
Differences between children's actual and preferred mode for the trip to school.

Actual travel mode (%)	Preferred travel mode (%)					Mode share (%)
	Walking	Cycling	Bus	Transit	Car	
Walking	**40.7**	23.2	0.5	0.5	1.8	66.8
Cycling	0.2	**2.4**	0.0	0.0	0.0	2.6
Bus	1.3	2.3	**0.1**	0.2	0.2	4.1
Transit	0.0	1.0	0.1	**0.5**	0.0	1.6
Car	7.1	12.3	0.6	0.5	**4.4**	24.8
Mode preference (%)	49.3	41.3	1.3	1.7	6.4	100.0

Note: Mode share refers to the percentage of participants using a given travel mode, and mode preference to the percentage of participants who would prefer to use a given mode. Based on the cell percentages, 40.7% of the participants are walkers who prefer to walk and 23.2% are walkers who would prefer to bike. Boldface numbers indicate agreement between actual and preferred mode. $\kappa=0.19$; $p<0.001$.

Table 3
Differences between children's actual and preferred mode for the trip to home.

Actual travel mode	Preferred travel mode (%)					Mode share (%)
	Walking	Cycling	Bus	Transit	Car	
Walking	**44.2**	24.9	0.5	0.5	1.8	73.2
Cycling	0.2	**2.8**	0.0	0.0	0.1	3.1
Bus	0.7	2.6	**0.2**	0.2	0.2	3.9
Transit	0.1	0.5	0.1	**0.7**	0.0	1.4
Car	6.2	8.5	0.4	0.2	**3.1**	18.4
Mode preference (%)	51.4	39.3	1.2	1.6	6.5	100.0

Note: Mode share refers to the percentage of participants using a given travel mode, and mode preference to the percentage of participants who would prefer to use a given mode. Based on the cell percentages, 44.2% of the participants are walkers who prefer to walk and 24.9% are walkers who would prefer to bike. Boldface numbers indicate agreement between actual and preferred mode. $\kappa=0.18$; $p<0.001$.

Table 4
Change in actual and preferred travel mode between the morning and afternoon trips.

Actual travel mode (% change)	Preferred travel mode (% change)					Mode share change (%)
	Walking	Cycling	Bus	Transit	Car	
Walking	−3.5	−1.7	0.0	0.0	−1.2	−6.4*
Cycling	0.0	−0.4	0.0	0.0	−0.1	−0.5
Bus	0.6	−0.3	−0.1	0.0	0.0	0.2
Transit	−0.1	0.5	0.0	−0.2	0.0	0.2
Car	0.9	3.8	0.2	0.3	1.3	6.4*
Mode preference change (%)	−2.1	2	0.1	0.1	−0.1	N/A

Note: The numbers indicate the percentage difference between the morning and afternoon trips (negative values indicate a greater percentage in the afternoon). For example, the proportion of participants who walk and express a preference for walking is 3.5% higher for the afternoon trip.

* Indicates significant change between morning and afternoon trips based on McNemar's test ($p<.05$).

Please cite this article as: Larouche, R., et al., “I'd rather bike to school!”: Profiling children who would prefer to cycle to school. Journal of Transport & Health (2016), http://dx.doi.org/10.1016/j.jth.2016.06.010

Given the multiple benefits of cycling to/from school among children and youth (Andersen et al., 2011; Larouche et al., 2014b; Østergaard et al., 2012), the habitual nature of travel behaviors (Faulkner et al., 2010; Gardner and Abraham, 2008) and the potential for childhood PA to carry over into adulthood (Malina, 1996; Telama et al., 2005), the observation that such a high proportion of children would prefer to cycle is highly relevant for public health. While children may be powerful advocates for cycling (and sustainable

Table 5
Univariate models of the correlates of being a potential school cyclist.

Variable	Categories/Units	Trip to school			Trip to home		
		OR	95% CI	*p*	OR	95% CI	*p*
Gender	Girl	0.65	0.33–1.29	0.218	0.61	0.25–1.46	0.268
	Boy	Reference					
Child's age	Each year of age	1.49	0.95–2.36	0.084	1.07	0.61–1.89	0.818
Body mass index	Each kg/m^2	**0.92**	**0.84–1.00**	**0.041**	0.95	0.87–1.05	0.330
MVPA	Each minute	1.02	0.99–1.05	0.208	**1.04**	**1.00–1.09**	**0.038**
Accelerometer counts/minute	Each additional 100 counts/min	1.20	0.93–1.55	0.163	**2.01**	**1.27–3.16**	**0.003**
Access to a bicycle	Yes	2.28	0.73–7.74	0.151	0.56	0.06–5.15	0.605
	No	Reference					
Independent mobility[a]	Never	1.23	0.64–2.36	0.531	1.89	0.85–4.21	0.117
	At least sometimes	Reference					
Number of cars	1 or less	0.94	0.49–1.83	0.860	0.70	0.32–1.53	0.372
	2 or more	Reference					
Number of driver licenses	1 or more	0.94	0.41–2.17	0.890	0.61	0.25–1.47	0.271
	2 or more	Reference					
Number of adults employed full-time in the household	None	0.63	0.26–1.57	0.328	0.88	0.29–2.68	0.827
	1	1.19	0.58–2.44	0.628	1.92	0.81–4.56	0.139
	2 or more	Reference					
Number of adults employed part-time in the household	None	0.82	0.38–1.79	0.620	**0.35**	**0.12–1.00**	**0.049**
	1 or more	Reference					
Other language spoken at home	Yes	0.74	0.39–1.42	0.368	0.51	0.23–1.13	0.096
	No	Reference					
Family type	Two-parents	Reference					
	Other	0.78	0.32–1.89	0.583	0.83	0.29–2.43	0.738
Father's education	College or less	Reference					
	University	0.93	0.48–1.82	0.834	1.00	0.44–2.25	0.991
Mother's education	College or less	Reference					
	University	1.04	0.54–2.02	0.897	1.08	0.48–2.41	0.847
Father's employment	Full-time	Reference					
	Other	0.48	0.23–1.00	.050	0.64	0.26–1.57	.327
Mother's employment	Full-time	Reference					
	Other	1.93	0.96–3.87	.063	**2.34**	**1.00–5.44**	**.048**
Distance from school	Each kilometer increase	0.92	0.78–1.10	.360	0.98	0.86–1.12	.763
Neighborhood type	Old BE, low SES	0.60	0.25–1.47	.266	**0.25**	**0.07–0.86**	**.028**
	Old BE, high SES	1.75	0.58–5.28	.321	0.56	0.15–2.06	.384
	New BE, low SES	0.63	0.29–1.39	.256	**0.29**	**0.10–0.82**	**.019**
	New BE, high SES	Reference					
Data collection season	Spring	**2.85**	**1.45–5.59**	**.002**	**3.53**	**1.56–7.96**	**.002**
	Fall	Reference					

Note: Only participants who traveled to or from school by car and who expressed a preference for cycling (i.e., potential school cyclists) or for being driven ("non-school cyclists") were included in these models. Models indicate the odds ratios of being a "potential school cyclist" relative to a "non-school cyclist". Boldface coefficients and *p*-values indicate statistical significance.

[a] Independent mobility was assessed by parent report. BE: built environment; MVPA: moderate-to-vigorous physical activity; SES: socio-economic status.

Table 6
Multi-variable model of the correlates of being a potential school cyclist for the trip to school and trip home from school.

Variable	Categories/units	Trip to school			Trip to home		
		OR	95% CI	p	OR	95% CI	p
Gender	Girl	0.70	0.34–1.47	0.349	0.87	0.23–3.30	0.843
	Boy	Reference					
Distance	Each kilometer increase	0.93	0.77–1.11	0.412	1.06	0.79–1.42	0.696
Body mass index	Each kg/m^2	**0.89**	**0.81–0.98**	**0.014**	[a]	[a]	[a]
Accelerometer counts/minutes	Each additional 100 counts	[a]	[a]	[a]	**2.31**	**1.34–3.96**	**0.002**
Independent mobility	At least sometimes	[a]	[a]	[a]	**9.75**	**2.60–36.63**	**0.001**
	Never	Reference					
Number of part time workers in the household	None	Reference					
	At least 1	[a]	[a]	[a]	**6.11**	**1.41–26.52**	**0.016**
Other language spoken at home	Yes	[a]	[a]	[a]	**0.28**	**0.09–0.92**	**0.036**
	No	Reference					
Data collection season	Spring	**2.83**	**1.39–5.76**	**0.004**	[a]	[a]	[a]
	Fall	Reference					

Note: The model indicates the odds ratios of being a "potential school cyclist" relative to a "non-school cyclist". Boldface coefficients and *p*-values indicate statistical significance.

[a] Indicates that a variable was not included in the final model. SES: socio-economic status. Model effect size for the trip to school and to home respectively: Nagelkerke R^2=0.129 and 0.421.

transportation in general), their voices are rarely solicited or heard (Gleeson and Sipe, 2006). In contrast, according to the UNICEF's (2014) concept of child-friendly cities, children should be viewed as active agents whose voices are taken into consideration in decision-making processes. At a broader policy level, greater adoption of a child-friendly city approach could make the environment more favorable for children to use their preferred travel mode. In Canada, such an approach is evident in the recently developed child- and youth-friendly land-use and transport planning guidelines (Gilbert and O'Brien, 2010). However, greater implementation of the guidelines is needed to maximize their potential effect.

At the individual level, it is important to learn more about the characteristics of driven children who would prefer to cycle because these children may be more receptive to cycling interventions. To this end, we dichotomized participants who traveled by car as potential school cyclists and non-school cyclists. Intervention strategies may need to be tailored to individuals' willingness to change, as emphasized in the transtheoretical model (Prochaska and Velicer, 1997). Potential school cyclists may be more receptive to interventions aiming to address perceived barriers to cycling, which may include parental concerns about safety (Shaw et al., 2015). For these children to cycle to/from school, interventionists should consider targeting parents as they are considered to be the gatekeepers of children's mobility (McMillan, 2005; Panter et al., 2008; Faulkner et al., 2010). They should also involve children and other stakeholders who can contribute to make the environment more suitable for cycling (e.g., school administrators, urban planners, and policy-makers). In contrast, interventions targeting non-school cyclists and their parents may first need to occur to raise awareness about the benefits and the feasibility of cycling to/from school, and/or about the unintended negative consequences of driving children to school (e.g., delaying the development of children's independent mobility, depriving an important source of PA, increasing exposure to traffic and pollution for those children who engage in active transportation, etc.).

As we are aware of no previous studies that examined the correlates of children's stated preference for cycling, we compare our results with previous literature on the correlates of cycling and AST in general. Caution is warranted in interpreting these comparisons because stated preferences reflect intention/motivation rather than actual behavior. We observed that children who participated in the spring season were more likely to indicate a preference for cycling to school. Interestingly, previous studies in Toronto (Mitra and Faulkner, 2012) and in the province of Ontario (Robertson-Wilson et al., 2008) found no relationship between AST and season. However, in those studies, walking accounted for the overwhelming majority of active trips, and season may be perceived as a greater barrier for cycling than for walking. A Norwegian study reported a large decrease in cycling during the winter, but in most cases, children switched to walking (Børrestad et al., 2011). From a different perspective, season might be a greater barrier for infrequent cyclists than for those who are habituated to cycling (Bergstrom and Magnusson, 2003). An unfavorable social norm for cycling and poor maintenance of (low quality) cycling infrastructure may also explain the scarcity of cycling in the fall and winter in the majority of North American cities. In contrast, winter cycling is quite common in other Nordic cities such as Oulu (Finland), which is located close to the Polar Circle (Pratte, 2011).

Interestingly, distance between home and school, which is known to be the most consistent environmental correlate of AST (Wong et al., 2011a), was not associated with the likelihood of being a potential school cyclist. Average distance was 1.8 km for children driven to school and 2.2 km for children driven from school. Such distances should not be sufficient to deter cycling.

Children who had at least some independent mobility were almost ten times more likely to express a preference for cycling home from school. This finding is consistent with previous literature showing that children who are afforded more independent mobility are more likely to engage in active transportation (Mammen et al., 2012; Page et al., 2010) and are more active overall (Page et al., 2010; Schoeppe et al., 2013; Stone et al., 2014). Nevertheless, our finding suggests the existence of other barriers that prevent children from actualizing

Please cite this article as: Larouche, R., et al., "I'd rather bike to school!": Profiling children who would prefer to cycle to school. Journal of Transport & Health (2016), http://dx.doi.org/10.1016/j.jth.2016.06.010

their independent mobility. It is also noteworthy that our question about independent mobility was not specific to school travel, so potential school cyclists may be granted permission to go to other destinations alone (or with friends) and they may strive to extend the limits of their independent mobility (Valentine, 1997).

Children living in households with at least one adult working part-time were about six times more likely to indicate a preference for cycling in the afternoon. Presumably, parents who work part-time may have more flexible work hours, thereby allowing them to escort their children to/from school. When escorting their children, they may choose the mode that is most convenient to them (Faulkner et al., 2010). Because work flexibility was not assessed in our study, future research is warranted to test this hypothesis. In addition, children whose family spoke a language other than English at home were less likely to indicate a preference for cycling for the afternoon trip. Among participants included in our regression models, children from non-English-speaking families were less likely to experience at least some independent mobility (32.5% vs. 56.6%; $p = .002$; data not shown). They may also have less cycling experience. Consistent with our findings, previous research in the Netherlands has shown that children and youth from other nationalities are less likely to cycle to/from school, and the authors attributed these large differences to cultural differences given that there is a strong cycling culture in the Netherlands (Bere et al., 2008; de Bruijn et al., 2005).

More active children were more likely to express a preference for cycling for the afternoon, but not for the morning trip. Specifically, the odds of being classified as a potential school cyclist almost doubled for each increase of 100 accelerometer counts/min, an increment that is lower than the standard deviation of 144.8. Although not examined in the present study, one may suppose that more active children have a more positive attitude toward cycling and a greater intention (or motivation) to cycle.

Interestingly, having a lower BMI was associated with children's preference for cycling for the morning, but not for the afternoon trip. Previous research has shown that overweight or obese children and youth present reduced intrinsic motivation for PA (Hwang and Kim, 2013; Markland and Ingledew, 2007) and engage in less PA, especially vigorous PA (Abbott and Davies, 2004; Hwang and Kim, 2013).

Finally, our observation that walking was more prevalent in the afternoon whereas car travel was more prevalent in the morning is consistent with previous AST research (Buliung et al., 2009; Wong et al., 2011b; Yarlagadda and Srinivasan, 2008). We also noted differences in the factors associated with children being classified as potential school cyclists between the morning and afternoon trips. Similarly, previous research has shown that the correlates of AST differ between the morning and afternoon trips (Mitra et al., 2010; Yarlagadda and Srinivasan, 2008). Of particular interest, we note less variation between the morning and afternoon in children's preferred travel mode than in their actual travel mode. The observed differences in the correlates of children's stated preference for cycling between the morning and afternoon trips may be influenced by the other activities that occur before or after school, and by the time available for commuting. However, it is worth noting that our analyses examining the correlates of stated preference for cycling were restricted to children who were driven to or from school. As fewer children were driven from school, the subsamples for the morning and afternoon trips were different, and this may partly explain the observed differences.

The main limitation of the study is the cross-sectional design, which precludes causal inferences. Second, the sub-sample of participants included in our regression analyses was small and, as a result, regression coefficients included substantial uncertainty. Third, children reported their actual and preferred school travel mode and this could be subject to social desirability bias. However, a recent review of the literature suggested that measures of child-reported AST show high test-retest reliability and convergent validity between child and parent responses (Larouche et al., 2014a). Fourth, we could not subdivide potential school cyclists based on parental permission to cycle because the question about independent mobility was not specific to cycling. Fifth, the generalizability of the findings to other North American cities may be limited due to the high prevalence of active transportation in urban areas of Toronto, but we believe that the findings could be relevant for other dense urban areas where the average distance between home and school is low and therefore conducive to active transportation. It is also notable that a survey of children's independent mobility in 16 countries also indicated high preference for cycling among children (Shaw et al., 2015), so the stated preferences reported herein are not unique to Toronto. Finally, while our models explained a relatively large proportion of the variance (especially for the afternoon trip), the inclusion of other variables such as children's attitudes toward cycling and their perceptions of their environment could have increased our predictive ability.

Strengths of the study include the large sample size for the concordance analyses and the stratified sampling strategy, which maximized variability in terms of neighborhood type and area-level SES. Furthermore, we measured children's actual route to/from school rather than relying on the assumption that children necessarily take the shortest path (Buliung et al., 2013). The classification of children who do not currently cycle to/from school as potential school cyclists and non-school cyclists provided a novel strategy to identify potential targets for future cycling interventions. Finally, we examined the correlates of stated preference for cycling separately for the morning and afternoon trips given previous research showing higher rates of active travel in the afternoon trip (Buliung et al., 2009; Wong et al., 2011b). Our findings are supportive of this analytical distinction.

5. Conclusion

We observed that while only 2–3% of children reported cycling to or from schools, about 40% of children would prefer to do so, including about half of children who were driven to school. Factors associated with the likelihood of being classified as a potential school cyclist differed for the morning and afternoon trips. Children who had a lower BMI and those who participated in the study during the spring months were more likely to indicate a preference for cycling to school. Children who were granted some independent mobility, who were more active and who lived in households with at least one parent working part-time had higher odds of being classified as potential school cyclists for the afternoon trip. In contrast, those who lived in households who spoke a language other than English at home were less likely to indicate a preference for cycling. These findings, in a sample of children who generally lived within a short distance to school, suggest that there may be a substantial potential for increasing cycling in Toronto if children's stated preferences for cycling could be harnessed within behavior change interventions. Nevertheless, the role of parents as mediators between children's preference/intention to cycle and cycling behavior warrants future investigation.