

Investigating the Relationship between Motor Vehicle Speed and Active School Transportation at Elementary Schools in Calgary and Toronto

February 3, 2020

CHASE Monthly Webinar Series

Presenter: Rebecca Ling, MPH

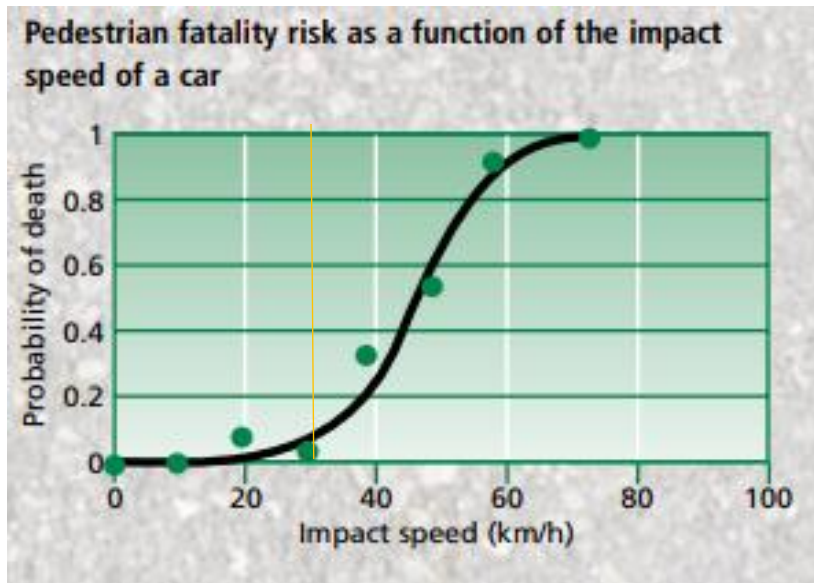
Coauthors: Linda Rothman, Brent Hagel, Colin Macarthur, Meghan Winters, Tony Churchill, Tate HubkaRao, Liraz Fridman
Alison Macpherson, Marie- Soleil Cloutier, Andrew Howard

Background

- Majority of children and youth do not meet physical activity recommendations (Katzmarzyk, 2000)
 - Promote active school transportation as a means of physical activity
- Pedestrian-related injuries account for 12% of all injury-related deaths in children under 14 years old (Canadian Council of Motor Transport Administrators, 2013)



Background



Speed and Injury Relationship

- 10% risk of fatality for pedestrian struck by car travelling at 30 km/h or below
- At 50 km/h, risk increases exponentially to 80%

Literature Review

- In study by Oluyomi (2014), parents who reported that traffic safety was *not a problem* were more likely to report that child walks to school compared to parents who reported that traffic safety was *always a problem* (OR=2.86, 95% CI: 1.64, 4.99)
- Parents' perception of traffic safety at the school is associated with mode of transportation (Oluyomi, 2014; Rothman, 2018; Wilson, 2018)
 - Self-reported measures of traffic safety and/or school travel

Child Active-Transportation Safety and the Environment (CHASE) Study

- Objective – to examine the built environment and child and adolescent active transportation to schools within and across multiple large Canadian urban centres
- 552 schools observed in 7 cities across Canada, including Vancouver, Surrey, Calgary, Peel, Toronto, Montreal and Laval



Objective



To investigate the relationship between vehicle speeds in front of schools and active school transportation

- To examine this relationship using 3 different speed definitions
 1. Vehicles travelling over 30 km/h
 2. Vehicles travelling over the posted speed limit
 3. 85th percentile speed
- To examine the influence of the built environment on vehicle speeds and active school transportation



School Sample

Calgary (n=46)

- 46 of 125 CHASE schools
- Randomly selected
- Grades JK-8

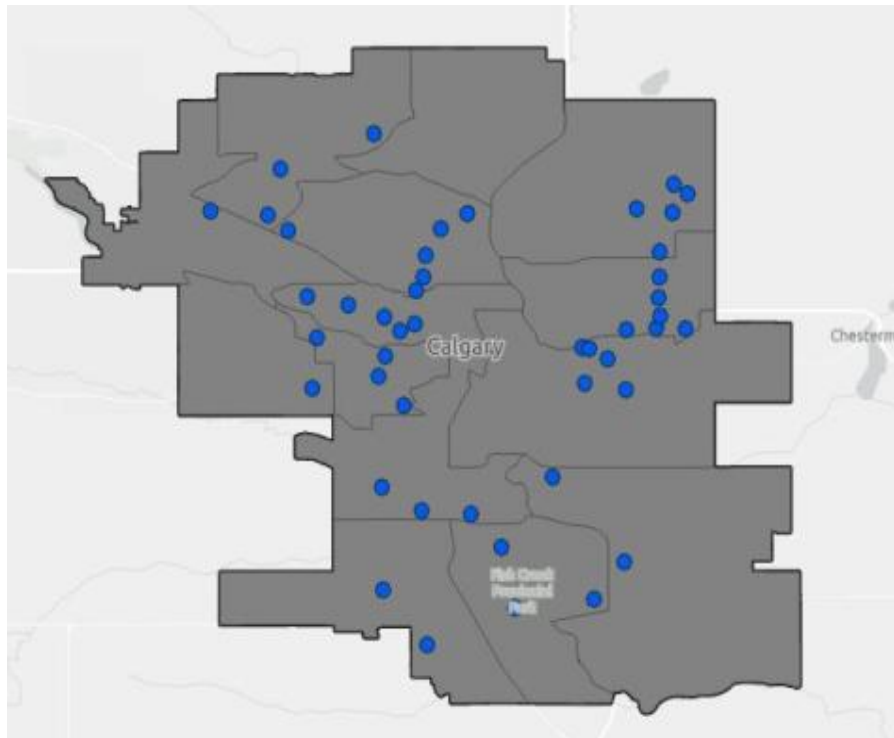
Toronto (n=42)

- 26 of 75 CHASE schools
- 16 schools from another study
- Grades JK-8

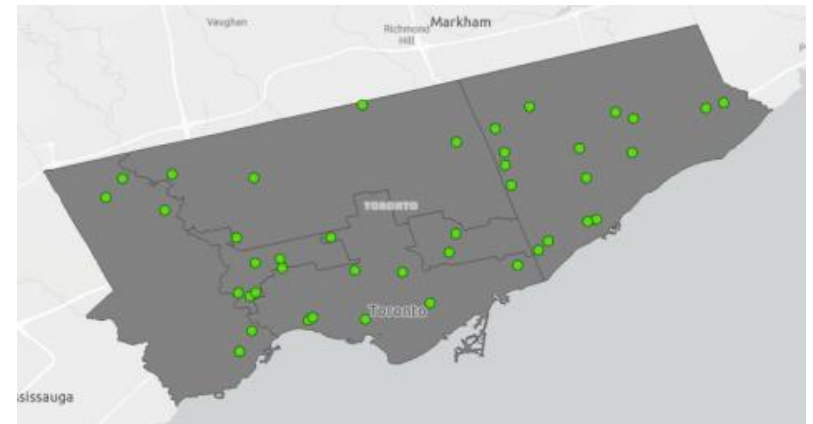
Vancouver, Surrey, Peel, Montreal and Laval schools were not included because vehicle speed data were not available

Maps of Schools

Calgary: 46 schools



Toronto: 42 schools






Data

School Travel Counts

- Conducted in May and June, 2018 by trained university student observers
- 25 mins during morning drop-off period
 - 20 mins before and 5 mins after the bell



Data Vehicle Speeds

	Calgary	Toronto
	Individual vehicle data by time and speed	Grouped data by 15 mins intervals and speed bins
	1 to 9 days	24 hours, for 3 consecutive days
	Weekends, holidays or data collected for <1 day	None

Data

Vehicle Speed Times

Vehicle speeds assessed during School Activity Times operationally defined from 7:30 AM to 6 PM

Calgary School Zones

- Operating speed limit changes to 30 km/h between 7:30 AM and 9:00 PM

Toronto School Zones

- Speed limit varies between 30 km/h and 60 km/h depending on the type of roadway

Data

School Environment

- Using Google Street View, within 200m of the main entrance, we captured:
 - Speed limits, road type and presence of sidewalks, cycling infrastructure, and pedestrian crossovers
- From school observations data, the presence of school crossing guards was collected.

Analysis

- **Outcome:** Proportion of students using active school transportation (AST)
- **Exposure:** Vehicle speed metrics, defined as
 1. Proportion of vehicles over 30 km/h (%)
 2. Proportion of vehicles over speed limit (%)
 3. 85th percentile speeds (km/h)

Analysis

- **School Environment Covariates:**
 - Cycling infrastructure (present vs absent)
 - Pedestrian crossovers (present vs absent)
 - Crossing guard (present vs absent)
 - Road classification (local vs arterial)
- Beta regression models, stratified by city
- Reported as odds ratios with 95% confidence intervals

School Environment Characteristics

Table 1: School Environment - Roadway Characteristics

CHARACTERISTICS	Calgary, N=46 n (%)	Toronto, N=42 n (%)
Road type:		
Local/collector	44 (96%)	32 (76%)
Minor/major arterial	2 (4%)	10 (24%)
Speed limit:		
30 km/h	46 (100%*)	11 (26%)
40 km/h	0 (0%)	21 (50%)
50 km/h	0 (0%)	7 (17%)
60 km/h	0 (0%)	3 (7%)

* All schools in Calgary set 30 km/h zones during school activity times

School Environment Characteristics

Table 2: School Environment – Walkability and Safety Characteristics

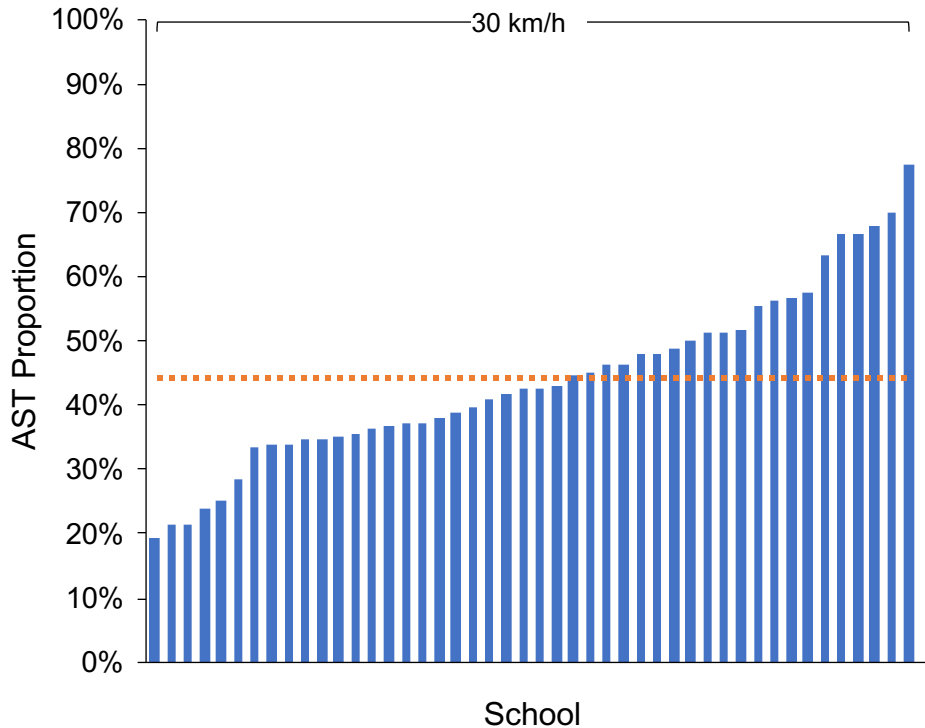
CHARACTERISTICS	Calgary, N=46 n (%)	Toronto, N=42 n (%)
Sidewalk (%)		
One side	3 (6%)	2 (5%)
Both sides	43 (94%)	40 (95%)
Presence of cycling infrastructure (%)	4 (9%)	2 (5%)
Presence of crossing guards (%)	27 (59%)	28 (67%)
Child only	10 (22%)	1 (2%)
Adult only	4 (9%)	24 (57%)
Both child and adult	13 (28%)	3 (7%)
Presence of pedestrian crossovers (%)	40 (87%)	31 (74%)

Results

Active School Transportation

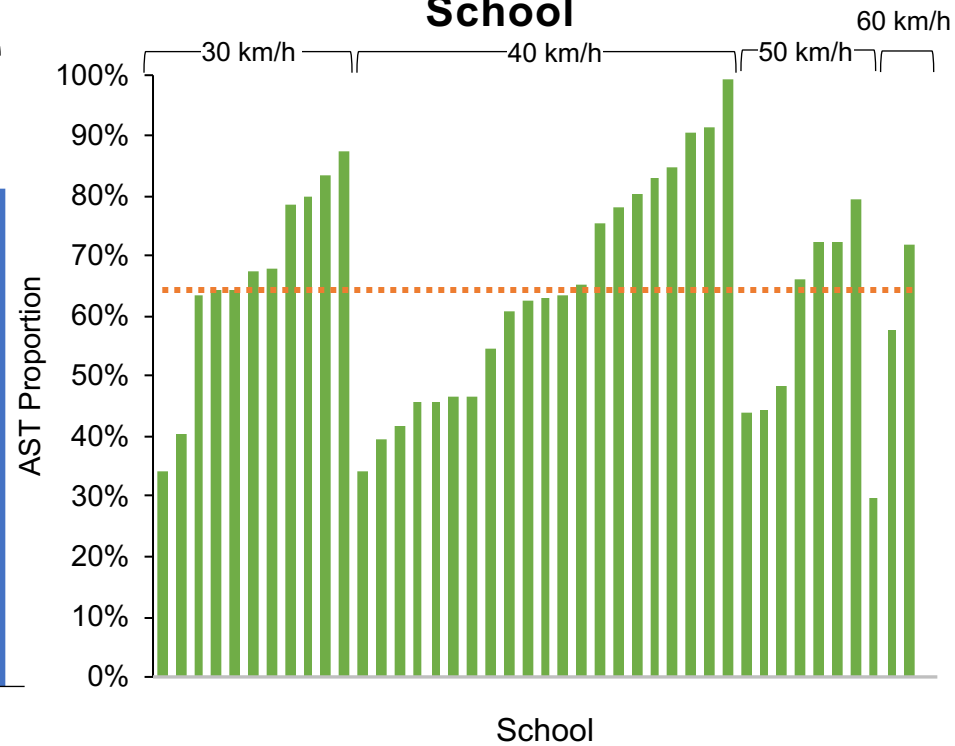


Calgary – AST Proportion by School



Calgary Average = 44%

Toronto – AST Proportion by School



Toronto Average = 64%

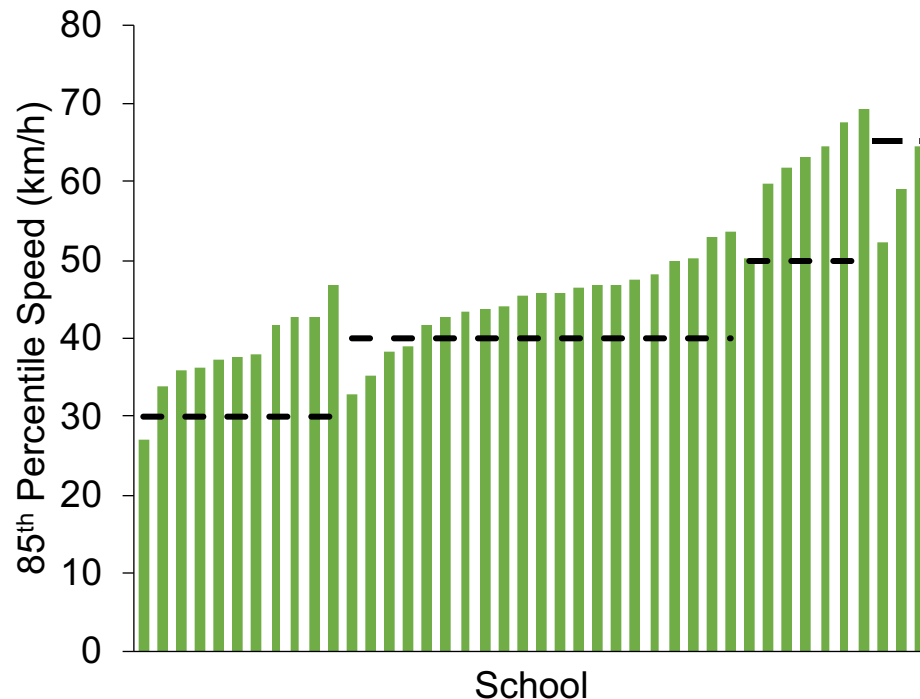
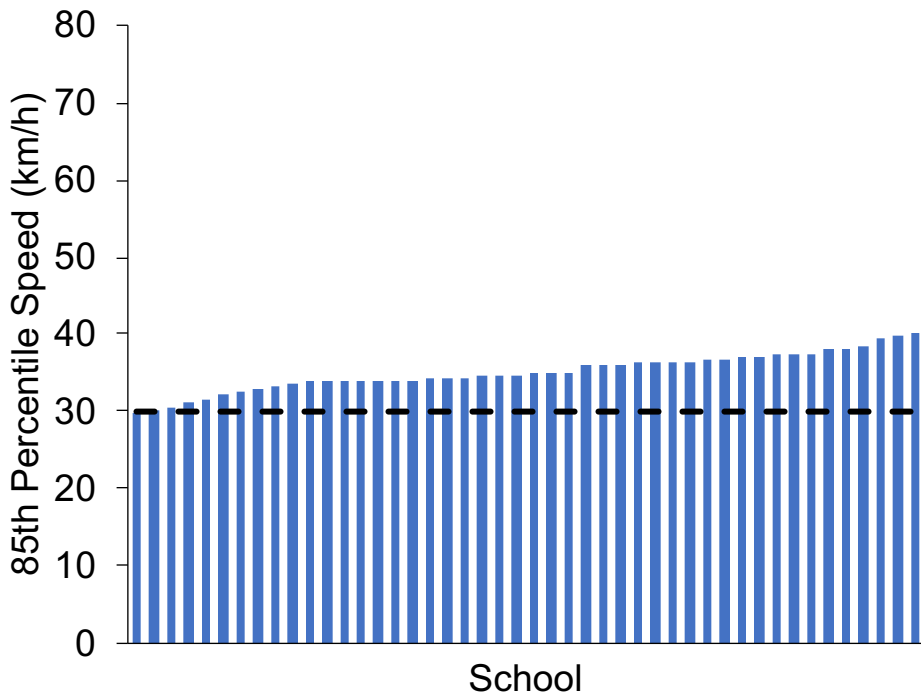
Results

85th Percentile Speeds



Calgary - 85th Percentile Speeds by School

Toronto - 85th Percentile Speeds by School



Speed limits marked by dotted lines

Calgary

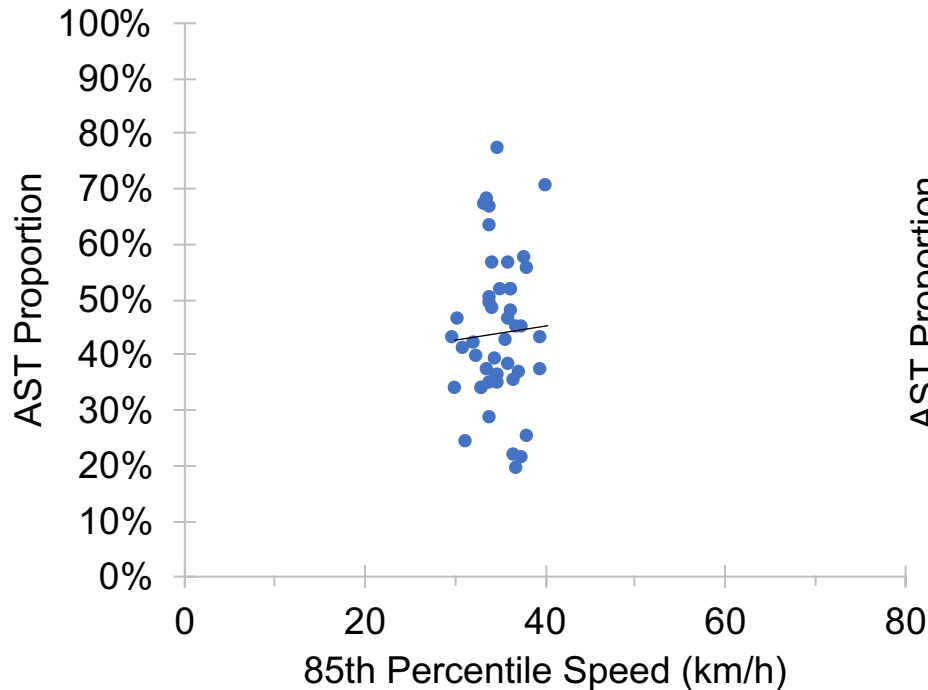
Average 85th Percentile Speed = 35 km/h

Toronto

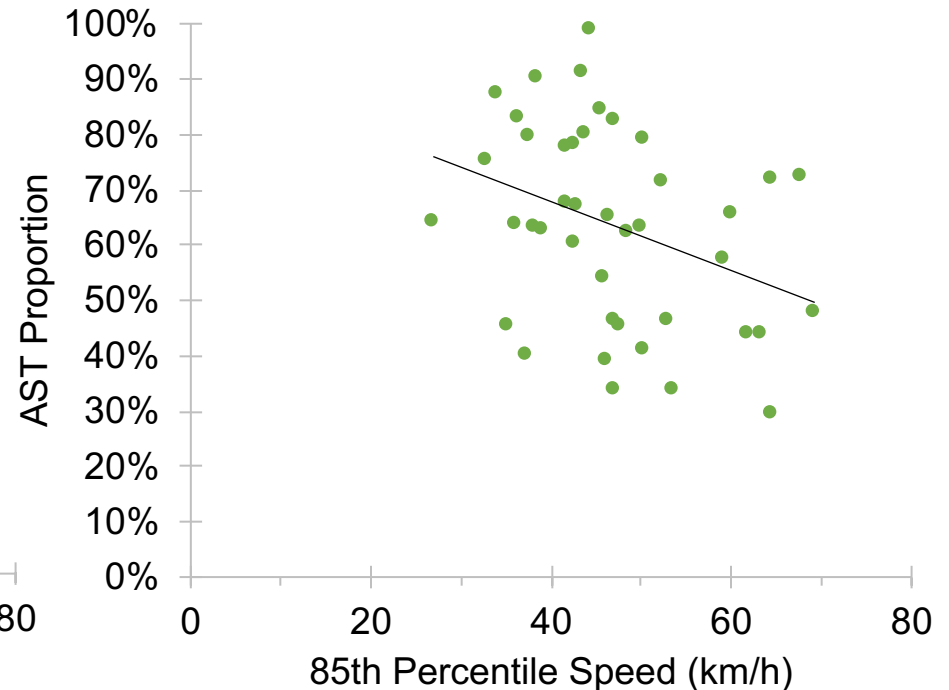
Average 85th Percentile Speed = 47 km/h

Results – AST and Vehicle Speeds

Calgary Schools - Relationship between AST and 85th Percentile Speed



Toronto Schools - Relationship between AST and 85th Percentile Speed



Overall trend depicted by solid lines

Calgary

AST and Vehicle Speed Analysis

Table 3: Results from AST Models for Calgary

Outcome: Proportion of AST	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Speed Definitions		
Speeding over 30 km/h per 10% of vehicles	0.97 (0.88, 1.08)	0.98 ^a (0.88, 1.09)
Speeding over speed limit per 10% of vehicles	0.97 (0.88, 1.08)	0.97 ^a (0.87, 1.08)
85 th percentile speed per 1 km/h	1.01 (0.94, 1.08)	1.00 ^b (0.94, 1.07)

OR: Odds Ratio, CI: Confidence Intervals

^aAdjusted for cycling infrastructure, crossing guard, pedestrian crossover, road type

^bAdjusted for cycling infrastructure, crossing guard and pedestrian crossover

Toronto AST and Vehicle Speed Analysis

Table 4: Results from AST Models for Toronto

Outcome: Proportion of AST	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Speed Definitions		
Speeding over 30 km/h per 10% of vehicles	0.90 (0.80, 1.01)	0.90 ^a (0.77, 1.04)
Speeding over speed limit per 10% of vehicles	0.90 (0.81, 0.99)	0.90^a (0.82, 0.99)
85 th percentile speed per 1 km/h	0.97 (0.95, 1.00)	0.97^b (0.95, 0.99)

OR: Odds Ratio, CI: Confidence Intervals

^aAdjusted for cycling infrastructure, crossing guard, pedestrian crossover, road type

^bAdjusted for cycling infrastructure, crossing guard and pedestrian crossover

AST and Vehicle Speed Adjusted Analysis

- In Toronto schools, the odds of children using AST significantly decrease by 3% for every 1 km/h increase in 85th percentile speeds (adjusted OR=0.97, 95% CI: 0.95, 0.99)
- In Calgary schools, there is no significant relationship observed between AST and 85th percentile speeds (adjusted OR=1.00, 95% CI: 0.94, 1.07)

School Environment Effects

Table 4: Adjusted AST Models with School Environment Covariates

	Calgary Schools	Toronto Schools
Outcome: Proportion of AST	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Exposure: 85th percentile speed per 1 km/h	1.00 (0.94, 1.07)	0.97 (0.95, 0.99)
School Environment Variables		
Pedestrian crossover vs none (ref)	0.89 (0.54, 1.46)	1.26 (0.76, 2.10)
Cycling infrastructure vs none (ref)	1.29 (0.73, 2.25)	2.97 (0.97, 9.03)
Crossing guard vs none (ref)	0.88 (0.62, 1.23)	1.43 (0.90, 2.26)
Arterial roads vs local roads (ref)*	---	---

*Road type was highly correlated with the 85th percentile speed and was removed from the model

Discussion

- “High” vehicle speeds prevalent in front of schools
 - 85th percentile speeds: 35 km/h in Calgary and 47 km/h in Toronto
 - Percentage of drivers over speed limits: 45% in Calgary and 42% in Toronto
- In Toronto, 72% of vehicles going over 30 km/h, where speed limits range from 30 to 60 km/h

Discussion

- Differences in school travel between cities
 - 44% AST in Calgary vs. 64% AST in Toronto
- Observed significant relationship between AST and vehicle speeds in Toronto
 - Consistent with previous studies that used self-reported measure for traffic safety (Oluyomi, 2014; Rothman, 2018; Wilson, 2018)

Limitations

- Misclassification bias of AST, speeds and school environment covariates
- School sample size
- Selection bias in school criteria
- Confounding

Conclusion

- Almost 50% of vehicles do not comply with speed limits in Calgary and Toronto school zones



- Need for targeted interventions at schools to reduce speeds
 - Lower speed limits, speed cameras, police enforcement, physical traffic calming measures



CHild Active-Transportation Safety and the Environment

Brent E. Hagel, Andrew Howard, Alison Macpherson, Pamela Fuselli

University of Calgary, Hospital for Sick Children, York University, Parachute

Co-investigators

- Alberto Nettel-Aguirre, UofC
- Carolyn Emery, UofC
- Colin Macarthur, SickKids
- Donald Voaklander, UofA
- Gavin McCormack, UofC
- Gregory Morrow, UC Berkley
- Guy Faulkner, UBC
- Ian Pike, UBC
- Juan Torres, Udm
- Kathy Belton, UofA
- Kelly Russell, UofM
- Linda Rothman, Ryerson University
- Liz Owens, Alberta Transportation
- Marie-Soleil Cloutier, INRS
- Meghan Winters, SFU
- Ron Buliung, UofT
- Sarah Richmond, Public Health Ontario
- Tracey Ma, George Institute

Research Coordinators

- Tona Pitt, UofC (National)
- Tate Hubka, UofC
- Janet Aucoin, UofC
- Moreno Zanotto, SFU
- Rebecca Ling, SickKids

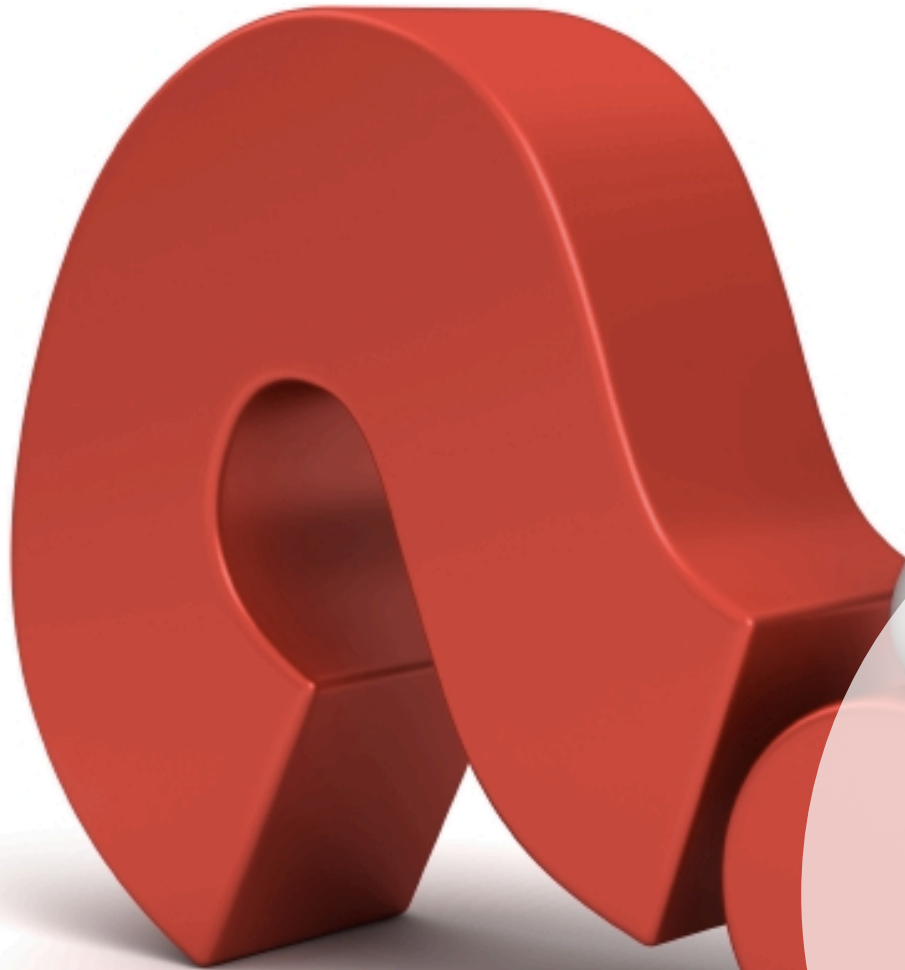


This study was supported by the CIHR Team Grant: Environments and Health: Intersectoral Prevention Research, The Built Environment and Active Transportation Safety in Children and Youth #IP2-150706.

This study was conducted by the CHASE (Child Active Transportation Safety and the Environment) group of investigators and their partners. We would like to thank the study participants for generously providing their time, as well as all the members of CHASE, including; investigators, collaborators, partners, staff, and trainees.

Thank you





**Thank you.
Questions?**

Rebecca Ling

rebecca.ling@sickkids.ca

References

Katzmarzyk, P. T., Gledhill, N., & Shephard, R. J. (2000). The economic burden of physical inactivity in Canada. *CMAJ : Canadian Medical Association Journal*, 163(11), 1435–1440.

Linda Rothman, Alison K. Macpherson, Timothy Ross, Ron N. Buliung. (2018). The decline in active school transportation (AST): A systematic review of the factors related to AST and changes in school transport over time in North America, *Preventive Medicine*, 111, 314-322.
<https://doi.org/10.1016/j.ypmed.2017.11.018>.

Oluyomi, A. O., Lee, C., Nehme, E., Dowdy, D., Ory, M. G., & Hoelscher, D. M. (2014). Parental safety concerns and active school commute: correlates across multiple domains in the home-to-school journey. *International Journal of Behavioral Nutrition and Physical Activity*, 11(1), 32.
<https://doi.org/10.1186/1479-5868-11-32>

Pasanen E. & Salminvaara H. Driving speeds and pedestrian safety in the city of Helsinki. *Traffic Injury and Control* 1993; 34 (6): 308-310.

Canadian Council of Motor Transport Administrators. (2013). Countermeasures to Improve Pedestrian Safety in Canada. Accessed from
https://ccmta.ca/images/publications/pdf/CCMTA_Pedestrian_Report_Eng_FINAL.pdf. Date accessed January 28 2020.

Wilson, K., Clark, A. F., & Gilliland, J. A. (2018). Understanding child and parent perceptions of barriers influencing children's active school travel. *BMC Public Health*, 18(1), 1053.
<https://doi.org/10.1186/s12889-018-5874-y>