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Review Article

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

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ABSTRACT

Active travel to school has declined during the last 50 years in North America. During the last decade, the children's active school transportation (AST) literature has grown. This systematic review provides an updated examination of AST correlates, and discusses why school travel mode (STM) share may have changed over time. AST trends are described and a systematic literature review of AST correlates in North America for the period 1990–2016 was conducted. Strength of association between correlates and AST, and relationship direction are assessed and reported. Graphical presentation of correlates included in ≥ 5 studies were included. Sixty-three studies were identified and reviewed. Distance to school was most strongly associated with AST. Individual, parental and societal correlates had moderate positive associations with AST including: child age, lower parental education, income and other income related factors, race and positive perceptions of AST. Longitudinal studies were few in number, as were studies about exceptional populations, policy, and interventions. AST intervention should focus on key AST correlates. Social and environmental diversity calls for local solutions to school travel challenges. Changes in AST correlates over time should be considered for evaluating existing policy approaches, and to support development of new policy, regulation, design, and program interventions.

1. Introduction

School transport has changed considerably throughout the automobile century; the use of active modes for school travel has declined over the last 50 years. In the United States, nearly half (49%) of children aged 5 to 14 (i.e. kindergarten to grade 8) actively travelled to school in 1969, but by 2009, only 13% engaged in active school travel (AST) (McDonald et al., 2011). In the Greater Toronto and Hamilton Area (GTHA), Canada auto mode share more than doubled between 1986 and 2011 for 11–17 year olds (Smart Commute, 2015a). Buliung et al. (2009) suggested that the AST decline might have reached its nadir by 2006; however, even in the City of Toronto, where walking to school is more common than other GTHA locations, to/from school walking mode share for 11–13 year olds declined again between 2006 and 2011 (to school: 48% to 45%, from school: 55% to 50%) (Smart Commute, 2015b).

While AST has declined, the prevalence of childhood obesity and emergence and earlier onset of other chronic diseases has risen (Janssen and LeBlanc, 2010; Shields, 2005). Increased sedentary activity offers partial explanation for these trends (Rennie et al., 2005; Trost et al., 2001; Goran, 1997). There are immediate and lifelong physical activity, social, and health benefits related to AST. The school trip represents an important opportunity for daily physical activity and social contact. Evidence from Denmark indicates that active children concentrate better at school (Vinther, 2012). Children who cycle to school have been found to have a higher degree of activation (i.e. alertness and activity) during school than those who travelled by car (Westman et al., 2013). Systematic reviews have found that children who are independently mobile and use AST modes accumulate more physical activity (Schoeppe et al.,

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2013; Faulkner et al., 2009). AST has also been associated with healthier body composition and levels of cardiorespiratory fitness (Lubans et al., 2011). Finally, establishing an active lifestyle in childhood could influence physical activity and transport decisions into adulthood (Telama et al., 2005).

The literature on children's school transportation and AST has grown recently. There have been numerous special issues and peer review publications dedicated to children's transport, alongside increased attention to developing child-friendly transport policies. Previous reviews of children's travel literature were not school travel-specific, focused only on a specific domain of correlates, were not systematic or adequately rigorous, or were not recently published (Lu et al., 2014; Wong et al., 2011; Pont et al., 2009; Sirard and Slater, 2008; Stewart, 2011). A systematic review of the literature was conducted to identify correlates representing different social-ecological domains related to AST in North America and to discuss how changes in these correlates could impact school travel over time. The review process covered > 25 years of research.

2. Methods

2.1. Social-ecological model

The social-ecological model for health promotion provides a framework for organizing and understanding factors that can influence health behaviours (McLeroy et al., 1988; Centers for Disease Control and Prevention, 2015). The model has four layers: individual, social environment, built environment and policies. This review used an adapted model, as AST as a health behaviour is not solely determined by the individual child, but is strongly influenced by parent(s)/caregiver(s) (McMillan, 2005). The individual layer incorporates both child and parent/caregiver characteristics (Appendix A). Neighbourhood and school characteristics were also incorporated into the social environment influences layer (Appendix A). Since AST is influenced by the objectively measured built environment and how parents and children perceive it, the built environment layer includes both objective and reported built environment measures.

2.2. Search strategy

The search strategy was developed in consultation with a research librarian at York University, Toronto, Canada (Appendix B). Literature published between January 1990 and July 30, 2016 was searched across seven electronic databases related to school travel modes (STM). The reference lists of 18 relevant review articles were searched for additional papers. Search results are illustrated using a PRISMA flow diagram (Fig. 1) (Liberati et al., 2009).

2.3. Eligibility

Two researchers independently reviewed titles and abstracts and determined eligibility using screening questions (Appendix C). Eligibility discrepancies were resolved through inter-reviewer discussion and consultation with a third researcher as required. Studies were included when all involved researchers reached consensus. The level of agreement was assessed at each screening stage, using a Kappa coefficient. The thresholds were 0.21–0.40 (fair), 0.41–0.60 (moderate), 0.61–0.80 (substantial), and 0.81–1.00 (almost perfect) agreement (Landis and Koch, 1977) Full-text screening was conducted using standardized checklists. Inclusion and exclusion criteria were:

Table 1

Inclusion criteria
- English
- North America
- Peer-reviewed, full published papers
- Quantitative data describing AST trends
- School transportation outcome (AST (walking, cycling), driving/being driven, school bus)
- > 50% sample composed of children ages 4–12 years, or junior kindergarten to grade 8, or separate models for children ages 4–12
- Empirical data with multivariate modelling or stratified results of transport outcomes and defined evidence of statistical significance (i.e. confidence intervals or p values)

Exclusion criteria
- Reports
- Qualitative studies
- Descriptive studies with only bivariate analyses

The review focused on North American studies, as the AST "context" is very different in Europe and Asia for a wide variety of reasons, such as for example, the historical development of many urban centers and resulting built environments, policies around AST, and the culture of automobility. By only examining studies in North America, a wide variance in context has been controlled for that would exist if studies set in North America were mixed with those conducted on other continents.

2.4. Data extraction

Extracted data included: publication year, location (country, urban/suburban), data source year(s), study design, journal, author disciplines, study population, age/grade, outcome mode and frequency (either to and/or from school pooled or measured separately), outcome data sources, correlate data sources and spatial units of measurement for studies with a mapping component (Appendix D). Study location was included in Appendix D, to provide some insight into variation in geographical context where the studies took place. As the vast majority of AST in North America is walking (versus cycling or other non-motorized modes) results with an overall AST outcome and a walking outcome have been combined (Buliung et al., 2009; Rothman et al., 2014a; McDonald, 2008). If the study outcome was cycling, school bus, transit or carpool, this information was extracted separately. Data extraction was set up to also identify if other correlates were controlled for, including: distance/time to school, age/grade, gender, socioeconomic status (i.e. education, income) and car access. Results were only extracted for fully adjusted models.

2.5. Synthesis of results

A conventional vote-counting procedure was used to summarize the number of statistically significant results and the direction of the relationships between correlates and outcomes (Bushman and Wang, 1994). Statistical meta-analysis was not conducted due to heterogeneity in measured outcomes. The Cochrane handbook indicates that vote-counting may be considered when standard meta-analytical techniques cannot be applied, such as when there is no consistent outcome measure (Higgins and Green, 2008). Narrative summaries of studies were prepared including tables describing each study's sample, outcome measures, data sources and research design. Limitations in the research data related to AST were identified (Valentine et al., 2010).

Potential correlates were organized according to the social-