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The school environment and student car drop-off at elementary schools

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ABSTRACT

There has been an increase in vulnerable road user fatalities in the City of Toronto, Canada, necessitating greater emphasis on traffic safety measures. Potentially risky student drop-off behaviours by private vehicle drivers are frequently observed around schools which may contribute to collision risk. A cross-sectional observational study conducted in the spring, 2015 at 100 Toronto elementary schools, examined built environment features associated with risky student drop-off and pedestrian behaviours. Observers completed a checklist to identify risky behaviour outcomes. Covariates included the proportion of children observed dropped off by private vehicles, built environment features (within 200 m of schools) and school social disadvantage. Logistic regression was conducted for each outcome. The most common risky behaviours observed were dropping children at the opposite side of the road from schools (79%) and reversing dangerously (64%). The most common child pedestrian behaviours were crossing at uncontrolled midblock locations (85%) and crossing between parked cars (61%). Traffic congestion around schools was associated with double parking (OR 5.96), reversing (OR 4.14) and crossing between parked cars (OR 2.71, children). Less parking blocking crossing controls (OR 0.26) reversing (OR 0.37) uncontrolled midblock crossing (OR 0.26, children) and crossing between parked cars (OR 0.31, children) was observed where there were designated car drop-off areas. Driver texting appeared less common when crossing guards were present (OR 0.18). Greater school disadvantage was associated with uncontrolled pedestrian midblock crossings (OR 14.37, children). Findings will help develop policy and interventions targeting collision risk around schools as part of Toronto's new Road Safety Plan.

1. Introduction

Although child pedestrian hospitalizations and deaths in Canada have been in decline, the burden remains high (Safe Kids Canada, 2007; CIHI, 2008). In 2013, there were 23 child pedestrians <14 years killed and over 1100 injured on Canada's roads (Transport Canada, 2013). In the City of Toronto, there were 1465 pedestrian motor-vehicle collisions (PMVC) reported to police over a ten month period (January-September 2013), the injured included 114 (8%) children (City of Toronto, 2013). There has been a recent increase in vulnerable road user fatalities (pedestrians, cyclists and motorcyclists) in the City of Toronto. Between 2011 and 2015, the number of vulnerable road user fatalities on Toronto roads have more than doubled, from 22 to 50, with pedestrian fatalities also more than doubling from 18 to 39 during the same time period (Toronto Co., 2016). These data both motivate and necessitate placing greater emphasis on traffic safety research and intervention within Canada's largest city.

Much of children's exposure to traffic as pedestrians occurs during school travel. Parents cite traffic safety as an important reason why they accompany or drive their children to school (Faulkner et al., 2010; Timperio et al., 2006; McMillan, 2007). The traffic environment around schools is also an issue of concern for parent or school councils, and school administrators. Generally, the risk of child PMVC is low and should not preclude walking to school. However, the school trip, site and surrounding area come into focus for prevention, as collisions involving children are more common closer to schools and a large proportion occur during school travel times (Warsh et al., 2009; Macpherson et al., 1998; Waygood and Susilo, 2015; Rothman et al., 2015).

Traffic safety has primarily been the responsibility of parents and children and the focus has been on educational initiatives

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and pedestrian behavioural change, in light of the auto-dominance of the mobility structure in Canadian cities (Parusel and McLaren, 2010). There is no evidence of effectiveness of educational initiatives directed at changing pedestrian behaviour in reducing pedestrian collisions (Duperrex et al., 2002). A far more effective strategy to protect child pedestrians around schools is to create a safer road traffic environment (Roberts et al., 1995a, 1994). However, how the school built environment affects driver and pedestrian behaviours has not been well described, and is subject to local differences, neighbourhood to neighbourhood, city to city (Fyhri et al., 2011; Zhu and Lee, 2009). This study questions how the built environment associates with risky driver drop-off behaviours, and describes pedestrian behaviours during the morning school drop-off. This research also aims to identify potential built environment interventions to help inform policy and design for safer pedestrian environments around schools.

2. Literature review

This literature review describes the relationship between the built environment and traffic safety with a focus on children and schools. School travel and exposure to traffic are then described including risking driving and traffic congestion around schools. The implications for child pedestrian motor vehicle collisions are then discussed.

2.1. The built environment and traffic safety

The built environment of urban areas can have a strong impact on traffic safety. Wide arterial roadways which are common in suburban areas of North American cities, arterial-oriented commercial developments and big box stores have been associated with increased incidences of collisions and injuries (Dumbaugh and Rae, 2009). Higher density communities, narrow roads and traffic calming measures have been associated with fewer crashes (Ewing and Dumbaugh, 2009). Fewer child pedestrian motor vehicle collisions have been associated with playgrounds and parks, more traffic calming, lower traffic speeds and lower land use mix (Rothman et al., 2014). Safety features to prevent collisions related to the built environment around schools have been identified to include: higher multi-family dwelling densities, traffic calming and fewer one-way streets. The built environment around schools is important, in that more children walking to school does not lead to more pedestrian collisions if the environment is safe (Rothman et al., 2014). However the relationship between the built environment around schools and driving and pedestrian behaviours during peak travel times remains unknown.

2.2. School travel and exposure to traffic

Traffic congestion around schools has been an increasing problem because, in addition to drive-thru traffic, more children are being driven to school and less are using active transportation (La Vigne, 2007). In Canada, the 2013 Active Healthy Kids Report Card on Physical Activity indicated 24% of 5–17 year olds use active school transportation only, and 14% use a combination of inactive and active modes (Active Healthy Kids Canada, 2013). Walking auto mode share has increased from 12% to 29% from 1986 to 2011 in the City of Toronto, with walking mode share decreased from 59% to 45% (Smart Commute, 2015). It has been estimated that in Toronto, school trips account for 20% of peak hour morning traffic (Smart Commute, 2016). This increase in car travel has resulted in school-related traffic congestion, which can contribute to lost time from jobs and road rage, while potentially contributing to increased risk of child PMVC (La Vigne, 2007; Rothman et al., 2014; Active Healthy Kids Canada, 2013).

Studies have found a strong association between higher traffic volumes and child PMVC, with high traffic volumes and exposure to vehicular traffic being of concern near schools during school travel times (Petch and Henson, 2000; Roberts et al., 1992, 1995b; Roberts and Crombie, 1995). In a study of children <13 years in Toronto, Canada, 48% of child PMVC occurred during school travel times (Rothman et al., 2015). The risk ratio for PMVC within 150 m of a school was almost 6 times higher than that for distances >450 m from a school. The risk ratio increased to over nine times for fatal collisions (Warsh et al., 2009). In Florida, 71% of collisions involving child pedestrians and bicyclists age 4–18 years occurred within a ½ mile radius of a school during school commuting periods (Abdel-Aty et al., 2007). In Montreal, Canada, Macpherson et al. found that exposure to traffic during school travel was correlated with child pedestrian injury(Macpherson et al., 1998). Gropp et al. found that greater exposure to traffic in terms of regular active transportation to school at larger distances was associated with higher odds of active transportation injury (Gropp et al., 2013). Peaks in child pedestrian fatalities occur in the morning in Canada, corresponding with school travel time (Waygood and Susilo, 2015). Altering school attendance times so that school travel does not occur during peak morning commute times has been suggested to reduce pedestrian exposure to traffic (Roberts et al., 1995b). This type of intervention could produce a 15 percent reduction in encounters between child pedestrians and motor vehicles in some places (Yiannakoulias et al., 2013). The increase in school traffic congestion as a result of declining active school transportation may contribute to risky driving and pedestrian behaviour around schools.

2.3. Risky driving and traffic congestion near schools

There are several descriptive studies related to risky driving and traffic congestion near schools. Excessive speeding on roadways has been identified as an issue, with an Australian study finding that speeding >10 km/hr. over the posted limit was more prevalent on school zone roads than other roads, with 23% of the distance traveled in school zones above the limit (Ellison et al., 2011; Taft et al., 2000; Anderson et al., 2002). In another study by Safe Kids, 45% of vehicles ignored stop signs and another 25% stopped in or past crosswalks near schools (Cody and Hanley, 2013). Thompson and Fraser, 1985 found that 36% of vehicles observed outside junior schools in Nottingham, U.K. were travelling faster than the posted speed limit. In the same study no relationship was found between the presence of children near the road and vehicle speed (Thompson and Fraser, 1985). In a Canadian Automobile Association (CAA) study of school traffic around three schools in Winnipeg, Manitoba; police force observers reported 548 incidences of dangerous driving in less than two hours. These incidences included: speeding in school zones, distracted driving, and failure to stop at a crosswalk or stop signs (Ketches, 2016).

2.4. Risky driving near schools and child PMVC

Previous research has found contradicting results regarding the relationship between higher densities of on-street parking, which is an issue around schools during drop-off and pick-up times, and child PMVC, with some studies identifying onsite parking as a risk and others as a protective factor for collisions (Roberts et al., 1995a; Agran et al., 1996; Christie, 1995). On-street legal or illegal parking can obscure the vision of both pedestrians and drivers creating risk of collision. A study of 118 elementary schools conducted in 2011 in Toronto, Canada, found a strong association between risky school drop-off behaviours and traffic congestion

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