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Active and Safe Routes to School: Evaluating School Travel Planning to Support Children's Active Travel

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Abstract

Most Canadian children are not achieving their daily recommended physical activity (PA) levels despite the many emotional, psychological, and physiological benefits of PA. Walking or wheeling to/from school, or active school travel (AST), is a viable method for improving children's daily participation in PA. In Canada, the Active and Safe Routes to School initiative promotes AST through its comprehensive School Travel Planning (STP) program. Utilizing a mixed-methods approach, broadly, this thesis investigates the i) implementation and ii) effectiveness of a regional, two-year STP program supporting AST. This thesis includes a systematic review of AST intervention models implemented in North America, a qualitative investigation of the program's implementation and sustainability, and a quantitative analysis of the STP program's impact on AST participation and perceptions. Findings are relevant to intervention facilitators and evaluators, school administrators, public health practitioners, local law enforcement agencies, community planners, and parents.

Keywords

Co-Authorship Statement

Each integrated article within this thesis has been or will be submitted for publication in a peer-reviewed journal. Adrian Buttazzoni was the primary author and performed data collection, data analysis and writing of each chapter. Chapter 2 was co-authored by Emily Van Kesteren, RN, Dr. Tayyab Shah, and Dr. Jason Gilliland. For Chapter 3, co-authors included Dr. Stephanie Coen and Dr. Jason Gilliland. Chapter 4 was co-authored by Dr. Andrew Clark, Dr. Jamie Seabrook, and Dr. Jason Gilliland. All co-authors on each paper were involved in the conception of the methods, development of procedures, and analysis of their respective manuscript. The Active and Safe Routes to School program is a regional partnership, of which the Human Environmental Analysis Laboratory is a member. The partnership has been a primary supporter of this research.

A version of Chapter 2, which presents a systematic review that was published in the American Journal of Preventive Medicine, and of Chapter 3, which presents the qualitative evaluation that has been accepted by Social Science and Medicine, are presented in this thesis. Chapter 4 appears in this thesis in the state it was prepared for submission to an academic journal. Each article has been formatted to APA citation style for the purposes of this thesis. Below are the citations for each of the three integrated articles.

Chapter 2: Buttazzoni, A. N., Van Kesteren, E. S., Shah, T. I., & Gilliland, J. A. (2018). Active school travel intervention methodologies in North America: A systematic review. *American Journal of Preventive Medicine, (55)*1, doi:10.1016/j.amepre.2018.04.007.

Chapter 3: Buttazzoni A. N., Coen S. E, & Gilliland J. A. (2018). Supporting active school travel: A qualitative analysis of implementing a regional safe routes to school program. *Social Science & Medicine.* In press.

Chapter 4: Buttazzoni A., Clark A., Seabrook J., & Gilliland J. Promoting active school travel in elementary schools: A regional case study of the school travel planning intervention. Prepared for submission to a publishing journal.

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"Learn to treat life to the best, put stress to rest." – C.W.

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List of Abbreviations

ASRTS	Active and Safe Routes to School (Canada)
AST	Active School Travel
ELMO	Elgin-St. Thomas-London-Middlesex-Oxford
HEAL	Human Environments Analysis Laboratory
LDCSB	London District Catholic School Board
MOT	Mode(s) of Travel
MVPA	Moderate-to-Vigorous Physical Activity
MSA	Multiple Streams Approach
PA	Physical Activity
TPB	Theory of Planned Behaviour
SES	Socio-economic Status
STP	School Travel Plan(ing)
SRTS	Safe Routes to School (U.S.)
TVDSB	Thames Valley District School Board
UWO	University of Western Ontario
"6 E's"	Education, Encouragement, Enforcement, Engineering, Equity, Evaluation

Chapter 1

1 Introduction

1.1 Research Context

Physical activity levels among Canadian children have seen no significant progress in recent years (Statistics Canada, 2017) despite the federal government having developed detailed guidelines in 2002 (Janssen & Leblanc, 2010). Only 9.3% of 5-17 year olds currently meet their recommended daily physical activity guidelines of 60 minutes of moderate-to-vigorous physical activity (Public Health Agency of Canada, 2017). Children today are instead developing deleterious daily routines: 51% of 5-17 year olds are engaging in excessive amounts of screen-time (ParticipACTION, 2018) compared to recommendations of no more than 2 hours per day (Canadian Society for Exercise Physiology, 2012). As these children progress into adulthood, their continued inactivity can lead to serious chronic health issues such as low bone density, hypertension (i.e., high blood pressure), type 2 diabetes, and obesity (Centers for Disease & Prevention, 2011). With these concerning health behaviours continuing to take foot in Canada, now almost 1 in 7 children or youth are classified as obese (Rao, Kropac, Do, Roberts, & Jayaraman, 2016).

In response to this critical public health issue, non-profits (e.g., ParticipACTION, 2016), researchers (e.g., Spence, Faulkner, Bradstreet, Duggan, & Tremblay, 2015), and the public sector (e.g., Government of Canada, 2012) have called for the development and adoption of more physically active lifestyles. Regular physical activity has many benefits for children such as improved quality of life (Eijkemans, Mommers, Aisma, Thijs, & Prins, 2012), healthier body composition (Moore et al., 2003), and enhanced motor skill development (Fisher et al., 2005). Moreover, children that report higher levels of physical activity also tend to have more friends and higher self-confidence (Cragg & Cameron, 2006).

Active school travel (AST), which is any form of human-powered transportation (e.g., walking, cycling, skateboarding etc.) to and/or from school, represents an eminently viable opportunity for children to increase their daily physical activity levels and experience such benefits. Children who more frequently engage in AST are more physically active overall (Larouche, Saunders, Faulkner, Colley, & Tremblay, 2014; A. Martin, Kelly, Boyle, Corlett, & Reilly, 2016;

Schoeppe, Duncan, Badland, Oliver, & Curtis, 2013). In fact, cycling to school is also associated with higher cardiorespiratory fitness in children and adolescents (Andersen, Lawlor, Cooper, Froberg, & Anderssen, 2009). Nonetheless, despite these associated positive outcomes, current participation levels in AST have declined over recent decades and remain relatively low today (Buliung, Mitra, & Faulkner, 2009; McDonald, 2007). Presently in Canada less than a third (25% to 31% of boys and 19% to 29% of girls) of grade 6-10 students report using an active mode of transportation to school, whereas, conversely, over two-thirds (64% to 71% of boys and 67% to 80% of girls) reported utilizing passive modes (Government of Canada, 2016). As a consequence, just 26% of 12-17 year olds spend ≥ 20 minutes per day engaged in active transportation (ParticipACTION, 2018). There are many different factors contributing to this current state of AST, notably the numerous personal and community level influences that shape the decision to actively commute (Larsen, Gilliland, & Hess, 2012; Larsen et al., 2009).

AST is a multifactorial issue that is influenced by a number of intrapersonal (e.g., personal attitudes), familial (e.g., vehicles in home), neighbourhood (e.g., low/high socioeconomic status), and environmental (e.g., walkability) factors. Foremost, older children (Buliung et al., 2009; S. L. Martin, Lee, & Lowry, 2007; Oliver et al., 2014), boys (Bungum, Lounsbery, Moonie, & Gast, 2009; Evenson, Huston, McMillen, Bors, & Ward, 2003; Larsen et al., 2009; McDonald, 2012), and shorter distances (D'Haese, De Meester, De Bourdeaudhuij, Deforche, & Cardon, 2011; Larsen et al., 2012; Potoglou & Arslangulova, 2017; Wong, Faulkner, Buliung, & Irving, 2011) have been identified as primary correlates of participation in AST. Other notable factors at the intrapersonal and family levels include, for example, students from home situations with lower family satisfaction (Yang, Ivey, Levy, Royne, & Klesges, 2016), lower socioeconomic status (Faulkner, Stone, Buliung, Wong, & Mitra, 2013), and fewer cars (Gropp, Pickett, & Janssen, 2012) reporting higher engagement in AST. Contrarily, the convenience of driving (Ahlport, Linnan, Vaughn, Evenson, & Ward, 2008) and perceived safety of the commute (Hume et al., 2009) can negatively influence AST participation. Significant neighbourhood and environmental variables positively associated with AST include high residential density (Carlson et al., 2014; Dalton et al., 2011), the presence of recreational facilities (Leslie, Kremer, Toumbourou, & Williams, 2010), and sidewalk availability (Oluyomi et al., 2014). Meanwhile, perceived traffic safety (Panter, Jones, & Van Sluijs, 2008; Zhu & Lee, 2009) and traffic volume (Price, Pluto, Ogoussan, & Banda, 2011) can hinder engagement. Given the complexities and

nature of commuting decisions, as well as the current low participation rates, a variety of comprehensive interventions have been established and employed in recent years to improve AST participation.

Interventions to support AST have been implemented on a global scale (Villa-González, Barranco-Ruiz, Evenson, & Chillón, 2018). Such programs promoting AST participation and awareness take various forms including encouragement initiatives like walking promotions (e.g., Hunter, de Silva, Reynolds, Bird, & Fox, 2015), policies such as drop-off spots (e.g., Vanwolleghem, D'Haese, Van Dyck, De Bourdeaudhuij, & Cardon, 2014), and education programs to improve AST knowledge (e.g., Bovis, Harden, & Hotz, 2016) among many other strategies. In several of these instances the initiative has been developed and facilitated by multiple cross-sector collaborators. AST partnerships often include: non-profits, parents, principals, police, intervention-specific individuals (e.g., curriculum instructors), teachers, and university staff (Buttazzoni, Van Kesteren, Shah, & Gilliland, 2018). With respect to Canada, in 2006 a leading nation-wide intervention was developed to bring together groups of local stakeholders to address AST; this was advent of the School Travel Plan (STP) program (Active and Safe Routes to School, 2018b).

The STP program is a school-based, cross-sector intervention that promotes and raises awareness of AST through implementing a variety of strategies. At the core of the STP model is the creation of a committee that encompasses key stakeholders including municipal officials (e.g., engineers), local non-profits, parents, school administrators, and public health practitioners who collectively develop and implement an action plan tailored to their school's AST issues (Active and Safe Routes to School, 2018c). The formation of the STP committee is just one phase in the five-phase process of the STP model (Active and Safe Routes to School, 2018c): *(1) Set-Up*: the STP committee is formed and the group begins to develop timelines for data collection; *(2) Baseline Data Collection*: youth and family surveys are distributed at the school, and subsequently collated and analyzed, a school walkabout (a walkthrough of the neighbourhood to assess AST barriers by the committee) is conducted, and traffic counts with volunteers are carried out; *(3) Action Plan Development*: the STP committee, based on the survey information, develops an action plan of strategies (i.e., education, encouragement, enforcement, engineering, and/or equity initiatives) to support AST at their school; *(4) Action Plan Implementation*: the STP committee delegates duties among members and implements the action plan strategies; *(5)*

Evaluation: follow-up youth and family surveys are distributed, collated, and analyzed, the STP committee evaluates and communicates its progress to the school community.

It is the primary intention of this thesis to systematically evaluate the STP intervention model and understand its implementation, sustainability, and effectiveness through complementary analyses. By examining both the intervention's implementation and impacts, this thesis aims to contribute to the academic and public health fields in two specific regards: i) by providing a conceptually and methodologically rigourous case study analysis of a regional AST initiative, and ii) by offering practical directions for future study and intervention development and implementation. Ultimately, this thesis aims to advance the quality and strength of the evidence supporting AST interventions as efficient, effective, and sustainable public health initiatives, and, more broadly, AST as a desirable lifestyle choice for families.

1.2   Theoretical Framework

Theoretical frameworks play an important role in guiding and supporting research studies, and are the foundation for which knowledge is constructed and analyzed (Grant & Osanloo, 2014). The selection of theory for research is therefore not arbitrary, but rather a reflection of a researcher's beliefs and understandings about the nature of knowledge and how it exists in relation to the research of a particular phenomenon (Lysaght, 2011). Thus, as Eisenhart elaborates, a theoretical framework is a "structure that guides research by relying on a formal theory…constructed by using an established, coherent explanation of certain phenomena and relationships" (1991, p. 205). Simply put: a theoretical framework has implications for every decision that is made during the course of the research process (Mertens, 1998).

With theoretical frameworks needing to be applicable, appropriate, and useful to their study, and to fulfill these criteria across the three different types of manuscripts included here, this thesis utilizes three different theoretical frameworks. A different framework was utilized in each article primarily as a consequence of the aim, content, scale, outcomes, and discussions – although related to AST – being distinct between the studies. Furthermore, this structure allowed for each manuscript to stand on its own, and better answer the stated research questions of the corresponding manuscript both more appropriately and fully. Ultimately, each of these three theoretical frameworks offer a method by which to identify and interpret social issues and

phenomena, as well as devise potential solutions that engender change. The theoretical framework used in each integrated article is explained, as well as its application, in more detail in its respective manuscript. A brief summary and layout of the theories is provided in Table 1.1.

Table 1.1 Theories utilized in thesis

Chapter	Name of Theory	Description of Theory
2	**Multiple Streams Approach** (Kingdon & Thurber, 1984)	Developed by political scientist John Kingdon, the Multiple Streams Approach, largely, is a public policy oriented theory which functions through analyzing the interplay of three streams (problem, policy, and politics) that operate concurrently and how they can align to create 'policy windows' for change to occur (Cairney & Jones, 2016). The multiple streams approach is applied in the systematic review of AST interventions to present a practical discussion regarding intervention conception, design, implementation, functioning, and evaluation for program facilitators and evaluators.
3	**Field Theory** (Burnes & Cooke, 2013)	Established by social psychologist Kurt Lewin in the 1930s, Field Theory posits that potential group behaviour change is possible to understand, and to an extent predict, by considering their environment, or 'life space', which is comprised of several contextual forces (both positive and negative) that shape their behaviour at a given point in time (Diamond, 1992). Field theory is adapted and applied to the qualitative analysis to interpret the group interactions and spaces of STP committees, and consequently analyze the forces that are present in the intervention's implementation process, as well as which affect its perceived sustainability.
4	**Theory of Planned Behaviour** (Ajzen, 1991)	A theory that is commonly used in physical activity literature, the Theory of Planned Behaviour, broadly, submits that an individual's intention to perform a specific behaviour is the proximal predictor of action, but also notes the importance of attitude, perceived behavioural control, and subjective norms as influencers in the formation of intentions (Ajzen, 1991). The Theory of Planned Behaviour is adapted and applied to the quantitative analysis to understand children's and parent's perceptions of AST barriers and neighbourhood characteristics, and commuting behaviours from pre- to post-intervention.

1.3 Research Objectives and Questions

The overarching aim of this thesis is to evaluate the implementation and impacts of an intervention designed to support AST, in this instance the STP model. This thesis includes a comprehensive evaluation of a regional Active and Safe Routes to School (ASRTS) program's two-year STP intervention and its implementation process and impacts at the elementary school level. More specifically, this thesis evaluates the STP intervention by examining its (1) perceived functioning, efficacy, and sustainability as described by the individuals who have facilitated the program in schools, and (2) effectiveness in changing AST commuting behaviours among children and the perceptions of barriers to AST held by both children and parents. A more thorough and in-depth understanding of the implementation and effectiveness of the STP program is necessary to inform policymakers and public health practitioners on the best practices and intervention designs that can support children's physical activity via AST.

To accurately and appropriately meet the objectives of this thesis the following research questions were asked:

1) What are the supporting designs, methodologies, and reported outcomes of recent AST interventions in North America?
2) How do STP facilitators and committee members perceive the practices used to implement their STP program to influence the functioning and sustainability of the intervention?
3) How does an STP intervention influence children's and parent's perceptions of known AST barriers and facilitators, as well as the commuting behaviours of children?

To answer these research questions and conduct a comprehensive assessment, this thesis is first contextualized by a systematic review on contemporary intervention methodologies and then subsequently connects an evaluation of the STP intervention's functioning and long-term viability with an analysis of the outcomes produced by the intervention. AST is a complex health behaviour that is influenced by a number of different social, environmental, individual, and neighbourhood variables. This thesis aims to account for as many of these known physical activity variables as possible in its program evaluation.

1.3.1   Rationale

There are a few important and novel contributions which justify this thesis' undertaking. First, and most broadly, it is widely known that health behaviours that are learned during childhood tend to be carried into adulthood, and consequently those more active tend to have longer and healthier lives than those less active (U. S. Department of Health and Human Services, 2002). This thesis offers a comprehensive assessment of children's health behaviours, and of an intervention designed to improve such behaviours. Second, and more specifically, this thesis documents the state of AST intervention methodologies, systematically reviewing the planning, implementation, and evaluation of school-based programs in North America. Third, this thesis investigates the implementation, efficacy, and effectiveness of a regional-scale AST intervention, offering, to the authors' knowledge, one of the first in-depth mixed-method case study evaluations. Last, this thesis synthesizes the results of three individually-focused, but complementary, manuscripts to offer insight apropos of best practices, methods, and strategies to build and support AST habits for children during their most critical years of development.

1.4   The Active and Safe Routes To School (ASRTS) Program

This thesis evaluates the Elgin-St. Thomas-London-Middlesex-Oxford (ELMO) Active and Safe Routes to School (ASRTS) program located in Southwestern Ontario (see Figure 1). A national health promotion initiative, the ASRTS program in Canada has helped to facilitate local and regional level partnerships such as ELMO ASRTS since 2006 (Active and Safe Routes to School, 2018b). The ELMOS ASRTS program is a regional partnership with representation from local municipalities, schoolboards, law enforcement agencies, health units, non-profits, and community and research partners (http://activesaferoutes.ca/about-us/our-partners/). As a regional partnership, ELMO ASRTS specifically aims to support the implementation of STPs in schools by encouraging "active transportation to and from school by developing an action plan to build upon strengths and work to remove concerns [around schools]" (Active and Safe Routes to School, 2018d). In this thesis, the ELMO ASRTS program utilized several initiatives and strategies to support AST, with primary focuses on: education (e.g., instructional street crossing videos, bicycle safety presentations), encouragement (e.g., walk to school days, class AST participation competitions), enforcement (e.g., commissionaire programs, crossing guards), and engineering (e.g., installation of crosswalks, pedestrian crossovers). In all, the partnership has

helped facilitate STPs at 33 schools across the region as of the end of the 2017/2018 school year (Active and Safe Routes to School, 2018a).

Figure 1.1 Elgin-St. Thomas-London-Middlesex-Oxford region map
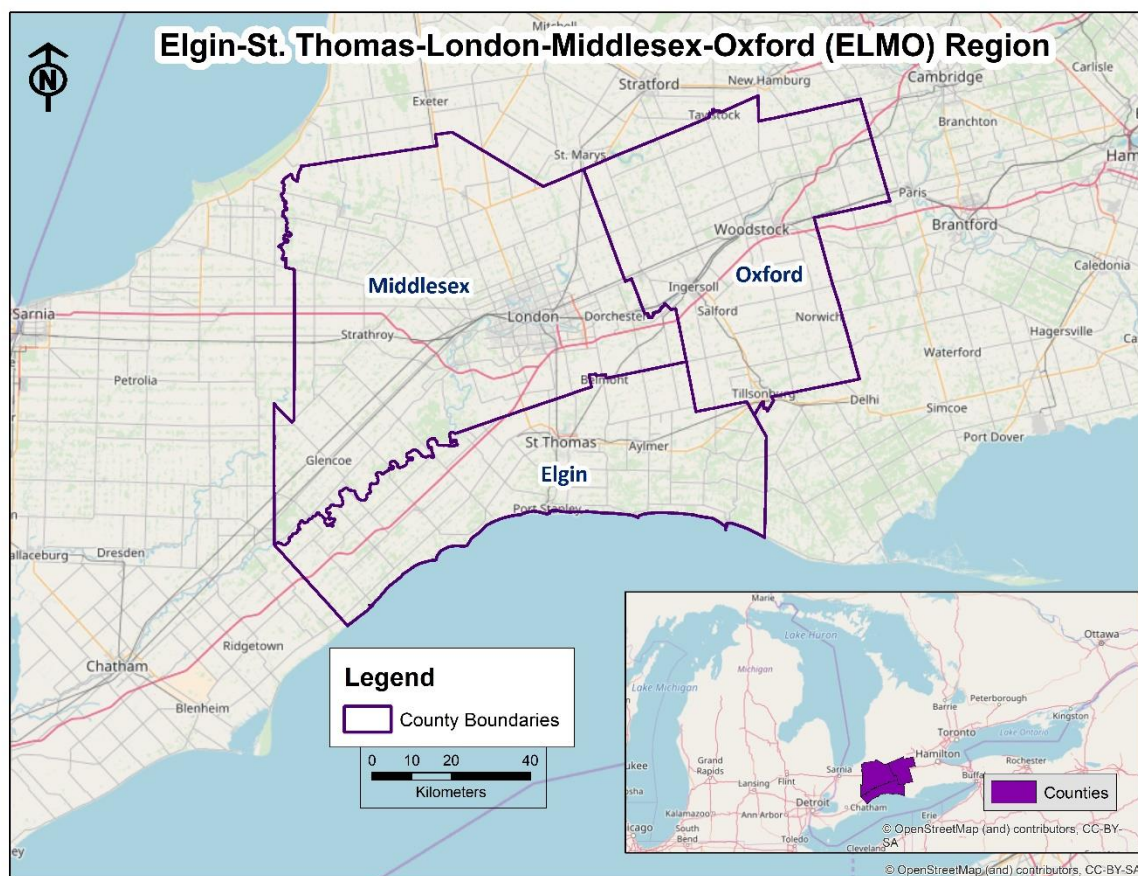
Ethics for the research that contributed to this thesis were approved by the Non-Medical Research Ethics Board of the University of Western Ontario (NM-REB #: 105635), and were obtained prior to the commencement of any research activities (see Appendix A). The two school boards involved with the ELMO ASRTS program, Thames Valley District School Board (TVDSB) and London District Catholic School Board (LDCSB), formally granted permission for this evaluative research via their internal research ethics boards. Schools throughout the TVDSB

and LDCSB that participated in the ASRTS program during the evaluations in this thesis were originally recruited to the program based on a school assessment of their needs conducted by the respective school public health nurse and principal. Once in the ASRTS program, principals at the participating schools were asked for permission for the evaluation activities to be undertaken at their school. With permission granted the recruitment of committee members for the focus groups, as well as the research team's recruitment of STP facilitators for interviews was undertaken (Chapter 3). Also permitted was the distribution of family surveys to all families at the schools, and youth surveys to grade four to eight students with consent (Chapter 4).

No ethics were needed or obtained to complete the systematic review contained in this thesis (Chapter 2). Participants involved in the qualitative evaluation were first read a guideline statement to explain the nature of the research and their participation (see Appendices B & C) before any further steps were initiated. Information about their anonymity and steps taken to ensure the security of data were subsequently disclosed to participants. To complete the obtaining of informed consent prior to the audio recording, participants were then explicitly asked if it was okay that the conversation would be taped. Further details on the qualitative methods are contained in the second integrated article, Chapter 3.

All of the students who participated in the quantitative evaluation were granted permission to participate in the research study by returning a signed consent slip from their parents, and subsequently filling out their own assent form (see Appendices D and G). Consent forms and a letter of information to inform the parents of the research and their rights (see Appendix F) were sent home with the children as a part of the family survey that students received at the participating schools. Parents and children completed detailed surveys (see Appendices E and H) that documented their demographic and household information, daily trips to/from school over the course of a week including time and mode of travel for the trip, and perceptions of neighbourhood AST barriers and facilitators. All sensitive data were securely stored on encrypted hard drives or in locked filing cabinets in the Human Environments Analysis Laboratory (HEAL) at the University of Western Ontario. More information on these methods can be found in the third integrated article, Chapter 4.

1.5   Thesis Process

Deliberate research and writing processes were undertaken in this thesis. Beginning with the systematic review (Chapter 2), database searching and collation of potential studies was carried out in early 2017. Review analysis and writing were conducted in the subsequent months, culminating in the manuscript being submitted in December 2017. Qualitative data (Chapter 3) collection began in October 2016 and was mostly finished by August 2017; one final interview was completed in December 2017. An iterative process of data collection, analysis, and refining and writing was completed during the process of developing the manuscript, concluding with Chapter 3 being submitted in May 2018. For the quantitative evaluation (Chapter 4), depending on the respective school's timeline, baseline data collection began with the commencement of the 2014-2015 school year and was completed at the end of the 2015-2016 school year. Follow-up data collection began near the end of the 2015-2016 school year and was completed in April of 2018. Writing and analysis of Chapter 4 was undertaken in the summer of 2018, and the manuscript was submitted at the end of July 2018. Completing the thesis, the synthesis and introduction chapters were written and completed in the spring and summer of 2018.

1.6   Thesis Format

This thesis is organized and presented in an integrated article format consisting of three stand-alone manuscripts. One systematic review and two independent original research studies are presented in this thesis. The systematic review focuses on North American-based AST interventions, and provides an analysis of the types of interventions currently being implemented, as well as how they have been assessed. Following the review are two research studies that evaluate the ELMO ASRTS STP program at various schools located throughout the region. Although both research studies focus on evaluating the STP intervention, each article examines specific characteristics and aspects of the program. Consequently, this thesis aims to comprehensively evaluate the ELMO ASRTS STP program in order to: (1) explore how the STP program model can be made more sustainable and equitable, and (2) more thoroughly understand in what ways the school-based intervention has been and can be effective in supporting AST in the future. The thesis structure is as follows:

Chapter 2 is a systematic review which documents and analyzes the existing literature (n=22 primary research articles) pertaining to AST interventions. To enhance the generalizability of the results, this review applies the Multiple Stream Approach (MSA) to illustrate various ways in which AST interventions can be improved both during implementation and evaluation. The review also identifies future areas for research that the two following manuscripts address.

Chapter 3 is the first original research article of this thesis. This chapter qualitatively explores the perceived functionality, efficacy, and sustainability of the STP intervention from the perspective of facilitators and committee members. Drawing on Kurt Lewin's Field Theory of organizational change, this article analyzes and discusses the intervention environment characteristics that can be fortified and abated to help facilitate positive group change and improve the long-term sustainability of the intervention.

Chapter 4 is the second original research study contained in this thesis. In this chapter, a quantitative evaluation assesses the impact of the two-year STP intervention on both child and parents perceptions of neighbourhood barriers and facilitators to AST, along with children's commuting behaviours from pre- to post-intervention. Utilizing the Theory of Planned Behaviour, this manuscript discusses the aspects of individual's intentions as they relate to perceptions of AST and their subsequent commuting behaviours.

Chapter 5 concludes this thesis by synthesizing and linking the findings from each of the three integrated articles. Here, the research contributions, the methodological contributions, the limitations of the research, potential policy implications, and recommendations for future research are discussed.

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Chapter 2

2 Active School Travel Intervention Methodologies in North America: A Systematic Review

2.1 Abstract

Context: As children's lifestyles have become increasingly sedentary, active school travel can be a relatively accessible way to increase their daily physical activity. In recent years, several different models of interventions have been utilized to promote children participating in active school travel. This review documents and analyzes the different active school travel intervention methodologies that have been used in North America (Canada or U.S.) by collecting, organizing, and evaluating data relating to all phases of active school travel interventions.

Evidence acquisition: A key word search was used and applied in six databases (BIOSIS Previews, GeoBase, PubMed, SCOPUS, SPORTDiscus, Web of Science) to gather scholarly literature. A total of 22 studies evaluating children's active school travel interventions in a North American setting (four Canada, 18 U.S.) were identified for the period between January 2010 and March 2017.

Evidence synthesis: Applying the Safe Routes to School Education, Encouragement, Enforcement, Engineering, Equity, and Evaluation ("6 E's") framework, interventions were thematically assessed for their structure and organization, approaches and methods, and outcomes and discussions. Encouragement and education were the most commonly observed themes within the different methodologies of the studies reviewed. Details relating to intervention approaches and methods were common; whereas data relating to intervention structure and organization received much less attention.

Conclusions: Kingdon's multiple streams approach was applied to frame the findings for program facilitators and evaluators. Within the multiple streams approach, several considerations are offered to address and potentially improve active school travel intervention conceptualization, partnerships, organization, and evaluation.

2.2 Context

Obesity rates among children aged 3–19 years in Canada and the U.S. have more than doubled since the late 1970s (Carroll, Navaneelan, Bryan, & Ogden, 2015). Although childhood obesity is a complex issue, one important contributing factor has been physical inactivity (Tremblay & Willms, 2003). Among children aged 5–17 years in Canada, just 13% of males and 6% of females meet their recommended physical activity guidelines by participating in a minimum of 60 minutes of moderate to vigorous physical activity per day (Statistics Canada, 2015). Similarly, more than 80% of adolescents in the U.S. do not meet their recommended guidelines for aerobic physical activity (U.S. Department of Health and Human Services, 2010).

Coinciding with the rise in physical inactivity among children has been a decline in active school travel (AST). AST, which is any form of human-powered transportation, such as walking or cycling, to/from school, has seen a marked drop in participation in recent decades throughout the United States (McDonald, 2007). Longer travel distances have been strongly connected to the decline in AST, as an increase in the distance between home and school leads to fewer children using AST (Larsen, Gilliland, & Hess, 2012; Larsen et al., 2009; Martin & Carlson, 2005). Concurrently, parental perceptions of safety have also limited children's opportunities to participate in AST (Chillón et al., 2014). Developments such as the rise of the automobile as the natural mode of travel for children illustrate the impact of social control barriers on AST (Fotel & Thomsen, 2002). Toronto, Ontario—Canada's largest city—provides a telling case of the eventual outcome: the proportion of children being driven to school has more than doubled in the past 30 years (Buliung, Mitra, & Faulkner, 2009). Motivating children and families to reverse this trend has considerable potential for children's health.

Increasing AST has many physical, developmental, and social benefits. Evidence connecting youth participation in AST has shown improvements in physical fitness and social development (Government of Canada, 2017), as well as academic performance and preparedness (Middlesex-London Health Unit, 2017). In fact, when directly compared with children who more frequently use passive modes of transportation, those who participate in AST are more likely to be more active overall, expend more energy, meet their prescribed daily moderate-to-vigorous physical

activity recommendations (Faulkner, Buliung, Flora, & Fusco, 2009), and build richer social lives (Mackett, Brown, Gong, Kitazawa, & Paskins, 2007). To increase participation levels, several different AST intervention models have been implemented throughout North America.

2.2.1   Active School Transportation Interventions

Active school transportation interventions generally follow a collaborative, multistep methodology. School Travel Planning, for example, utilizes a collaborative and structured process between a school and the local community to facilitate the building of support for AST, auditing of existing facilities and local infrastructure, development and implementation of an action plan, and ongoing monitoring (Cairns & Newson, 2006). Interventions to address AST, however, can take many forms. Intervention models include health promotion (e.g., walk to school days), community enforcement/safety initiatives (e.g., walking school bus), and infrastructure changes (e.g., building of sidewalks) (Meiklejohn & Bagnati, 2013). Although all forms have potential, there is still uncertainty over which AST intervention designs may be the most effective (Baslington, 2008; Macmillan, Hosking, Connor, Bullen, & Ameratunga, 2013). Because of its appropriateness, and to account for the methodologic variety within AST models, the Education, Encouragement, Enforcement, Engineering, Equity, and Evaluation ("6E's") of the Safe Routes to School (SRTS) National Partnership framework (Safe Routes to School National Partnership, 2017) will be used to categorize and analyze the interventions in this review.

2.2.2   Current State of Reviews and Justification

There are a few reviews covering active transportation, with Chillón et al. (2014) providing the first review on this specific topic of AST interventions. Pang and colleagues (Pang, Kubacki, & Rundle-Thiele, 2017) provided an update on this initial review, conducting a global search and providing comparative results, while also examining the use of theory in AST interventions. Expanding on this base, there are some important points to justify this review. First, this review focuses on a specific geographic area (North America) to provide a focused, contextually consistent review. Context is important when considering AST research, as social norms (Mandic et al., 2017), environments (Ghekiere et al., 2016), and policy (Chriqui et al., 2012) have been suggested to influence AST behaviour. Second, this review provides a comprehensive

documentation of all aspects related to intervention design and methodology. The focus is centered on methodology for a few reasons; principally, because recent research has discussed the importance of intervention sustainability (Ahern et al., 2017), programming (Crawford & Garrard, 2013), and collaboration (Eyler et al., 2008) in relation to improving AST. Finally, this review generates a pragmatic discussion for practitioners. Analysis is conducted utilizing the AST-specific SRTS 6E's framework (Safe Routes to School National Partnership, 2017) to organize findings thematically, whereas the subsequent discussion is framed in Kingdon's agenda-setting multiple streams approach (MSA) (Kingdon, 2011).

2.2.3   Review Question and Objective

In conducting this review, the research team asked: what are the supporting designs, methodologies, and reported outcomes of the most modern AST interventions? To ensure the quality of this question, Petticrew's and Roberts' (2006) "PICOC" model was applied. The question breaks down as follows:

- **population**: school-aged children (generally ages ≤14 years, but up to 19 years in some cases);
- **intervention**: interventions that support/promote AST;
- **comparison**: none;
- **outcome of interest**: supporting designs and methodology characteristics, and outcome foci and discussion relating to AST; and
- **context**: elementary, middle, or high school setting in North America.

There were two primary objectives in this review. Foremost, this review documents the different AST intervention methodologies. This includes characteristics relating to organization, design, implementation, and reported outcomes and discussions. Secondly, this review assesses the various AST interventions according to the SRTS 6E's framework to create a thematic analysis.

2.3   Evidence Acquisition

2.3.1   Search Strategy

Eligible articles were identified through searching electronic databases (current as of March 2017). With the help of one health science and one geography librarian, the search strategy

identified four important conceptual categories. Variations of each concept (active, travel, school, and intervention) were identified and truncated as necessary to produce optimal results. The following search strategy was applied: (*active* or *walk* or *bike* or *cycl**) and (*transport** or *travel* or *commut** or *journey* or *route* or *trip*) and *school** and (*intervention* or *program** or *project* or *initiative* or *promot**). The electronic databases needed to incorporate content relating to health and policy, as well as geography and urban design. Based on these considerations, the search strategy was carried out in six specifically chosen databases: BIOSIS Previews, GeoBase (as a part of Engineering Village), SCOPUS, PubMed, SPORTDiscus, and Web of Science.

2.3.2   Eligibility Criteria

Articles included in this review were required to meet eight specific criteria. These criteria were that each study: (1) focused on an AST intervention; (2) contained a significant focus on, or presented a contribution towards understanding, the AST intervention, thus was an evaluation; (3) contained some description of the intervention design, methodology, and implementation; (4) contained some form of a quantitative outcome and reported a primary outcome related to AST; (5) focused on children or adolescents (target population aged 5–19 years); (6) was published after January 2010; (7) was conducted in North America (Canada/U.S.); and (8) was written in English.

2.3.3   Study Selection and Review Process

The initial search of the six databases resulted in 9,013 articles (Figure 2.1). PubMed presented 4,158 papers, GeoBase 2,258, SCOPUS 1,102, Web of Science 839, SPORTDiscus 433, and BIOSIS Previews 223. After screening the titles, 1,026 potentially relevant articles were identified. Searching for duplicates removed another 338 potential papers, whereas vetting of abstracts resulted in another 559 articles being excluded. Full-text assessments of the remaining 129 articles were first conducted by one author, with a second providing a decision on all articles in question. Eventually, 108 articles were deemed as not meeting the inclusion criteria in some regard (e.g., insufficient evaluation). One additional article was added through examining reference lists, resulting in 22 studies being retained for the review.

Figure 2.1 Summary of the database search and the process of study selection
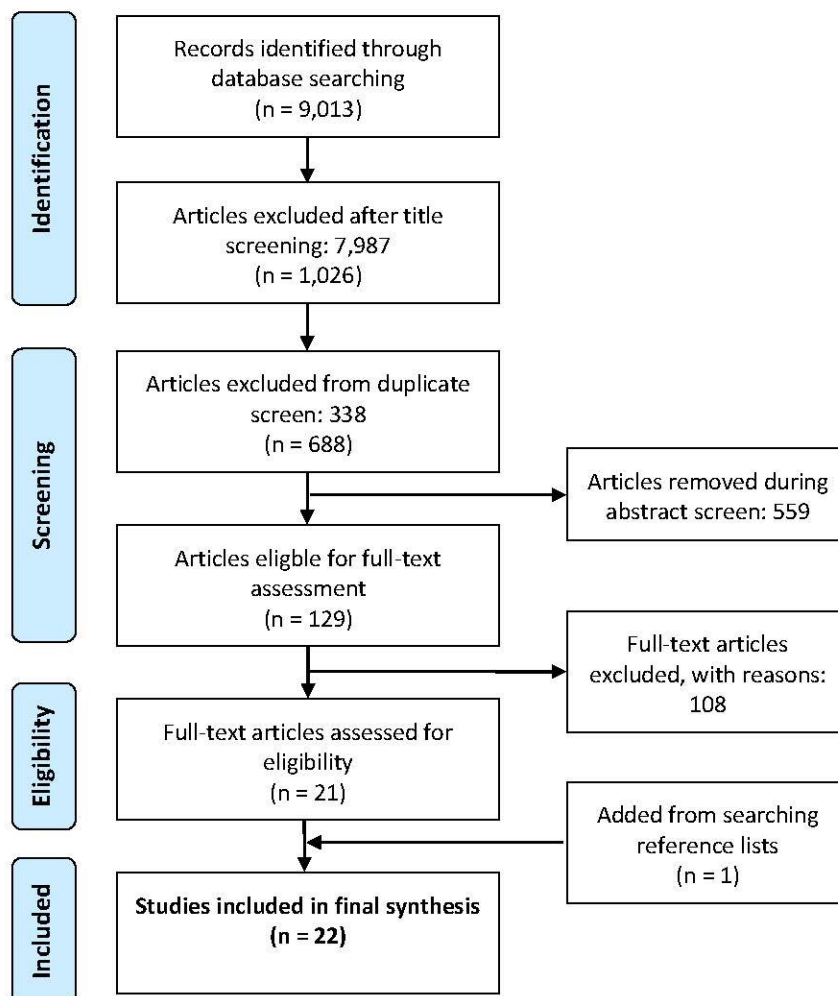
2.3.4 Data Extraction

Specific data extracted from the articles (Appendix 2.1) was carried out by intervention phase (i.e., planning, implementation, evaluation). Background information such as study design, region, sample details, and year of publication were extracted first. Extracted next were organization and structure data, including theoretical background (if applicable) and available intervention methodology characteristics (aim/approach 6E's, involved stakeholders, and roles). Subsequently, data were extracted on available design and methods (i.e., length of intervention, follow-up length, measurement tools, processes, and resources). Finally, data were extracted on children's AST-related reported outcomes and discussions.

2.3.5   Quality Assessment and Risk of Bias in Individual Studies

Quality assessment (QA) was conducted using the Effective Public Health Practice Project's (Effective Public Health Practice Project, 2009a) QA tool (Table 2.1). Global ratings were developed by two separate reviewers as per the Effective Public Health Practice Project guidelines, who first calculated independent scores for each article, and then subsequently compared evaluations (Effective Public Health Practice Project, 2009b). The comparison of evaluations helped resolve the grading variability and settle the outstanding differences.

The QA examination found all 22 studies to have a strong global rating. This finding is likely the result of a few developments. Most importantly, the team graded conservatively regarding the weak rating, especially when in doubt on a particular methodological aspect. Articles that did not clearly state a specific criterion were not given lower credibility with a weak rating, but rather they were given a "cannot tell" explanation that did not negatively affect their global rating. Second, the team found the tool to be cautious towards the weak rating. Structurally, the Effective Public Health Practice Project tool has many areas where interpretation or judgement on the part of the assessors is required. This creates several instances where the evaluation becomes subject to interpretations as the method of measure. Consequently, this resulted in many moderate ratings in situations where the evaluators had discrepancies. With the structure of the tool requiring one weak rating to have a moderate global rating, the team's conservative rating style very likely contributed to this consistency in the QA.

Table 2.1 Quality assessment of North American active school travel interventions (n=22)

Background information	Quality assessment						
Author, country, region	Selection bias	Study design	Confounders	Blinding	Data collection method	Withdrawals & dropouts	Global rating
(Bovis, Harden, & Hotz, 2016) U.S.: Miami-Dade County, FL	1	2	NA	2	1	2	1
(Buckley, Lowry, Brown, & Barton, 2013) U.S.: Moscow, ID	2	2	1	2	1	NA (CS)	1
(Buliung, Faulkner, Beesley, & Kennedy, 2011) Canada: AB, BC, NS, ON	2	2	2	2	1	2	1
(Bungum, Clark, & Aguilar, 2014) U.S.: Henderson, Nevada	2	2	1	2	1	NA (QE)	1
(Cuffe, Harbaugh, Lindo, Musto, & Waddell, 2012) U.S.: Boulder, CO	2	2	NA	2	2	NA (Observation; ITS)	1
(DiMaggio & Li, 2013) U.S.: New York City, NY	2	2	2	2	1	NA (RCS)	1
(DiMaggio, Brady, & Li, 2015) U.S.: Texas	2	2	NA	2	1	NA (RCS)	1
(Faulkner, Zeglen, Leatherdale, Manske, & Stone, 2014) Canada: Toronto, ON	1	2	2	2	1	NA (Serial Cr-S)	1
(Gutierrez et al., 2014) U.S.: Miami, Florida	1	2	1	2	1	NA (QE)	1
(Harvey, Liguori, Ezell, & Zinke, 2015) U.S.: Franklin County/ Chattanooga, TN	1	1	1	2	1	2	1
(Hoelscher et al., 2016) U.S.: Texas	1	2	1	2	1	NA (QE)	1
(Lachapelle, Noland, & Von Hagen, 2013) U.S.: Northern NJ and Ocean Township, NJ	1	2	2	2	1	2	1
(Livingston et al., 2011) U.S.: Newark, NJ	1	2	NA	2	1	1	1
(George Mammen et al., 2014) Canada: National.	1	2	NA	2	1	2	1
(Mammen, Stone, Buliung, & Faulkner, 2014) Canada: National	2	2	NA	2	1	NA (Serial Cr-S)	1
(McDonald, Yang, Abbott, & Bullock, 2013) U.S.: Eugene, OR	1	2	1	2	1	NA (QE)	1
(McDonald et al., 2014) U.S.: CA, DC, FL, TX	2	2	2	2	1	NA (Serial Cr-S)	1
(Mendoza et al., 2011) U.S.: Houston, TX	1	1	1	1	1	1	1
(Ragland, Pande, Bigham, & Cooper, 2014) U.S.: CA	2	2	1	2	2	NA (RCS)	1
(Sayers, LeMaster, Thomas, Petroski, & Ge, 2012) U.S.: Columbia, MO	2	2	1	2	1	2	1
(Sirard, McDonald, Mustain, Hogan, & Helm, 2015) U.S.: Minneapolis, MN	1	2	2	2	1	1	1
(Stewart, Moudon, & Claybrooke, 2014) U.S.: FL, MS, WA, WI	2	1	NA	2	1	1	1

Notes: QA Tool accessible through https://merst.ca/wp-content/uploads/2018/02/quality-assessment-tool_2010.pdf. Criteria Scale: 1–Strong, 2–Moderate, 3–Weak, NA–Not Applicable. Global Rating System: 1–Strong (no WEAK ratings), 2–Moderate (one WEAK rating), 3–Weak (two or more WEAK ratings) || CS, Case Study; Cr-S, Cross-Sectional; ITS, Interrupted Time Series; NA, Not Applicable; QE, Quasi-Experimental; RCS, Retrospective Case Study; (U)CBA, (Un)Controlled Before-After

2.4   Evidence Synthesis

2.4.1   General Characteristics of Reviewed Studies

A total of 22 articles were systematically reviewed (Table 2.2). Although a few sample sizes and study design groupings were more common, there were no overwhelmingly prevalent categories. Some sample sizes were unclear due to issues relating to data collection length or sampling method. Samples of elementary school children (aged ≤14 years) were the focus of 17 studies, whereas adolescents (aged ≤19 years) were included in five articles. The majority of the studies were conducted in the U.S. (18 versus four in Canada). U.S. geography was heavily focused in two regions of the country: the (1) South/Southeast (8/18=44.4%) and (2) West (6/18=33.3%). Canadian geography that was represented was not specific to any region, as three of the four articles were national in scope. Publishing by year was relatively consistent throughout the search timeframe as only one year (2014), produced more than four articles. Although AST has historically been a geography-oriented topic, more recently it appears to have become interdisciplinary based on lead author affiliations. Of the first authors, six were listed with a geography or urban or transport planning background, five were in medical sciences or neuroscience, five were health science or nutrition, four were public health, and one author in another discipline, and one unclear.

Table 2.2 General characteristics of the papers reviewed (n=22)

General characteristics of paper	Articles	Canada/U.S.
Total sample size		
1–499	4	0/4
500–999	2	1/1
1,000–1,499	3	1/2
1,500–1,999	0	0/0
≥2,000	8	1/7
Not reported/Unclear	5	1/4
Study design		
Case study (including retrospective)	4	0/4
Cohort (including analytic)	2	0/2
Cross-sectional (including serial)	3	2/1
Interrupted time series	2	0/2
Longitudinal	1	1/0
Quasi-experimental	6	0/6
RCT	1	0/1
(Un)Controlled before–after	3	1/2
Geographic origin		
Canada	4	4/0
U.S.	18	0/18
Year of publication		
2010	0	0/0
2011	3	1/2
2012	2	0/2
2013	4	0/4
2014	8	3/5
2015	3	0/3
2016	2	0/2
2017	0	0/0
Discipline of first author[a]		
Geography/Urban or transport planning	6	1/5
Economics	1	0/1
Health science (including kinesiology)/Nutrition	5	3/2
Medical science/Neuroscience	5	0/5
Public health	4	0/4
Not reported/Unclear	1	0/1

[a]Same first author on multiple articles counted twice in their respective discipline (see DiMaggio, Mammen and McDonald in Appendix Table 1).

2.4.2   Approaches, Stakeholders, and Theoretical Frameworks

Of the 6E's, five (not including Evaluation) were represented in the approaches of the included articles. Encouragement (63.6%), Education (50.0%), and Engineering (45.4%) were the most common foci (Table 2.3), with several studies containing multiple approaches. Of such multi-focused studies, many were often either the comprehensive, multiyear SRTS (eight, all U.S.) or School Travel Planning (three, all Canada) program evaluations. Within the papers that focused on elementary school children exclusively, Encouragement approaches were most frequently reported in some manner (12/17=70.5%). Equity was by far the least frequently observed approach with only four (18%) studies seemingly incorporating the approach. Although Equity is the newest of the 6E's, the result may be because of factors such as access to higher-risk students or lower SES schools being more complicated. Additionally, Equity appears to represent more of a lens that facilitators can consider applying to their initiatives, rather than being a robust strategy itself.

Table 2.3 Design and methodology characteristics (n=22)

Intervention characteristics of paper	Articles	Canada/U.S.
Intervention approaches[a]		
Education	11	2/9
Encouragement	14	3/11
Enforcement	8	2/6
Engineering	10	2/8
Equity	4	0/4
Evaluation[b]	22	4/18
Outcome measure[a]		
Accelerometers/ID tags	4	1/3
Crash/Injury data analysis	2	0/2
In-class tallies/Hands-up survey	5	2/3
Observation tallies or counts	7	0/7
Reports/Profiles/Action plans	2	0/2
Self-reports	2	1/1
Surveys/Questionnaires	14	3/11
Tests	3	0/3
AST-related reported outcome(s)[a]		
Awareness/Safety	6	2/4
Behavioural	4	0/4
Educational	4	0/4
Environmental/Pollution	1	0/1
Participation	12	3/9
Perception	4	1/3
Physical activity	3	1/2

[a]Several articles utilized multiple measures and examined interventions that contained multiple approach characteristics and reported outcomes.
[b]The nature of this review (requiring an assessment) by default ensures all included articles contain an evaluation. ID, identification; AST, Active School Travel

Of the 14 papers that reported on involved stakeholders, common partners were SRTS or program representatives, school administration (e.g., principal), teachers, parents, police, and intervention-specific individuals (e.g., curriculum instructors). However, information on the organizations, expected contributions, and roles of the stakeholders involved in the various AST interventions was often scarce. The Ecological Approach was applied to all SRTS (U.S.) and School Travel Planning (Canada) studies as a guiding philosophy for their respective programs (Active and Safe Routes to School, 2017; Levin Martin, Moeti, & Pullen-Seufert, 2009), thus

making it the most common framework (12/22=54.5%). Social Cognitive Theory (3/22=13.6%) was the only other reported framework; with one paper (Hoelscher et al., 2016) noting both.

2.4.3   Measures and Resources

The method and measurement tools used to evaluate AST were diverse. Surveys or questionnaires (63.6%) were the most common measurement tools, with observations (31.8%) and in-class assessments (22.7%) the next most regularly used. Just over half the articles (13/22=59%) reported using multiple tools to measure their AST-related outcomes. Reported follow-up time periods also represented a wide range. On the shorter end were follow-ups of 1 day to 1 week, whereas longer follow-ups went for as long as 3 years.

Among education initiatives (e.g., safety curriculum), tools such as standardized tests, surveys, and tallies were commonly used. Consistency with regards to application was cited as a top quality with such tools. Evaluations of Encouragement and Enforcement saw more complex trends because of increased numbers of variables; the most notable being the multiple environments to account for (social, natural, and built environment). In response, such initiatives often employed complementary tools; observational and questionnaire tools were used for assessing social elements, such as parent and child perceptions, whereas devices like accelerometers and identification tags helped to improve the accuracy of environmental assessments. Unlike the other "E's", Engineering projects commonly made use of retrospective methods, such as crash reports, geocoded data, and injury collision data, which were commonly reported and expressed to be helpful for the level of detailed information provided (e.g., extent of injury, contributing factors).

Almost all (19/22=86.3%) articles reported specific resources that were used throughout the interventions. Frequently reported resources included human (e.g., volunteers), financial (e.g., $10 vouchers), community supports (e.g., Department of Transportation data), and classroom materials (e.g., instructional videos). Community resources also played a role in the implementation of interventions, with the most commonly cited being university connections (5/22), outside expertise (3/22), and local agencies (3/22).

2.4.4   Outcomes and Discussions

Throughout the studies, seven different outcome themes were used to categorize the results (Table 3). Participation-related outcomes (54.5%) were the most frequently reported followed by awareness/safety, behavioural, education, and perception (each 18.1%). At least one positive outcome was noted in all studies; however, the impacts of the positive outcomes varied significantly. For example, within the category of participation-related interventions there was a range of AST increases from 13% (Cuffe et al., 2012) to 333% (Buckley et al., 2013). Despite their initial successes, interventions with shorter-term follow-up periods (11/22 or 50%, ≤6 months) often noted post-intervention results which were generally ephemeral in nature (DiMaggio et al., 2015; Harvey et al., 2015). Among these articles, the need for more time to create significant change was also often discussed (Bovis et al., 2016; Gutierrez et al., 2014; McDonald et al., 2014; Mendoza et al., 2011). Papers with longer-term follow-ups (6/22 or 27.2%, >6 months; five studies were unclear) typically discussed results as being more modest and often expounded on the complexities of trying to measure AST while accounting for multiple variables (e.g., seasonality, multiple interventions, etc.).

2.5 Discussion

This is the first review to document all aspects related to AST intervention design and methodology, as well as to examine AST specifically in the North American context. To frame this discussion in an applicable way for facilitators and evaluators Kingdon's multiple streams approach (MSA) (Kingdon, 2011) was adapted for AST, primarily because of its well-documented history of being applied in health domains (Jones et al., 2016). Broadly, the MSA suggests that policy-making and change is primarily the result of three distinct streams: problem, policy, and politics (Kingdon & Thurber, 1984). In the problem stream the MSA posits that officials are likely to pay attention to an issue if it is defined as problematic, and thus has potential to become a priority on the political agenda. In the second stream, policy, proposals are formulated to address the problem. Successful proposals are deemed to conform to existing value constraints, be technically feasible, and possess adequate and obtainable resources. Last, the politics stream consists of three circumstantial elements that illustrate how political contexts influence the prioritization of an issue: the national mood (public view of issue), party ideology (behaviour of local institutions), and the balance of interests (aggregate position of relevant

issue). In addition to the three streams are the two concepts of policy windows and policy entrepreneurs. Policy windows are situations that occur when two streams meet at a given time and context, subsequently creating an opportunity to create change. Policy entrepreneurs represent the individuals or groups that connect streams and exploit policy windows to create change. In the context of AST, the MSA offers an agenda-setting framework that was used to raise considerations that facilitators and evaluators can contemplate in their efforts to positively improve the design, organization, and sustainability of interventions.

2.5.1 Intervention Organization and Structure

Perhaps the most notable finding in relation to organization and structure was the consistency in supporting frameworks, as 63% of included studies utilized either the multilayer Ecological Approach or Social Cognitive Theory. Despite this perceived consistency, discussions regarding the involved partners and setups supporting AST interventions were rather laconic. Detailed explanations of the roles, expectations, and contributions of those involved throughout the intervention process were rarely found. It is acknowledged that this may be a result of publishing limitations; however, the omission remains conspicuous and should be addressed in future research to improve intervention sustainability.

Regarding the MSA, a more comprehensive understanding of the setups, personnel, and social organization structures supporting AST interventions has potential implications for policy and politics. Full disclosure of these details could assist in the formation and identification of more effective policies and intervention strategies to support AST; particularly, if specifics regarding methods used to assess the technical feasibility and necessary levels of resources and institutional support for AST interventions become better understood. Additionally, a more robust focus on partnerships could provide a better understanding of the attitudes held by commonly involved stakeholders, and the general priority of AST as an issue in public sector spheres.

2.5.2 Intervention Approaches and Methods Aspects

Among the approaches and methods findings, efficacy was an overarching theme with implications for intervention design and facilitation. Engineering approaches, for example, are more often correlated with injury reduction outcomes. Noting this, it would stand to reason that

initiatives that seek to reduce injury rates would be prudent to incorporate such a focus over the other E's. The other notable finding was the high number of Education and Encouragement approaches; however, this may likely be the result of short-term knowledge outcomes being easier to impact and measure than long-term, multifactorial outcomes, such as injury rates.

Understanding the selection of an appropriate intervention approach within the MSA highlights a few considerations for facilitators regarding the significance of how problems are defined, and the role of relevant politics. First, the process of determining the appropriateness and probability of success for an approach at a given school is likely to be affected by the definition of the issue or concern. For instance, the less consequence attached to an AST issue (e.g., safety, physical activity promotion) the more limited, both in options and impact, potential approaches may be as result of the level of resources provided by stakeholders lessening conjointly with their urgency to address the problem. Second, community capacity and priority should be factored into the intervention approach selection process. If a school community or AST partnership, and to a larger extent the political community, lacks the competency and expresses an apathetic view regarding the implementation of the most suitable approach, this should be properly accounted for in the planning stages. Going forward, facilitators may want to look beyond solely identifying their school's preferred strategy and desired outcome, and assess the perceived urgency of their issue, required resources, available support networks, and community capacity.

As with the approaches, the review of the methods present a few considerations for intervention evaluators. The most notable finding in this area was the frequency of complementary tools and methods being employed to accurately assess several different factors including social influences (surveys, questionnaires, tests) and the built environment (GPS, accelerometers). A quality example of complementary methods lies in the study by McDonald et al. (2013) where survey data assess school trip travel mode, school and district report cards provided school characteristics information, and geographic information system (GIS) and Census data assessed environmental characteristics. In this respect, within the MSA, there is potential for the future contributions of evaluators to improve policies targeting AST change. Precisely, an evaluator's selection of an appropriate set of complementary tools can bring together new ideas and help generate research that develops novel strategies which more effectively influence change, as well as create an increased sense of urgency among officials or potential funders.

2.5.3   Active School Travel Interventions Going Forward

When documenting the conceptual designs of AST interventions, two themes emerged in the form of singularly focused initiatives (one E, 6 months or less) and broadly focused initiatives (multiple E's, more than 6 months). Future designs of AST interventions should consider the significance of this dichotomy. Supporting this broader design are frameworks, such as Comprehensive School Health in Canada (The Joint Consortium for School Health, 2017), and Coordinated School Health in the U.S. (Murray, Low, Hollis, Cross, & Davis, 2007). The core philosophy of these frameworks generally holds that a population's health is the result of the social and physical environments, skills, behaviours, social networks, and public policy relevant to a population (Centers for Disease Control and Prevention, 2017). Consequently, a greater variety of socioecological variables are commonly accounted for, multiple tools are employed, and follow-ups are given more time and hold the potential to create more significant and lasting impacts. Employing a broader design, however, is subject to complex analytical issues as its processes can be difficult and outcomes potentially abstruse. For example, frequent issues identified through this review included difficulties with deciphering which specific approach, or E, was most responsible for which particular change or outcome. Often compounded by a lack of organizational details, it was also difficult to discern the impacts that each involved partner may have played in each focus/strategy.

In the MSA, this discussion concerning conceptual intervention designs and scale broaches the play and importance of AST champions (entrepreneurs) and intervention opportunities (windows). Notably, competent facilitators and diligent evaluators appear to have great potential to be successful AST champions. These individuals specifically possess the agency to assemble the resources (e.g., intervention materials, complementary evaluation tools), increase target audiences' urgency regarding issues, and build the integrated network of committed partners required to create AST intervention opportunities. Thus, when deliberating over intervention design and scale, it is surmised that facilitators and evaluators may want to focus on analyzing if they: (1) have successfully framed AST as a priority issue for their school community and relevant officials; (2) offered strategies that enmesh policy and politics in furtherance of creating a favourable intervention opportunity; and (3) accounted for the necessary agency to mobilize AST advocates, community partners, officials, and school administrators to be fully engaged

stakeholders in the intervention. Keeping in mind appropriateness, it would seem that with more urgency and a mobilized network of partners, a broader approach becomes increasingly viable.

2.5.4   Limitations

This review is not without limitations. First, as previously alluded to, there was a lack of background data that inhibited fully contextualizing the results of each intervention. Important details, such as those regarding the surrounding communities under study, were not fully considered due to the dearth of information available in the reviewed articles. Second, this review acknowledges its focus on synthesizing quantitative findings. In doing so, this resulted in the exclusion of some potentially valuable data in qualitative studies or findings. Finally, the nature of AST intervention research has its inherent limitations. Likely all relationships found in the reviewed articles are correlational and not causative due to the nature of current AST research, and any interpretations of such results should acknowledge this.

2.6 Conclusion

From the findings there are a few notable areas for future study. Research regarding the community and political streams (e.g., advocacy campaigns, interest groups) and factors (e.g., resources, AST champion strategies) that can facilitate policy change may improve the sustainability of AST interventions through generating approaches of how to exploit intervention windows. Additionally, investigations of the partnerships implementing AST interventions have the potential to assist in better understanding the existing perspectives and priority of commonly involved stakeholders and public-sector institutions with the agency to influence AST change.

2.7 Acknowledgements

2.8   References

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2.9 Appendices

Appendix 2.1 Full table with data extracted from studies included in the systematic review (n=22)

Basic Info	*Organization, Design and Methodology*			*Discussion*
Author (Year), Region Sample, and Design and Theoretical Framework	**Intervention Type, Stakeholders, and Approach* (6 Es*).**	**Intervention Description, Resources, and Measurement Tool(s).**	**Implementation Process and Details.** (*Follow-up length based on first report of evaluation post-program/intervention)	**Children's AST-Related Reported Outcome(s) and Conclusion(s).**
Bovis et al. (2016), US: Miami-Dade County, FL. 454 children at 16 elementary schools. Quasi-experimental; no framework.	Intervention: WalkSafe Pre-Kindergarten Pedestrian Safety Curriculum. Stakeholders noted: ✔ **Education, Encouragement, Equity**.	Evaluation of a WalkSafe Pre-K Pedestrian Safety Curriculum. Resources: videos, formal educational curricula, workbooks, and outside simulation activities to promote pedestrian safety. Tool(s): standardized assessment test.	Curriculum was set up over 5 consecutive days of lessons conducted during the school week. Each lesson included a DVD/video for classroom instruction. Lessons were split into three sections, one for instructional mode, one for modeling mode, and one for creative mode. Follow-up: 1 month.	A statistically significant difference was found between pretest knowledge ($M = 5.49$, $SD = 1.54$) and posttest knowledge ($M = 6.64$, $SD = 1.35$) assessment scores across all 454 subjects, $t(452) = -16.22$, $p < .001$, 95% CI $[-1.29, -1.01]$.
Buckley et al. (2013), US: Moscow, ID. ~400 students at 3 elementary schools (2 intervention, 1 control). Case study; no framework.	Intervention: "International Walk to School Day" in the fall, "Fill the Racks!" in the spring. Stakeholders noted: ✔ **Encouragement**.	Assessment of AST promotion days/events. Resources: human (e.g. coordinating partners, recruiting volunteers). Tool(s): volunteer counts/observations of AST, also interviews and surveys.	The state SR2S Coordinator planned organized and marketed the designated days for AST. Specifically, they worked to recruit volunteers to help with the data collection processes. Follow-up: Fall -1 day, Spring – 1 week and 2 weeks after.	Fall: 101% increase in the number of students and parents participating in AST. Spring: increased AST was sustained for at least two weeks after the event. Students with parents increased by 333% on the SR2S day (Pearson chi-squared = 11.0, **p = 0.001**).
Buliung et al. (2011), Canada: AB, BC, NS, ON. 12 schools (3 per province), 748 boys and 741 girls. Uncontrolled before-after; Ecological approach.	Intervention: STPs. Stakeholders noted: X **Engineering, Enforcement; emphasis on Education, Encouragement**.	Evaluation of a STP pilot program and the entire STP process in predominantly suburban settings. Resources: STP committees. Tool(s): hands-up classroom surveys to capture to and from school transport mode, household questionnaires.	STPs follow a 5-step process: 1. Program setup, 2. Data collection and problem identification, 3. Action planning, 4. Implementation, 5. Ongoing monitoring. Interventions were classified using 4 categories: (1) education, (2) activities and events, (3) CIPs, and (4) enforcement. Follow-up: ~1 year.	The rate of AST across all schools increased from 43.8% (baseline) to 45.9% (follow-up). Parents indicated that the 3 most effective school travel program activities were safety education (24.0%), special events (24.0%), and CIPs (19.0%). 13.3% of surveyed households reported that the program, resulted in less driving.

Bungum et al. (2014), US: Henderson, NV. 2 K-5 schools, intervention school population 638; comparison 698. Quasi-experimental; no framework.	<u>Intervention</u>: Promotional "Nevada Moves Day" (NMD). Stakeholders noted: ✔ **Encouragement**.	Assessment of the effects of an AST promotion day. <u>Resources</u>: announcements, media ads, telephone messages, sheet reminders, P.E. class promotion, P.E. teacher announcements. <u>Tool(s)</u>: Observations.	Event was promoted through different methods using the various resources. One-day intervention program. 3 consecutive weeks of observations: initial data were collected one week before the event and the second was on NMD, and the final data collection was collected one week later. <u>Follow-up</u>: 1 day.	A significant difference between the two schools over the three days of data collection in overall ATS rates, this was observed on NMD, when rates (17.9% vs. 7%) were significantly higher (x^2=27.2; **p<.001**) at the intervention school.
Cuffe et al. (2012), US: Boulder, CO. 7 (K-6 or K-8) schools in a 15-mile radius of Boulder, CO. Interrupted time series; no framework.	<u>Intervention</u>: Incentive-based promotion program to increase AST. Stakeholders noted: ✔ **Encouragement**.	Evaluation of a promotion program with opportunities to win prizes for AST participation. <u>Resources</u>: $10 cash prizes, $10 vouchers to a local bicycle store. <u>Tool(s)</u>: radio-frequency ID (RFID) tags, observations.	Principals specified "prize periods" throughout the year. Children who rode their bicycle to school each day of a prize period entered a lottery to win a $10 cash prize or a $10 voucher to a local bicycle store. <u>Follow-up</u>: 1 year.	Prize periods significantly increased the probability of AST by 4.2–4.8 percentage points, or 17.6%–20.4%. Results imply that the opportunity to win a voucher increases the probability a participating child rides by 3.2 percentage points (13.6%).
DiMaggio et al. (2013), US: New York City, NY. 124 schools involved with SRTS, 30 with SRTS / 94 without. Retrospective case study; Ecological approach.	<u>Intervention</u>: State-funded SRTS project. Stakeholders noted: X **Engineering**.	10-year analysis of SRTS programs focused on reducing school-aged pedestrian injury in NYC. <u>Resources</u>: SRTS data obtained from the NYC DOT. <u>Tool(s)</u>: Geocoded motor vehicle crash data, ArcGIS shapefiles.	Interventions included new traffic and pedestrian signals; the addition of exclusive pedestrian crossing times, speed bumps, speed boards (radar-equipped digital signs that display speeds), high-visibility crosswalks; and new parking regulations. <u>Follow-up</u>: unclear; period was 2 years.	School-aged children pedestrian injury rate decreased 33% (95% CI). Annual rate of school-aged pedestrian injury during travel times decreased 44% (95% CI) from 8.0 injuries per 10 000 population in the pre-intervention period (2001–2008) to 4.4 injuries per 10 000 population in the post-intervention period (2009–2010) in census tracts with SRTS programs.
DiMaggio et al. (2015), US: Texas. 313 SRTS programs, 52,042 reported injuries. Retrospective case study; Ecological approach.	<u>Intervention</u>: State-funded SRTS project. Stakeholders noted: X **Engineering**.	Assessment of an SRTS program to reduce school-age pedestrian and bicyclist injuries. <u>Resources</u>: Pedestrian crash data via Texas DOT Crash Records Info System. <u>Tool(s)</u>: police reports on pedestrian injuries in the state of Texas.	Analyses based on state-wide data for districts that received funding after 2010 and those that did not. Engineering interventions were improvements of the built environment such as sidewalks, bicycle lanes, and safe crossings. <u>Follow-up</u>: unclear.	Annual school-age pedestrian fatality rates decreased 37.1% (95% CI 14.9%, 59.4%) from 1.1 per 100,000 population before SRTS intervention to 0.7 per 100,000 population after SRTS intervention. Annual rates of child (5-19) pedestrian and bicyclist injuries between pre- and post-SRTS periods declined 42.5% (95% confidence interval (CI) 39.6% to 45.4%).

Faulkner et al. (2014), Canada: Toronto, ON. 856 grade 5 and 6 students at 18 elementary schools. Serial cross-sectional; Ecological approach.	<u>Intervention</u>: Policy to Promote PA and AST. Stakeholders noted: ✔ **Encouragement**.	Evaluation of school policy on students' time spent in light-to-vigorous PA as AST. <u>Resources</u>: school administrators. <u>Tool(s)</u>: student self-report survey, parent survey, accelerometers.	School Health Environment Survey was used to assess a school's programs, policies and resources. Each child in the data set accumulated at least 10 hours of wearing time for at least 3 weekdays and one weekend day. <u>Follow-up</u>: 1 year.	Support for AST (scaled X2 diff(Δ df = 2) = 9.49, p = 0.009) and the presence of written policies/practices for PA were significantly associated with PA (scaled X2 diff (Δ df = 2) = 6.93, **p = 0.031**).
Gutierrez et al. (2014), US: Miami, FL. 14 elementary schools, and 58 intersections (34 intervention and 24 control intersections sites). Quasi-experimental; Social cognitive theory.	<u>Intervention</u>: Safety awareness campaign. Stakeholders noted: ✔ **Education, Encouragement, Equity**.	Evaluation of increased crossing guard presence and the likelihood children using safe AST. <u>Resources</u>: awareness campaign via automated phone message provided by Miami-Dade County Public Schools. <u>Tool(s)</u>: SRTS Parent Surveys, headcount tallies.	Intervention schools received two components: (1) the positioning of the new crossing guards and (2) the implementation of an awareness campaign. Awareness campaign: automated phone message from Miami-Dade County Public Schools notifying all school faculty, staff, and parents of the new guards and their location. <u>Follow-up</u>: 6 months.	Increase in the number of children utilizing supervised routes. Comparison of intervention vs. control supervised routes revealed significantly more children walking in supervised intersections at intervention schools.
Harvey et al. (2015), US: Franklin County/ Chattanooga, TN. 165 grade 4 students at 4 elementary schools. Cohort Analytic; Ecological approach.	<u>Intervention</u>: SRTS Safety intervention. Stakeholders noted: ✔ **Education, Equity**.	Evaluation of SRTS lessons based on whether socioeconomic status affects students' AST knowledge outcomes. <u>Resources</u>: teacher training via the League of American Bicyclist. <u>Tool(s)</u>: surveys about cycling knowledge.	Student-teachers trained with the local bike education agency to prepare the curriculum and assure consistency. Lessons were designed for children to learn traffic awareness skills, correct helmet fit and use, bike handling, bike fit, safety checks and how to check where to ride. <u>Follow-up</u>: 4 weeks.	When grouping all four schools, a paired sample *t*-test showed a significant improvement in overall test scores (Pre 6.39 [+/-1.854 v. Post 6.91 [2.275], *t*=-3.426, df=137, *p*=.001). A significant interaction between post-test scores and SES (L = 7.60 [+/- 2.425] v VL = 6.6 [2.146], *t* = 3.1672, df = 136, *p* = **0.002**) was found, suggesting SES had an influence on post-test scores.
Hoelscher et al. (2016), US: Texas. 4th grade students at 78 schools (73 w/ follow-up). Quasi-experimental, (serial cross-sectional sample); Ecological approach and Social cognitive theory.	<u>Intervention</u>: SRTS programs as a part of the Texas Childhood Obesity Prevention Policy Evaluation study. Stakeholders noted: X **Engineering**.	Comparative analysis of projects (infrastructure v. non-infrastructure) on student AST, PA, and psychosocial antecedents. <u>Resources</u>: school districts, parents. <u>Tool(s)</u>: self-report counts, written tally sheets, questionnaires, student and parent surveys.	Non-infrastructure (NI): educational, encouragement, enforcement, and evaluation activities. Infrastructure (I): engineering project(s) to facilitate AST such as sidewalks, crosswalks etc. <u>Follow-up</u>: 3 years.	Morning percent AST in I and NI schools were significantly higher than C schools (*p* = **.024**, *p* = **.013**, respectively). Afternoon percent AST in NI schools decreased more over time compared with C schools (*p* = **.009**). I and NI school students had higher AST self-efficacy; similar results were noted for parents in I schools.

Lachapelle et al. (2013), US: Northern New Jersey and Ocean Township, NJ. School intervention: 588 students in grades 4–6. Controlled before-after; no framework.	Intervention: Bicycle Safety Program. Stakeholders noted: ✔ **Education**.	Evaluation of the effectiveness of two bicycle education programs. Resources: ads used to contact or solicit schools, helmets, bicycles. Tool(s): standardized pre- and post-training surveys and tests.	Curriculum included both on and off-bicycle lessons. Children were asked to answer a survey about their bicycling behaviour and a pre-training test of bicycle knowledge prior to the program. Follow-up: ~5 weeks.	Majority (55%) of children improved significantly from pre-to post- intervention. Greatest improvements were seen in questions associated with safety. In the school sample only two responses showed no statistically significant improvement between the tests; questions on proper helmet use and stop sign behaviour.
Livingston et al. (2011), US: Newark, NJ. 1,564 (K-4) students from 9 schools educated; 1,288 children observed. Interrupted time series; no framework.	Intervention: Pediatric Pedestrian Education Program (WalkSafe program). Stakeholders noted: ✔ **Education, Enforcement**.	Examination of an education program for long-term cognitive and behavioural changes in school children. Resources: educational module, teachers, interactive assembly. Tool(s): observation, standardized pre-, post- and follow-up tests.	The program consisted of three sessions conducted over three consecutive weeks. Day 1 was a 45-minute educational module. Day 2 was an assembly. Day 3 was another 45-minute educational module back in the classroom facilitated by the teacher. Follow-up: 3 months.	All grades had improved test scores immediately and at 3 months. Students moving from gr. 3 to 4 showed long-term retention (K→1: 7.7 vs. 6.7; grade 1→2: 7.8 vs. 6.7; gr. 2→3: 7.3 vs. 6.8; gr. 3→4: 7.1 vs. 8.0; all $p < 0.05$ year 2 pretest vs. year 1 3-month post-test). Children walking alone tended to look left-right-left notably more than those with an adult (67% vs. 20%; $p < 0.0001$).
Mammen et al. (2014a), Canada: National. 106 elementary schools (K–8) across Canada (excl. Que., YT, and NU). Longitudinal; Ecological approach.	Intervention: STPs. Stakeholders noted: X **Education, Encouragement Enforcement, Engineering**.	Evaluation of rates of AST in both the a.m. and p.m. periods; an identification of predictors of mode change. Resources: STP committees. Tool(s): data collected from the school profile form, hands-up classroom survey and the written plan of action.	Stakeholder committees developed written plans of action and implemented school-specific strategies to increase AST. All action items/strategies were collated and classified into four main categories: 1) Education 2) Activities and events 3) CIPs 4) Enforcement. Follow-up: 1 year.	Baseline and follow-up data showed that 27% and 31% of children engaged in AST to and from school, respectively. In total, there was an increase in AST in the a.m. period in 21 schools. There was a range in AST change post-intervention, from a decline of 26% to an increase of 23%. In the p.m. period, there was an increase in AST at 23 schools.
Mammen et al. (2014b), Canada: National. 103 elementary schools across Canada (excl. Que.), parent surveys (n=7827). Serial cross-sectional; Ecological approach.	Intervention: STPs. Stakeholders noted: X **Education, Encouragement Enforcement, Engineering**.	Evaluation of STPs in relation to characteristics associated with mode shift from driving to AST through follow-up parent survey data. Resources: STP committees. Tool(s): retrospective cross-sectional parental survey.	Strategies would generally relate to; (a) infrastructure modifications/additions; (b) safety education; (c) special walking events; (d) walking buddies/ walking school bus formation; (e) AST newsletter dissemination and (f) identification of best routes to school. Follow-up: 1 year.	~17% (AM: n=1188; PM: n=1211) of the sample reported driving less at one-year follow-up both in the morning and afternoon periods. ~35% of these families reported that CIP (spec. school-related signage, bicycle racks) and safety education (spec. parent/child safety education and workshops, best routes to school mapping) were the top strategies.

McDonald et al. (2013), US: Eugene, OR. 14 primary/middle schools; data collected for 1000–2300 students annually. Quasi-experimental; Ecological approach.	Intervention: Eugene SRTS project. Stakeholders noted: ✔ **Education, Encouragement Enforcement, Engineering**.	Assessment of the Eugene, Oregon's SRTS program on AST among children. Resources: interviews with school personnel involved in the program and groundtruthing. Tool(s): specialized school travel survey, student travel tally sheet, parent survey.	Distinct SRTS treatment combinations were identified: education/ encouragement only; education and cross walks/sidewalks; education and Boltage; education and covered bike parking; education and 2 SRTS programs. Follow-up: ~6 months.	SRTS interventions appeared to have a cumulative impact; schools with more types of interventions had larger proportions of students engaging in AST. Boltage program was associated with an increase of 5 percentage points in walking and 4 percentage points in biking. Education and encouragement programs were associated with a 5 percentage point increase in biking.
McDonald et al. (2014), US: CA, DC, FL, TX. 801 total schools, 47% with SRTS, 53% without; annual reports for 65,000 students and 16,000 parents. Serial cross-sectional; Ecological approach.	Intervention: State-funded SRTS projects. Stakeholders noted: ✔ **Education, Encouragement Enforcement, Engineering**.	Analysis to assess how the proportion of students engaging in AST changed after the introduction of SRTS programs. Resources: SRTS funding info, DOT information, interviews of SRTS program managers, school and municipal staff, and state/local health departments. Tool(s): student and parent surveys.	At about half of the schools travel mode was surveyed at multiple points; other half reported one time. Non-infrastructure programs: education, encouragement, enforcement. Infrastructure programs: sidewalks, signs, crosswalks, traffic calming, bicycle parking. Follow-up: unclear.	Engineering improvements were associated with an absolute increase of 3 percentage points in AST, (relative increase of 18%). Walking and bicycling rose by 1.1 percentage points ($p = .002$) with each year of participation in SRTS. Education and encouragement, for each year of participation, was associated with a 0.9 percentage point increase in walking and bicycling ($p = .025$).
Mendoza et al. (2011), US: Houston, TX. 4th grade student as 8 schools (N = 149). Randomized controlled trial; Social cognitive theory.	Intervention: Walking School Bus. Stakeholders noted: ✔ **Encouragement, Equity**.	Evaluation of a WSB program on children's rates of AST and PA. Resources: information provided by the school district on school transportation, WSB training. Tool(s): 2 different questionnaires.	Walking school bus routes averaged 0.8 mile and had 8-12 children per 2 staff. Each intervention school had 1-3 walking routes based on children's home addresses. Trained study staff walked the children to and from school up to 5 days/week. Participants' parents completed a sociodemographic survey. Follow-up: 4-5 weeks.	Intervention children increased AST (mean +/- SD) from 23.8% +/- 9.2% (time 1) to 54% +/- 9.2% (time 2), whereas control subjects decreased from 40.2% +/- 8.9% (time 1) to 32.6% +/- 8.9% (time 2) ($P < .0001$). Acculturation and parent outcome expectations were both significantly and positively associated with the change in percent of AST. There was also a ~36% decrease in motor vehicle commuting.
Ragland et al. (2014), US: California. 47 schools, pedestrians and bicyclists (ages 5-18 years). Retrospective case study; Ecological approach.	Intervention: State-funded SRTS project, specifically safety study. Stakeholders noted: X **Engineering**.	Assessment of the SRTS program in California; infrastructure projects. Resources: data via California Statewide Integrated Traffic Records System. Tool(s): injury collisions data, SRTS parent survey re: mobility and reported barriers to AST.	A funded project at a school site could list 0, 1, or multiple countermeasures (e.g. SRTS project funding construction of curb ramps). Injury collision data were compared with changes in the numbers of injury collisions that occurred 250 ft.+ of the countermeasures but within a quarter mile of a school. Follow-up: unclear.	Collisions involving pedestrians and bicyclists ages 5 to 18, found an incident rate ratio (IRR) of 0.47, this corresponded to a 50% reduction in collisions in the treatment area (<250 ft. of the countermeasure) in relation to the area outside the treatment area.

Sayers et al. (2012), US: Columbia, MO. 3 schools (77 students, ages 8-9). Controlled before-after; no framework.	Intervention: Walking School Bus. Stakeholders noted: ✔ **Encouragement**.	Evaluation of a walking school bus program. Resources: recruitment flyers. Tool(s): Actigraph GT1M biaxial accelerometer, surveys.	Objective measures of physical activity were obtained using the Actigraph GT1M biaxial accelerometer. Data was collected over 7 days of children participating in a WSB, and a comparative nonparticipating group. Follow-up:7 days.	No differences in objective 7-day physical activity measures between WSB participants and nonparticipants. When comparing the relationship of % MVPA and age, the slope of the regression line was steeper for those children not participating in the WSB.
Sirard et al. (2015), US: Minneapolis, MN. ~20,500 students across 39 schools. K-5 and K-8 schools. Quasi-experimental; no framework.	Intervention: Policy change to restrict school choice based on distance. Stakeholders noted: ✔ **Enforcement**.	Assessment of policy restricting school choice for elementary school students. Resources: Parents notified through school websites and newsletters. Tool(s): transportation survey, observations.	The city was divided into three zones (zone 1 = North, zone 2 = Southeast, and zone 3 = Southwest), and parents chose a school within their home zone. Observations completed in the spring and fall of 2010, before and after the policy change went into effect. Follow-up: ~6 months.	Distance to school significantly decreased (1.83 +/- .48 miles to 1.74 +/-.46 miles; **p =.002**), however there weren't any significant changes in morning or afternoon AST or the number of automobiles in the morning or afternoon.
Stewart et al. (2014), US: FL, MS, WA, WI. 48 completed SRTS projects and 53 schools affected. Cohort; Ecological approach.	Intervention: State-funded SRTS projects. Stakeholders noted: X **Education, Encouragement Enforcement, Engineering**.	Cross-state assessment of changes in rates of AST after SRTS projects. Resources: multiple including SRTS coordinators. Others not specified. Tool(s): In-class tallies using National Center for SRTS instrument, direct observation.	Infrastructure projects: sidewalk or crosswalk construction, installation of permanent signage bicycle rack installation, traffic calming/ control such as speed bumps etc. Non-infrastructure projects: media campaigns or promotions, increased police patrol, walk or ride to school day events, walking school buses, education activities. Follow-up: "one to several months after project completion".	Overall rates of all AST increased by 37% (from 12.9% to 17.6%) at the 52 projects and 80 schools represented with both pre-project and post-project AST data. Walking increased by 45% (from 9.8% to 14.2%) across the 40 projects and 55 schools represented, and bicycling increased by 24% (from 2.5% to 3.0%) at the 36 projects and 50 schools represented.

Notes: (1) Articles evaluating SRTS/STP programs were stated as having an ecological approach for their theoretical framework as this model is foundational in those programs; (2) All approaches include evaluation due to the nature of this review (6 Es [http://www.saferoutespartnership.org/healthy-communities/101/6Es]: Education, Encouragement, Enforcement, Engineering, Equity, Evaluation). (3) ***Abbreviation*s**: AST = Active School Travel, CIP = Capital Improvement Projects, DOT = Department of Transportation, MVPA = Moderate-to-Vigorous Physical Activity, PA = Physical Activity, RA = Research Assistants, SRTS/SR2S = Safe Routes to/2 School, STP = School Travel Planning, WSB = Walking School Bus.

Chapter 3

3 Supporting Active School Travel: A Qualitative Analysis of Implementing a Regional Safe Routes to School Program

3.1 Abstract

Physical inactivity among children is a significant public health concern. Active school travel (AST) methods, such as walking and wheeling to school, can be a valuable way to increase children's levels of daily physical activity. In Canada, Active and Safe Routes to School (ASRTS), a national health promotion initiative, has led the campaign for AST through its flagship school travel plan (STP) program. While some studies have examined the physical activity outcomes of STP programs, at present little is known about the on-the-ground implementation processes that impede or facilitate the success of STPs. Through a thematic analysis of 18 interviews with STP facilitators and 4 focus groups with the larger STP committees, our study evaluates the factors shaping the functioning of STP interventions at ten elementary schools participating in a regional ASRTS program in Southwestern Ontario. Our analysis yielded six themes that have implications for STP implementation and sustainability: 1) accounting for school context; 2) establishing committee capacity and leadership; 3) supporting STP action; 4) responsiveness to external and internal barriers; 5) engaging schools at the grassroots level; and 6) building future champions. We draw from Lewin's Field Theory and discuss the forces affecting STP committees to frame our findings in a way that can be discussed to support the building of efficient, effective, and viable AST intervention environments.

3.2 Introduction

Engagement in physical activity (PA) has important physical (L. Larsen, Kristensen, Junge, Rexen, & Wedderkopp, 2015) and cognitive (Fedewa & Ahn, 2011) health benefits for children. However, 81% of adolescents (11-17 years old) worldwide are not attaining sufficient levels of PA (World Health Organization, 2018). Such low levels of PA are even more concerning considering that habits developed during childhood can transfer into adulthood (Telama et al., 2005). Active school travel (AST), such as walking or cycling to/from school, has been suggested as a key method to improve PA opportunities for children (Sallis et al., 2006). With children under 13 years old spending 15% of their time during an average week in school (Hofferth & Sandberg, 2001), incorporating AST into daily routines has the potential to not only increase children's PA, but also contribute to their overall health by reducing harmful vehicular emissions in the school area (Bearman & Singleton, 2014).

Participation in AST has many potential benefits for children, including helping children achieve up to 30% of the recommended 60 minutes per day of moderate-to-vigorous PA (van Sluijs et al., 2009). Moreover, increases in children's AST have been associated with increased fitness levels (Lubans, Boreham, Kelly, & Foster, 2011), reduced perceived stress (Lambiase, Barry, & Roemmich, 2010), improved mental health (Fyhri & Hjorthol, 2009), and the generation of positive emotions (Ramanathan, O'Brien, Faulkner, & Stone, 2014). However, despite its many potential benefits, AST participation rates have declined internationally (Grize, Bringolf-Isler, Martin, & Braun-Fahrländer, 2010; McDonald, 2007; van der Ploeg, Merom, Corpuz, & Bauman, 2007). Thus, building regular engagement in AST represents an opportunity for public health practitioners and school communities to address children's physical inactivity.

Factors influencing AST participation are multiple and complex, including distance to school (Emond & Handy, 2012; K. Larsen, Gilliland, & Hess, 2012; K. Larsen et al., 2009), child age (Bere, van der Horst, Oenema, Prins, & Brug, 2008; Robertson-Wilson, Leatherdale, & Wong, 2008), and gender (Evenson, Huston, McMillen, Bors, & Ward, 2003; K. Larsen et al., 2009). For instance, perceptions of traffic safety (Helbich et al., 2016) and social concerns around stranger danger (Panter, Jones, van Sluijs, & Griffin, 2010) and bullying (Zwerts, Allaert, Janssens, Wets, & Witlox, 2010) influence children's rates of walking, while environmental variables, such as block density, signalized intersections (Mitra & Buliung, 2012) and street trees

(K. Larsen et al., 2012) are linked to AST. With community-based organizations, policy-makers, and public health practitioners seeking ways to effectively address these multiple, intersecting influences on AST, a myriad of interventions have been implemented globally (Larouche, Mammen, Rowe, & Faulkner, 2018).

In Canada, Active and Safe Routes to School (ASRTS), a national health initiative developed by Green Communities Canada, adapted the school travel plan (STP) model from international best practices and started piloting AST programs in 2006 (Active and Safe Routes to School, 2018a). Central to the STP intervention are facilitators who play a pivotal role in promoting the program to the school community, establishing a larger STP committee of community partners (e.g., municipal officials, parents, police, principals, public health practitioners), and overseeing the development of a school-specific action plan (Active and Safe Routes to School, 2018b). STP action planning is comprised of five steps (see Figure 3.1). Developed with the assistance of several safety, physical activity, and educational resources, broadly, STPs promote and raise awareness of AST through what ASRTS calls the five 'Es': education, encouragement, enforcement, engineering, and evaluation (Active and Safe Routes to School, 2018c).

Figure 3.1 School travel plan intervention model

Set-Up	Baseline Data Collection	Action Plan Development	Action Plan Implementation	Evaluation
Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Committee of community partners and school representatives is created, and timeline established.	Surveys are distributed, collated, and analyzed, and walkabout (neighbourhood assessment), and traffic counts conducted.	STP committees devise action plan and delegate duties.	Action plan is implemented.	Follow-up surveys conducted, and STP committees evaluate and communicate progress.

Effective AST interventions require cross-sector collaborations. Recent research suggests that understanding how cross-sector partners perceive barriers and enablers to active travel assists in improving collaborative efforts (Cole, Burke, Leslie, Donald, & Owen, 2010). To our knowledge, however, only a few published studies have investigated the organizational dynamics of partnerships supporting AST interventions. Macridis and García Bengoechea (2015) provide an overview of different partnerships supporting AST programs and document how interventions are facilitated and operationalized. More pointedly, Mammen, Stone, Buliung, and Faulkner (2015) examined the perspectives of STP facilitators in the Canadian context and reported that collaboration, an organized model structure, and member involvement positively impacted implementation; subsequently, they called for future case studies to examine STPs in greater depth. Atteberry et al. (2016) and Cooper and McMillan (2010), meanwhile, examined the implementation of the Safe Routes To School program in the U.S. context, with the former, more recent paper recommending future work investigate the interactions of members within the partnerships and their implications for intervention implementation. Here, we present a detailed evaluation case study of the organizational features shaping the implementation and sustainability of an AST intervention (the STP model) from the perspectives of stakeholders

involved, as well as a first attempt to understand AST intervention dynamics using organizational change theory. To guide this study, we asked: 1) How do STP structure, organization, and resources influence the implementation of the STP intervention? and 2) What features of the STP intervention influence its efficacy and sustainability?

3.2.1   Theoretical Framework

Our evaluation examines a fundamental health promotion issue regarding to what extent committees implementing STPs perceive the organizational dynamics and related processes of change to enable and/or constrain the effectiveness of the STP intervention. We draw on Kurt Lewin's Field Theory of organizational change because it offers a conceptual lens by which to analyze group (STP committee) dynamics and behaviour in a particular setting (STP intervention) (K. Lewin, 1936). Broadly, Field Theory operates on the premise that behaviour is a function of a group's environment or 'field', and by considering the environmental complexities and influence(s) we can understand observed behaviours (K. Lewin, 1936). The field, though, is time dependent and composed of several interdependent 'forces' (K. Lewin, 1943) that, in the case of the STP program, include internal group characteristics such as management, personnel, strategies, and structure, as well as external characteristics such as the school and surrounding communities. Force field analysis can subsequently be utilized to identify the specific forces that should be abated or fortified to facilitate a group's desired planned change (M. Lewin, 1998). Thus, with Field Theory and its force field analysis, we make sense of our findings by conceptualizing the environment of an STP committee and considering the relational dynamics among the forces constraining and facilitating its implementation and sustainability.

Organizational change approaches have been applied in a variety of health-related contexts, including health promoting hospitals (Lee, Chen, Powell, & Chu, 2014), public health planning (Thomas, Hodge, & Smith, 2009), and heart health promotion (Riley, Taylor, & Elliott, 2003). Extending an organizational change approach to STP offers the opportunity to investigate how cross-sector partnerships define and respond to AST as a community-level issue, as well as what characteristics, personnel, and strategies participants deem most effective in and missing from their programs. Given the research gap on the organizational dynamics of partnerships supporting AST, organizational change theory – specifically Field Theory – can allow us to

examine and map a specific intervention environment and assess the infrastructure and capacity required to address its organizational challenges (Batras, Duff, & Smith, 2016). Ultimately, these insights will help generate evidence about best practices for STP intervention implementation and sustainability, which, in the long-run, has the potential to contribute to supporting children's increased and sustained engagement in AST.

3.3   Methods

3.3.1   Study Context

This study draws from schools participating in the Elgin-St. Thomas-London-Middlesex-Oxford (ELMO) ASRTS program in Southwestern Ontario, Canada. The ELMO tri-county region comprises both urban and rural communities, is home to 655,366 people (Statistics Canada, 2016), and located approximately halfway between Toronto, Ontario and Detroit, Michigan. School commuting contexts were framed by varying degrees of urbanicity (high density city centres to low density rural areas) and school demographics (student populations <300 to >600). Three schools were located in urban areas, five in suburban locales, and two in rural townships.

3.3.2   Sample and Recruitment

We recruited a purposeful sample through the ELMO ASRTS program because our goal was to learn in-depth about the ASRTS program, and thus participants with high levels of involvement in the program were targeted. We focused only on schools in their STP evaluation phase in order to gather perspectives on the full implementation of the program. As of December 2017, when data collection concluded, there were 21 elementary schools participating in the ELMO ASRTS program, of which 10 were in their evaluation phase. Within the region there are a variety of different built environments: one major city-center (London), three regional municipalities (St. Thomas, Strathroy, Woodstock), and several smaller rural communities. Representatives from all 10 eligible schools accepted an invitation to participate in this study. At the time of our study, participants had recently completed their follow-up data collection (e.g., surveys, traffic counts, walkabout) and were engaging in knowledge dissemination activities at their schools (e.g., presentations of school results, building summative school feedback reports). Our qualitative evaluation component complements these STP activities by focusing in-depth on insider perspectives of committee functioning and sustainability.

Eligibility criteria included that participants must: (1) have made a significant time commitment to, or helped in the planning of, their STP, (2) have working knowledge of the entire STP process, and (3) be able to thoroughly discuss their respective school's STP initiatives. Only key facilitators (public health nurses [PHNs] and principals) were invited to participate in the interviews as they were responsible for overseeing the entire implementation of their STP and could best speak to the specific details of the program. We selected an interview format to allow these individuals to deeply and critically reflect on their STP experiences (Dowling, Lloyd, & Suchet-Pearson, 2016). Invitations for the focus groups, meanwhile, were extended to all STP committee members deemed to be the most involved (i.e., active in the implementation of strategies, present at committee meetings) by their respective facilitator. Focus groups provided a way to engage with potentially disparate views within the groups (Owen, 2001), as well as facilitate a group dynamic that fostered the emergence of new ideas (Sim, 1998)—both of which are important given our intention to understand the intra-organizational functioning of STP committees. Our participants comprised 33 individuals: 12 PHNs, seven principals, one vice-principal, two teachers, seven parent representatives, one community partner, and three city/town representatives. A total of 22 individual were involved in the focus groups, of which a number of those same participants also completed individual interviews (i.e., they were program facilitators).

3.3.3   Data Collection

All ten participating schools had at least one facilitator interviewed either in-person (n=3) or over the phone (n=15), while five of the 10 participating schools were represented in the focus group discussions held on-site at schools. Both interviews and focus groups followed a semi-structured script to guide the discussion along the chronology of the STP intervention (see STP process depicted in Figure 1). Broadly, questions inquired about the facilitators and barriers of the methods and procedures at each stage of the STP intervention, as well as what changes could be made to particular processes. This format allowed a degree of comparability, while still offering flexibility for participants to raise issues most important to them (Axinn & Pearce, 2006).

Eighteen of 19 potential interviewees accepted to participate. Interviews were conducted by the lead author and ranged from 27 minutes to 1 hour and 14 minutes in length (average approximately 45 minutes). Of the 16 interviews with facilitators, three were conducted with two

PHNs present as in these cases the facilitator received substantial support from a second PHN and it was suggested they also participate. Additionally, we undertook one-on-one interviews with two municipal representatives who were STP committee members; one due to their school being unable to conduct a focus group, while the other had experiences with several STPs which positioned them to provide a level of insight that could be more fully explored in an interview than group setting.

Four focus groups ranging from four to eight people were organized and moderated by the lead author with the assistance of a second interviewer, a program representative, who also asked questions. We agreed to have a program representative as the second interviewer to ensure credibility and buy-in for the evaluation. Committee members were recruited to focus groups by their STP facilitator(s). All focus groups were approximately one hour in duration, with the longest being 70 minutes. To capture the school-level experience, each focus group consisted of four to eight school-specific STP committee members. On the recommendation of the facilitators, one focus group combined STPs from two schools due to their close geographic proximity and having frequently collaborated throughout the STP process.

All interviews and focus groups were audio recorded and transcribed verbatim by the lead author. Data were collected from October 2016 through December 2017 coinciding with the final schools from the initial STP program rollout having begun their evaluation phase. We altered any revealing information in quotations and used codes indicating committee member role to locate quotes (CP=Community Partner, CTR=City/Town Rep., PA=Parent, PR=Principal and PHN=Public Health Nurse, T=Teacher). This study was approved by the Non-Medical Research Ethics Board of the University of Western Ontario (NM-REB #: 105635).

3.3.4   Data Analysis

We utilized Braun and Clarke's (2006) thematic analysis process in which we began by deductively coding each transcript, of both interviews and focus groups, allocating large segments of text into five categories that corresponded with the outcomes of interest: (1) organization, (2) resources, (3) structure, (4) efficacy, and (5) sustainability. Next, we inductively coded within these deductive categories to identify recurrent ideas. We followed an iterative and systematic process whereby the definitions of codes were refined, merged, and

separated as needed, ultimately resulting in the generation of 30 robust codes with clear and discrete definitions. Next, we developed an intermediate set of concepts from these codes and engaged in another iterative process wherein we visually mapped the relationships between concepts in order to create our final themes (n=6) and show that each contains contrasting forces to navigate (see Figure 3.2, "+" = facilitating force, "–" = constraining force).

Figure 3.2 Analysis and code map
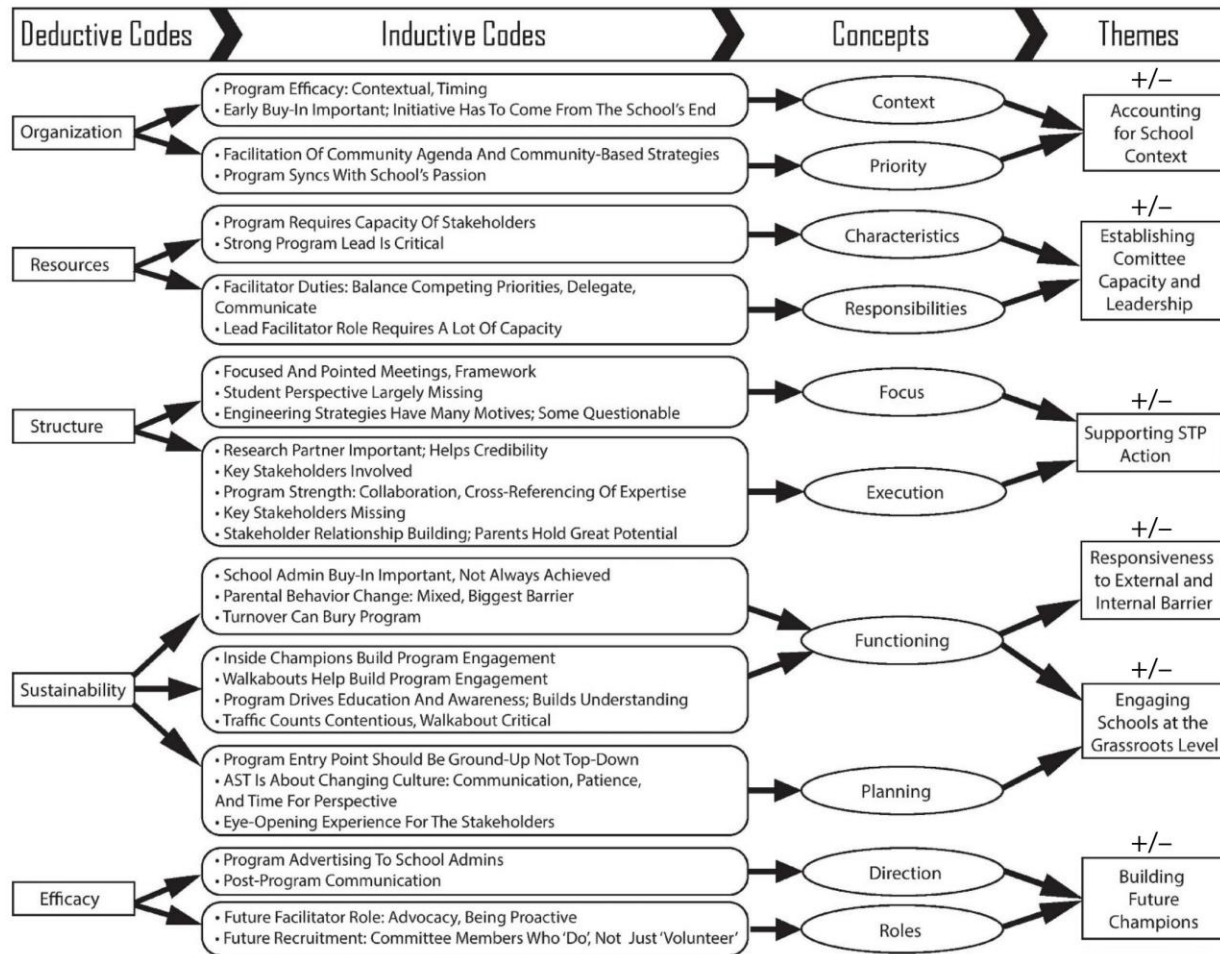
We employed several techniques to ensure rigour in our analysis. First, team members (A.N.B. and S.E.C.) critically discussed their differing interpretative possibilities of the findings at key points in the analysis, employing what Smith and McGannon (2017) describe as a practice of 'critical friends'. As an additional part of the 'critical friends' technique, on three separate occasions, a note taker was present during phone interviews to provide analytic feedback to the interviewer and engage in a hermeneutic discussion regarding the important topics covered. Next, the lead author engaged in reflexive processes to document, identify, and challenge the constructions of knowledge that they interpreted in the findings (Cowan & Taylor, 2016), including writing and maintaining detailed reflexive notes to critically consider researcher positionality, as well as evaluating the note taker's feedback to track new, emerging ideas and

concepts. Member checks were also occasionally conducted to ensure the clarity of specific points that participants raised during the course of their conversation. Last, to strengthen the 'confirmability' of the results, an audit trail was also maintained throughout the process of the study to track how and why various decisions were made (Baxter & Eyles, 1997).

3.4 Findings

3.4.1 Implementation

Our findings discuss the range of forces and relational dynamics that shape an STP's environment and viability from insiders' perspectives, as well as point to crucial considerations for best practices in developing and implementing an effective STP. Below, our findings are organized according to six themes divided across two central levels of the STP model: implementation and sustainability. As illustrated in Figure 3.2, within each theme are results reflecting both facilitating and constraining forces within an STP environment.

3.4.1.1 Accounting for School Context

Our participants stressed the importance of conducting a thorough evaluation of school context during the initial STP set-up phase. Participants frequently cited assessing school context prior to STP introduction as necessary for identifying school readiness and buy-in. As one facilitator explained, ensuring readiness to build a viable committee and obtain support from administration is critical for long-term prospects:

> I think that really having school buy-in and having an STP committee that has your parents on it, a teacher, and the school principal or VP on it, I think that's what you need. If you don't have that, I don't know if school travel planning will be as successful and as sustainable [...] I think that, even as a facilitator, we come and go at schools [...] if the principal changes, you still have that core group that is still there and still passionate about it. (PHN2)

Other facilitators echoed this, contending that schools exhibiting initiative to support AST in their set-up phase were those that developed STP committees with a diverse spectrum of committed members.

Several STP facilitators also noted the importance of precisely locating the motivation for the STP program in the context of school priorities. Deciphering whether a school's initiative to

participate in the STP program was internally driven (motivation comes from administration) versus externally driven (PHN drives the program) were interpreted as important forces affecting STP functioning. A few participants who felt a weak relationship with their school and that their STP was externally driven by a facilitator from outside the school administration elaborated that the resulting program milieu invited complacency and overreliance on the facilitator. As one PHN explained, this culminated in straining the sustainability of their STP:

> I feel that unless the PHN keeps supporting the school with all of the promotional items, I don't think much will happen at the school with the STP process. I think it has got to be driven by the PHN for this particular school [...] The nurse makes the announcements, writes the newsletter, and gets it out to the school [...] without a super engaged nurse leading that, I don't believe that the school, with their current administration, would do it independently. (PHN12)

When postulating ways to avoid such situations, a few facilitators expressed that identifying and subsequently building relationships between the STP committee and a school's "passion" (PHN7) (e.g., physical activity) could allow for the program to merge with an issue already carrying weight within a school administration, thus helping to internalize motivation for AST.

3.4.1.2   Establishing Committee Capacity and Leadership

Participants highlighted the intense capacity demands placed on facilitators as a constraining force. Facilitators, in particular, regularly relayed that heading an STP committee and organizing an STP action plan was "a huge learning process" (PHN5) and "an education piece" (PHN6), and often emphasized the substantial time commitment required of coordination tasks. Among many other duties, critical tasks included: balancing competing priorities within the committee; delegating assignments appropriately; and, facilitating committee communication. Facilitators painted a picture of the weighty totality of their tasks, with one PHN explaining how the practical realities add up:

> They [the facilitator] do all the behind the scenes work of taking information from the parent surveys, traffic counts, and designing the walkabout [...] the actual making of it [the action plan] into something readable and tangible is the STP facilitator […] If they weren't there, that action plan would never actually be something to look at. (PHN4)

Overall, the demands of the facilitator role was acknowledged to be one of the greatest challenges and potential liabilities for program success.

Participants also drew attention to the importance of leadership quality in developing a well-functioning STP committee, with an ideal leader seen as possessing genuine enthusiasm and drive. One facilitator, who helped support multiple STPs, encapsulated this perspective when they explained how leadership character is a fundamental force for the success of the STP process:

> [Who the] facilitator is, can, in my experience, make or break the success of the school travel plan. I think it is very important that they believe in the program. If it is just kind of a thing that they have to do – as in that is what the school has asked for and they are in that role – I don't find that it is nearly as successful as someone who really believes in the program, gets it, is passionate about it, and drives it and makes it happen. (PHN4)

Further supporting this notion were comments from participants who sensed their STPs lacked leadership or strong relationships between the facilitator and larger committee, resulting in poor organization and low program efficacy that ultimately hampered their program's efforts.

Like facilitators, many members of the larger STP committees posited that their roles benefited from clear definitions and expectations. There was consensus among committee members that having a defined role was essential to effectively contribute to their STPs and for the overall STP functioning. For example, one teacher's struggles to contribute to their STP stemmed from a lack of clarity regarding their specific role, as they explained "sometimes it can be overwhelming when you're looking at the big picture. That's how it was when I started, because I was trying to do it all and I couldn't, so I just felt defeated. But this year was like, 'Hey, I did 'Winter Walk Day' and it was cool. I did another promotion day [...] it was awesome'" (T2). By choosing to participate in specific events, this participant was able to carve out a discrete role that allowed them to strategically focus their efforts and contribute in what they viewed as an effective manner. It was ultimately suggested that clearly defining roles and expectations at the beginning of an STP, especially to establish the expected contributions of each committee member, is important in building an enterprising STP environment.

3.4.1.3 Supporting STP Action

When deliberating on committee characteristics and methods that best support the implementation of STP action plans, participants often spoke of the role of key personnel. On the one hand, public health unit supports (e.g., second PHN), parents, city/town representatives, a

research partner, and community organizations (e.g., cycling skills organization) were frequently singled out. However, municipal representatives were especially valued as crucial facilitating forces for bringing AST issues to high level decision makers and pushing to create changes:

> With our committee we had councilors and transportation people. We had a lot of infrastructure stuff done on behalf of this committee; we had a sidewalk outside the school [upgraded] [...] We had city councilors come out and look at the snow removal [...] [they created] the plans to make a priority for snow removal in school areas. (PHN3)

Conversely, there were several desired partners who were reportedly absent. Participants identified schoolboard facilities representatives and trustees, busing consortium representatives, students, and local neighborhood residents as additionally needed partners, principally because they were seen as having the ability to open up more avenues to affect change and support a wider array of action items.

One of the most important facilitating forces for success in action plan implementation our participants identified was the need for committees to establish an effective operational framework. Specifically, establishing a schedule of focused meetings was seen as crucial for attaining committee goals. Participants articulated that, ideally, issue-specific "ad hoc subcommittee[s]" (PR4) that would meet only for select issues are useful to improve overall efficiency. This was seen to limit the demands placed on committee members by only requiring them to attend their relevant meetings, thereby allowing each member to place attention on the action items pertinent to them rather than the entire action plan. Speaking about their efforts to promote AST education, one community representative emphasized how this schedule allowed them to focus their efforts "to get out and educate the community on some of the various traffic concerns and issues [...] [and] to engage people" on AST topics (CTR1). While it may seem mundane, the meeting schedule was said to be a key force in helping to build an environment that maximizes (or undermines) the efficiency and organization of STP committees.

When speaking about action plan implementation, participants also expressed extensive support for utilizing a collaborative approach that leverages committee expertise and facilitates the building of responsible but supportive intra-committee relationships. For instance, one facilitator directly credited the success of their STP to their committee's approach, explaining that it was highly beneficial to have the diversity of community partners "because you have so many

experts. It wasn't just one person that knew everything, but it was basically acknowledging that everyone had important information to share, they had different opinions" (PHN1). A parent added that this also helps to ensure responsibility and direction among the committee, commenting that they "liked having the diverse group – you got input from so many people [...] Like it's laid out so everybody knows their piece. I like that you can follow up and then meet again and say, 'Okay what are the next steps? Who's doing what? Where's the next project?'" (PA3). A collaborative approach was seen as a unifying force in the program.

Participants also cited the importance of how committees situated their intentions underpinning STP action items. Going back to the five 'Es' of ASRTS, participants largely viewed the rationales behind education, encouragement, and enforcement action items as supportive of their STP goals and appropriately implemented; however, engineering actions were more controversial. This was due to a common misconception that the visibility of infrastructure modifications was positively correlated with AST behaviour and perception changes, which could create unrealistic program expectations. One city representative described this conflict between community perceptions and engineering realities:

> Engineers are told not to use all-way stops because signage doesn't necessarily slow down speed. The perception is that you have got speeding, but from where the signs are warranted they [the drivers] actually travel faster mid-block to make up time. [This was indicated] and then there was a comment about speed bumps. Again, you can put speed bumps in but it will displace the people that want to [speed]. If the city is set up in a grid pattern, it will displace the speed to other streets. So I don't know if that will resolve the issue. (CTR3)

Other municipal representatives reiterated the importance of AST education, and concluded that supporting or advocating engineering action items cannot be viewed as a blanket solution for AST issues as it could foster the development of future constraining forces (e.g., false perceptions).

3.4.2   Sustainability

3.4.2.1   Responsiveness to External and Internal Barriers

Our investigation into STP sustainability found that timely navigation of both external and internal barriers is a crucial force for a functional STP committee environment. The greatest

external barriers cited by committee members were parent-related, especially misgivings about the capacity of the STP program to change parental attitudes. An illuminating example of this was captured in one participant's experience enforcing illegal parking, during which they noted having parents "react very badly to me" (CP1) and the principal receiving complaints despite their STP focusing heavily on parental education. Tensions related to parental support for the STP was a consistent concern raised by our participants, with one PHN plainly explaining "behaviourand attitudes are still very poor in the parking lot, people are still parking in the handicap parking, you know the designated parking spots [...] parents are still sitting there [on the side of the street] waiting for the kids – there still is lots of work that needs to be done" (PHN6). Ensuring timely responses to these documented issues and increasing parental education, especially early on in an STP, were suggested by participants as potential future remedies.

When focusing inwardly on the committees themselves, participants identified the greatest internal barrier, or constraining force, as facilitator turnover, primarily due to the logistical issues that ensued. Consequences of turnover were swift and ruinous, and could result in the STP plan being "put to a halt more or less" (PHN3), as happened in one case where both a principal and vice principal left a school at a critical point in the STP action plan. Several others' accounts confirmed that the time, resources, and education commitment to get a new facilitator up-to-speed was a daunting task to achieve mid-STP. Buy-in also resurfaced as an internal barrier as participants contended that poor committee buy-in resulted in apathy towards AST, low attendance at meetings, and a sense of the program as a formality or 'window-dressing' without real tangible outcomes. Ensuring buy-in and properly assessing a school's initiative re-emerged here as crucial forces to assist in weathering a major loss, or guarding against member apathy.

3.4.2.2   Engaging Schools at the Grassroots Level

Participants emphasized the importance of taking a 'bottom-' or 'ground-up' approach to maximize STP sustainability. The STP model of building a program around school-specific concerns and targets, rather than following a 'top-down' structure with scripted strategies, was favored by many participants as a way to maximize program efficiency. Participants reasoned this approach was conducive to developing crucial 'inside champions' (e.g., principal or teacher) who, as one PHN reflected, helped set a strong precedent for STP sustainability by leveraging

their relationships: "the principal, they are the gatekeeper. They identified a readiness and basically just highlighted the importance of the [program to] staff. That point – if it [the STP] is something that the principal is encouraging – the staff often, in my experience, will support what they [the principal] do" (PHN1). Champions were also viewed as a key facilitating force in pushing a more proactive STP mindset at their schools.

Another important grassroots characteristic for many participants was the data collection processes, particularly at baseline data collection in the STP set-up phase where participants identified valuable opportunities to build engagement within STP committees. Walkabouts, in particular, were reported as an experience that exposed members to the complexities of AST, and where the issues "came alive" (PHN2). One facilitator explained that this exposure helps to get "all those community partners – the parents, the school, everybody – together and see [the concerns], that's where the ball really starts to get rolling in the action plan […] that to me engages everybody" (PHN2). One parent representative expanded on this notion adding to it the educational value of the walkabouts:

> When we did the walkabout we were chatting with the city representative about traffic light safety and about pressing the button, and there were things I learned [...] That education that I received, it was like, 'Okay well there is obviously other people that don't know this' [...] I thought that was a strength because we learn something and then you learn what other people maybe should be knowing as well. (PA1)

Traffic counts, however, were much more contentious. Some participants believed that the traffic counts helped bring visibility to the program at their school, noting experiences of onlookers being inquisitive and supportive. Others struggled to see a greater purpose and detailed how community members were not happy with the observations and questioned their motives.

Long-term, participants also felt the grassroots approach was preferable because many claimed that, upon the completion of their STPs, AST was an issue requiring a genuine culture change. The concept of culture change, in its essence, was articulated as a matter of first increasing awareness about the complexity and timeline of AST issues, and then building a school-wide perspective that emphasizes patience. A city representative, using their committee as a small-scale example, argued that a bottom-up approach facilitated community connections with parents which helped build a realistic perspective of AST:

> There is a high degree of appreciation I feel from the parents that participate in the whole thing. They realize that there has been a solid effort put forward to try and make it work [...] It's been that way the past 25-30 years where everybody is driving their kid to school – it is not an easy task to take on and try and reverse that trend. (CTR1)

In hindsight, many participants acknowledged changing culture and perspectives represented potentially the greatest constraining force to building support for AST at their schools, primarily because of the social norms and perspectives that come with living in an auto-oriented society.

3.4.2.3   Building Future Champions

Building program champions was a central idea in our participants' views on developing sustainability with respect to an STP environment. Participants proffered two important functions for such individuals: being a proactive supporter of AST issues in their community, and a recruiter who identifies new members "who are doers" (PA4). To the former, many participants suggested that building more proactive proponents of AST may be a key force for improving buy-in, developing a clearer sense of direction or purpose for the STP, and advertising the program to schools. Recruiting 'doers' was commonly mentioned as a method to help drive change, with one principal elaborating that encouraging active involvement and building supportive parent-school relationships is a desirable characteristic for committee members:

> It is about [...] the doing versus the volunteering. So we might not have as many volunteers as we would like for some of the things [...] but when we built it the parents participated. They saw the value in the walking school bus, they were going to participate you could see it. They have seen the value in the work that we have done in the traffic, and they [...] are participating. (PR5)

To support the development of champions, participants made clear that cultivating 'doers' through showcasing meaningful changes could also be a future best practice.

3.5   Discussion

Collectively, our findings surface a number of STP best practices regarding program implementation and sustainability that can inform public health efforts supporting AST interventions. We return to Lewin's Field Theory of organizational change to ground our suggestions for improving STP, and more broadly AST, intervention environments in our discussion below. To illustrate the implications of our findings, we adapted Burnes and Cooke's

(2013) Lewinian life space model and topologically mapped our discussion of the STP committee environment, including the facilitating and constraining forces, in relation to Field Theory (see Figure 3.3).

Figure 3.3 Field theory model adapted to school travel planning
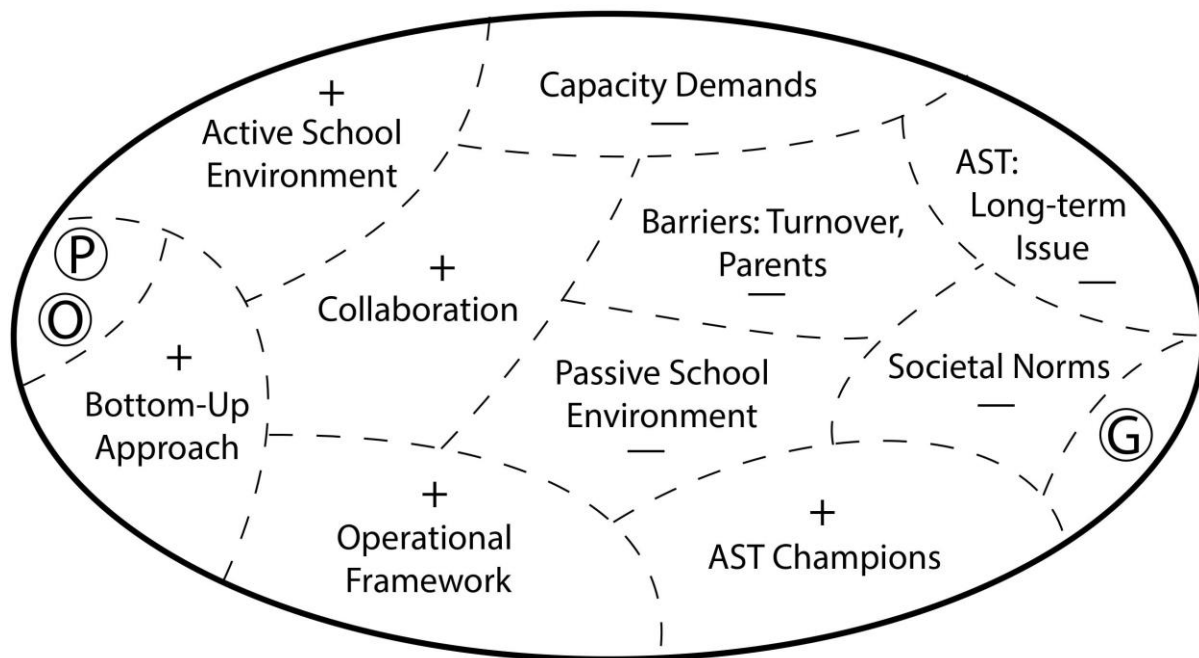
P = population (STP committee), O = current situation, G = targeted goal (improved functioning and sustainability), and those sectors between O and G represent various forces influencing change (Burnes and Cooke, 2013). "+" = facilitating force, "–" = constraining force.

3.5.1   AST Intervention Environments: Significant Forces Affecting Implementation

First, our study demonstrates the importance of the set-up phase in overall program functioning. Similar to other interventions which reported incorporating AST within a larger community project, such as community activity promotions (TenBrink, McMunn, & Panken, 2009), our study likewise indicates that the level at which the mechanism for change originates, top-down versus bottom-up, is significant for its long-term success. Although a review by Macridis and

García Bengoechea (2015) found that both bottom-up and top-down approaches have been previously employed in AST interventions to varying degrees of success, our findings firmly support utilizing the bottom-up approach. In particular, our findings confirm what the existing literature shows about this approach as advantageous for the mobilization of partners and resources in AST (Geraghty et al., 2009; Henderson et al., 2013).

The important forces to focus on and strengthen in the nascent stages of an AST intervention, from a Field Theory perspective, are thus those that create an 'active school environment', specifically school readiness and buy-in. Assessments of school motivation, prospective committee viability and diversity, and the potential to merge AST with a school's existing priorities are all important characteristics to consider and identify prior to program implementation. For example, if a school community exhibits a low level of internal motivation to help facilitate and support a program, preferring to be an ancillary player, we would suggest such an environment is passive and lacks the critical characteristics of a competent program. Instead, to cultivate an 'active school environment', future interventions should focus their initial efforts on expanding recruitment activities to community members not typically represented on STP committees (e.g., local residents and schoolboard representatives), find ways to engage parents in their program, and assess school priorities to see if AST can be incorporated into existing initiatives.

Regarding the implementation of AST programs, our study corroborates the importance of leadership and building strong intra-committee relationships. Weigand's (2008) review of AST literature initially noted the importance and influence that leaders, such as local government and school facilitators, have in future intervention implementation and monitoring, and our findings suggest analogous ideas. In fact, our findings go a step further and indicate that leadership can be instrumental in helping to establish a program precedent. However, our study also points to the implications of weak leadership. Recent research has reported issues such as missing partners (Heinrich, Aki, Hansen-Smith, Fenton, & Maddock, 2011) and community resistance (Deehr & Shumann, 2009) to AST interventions. In our evaluation, these issues were mentioned alongside instances of tenuous leadership and weak relationships. Given our results around the intensity of facilitator capacity demands, our research, like others (e.g., Hendy & Barlow, 2012), highlights

the relationship between adverse conditions and leadership outcomes, specifically in relation to successful program implementation.

With collaboration being suggested to be a positive force in addressing AST issues (Mammen et al., 2015), and Field Theory similarly noting the centrality of 'group dynamics' with respect to change (Burnes, 2004), we suggest that partnerships prioritize forces that promote cross-sector approaches, the development of a robust operational framework, and intra-committee relationship building during implementation. These priorities can help to foster an environment for partnerships that reduces facilitator capacity demands, thereby limiting potential liabilities (e.g., poor communication, organization). Our *supporting STP action* theme spotlighted group-based strategies, like clearly defining the roles and expectations for all committee members and developing a focused meeting schedule with issue-specific subcommittees, which could potentially be effective in this respect. Additionally, we advocate that future partnerships build several opportunities into their frameworks for AST education to address perception barriers. Walkabouts, for example, were widely supported for their ability to spur the engagement and education of individuals in the school community during the STP process. Engagement has been cited as an important aspect in AST partnerships (Kennedy & Mammen, 2017), and by building a partnership schedule or framework with more opportunities for engagement, we contend that this can also serve as a viable method to allow for community partners to educate each other and parents on AST, as well as build supportive relationships within the committee that help can help protect against barriers such as apathy.

Another important force in program implementation is operational barriers. Parental behaviours such as unsafe parking (Hinckson, 2016), attitudes concerning social support (Panter et al., 2010), and perceptions of neighborhood safety (Carver, Timperio, & Crawford, 2008) are noted AST concerns shared by our participants. We posit these issues also act as external barriers in relation to AST partnerships during intervention implementation. While other research may advocate that engineering strategies are best to support AST (Ewing & Dumbaugh, 2009), our results suggest a broader sweeping program to creating an environment more conducive to minimizing such barriers, specifically highlighting the potential of using a bottom-up, grassroots approach. As our findings indicate, the bottom-up approach may help motivate partnerships to spotlight local AST issues and drive the production of AST champions who can prioritize

whatever initiatives (e.g., crosswalks to improve walkability) are most pertinent to their school. Like Mammen et al. (2015), we found that champions were seen as critical to supporting AST for their ability to help develop program direction, recruit new members, and improve buy-in. With a wider and more passionate group supporting AST, future partnerships may have more reach in promoting the importance of AST as a worthy cause and changing parental concerns and perceptions.

An important facilitating force for AST partnerships to further explore, as pointed to by its near absence in our findings, is the role of students. Lacking student involvement is not new (e.g., Henderson et al., 2013); however, our participants did not identify a lack of student perspectives in the program as a barrier, but rather just a missing element. As per Field Theory's notion of mediating forces, this might represent a potentially critical new characteristic that partnerships could consider engaging to help increase their reach. Students may hold the potential to more effectively invoke pressure upwardly on parents and laterally on their peers to adopt AST behaviours. Importantly, the student-student relationship has been found to have a significant impact on motivation in other settings, such as academic goal pursuit (Wentzel, Battle, Russell, & Looney, 2010). The potential of this relationship dynamic to be translated to AST in order to improve student motivations, as well as to better understand their perspectives on effective programming, should be explored. Incorporating students and, if possible, generating student AST champions may be another method by which partnerships can extend their reach.

3.5.2   AST Intervention Environments: Forces to Improve Sustainability

Our findings indicate that intervention sustainability has much to do with perceptions and social norms. Like the Atteberry et al. (2016) and Mammen et al. (2015) studies, participants reported positive feelings regarding program efficacy; however, our participants were aware that societal perceptions had an important, adverse role in the larger AST participation discussion. The influence of an auto-oriented culture on travel mode decisions has been previously documented (Martinez, Ayala, Arredondo, Finch, & Elder, 2008), and many of our participants noted that the long-term nature of AST made it an issue that was difficult to properly address and convey to their communities. With a more thorough understanding of the scope and complexity of the issue, AST partnerships would benefit from framing AST as likely a slow process that needs to be facilitated by experienced change agents on STP committees.

Here it is important to consider that Lewin (1947) described the nature of change in Field Theory as ephemeral, suggesting that after a change (i.e., the intervention) it is not long until group behaviourreturns to its previous state. Therefore, based on the proactive sentiments documented in our findings, we offer two broader suggestions for future partnerships to guard against regressive behaviours. First, partnerships should prioritize efforts to foster a high level of communication with parents. If partnerships establish, early on, a proactive agenda to inform parents about the benefits and safety of AST, they may pre-empt negative parent perceptions and skepticism. Second, it is desirable to clearly establish the ownership of an AST intervention from inception. Having discernible ownership of the intervention within the STP committee, ideally by parents or champions, may help to establish an explicit mission for the program (e.g., advocacy, educational). A clear directive may also assist in focusing strategies on which community partners to recruit, resources to acquire, and methods to prioritize to effectively engage school communities.

3.5.3   Limitations

There are a few limitations to our study. This study investigated an AST intervention model that was primarily implemented in higher socioeconomic status (SES) neighborhoods. In only one instance did facilitators define their school as high-needs or high-risk, thus considerations and insights regarding potential equity issues are limited. We engaged a diversity of perspectives, but were only able to include a few municipal and community organization (e.g., non-profits) representatives as one non-profit organization closed and several other individuals had moved on to other roles. Consequently, while this study aimed to achieve a high level of rigour in its methods, an important implication to note here is that aspects of the organizational culture discussed in this study may be specific to the Canadian context. This must be taken into account in terms of the generalizability of our findings to other cultural contexts which may include different stakeholders.

3.6 Conclusion

To our knowledge, this is the first in-depth case study regarding the organizational dynamics of a regional partnership supporting AST via STP, as well as the first attempt to frame STP dynamics by drawing on an organizational change theory. The six themes we identified in our analysis

demonstrate that STP success is underpinned by a diversity of factors that range in scope from operational (e.g., meeting structure) to cultural (e.g., buy-in). This makes clear that in conceptualizing a plan for STP success, it is just as important that seemingly mundane aspects of committee operations be given as serious consideration as is taking into account the specificities and needs of the local school context. Based on these findings, we suggest that public health and community interventions aimed to support AST should i) emphasize the importance of thorough pre-implementation assessments and build 'active school environments', and ii) foster the development of a collaborative approach, a robust operational framework or schedule, and a school-wide pro-AST culture. For future study, investigating children's perspectives of AST interventions, ways to develop student champions of AST, and equity initiatives all hold significant potential to influence future programming.

3.7 Acknowledgments

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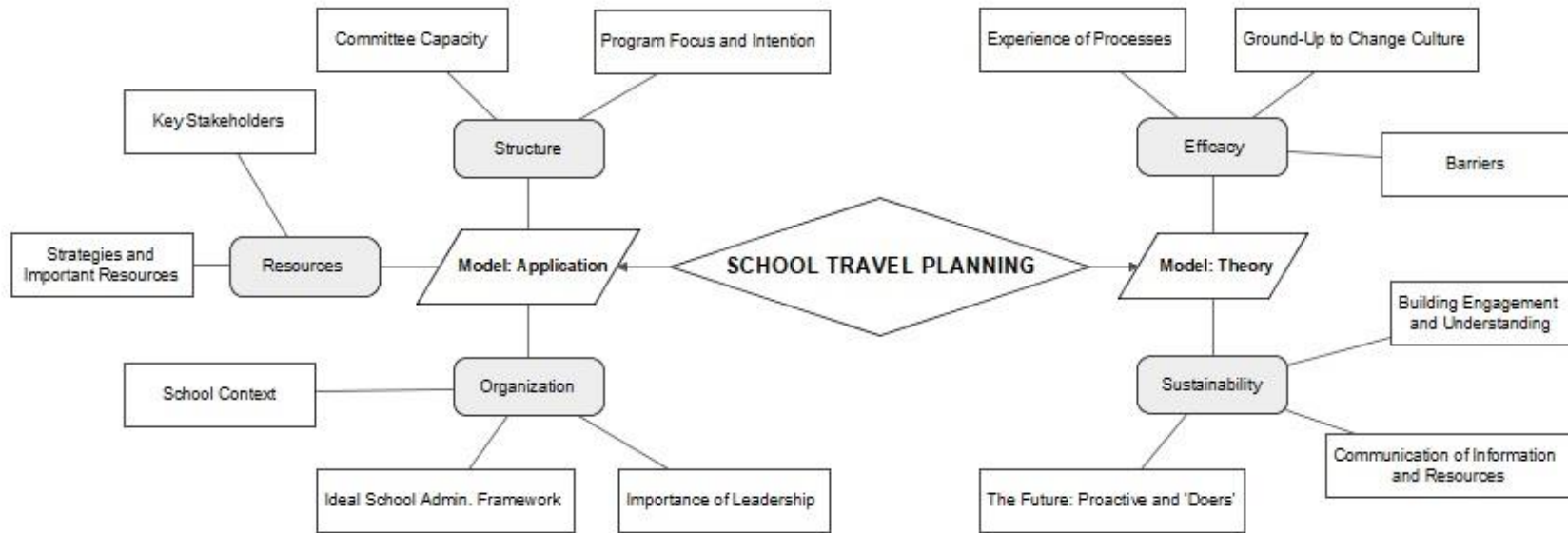
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3.9 Appendices

Appendix 4.1 Original code map

Appendix 4.2 Original theme map

Chapter 4

4 Promoting Active School Travel in Elementary Schools: A Regional Case Study of the School Travel Planning Intervention

4.1 Abstract

Physical activity is critically important to children's health and development, yet most North American children do not achieve their recommended daily levels of physical activity. Active school travel (AST) can be a viable way to increase children's daily activity levels by promoting opportunities to walk and wheel. To promote AST in Canada, Active and Safe Routes to School (ASRTS), a national health promotion initiative, has supported the implementation of School Travel Plan (STP) programs throughout the country. The STP program is a comprehensive 2-year intervention that is facilitated by a committee of community and school partners who implement education, encouragement, enforcement, and engineering initiatives at their school to support AST. This study examines the impact of the STP program on children's and parents' perceptions of AST barriers, and children's engagement in AST from pre- to post-intervention. In total, 13 schools representing a total sample of 4,720 parents and 2,084 children from across Southwestern Ontario, Canada were involved in this program evaluation. Findings indicate that the STP program was successful in significantly influencing children's and parents' perceptions of AST barriers, but more limited in affecting behavioural change. The Theory of Planned Behaviour was applied in the discussion to frame the results of the STP intervention from the perspective of improving intentions (i.e., motivation) to increase participation in AST. It is recommended that future interventions focus on parental education and empowerment initiatives to reduce an apparent intention-behaviour gap that exists in the complex and interdependent AST decision making process.

4.2   Introduction

Children's engagement in walking and wheeling to school, or active school travel (AST), is positively correlated with improved mental health (Yang et al., 2013), cardiorespiratory fitness (Voss & Sandercock, 2010), overall levels of physical activity (Larouche, Saunders, Faulkner, Colley, & Tremblay, 2014), and neighborhood social cohesion (du Toit, Cerin, Leslie, & Owen, 2007). Despite these benefits, AST has declined in recent decades throughout many countries including Australia (van der Ploeg, Merom, Corpuz, & Bauman, 2007), Canada (Buliung, Mitra, & Faulkner, 2009), Switzerland (Grize, Bringolf-Isler, Martin, & Braun-Fahrländer, 2010), the U.K. (Pooley, Turnbull, & Adams, 2005), and the U.S. (McDonald, 2007). In response to the decline in AST, a variety of interventions have been implemented; however, their effectiveness and impact have been limited primarily due to weak designs (Larouche, Mammen, Rowe, & Faulkner, 2018; Villa-González, Barranco-Ruiz, Evenson, & Chillón, 2018). The purpose of this study is to evaluate the impacts of a prominent AST intervention known as school travel planning (STP).

Reasons for the decline in children's AST are voluminous, with a major factor being the complexity of the decision to participate in AST (Wilson, Clark, & Gilliland, 2018). The decision to engage in AST is influenced by many social and environmental factors. The former comprises children's demographics, home context, and social norms and perceptions related to AST. Older children (Martin, Lee, & Lowry, 2007; Merom, Tudor- Locke, Bauman, & Rissel, 2006), males (Bookwala, Elton-Marshall, & Leatherdale, 2014; Bungum, Lounsbery, Moonie, & Gast, 2009; Larsen et al., 2009), and those living in lower socioeconomic status neighbourhoods (Molina-García & Queralt, 2017) are more likely to engage in AST. Additionally, the influence of modern car culture (Lorenc, Brunton, Oliver, Oliver, & Oakley, 2008), increased household income, greater car ownership (Pont, Ziviani, Wadley, Bennett, & Abbott, 2009), and parental perceptions of child safety (Chillón et al., 2014) are correlated with lower AST participation.

Environmental factors include the physical or built environment associated with the daily school commute. Neigbourhood characteristics such as the presence of sidewalks and street connectivity (Fulton, Shisler, Yore, & Caspersen, 2005; Panter, Jones, van Sluijs, & Griffin, 2010), higher levels of residential density (Carlson et al., 2014; Dalton et al., 2011), 'nice scenery' (Mandic et

al., 2014), and marked street crossings (Timperio et al., 2006) have been positively associated with AST. Conversely, greater distance to/from school (Larsen, Gilliland, & Hess, 2012; Panter, Corder, Griffin, Jones, & van Sluijs, 2013; Rodríguez & Vogt, 2009; Trapp et al., 2012), manufacturing/trade/office employment land use areas (Mitra, Buliung, & Roorda, 2010), and lower intersection density (Schlossberg, Greene, Phillips, Johnson, & Parker, 2006) have been associated with lower levels of participation in AST. Given this myriad of factors, policymakers, public health and planning practitioners, and school communities have sought to develop and implement comprehensive interventions to support AST.

Interventions that seek to change commuting behaviours do so through implementing a number of targeted initiatives that encourage and support families to shift from passive to active transport (Buttazzoni, Van Kesteren, Shah, & Gilliland, 2018). Common are health promotion activities like walking school buses (e.g., Sayers, LeMaster, Thomas, Petroski, & Ge, 2012), which aim to increase AST participation through emphasizing physical health benefits, and engineering strategies such as the installation of sidewalks, bicycle lanes, and safe crossings (DiMaggio, Brady, & Li, 2015) to increase the accessibility for and safety of AST trips. Other examples include awareness campaigns in the form of education curriculums that promote AST by improving children's safety knowledge (e.g., Bovis, Harden, & Hotz, 2016), and enforcement strategies such as crossing guard programs which can be used to support AST through increasing the visibility of trip safety (e.g., Gutierrez et al., 2014).

In Canada, a nationwide initiative known as Active and Safe Routes to School (ASRTS) has sponsored STP since 2006 to support AST (Active and Safe Routes to School, 2018a). STPs utilize multiple strategies in schools, and thus require each school to organize an STP committee comprised of municipal officials, parents, police, principals/vice-principals, and public health practitioners to implement the intervention (Active and Safe Routes to School, 2018b). Strategies can be categorized according to the "Es" of the U.S. Safe Routes to School program (Safe Routes to School National Partnership, 2017): education (e.g., cycling skills program), encouragement (e.g., Walk to School Day), enforcement (e.g., ticketing illegal parking), and engineering (e.g., building of sidewalks). A five-phase model is utilized by schools to implement the STP model (Active and Safe Routes to School, 2018b): *(1) Set-Up*: committee is established and a timeline is set; *(2) Baseline Data Collection*: surveys are distributed, collated, and analyzed, a school

walkabout (neighbourhood assessment of AST barriers) is conducted, and traffic counts are carried out; *(3) Action Plan Development*: STP committee develops an action plan; *(4) Action Plan Implementation*: action plan is implemented; *(5) Evaluation*: follow-up surveys are distributed, collated, and analyzed, and the STP committee communicates its progress. In its comprehensive approach to change commuting behaviours, the STP program targets multiple layers of the AST decision making process (e.g., education to improve self-efficacy, encouragement to improve exposure and opportunity, engineering to improve accessibility), and thus requires a comprehensive theory to frame its impact. Given its successful prior use in AST research (e.g., Murtagh, Rowe, Elliott, McMinn, & Nelson, 2012), we apply the Theory of Planned Behaviour (TPB) (Ajzen, 1991).

4.2.1   Theoretical Framework

Socio-cognitive theories such as TPB have often been applied in health and physical activity research (e.g., Ajzen & Driver, 1992; Norman & Conner, 2005; Romeike, Abidi, Lechner, de Vries, & Oenema, 2016). Support for the use of TPB in these fields is evidenced by a systematic review which found that, after accounting for statistical artifacts, individuals' attitudes, and to lesser extents, their perceived behavioural control (PBC) and self-efficacy, are key influences in forming their physical activity intentions (Hagger, Chatzisarantis, & Biddle, 2002). We follow in this style and apply TPB to frame the STP intervention's potential impacts on AST perceptions and behaviours, and to produce a theoretically-informed discussion for AST intervention facilitators and evaluators.

Fundamental in TPB is the notion that an individual's intention (i.e., their motivation) to perform a certain behaviour is the proximal predictor of their eventual behavioural outcome (Ajzen, 1991). Influencing an individual's intention are three primary determinants: attitude, PBC, and subjective norm (Ajzen, 1991). One's attitude is grounded in their behavioural beliefs (i.e., perceived advantages and disadvantages of performing a behaviour) and their appraisal of the positive and/or negative associations of a particular behaviour. The second determinant, PBC, has been previously defined as one's "perceived control over and confidence in performing a given behaviour" (Lowe et al., 2015, p. 758); in other words, it is the extent to which individual beliefs of control influence behaviour, or their self-efficacy. Last, subjective norm is a reference

to the perceived social pressure that influences an individual's conformation and engagement in a behaviour, or their neglect and inaction.

4.2.2   Study Objectives and Aims

Research specifically focused on the impacts and effectiveness of STP interventions is still emerging, with initial findings suggesting modest short-term gains (Buliung, Faulkner, Beesley, & Kennedy, 2011; Mammen, Stone, Buliung, & Faulkner, 2014). In their Canada-wide evaluation of STPs, Mammen et al. (2014) provided evidence of localized success and recommended that case studies be utilized to examine STPs in future research. We follow this suggestion and offer a case study evaluation of a regional STP program. To guide this study, we posed the following research questions:

i)   How does the STP intervention influence children's and parent's perceptions of known AST facilitators and barriers?

ii) How does the STP intervention influence the commuting behaviours of children?

iii) How does the STP intervention influence the commuting behaviours of children when controlling for gender, age, and distance between home and school?

4.3   Materials and Methods

4.3.1   Study Context

We conducted a serial cross-sectional intervention case study which evaluated 13 elementary schools (Kindergarten – Grade 8) participating in the Elgin-St. Thomas-London-Middlesex-Oxford (ELMO) ASRTS program in Southwestern Ontario, Canada. Home to 655,366 people (Statistics Canada, 2016), the study area is located approximately halfway between the major metropolitan areas of Toronto, Canada and Detroit, United States. Of the 13 schools that were involved in this study, four were in urban areas, seven in suburban areas, and two in rural areas. Data were collected between September 2014 and June 2018, with matched seasonality between baseline and two-year follow-up surveys at each school. All of the participating schools in this evaluation implemented at least three of the four "Es" (i.e., education, encouragement, enforcement, engineering) that represent distinct strategies (excluding evaluation). This study

was approved by the University of Western Ontario's Non-Medical Research Ethics Board (NM-REB #: 105635) and by the research officers/committees of the participating school boards.

4.3.2   Participants and Protocol

Schools self-selected their participation in this study via a needs assessment conducted by the principal and school health nurse, which resulted in their application to participate in the ASRTS program. Once in the program, classroom presentations were conducted by the school health nurse wherein they distributed consent forms and family surveys to the youngest and only children in JK to grade three, and parental consent forms for youth survey participation and family surveys to the parents of all children in grades four through eight. Family surveys were completed by parents of students in all grades, and children in grades four to eight with parental consent were asked to provide their own assent and complete a youth survey. Only students in the upper grades were asked to fill out surveys because as children mature, and roughly around grade four, they begin to acquire more autonomy (Janssen, Ferrao, & King, 2016). Therefore, these older children are more likely to have engaged in, and consequently have developed personal perspectives around, AST. Additionally, our previous research with elementary school children indicates that by this age children are capable of completing comprehensive self-report surveys.

Data collection for baseline and follow-up were carried out according to a common protocol. The family surveys were completed at home and returned with the child to school, while youth surveys were facilitated by the respective STP facilitator (i.e., public health nurse or principal) at their school with the help of volunteers during a designated school day. Both surveys were adapted from versions of the Healthy Neighbourhoods Survey which incorporates previously-validated questions from other well-regarded data collection instruments (e.g., the Neighbourhood Environment Walkability Scale, and the International Physical Activity Questionnaire for children), subsequently allowing for our study's results to be compared to others (Cerin, Saelens, Sallis, & Frank, 2006). Family and youth surveys generally followed the same format and were used to document demographics, daily commutes to and from school, commuting considerations (e.g., accompanying individuals on trip), perceptions of AST

neighbourhood characteristics and barriers, and areas of concern encountered during the regular commute.

The total sample population for this study was 4,720 parents and 2,084 children. In our first independent sample at baseline, there were 2,591 parent respondents (54.9%) and 1,176 (56.4%) children completing surveys. For our second independent sample at follow-up, the parent sample population was 2,129 (45.1%), and the child sample was 908 (43.6%). Although there were no official exclusion criteria, and all parents and their children in grades four to eight were invited to participate in the survey, the reality that some schools had significant English second language populations, or offered special academic programs that brought in children from across a city or region, likely resulted in some of these families and students excluding themselves from the survey process.

4.3.3   Measures

4.3.3.1   Perceptions of AST Barriers and Neighbourhood Characteristics

Data were obtained through a variety of question formats including dichotomous, multiple choice, and Likert-scale questions. Two independent mobility questions were first posed to parents and children about their trip to/from school: are they/you allowed to walk and allowed to bike to/from school (yes [1]; no [0]). Children's and parent's perceptions of barriers and facilitators were then gauged using a four-point Likert scale (ranging from strongly disagree / always no [1] to strongly agree / always yes [4]). Questions were posed to parents as "It is difficult for my child to walk or bike to school or their bus stop because … [e.g. It is too far or takes too much time]", and to children as "Does this stop you from walking/biking to school or to your bus stop? [e.g., It is too far or takes too much time]".

4.3.3.2   Dependent Variable: Commuting Behaviour

Commuting behaviour was measured by asking the parents of children of all ages to report how often in a typical week their child commutes to and from school by walking, cycling, skateboarding, rollerblading, personal vehicle, or bus. From this question, three dependent variables (i.e., to school, from school, all trips) were calculated for AST and by car trips to allow an examination of how the STP intervention influences school travel behaviours. AST trips were

calculated based on the number of trips taken by walking, cycling, skateboarding, or rollerblading to school (out of 5), from school (out of 5), and both to and from school (total out of 10) during a typical week. Car trips were calculated based on the number of trips taken by personal vehicle to school (total out of 5), from school (total out of 5), and both to and from school (total out of 10) during a typical week.

4.3.3.3   AST Commuting Independent Variables

There are three independent variables that can be used to better predict AST behaviours: age (Larsen et al., 2012; Larsen et al., 2009; Oliver et al., 2014), gender (i.e., boys more than girls) (Bungum et al., 2009; Larsen et al., 2009), and distance (i.e., those living in closer proximity to their schools) (Larsen et al., 2012; Wong, Faulkner, Buliung, & Irving, 2011); thus we controlled for them in our statistical analyses. Age is the age in years of each child that there is a survey for, which ranges from 3 to 14. Gender is classified as boys, girls, or self-identify, although all parents in our study identified their child as a boy or girl, thus it is treated as binary in this evaluation. Distance is measured as the shortest network distance between a child's home postal code (as specified by parents) and the child's school. Shortest network distance is calculated in ArcGIS 10.5 (Environmental Systems Research Institute, Redlands, California, U.S.) using the Network Analyst tool. While postal codes do not provide exact home locations, they have been shown to be appropriate proxies for home locations in our study area (Healy & Gilliland, 2012).

4.4   Theory and Calculation

4.4.1   Theory of Planned Behaviour

In our application of TPB to AST, we address each determinant (i.e., attitude, PBC, social norms) to understand the factors that contribute to the formation of an individual's intentions influencing their commuting behaviours. First, we differentiate our conception of attitude from PBC by reiterating what Ajzen (2002) notes about the nature of the TPB: PBC does not indicate the likelihood that a given behaviour will produce a specific outcome, but is a reference to a perceived degree of control or autonomy over the engagement in a behaviour. Thus, with respect to active commuting, attitude reflects the beliefs closely associated with the direct facilitation of AST from an individual perspective (e.g., enough sidewalks for AST, no bike racks), whereas

PBC is representative of AST perceptions that relate to the ability of children, and by extension families, to engage in AST (e.g., allowed to walk to/from school, no skills to bike). Last, subjective norms were questions which reference the influence and pressure that the desires of important others (e.g., friends, family members) have as a determinant on behavioral intentions (e.g., no one to walk with, easier to drive).

4.4.2   Statistical Analysis

A series of analyses were conducted to properly address the different research objectives of this study. For the first research question, to examine for changes in perceptions of AST barriers, we conducted Mann-Whitney U tests to determine whether there were any significant differences in means of the perceived barriers between the baseline and follow-up groups. A total of 24 and 22 relevant barriers, considerations, and neighbourhood characteristics germane to AST were presented to parents and children, respectively. With the STP program implementing a variety of initiatives that were aimed at the entire school communities of participating schools, the total samples for parents and children were included in this analysis.

To address the second research question of our study, the assessment of AST commuting behaviour changes from baseline to follow-up, we again ran Mann-Whitney U tests to compare commuting behaviours as reported by parents from baseline to follow-up. Commuting behaviour change for AST only included children who lived within 1.6 kilometres of the school, as children outside this distance are eligible for the school bus. Commuting behaviour change for car trips included the entire sample regardless of distance from school, as one of the goals of the STP program is to decrease the number of children driven to school, regardless if they are AST or bus eligible.

To answer the final research question in this study, to understand the impact of the STP program while accounting for differences in gender, age, and distance between home and school, we conducted six multiple linear regression models. Each one of the six commuting behaviour variables (i.e., AST to school, AST from school, AST to and from school, car trips to school, car trips from school, car trips to and from school) were entered as dependent variables in regression models. The AST set of models included three multivariable models that all controlled for gender, age, and distance as key correlates of AST, while examining the difference between

baseline and follow-up. The three car-trip multivariable models also focused on the difference between baseline and follow-up, but only gender and age were controlled for, as distance does not influence the likelihood of utilizing a car in trips to or from school. All statistical analyses were performed in IBM SPSS Statistics 24 (IBM Canada Ltd., Markham, Ontario, Canada).

4.5 Results

4.5.1 Descriptive Statistics

We produced descriptive statistics for the baseline and follow-up samples separately. At baseline, parents (i.e., family survey respondents) reported average weekly commuting patterns for children, of whom 47.3% were boys and 52.7% were girls, with an average age of 8.41 (SD: ±2.9). Within this baseline sample 63.8% of families lived within walking distance. Meanwhile, at follow-up, commute trips were reported for students who were 49.7% boys and 50.3% girls, with an average age of 8.90 (SD: ±3.0). Of the follow-up sample 62.4% of families lived within walking distance. Regarding the child samples (i.e., youth survey respondents), 42.7% were boys and 57.3% were girls with an average age of 10.63 (SD: ±1.4) at baseline, while 49.1% were boys and 50.9% were girls with an average age of 9.96 (SD: ±1.5) at follow-up.

4.5.2 Parent's Perceptions (All Families JK-8)

The presence of the STP intervention largely resulted in positive shifts among parents' perceptions of AST barriers from baseline to follow-up (see Table 4.1). Reports of perceived social barriers saw many promising trends as significant declines were observed with respect to the trip to school being easier to drive (p=0.02), the trip not being fun (p=0.03), and bullying or teasing happening during the trip (p=0.01). Many traditional barriers also saw significant decreases, such as a lack of sidewalks (p=<0.01), the trip being too far or taking too much time (p=0.01), not having anyone else to walk with (p=<0.01), and children lacking cycling skills (p=0.03).

Table 4.1 Changes in parents' perceptions of AST barriers from baseline to follow-up

	Baseline				Follow-Up				p
	Strongly Disagree (%)	Somewhat Disagree (%)	Somewhat Agree (%)	Strongly Agree (%)	Strongly Disagree (%)	Somewhat Disagree (%)	Somewhat Agree (%)	Strongly Agree (%)	
TPB: Attitude Perceptions									
Route feels unsafe due to traffic	32.5	16.5	22.1	28.9	36.3	13.8	21.8	28.2	0.12
Too many busy streets	40.2	18.4	19.2	22.3	40.6	19	18.9	21.5	0.57
Drivers speed on streets	11.7	25.6	35.5	27.3	12.3	22	36.1	29.5	0.07
Feels unsafe because of crime	51.4	21.1	17.3	10.2	56.9	21.7	13.4	7.9	**<0.01**
No bike rack	58.9	23.8	13	4.4	61.2	21.5	12.8	4.5	0.21
Route is boring	76.7	15.9	5.4	2	75.5	18.9	4.3	1.2	0.62
Not fun to walk	71	19.8	6.3	2.9	74	17.5	6.7	1.8	**0.03**
Might get bullied/teased	52.2	28.3	14.1	5.4	56.9	24.7	13.6	4.8	**<0.01**
There are lots of trees in area	8.5	19.3	34.3	37.8	9	17.5	32.9	40.4	0.14
Unsafe for child to walk alone	32.4	27.7	24.1	15.8	36.7	28	20.8	14.5	**<0.01**
Unsafe for child to walk with friends	43	32.6	15.8	8.6	48.4	30.8	12.5	8.3	**<0.01**
Too much stuff to carry	47.3	24.6	22.4	5.7	47.9	25.2	21.8	5.1	0.45
Get too hot/sweaty	67.4	19.4	9.8	3.4	69.4	18.7	9.4	2.5	0.12
Too much traffic along street we live on	37.8	31.6	19.1	11.4	39.1	31.2	19.2	10.5	0.34
TPB: Perceived Behaviour Control Perceptions									
Allowed to walk	35.2 (No)		64.8 (Yes)		33.3 (No)		66.7 (Yes)		0.19
Allowed to bike	58.3 (No)		41.7 (Yes)		54.2 (No)		45.8 (Yes)		**<0.01**
Not enough sidewalks	57.9	15.2	14.6	12.4	61.9	16	10.6	11.5	**<0.01**
Not enough bike paths/lanes	45.9	12.7	20.6	20.8	45.8	16.6	17.2	20.5	0.44
There are enough walking trails	21.9	18.8	27.4	31.9	18.7	19.2	27.3	34.8	**0.01**
No skills to bike	45	13.2	19.6	22.2	46.3	15.1	20.8	17.9	**0.03**
Too young to walk/bike	38.1	14.7	18.1	29.2	41.7	14.3	17.2	26.7	**0.01**
TPB: Subjective Norm Perceptions									
Easier to drive	43	16.2	23.3	17.5	47.4	13.4	23.1	16.1	**0.02**
Too Far/Takes too much time	54.5	12	14.4	19.1	57.8	12.6	11.9	17.6	**0.01**
No one to walk with	54.5	19.9	14	11.6	59.5	16.4	14.1	10	**<0.01**

*Significant results **bolded**. p=<0.05

There was also a heightened awareness of neighbourhood characteristics that facilitate AST among parents, with built environment characteristics seemingly having the most increased visibility among parents. Notably, the neighbourhood having enough walking trails (p=0.01) significantly shifted. Neighbourhood safety perceptions were similarly encouraging as parents' perceptions that their community was unsafe for their child to walk alone (p=<0.01) or with friends (p=<0.01) were curtailed. Conversely, there were also a number of areas where parents seem to remain rather hesitant. Although ability to cycle (p=<0.01) saw a significant increase, the much more popular method of walking (p=0.19) did not. Parents' feelings of AST and vehicular safety also showed no significant declines. This was highlighted in the results of the trip being unsafe due to traffic (p=0.12) and drivers' speeds (p=0.07), with the latter actually increasing, albeit insignificantly.

4.5.3   Children's Perceptions (Grades 4-8)

Children even more than their parents reported important significant changes in their perceptions of AST barriers (see Table 4.2). Foremost, children reported higher levels of autonomy as their permission to both walk (p=<0.01) and cycle (p=<0.01) to/from school saw significant improvements. Perceived social and convenience barriers such as bullying (p=<0.01), crime (p=<0.01), the commute not being fun (p=<0.01), and the daily commute being easier to drive (p=<0.01) all saw significant declines. Last, the perceived community safety barriers of drivers' speed (p=<0.01), traffic safety (p=<0.01), and worries about commuting alone (p=0.01) were also reduced.

Table 4.2 Changes in children's perceptions of AST from baseline to follow-up

	Baseline				Follow-Up				p
	Strongly Disagree (%)	Somewhat Disagree (%)	Somewhat Agree (%)	Strongly Agree (%)	Strongly Disagree (%)	Somewhat Disagree (%)	Somewhat Agree (%)	Strongly Agree (%)	
TPB: Attitude Perceptions									
Route feels unsafe due to traffic	53.8	18.2	14.3	13.7	65.6	18.1	9.5	6.8	**<0.01**
Streets too busy to cross	56.7	16.8	14.6	11.8	67.3	17.5	8.9	6.4	**<0.01**
Drivers speed on streets	38	28.1	4.3	2	40.1	36.1	16.3	7.5	**<0.01**
Feels unsafe because of crime	65.4	16.2	11.6	6.8	75.1	14.9	3.8	6.2	**<0.01**
No bike rack	66	18.2	10.8	5	76.6	10.7	7.4	5.3	**<0.01**
Route is boring	57.7	21.5	13.7	7.2	66.1	18.4	8	7.4	**<0.01**
Not fun to walk/bike	61.5	21.2	10.2	7	68.8	17.3	6.4	7.5	**<0.01**
Afraid of being bullied/teased	74.5	14.3	8.1	3.1	81.6	13.7	2.4	2.3	**<0.01**
There are lots of trees in area	14.4	21.7	27.1	36.7	8.5	18.1	33	40.4	**<0.01**
Unsafe to walk alone	67.3	16.6	8.8	7.3	71	20.1	5.6	3.3	**0.01**
Unsafe to walk with friends	79.8	12.7	3.5	4.1	87.9	8.7	2.1	1.3	**<0.01**
Too much stuff to carry	52.7	26.5	15	5.8	61.1	25.1	9.9	3.8	**<0.01**
Too hot/sweaty	63.8	23	8.5	4.7	66.7	23.1	7.7	2.5	0.08
TPB: Perceived Behaviour Control Perceptions									
Allowed to walk	26.8 (No)			73.2 (Yes)	20.2 (No)			79.8 (Yes)	**<0.01**
Allowed to bike	49.2 (No)			50.8 (Yes)	38.5 (No)			61.5 (Yes)	**<0.01**
Not enough sidewalks	60.3	16.2	13	10.5	74.2	14.9	5.7	5.2	**<0.01**
Not enough bike paths/lanes	48	17.1	19.4	15.5	70.1	13.8	9.1	7	**<0.01**
Bicycle lanes/trails easy to get to	31.3	22.3	24.8	21.7	25	22.1	28.7	23.1	**0.02**
No skills to bike	77.6	9.6	6.6	6.2	85.5	6.5	2.9	5.2	**<0.01**
TPB: Subjective Norm Perceptions									
Easier to drive	45.3	17.1	18.9	18.7	52.5	15	17.5	14.9	**<0.01**
Too far to walk/bike	61.4	15.2	10.3	13.1	69.8	17.1	5.5	7.7	**<0.01**
No one to walk/bike with	67.7	14.1	10.3	7.8	69.3	14.2	8.9	7.6	0.40

*Significant results **bolded**. p=<0.05

Children also reported improvements with recognizing features of the physical environment and other AST facilitators in the context of their daily commute. For example, they identified a lack of sidewalks (p=<0.01) and bike paths/lanes (p=<0.01) as less of a barrier at follow-up. They also reported having lots of trees on the streets of their route to school (p=<0.01) and good access to bicycle lanes (p=0.02), the latter complementing their reported improvements in ability perceptions like a lack of cycling skills (p=<0.01) declining.

4.5.4   AST Commuting Behaviours

4.5.4.1   AST Trips

Initial analyses (see Table 4.3) illustrate that some significant shifts in AST commuting trips occurred from baseline to follow-up. Trips to (p=0.02) and from (p=0.02) school significantly increased, whereas the total to and from trips did not (p=0.10). When controlling for age, gender, and distance in our multiple linear regression models, the baseline to follow-up active travel commutes (see Table 4.4) were no longer significant for any trip. AST trips to school (β= 0.073; p= 0.32; CI [95%]: -0.07 to 0.22), from school (β= 0.106; p= 0.13; CI [95%]: -0.03 to 0.25), and total trips (β= 0.003; p= 0.81; CI [95%]: -0.24 to 0.30) were also non-significant from baseline to follow-up.

Table 4.3 Changes in children's trips to/from school by AST vs by car

Single Trip	Baseline					Follow-Up					p
	0-1 Day (%)	1-2 Days (%)	2-3 Days (%)	3-4 Days (%)	4-5 Days (%)	0-1 Day (%)	1-2 Days (%)	2-3 Days (%)	3-4 Days (%)	4-5 Days (%)	
Number of days actively traveling to school	45.5	3.9	6.9	3.5	40.2	42.3	3.6	7.7	4.6	41.8	**0.02**
Number of days actively traveling from school	41.7	4.8	4.9	5.9	42.5	38.3	3.9	6.5	6	45.3	**0.02**
Number of days traveling to school by car	58.1	5.8	8	2.2	25.9	60.4	4.8	8.5	3.1	23.1	**0.04**
Number of days traveling from school by car	62.3	5.2	6.2	4.3	21.9	63.4	6	7.7	3.9	19	0.09
Total Trips	0-2 Days (%)	2-4 Days (%)	4-6 Days (%)	6-8 Days (%)	8-10 Days (%)	0-2 Days (%)	2-4 Days (%)	4-6 Days (%)	6-8 Days (%)	8-10 Days (%)	
Number of days actively traveling to/from school	41.3	5.5	9	5.9	38.3	37.9	5.9	10	6.4	39.8	0.1
Number of days traveling to/from school by car	57.3	7.1	11.5	3.7	20.4	58.5	8.3	11.7	4.1	17.4	**0.01**

*Significant results **bolded.** p=<0.05

Table 4.4 Changes in children's trips to/from school by AST (multivariable models)

	Model 1: AST to & From School			Model 2: AST To School			Model 3: AST From School		
	β	p	CI [95%]	β	p	CI [95%]	β	p	CI [95%]
Constant	3.621	0.00	3.18, 4.06	1.822	0.00	1.59, 2.06	1.767	0.00	1.54, 1.99
Follow-Up (referent: Baseline)	0.033	0.81	-0.24, 0.30	0.073	0.32	-0.07, 0.22	0.106	0.13	-0.03, 0.25
Gender (referent: Girl)	0.032	0.81	-0.24, 0.30	0.024	0.74	-0.12, 0.17	0.023	0.75	-0.12, 0.16
Age	0.309	**<0.00**	0.26, 0.35	0.144	**<0.00**	0.12, 0.17	0.172	**<0.00**	0.15, 0.20
Distance (in 100-metres)	-0.011	**<0.00**	-0.01, -0.01	-0.006	**<0.00**	-0.01, -0.00	-0.005	**<0.00**	-0.01, -0.00
R²	0.06			0.05			0.07		

*Significant results **bolded**. p=<0.05, β=standardized coefficient

4.5.4.2　By Car Trips

The rise in AST trips seen in our initial analysis (see Table 4.3) coincided with a few significant decreases in personal car trips. Personal vehicle trips to school (p=0.04) and overall car trips to and from school (p=0.01) significantly decreased. However, there was no statistically significant change in trips by car from school (p=0.09). Similar to the regression modelling of AST commuting behaviour, when controlling for gender and age, the outcomes for personal car trips to school (β=-0.05; p=0.38; CI [95%]: -0.17 to 0.07), from school (β=-0.04; p=0.46; CI [95%]: -0.15 to 0.07), and overall (β= -0.138; p= 0.21; CI [95%]: -0.35 to 0.08) from baseline to follow-up were no longer significant (see Table 5).

Table 4.5 Changes in children's trips to/from school by car (multivariable models)

	Model 4: By Car To & From School			Model 5: By Car To School			Model 6: By Car From School		
	β	p	CI [95%]	B	p	CI [95%]	β	p	CI [95%]
Constant	5.067	0.00	4.72, 5.42	2.564	0.00	2.37, 2.76	2.601	0.00	2.42, 2.78
Follow-Up (referent: Baseline)	-0.138	0.21	-0.35, 0.08	-0.053	0.38	-0.17, 0.07	-0.043	0.46	-0.15, 0.07
Gender (referent: Girl)	-0.267	**0.01**	-0.48, -0.05	-0.131	**0.03**	-0.25, -0.01	-0.128	**0.02**	-0.24, -0.02
Age	-0.240	**<0.00**	-0.28, -0.20	-0.108	**<0.00**	-0.13, -0.09	-0.136	**<0.00**	-0.15, -0.12
R^2	0.04			0.03			0.03		

*Significant results **bolded**. $p = <0.05$, β=standardized coefficient

The overall incidence of active commute trips among children to and from school saw no significant increases from baseline to follow-up when analyzed controlling for known AST correlates. Trends remained for both increasing active travel trips and decreasing the personal vehicle trips within these analyses, though.

4.6 Discussion

This study evaluated the impact of an STP intervention between baseline and a two-year follow-up on children's and parents' perceptions of AST barriers, as well as children's AST commuting behaviours at 13 elementary schools. Results of our analysis show that the two-year STP intervention was successful at positively influencing child and parent perceptions of AST barriers and their awareness of AST facilitators, but did not demonstrate significant behaviour changes. For the purposes of this discussion, we interpret the results of the STP intervention within the frame of TPB. As noted previously the TPB is a mediational framework which posits that, in theory, the effects of one's attitudes, perceived behavior control, and subjective norms regarding their performance of a behavior mediate their intention to perform the behaviour in question. Moreover, given the dyadic nature of a family's decision to allow their children to engage in AST, specifically that parental controls greatly impact a child's engagement in AST, we adapted Cook et al.'s (2018) TPB-informed actor–partner interdependence model for healthy physical coactivity to illustrate the complexity of the AST decision (see Figure 4.1).

Figure 4.1 Theory of planned behaviour and active school travel model
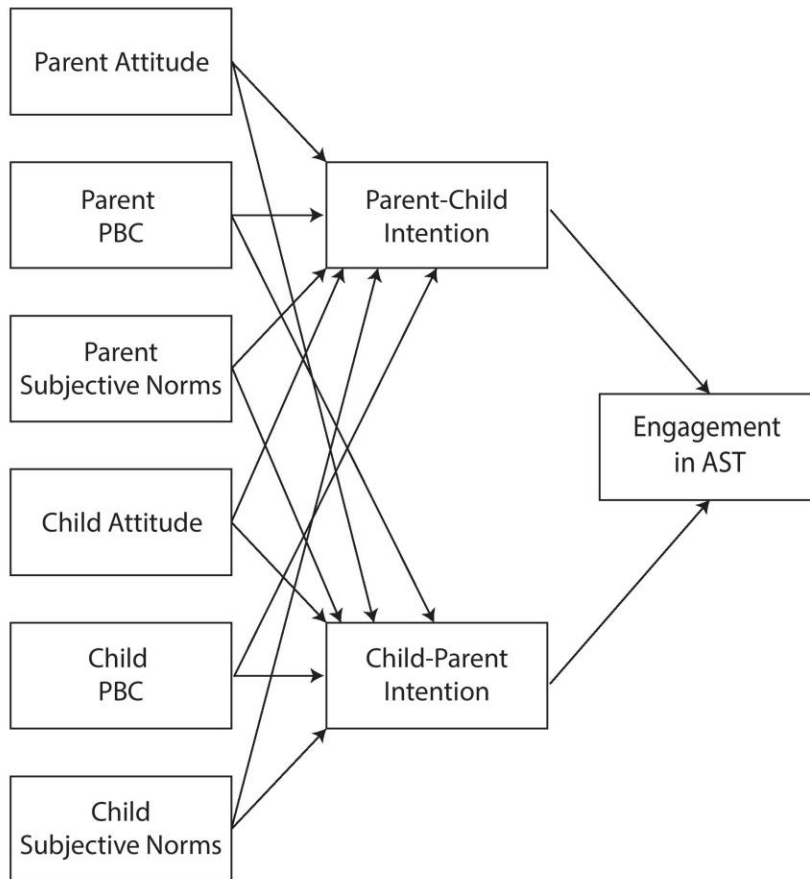
More specifically, Figure 4.1 illustrates the interdependence that exists within the AST decision making process. The actor–partner interdependence model integrates a view of the AST decision wherein one individual's or actor's outcome (children's engagement in AST) depends on another's or partner's (parents) characteristics relating to the issue (Kenny, Kashy, & Cook, 2006). Each one of the 12 paths from the first column to the second represent the different potential actor and partner effects with respect to the intent to engage in AST, as it relates to both the child and parent decision making processes. Ultimately, this figure displays potential

hypotheses to explore when understanding the impacts of the STP program on child and parent perceptions, as well as commuting behaviours.

4.6.1   Intervention Impact on Perceptions

The STP intervention had a positive effect on parental perceptions of AST barriers. Parents are typically reluctant to let children actively commute due to concerns associated with strangers, traffic (Carver, Timperio, & Crawford, 2008), a lack of confidence in cycling skills (Ducheyne, De Bourdeaudhuij, Spittaels, & Cardon, 2012) and their being too young (McMillan, 2007); the STP addressed a number of these perceived barriers in a positive manner. Particularly encouraging were the findings of declines in perceived barriers related to commuting preferences, the most notable result being the successful lowering of traditional convenience hurdles such as the trip being 'easier to drive' or 'too far' for AST. However, there are certain parental perceptions that were not as affected by the intervention, particularly known AST facilitators such as the presence of cycling and walking paths (Clark, Bent, & Gilliland, 2016), sidewalks (Ewing, Schroeer, & Greene, 2004), and trees/greenery/parks (Carver et al., 2005).

In the frame of TPB, the STP intervention appears to have improved parents' perceptions regarding PBC and subjective norms in a manner that suggests they have more pro-AST intentions at follow-up. Perhaps most importantly, parents reported a greater belief that their children have the ability and are better equipped to engage in AST, which is critical as autonomy has been recognized as an important influence on children's independent mobility (Alparone & Pacilli, 2012). Additionally, it is encouraging that parents have also subscribed to more constructive subjective norms regarding AST. For instance, at follow-up, reported perceptions relating to social pressures such as commuting children via passive travel modes (i.e., convenience) and AST taking too much time had declined among parents; these are important characteristics to note as parents are the ones that report time pressure concerns (Lorenc et al., 2008). In contrast, the third determinant of intention, attitude, did not seem to be as clearly altered. Findings reflecting parental attitudes illuminate that initiatives to improve perceptions of traffic, neighbourhood, and vehicular safety were much less cogent. Thus, even though parents' perceptions suggest that their PBC and subjective norms positively shifted to support AST

engagement at follow-up, their intentions regarding AST are muddied by their attitudes remaining seemingly more obstructive than facilitating.

Even more than their parents, children's perceptions of AST barriers appear to have been influenced by the STP program, especially their awareness of built environment characteristics, the safety of AST commuting, and the increase of autonomy to participate in AST. Each of these specific concerns – perceived traffic safety (Sallis et al., 2013), personal safety (Kirby & Inchley, 2009), and parental controls (Foster, Villanueva, Wood, Christian, & Giles-Corti, 2014) – have all been previously noted as key barriers to AST. Improving children's perceptions of these barriers represents an important achievement for the STP program in helping to facilitate AST commuting behaviours in the future. This significant increase in children's allowance to walk and the declines in perceived traffic safety, though, were not fully shared in the parents' findings. Other studies have found that the two groups can diverge on perceived barriers (e.g., Huertas-Delgado et al., 2017); in the present study this may be due to children being exposed to several STP intervention initiatives at their school (promotional events, safety assemblies, education videos, etc.) which their parents would not be exposed to.

Our findings also suggest that all three determinants noted in TPB as impelling intention among children appear to have been positively influenced by the STP intervention. Children's perceptions related to their attitudes, behavioural control, and social norms at follow-up all highlight that strident shifts within their intentions occurred, which implies that they want to engage in AST. Although these indicators illustrate a uniformly positive impact, it is important to keep in mind that children may not fully comprehend the scale of certain issues (e.g., neighbourhood crime) to the same extent as their parents. Moreover, when coupled with the intervention taking place mostly in schools and directed at students, these findings likely reinforce an intervention dose-response gradient, wherein significantly different levels of program exposure unevenly influenced the reporting of parents and children.

4.6.2   Intervention Impact on Commuting Behaviours

Changing the physical activity behaviours of children is a notorious challenge for health researchers (e.g., Baranowski et al., 2011; Barnett, Morgan, van Beurden, & Beard, 2008; Møller et al., 2014), and our evaluation further confirms this notion. The initial results suggested that

important behavioural changes were occurring over the duration of STP intervention, but our multivariable regression models only support that modest behavioural trends emerged. Nevertheless, given the continuing trends of declining children's independent mobility (Shaw et al., 2015; Shaw et al., 2013), these observed modest behaviour changes could be viewed as a success for the intervention in the short-term. The influence of age, gender, and distance were further reinforced as important variables influencing AST in this study.

Taken with the discussions related to perceptions, the intervention has helped improve children's attitudes, PBC, and subjective norms regarding AST, potentially to the point of their wanting to alter commuting behaviour; however, the interdependence between children's and parent's perceptions related to the AST decision seems to be a barrier encumbering the facilitation of AST behaviour change. In other words, these results may point to what can be described as an intention-to-behaviour gap that exists within the interdependent relationship between children and parents regarding their AST decision making processes. The STP program has taken first steps to addressing this gap but given the complexity of physical activity behaviour change, this should be an issue that is approached with a long-term focus. Based on research examining the contextual influence of schools (Guldager, Andersen, von Seelen, & Leppin, 2018), it would be worthwhile to explore how behaviour change is best achieved through school communities taking a long-term approach of developing supportive social environments, a concept that has been evaluated in other fields such as education (e.g., Fullan, 2007; McLeskey & Waldron, 2006).

4.6.3   Future Interventions, Implications for Policy and Practitioners

Our situating of the STP intervention in the Theory of Planned Behaviour posits that the program's multiple strategies model (the SRTS "Es") can be a sagacious approach to AST intervention programming. Of all the different strategies utilized in the STP model, based on our results, it is our estimation that education initiatives were likely the most correlated with effectiveness, as they can be complementary to many other strategies. For instance, the awareness of engineering or built environment changes can arise as a consequence of the prompting from education campaigns. As previously noted, the STP intervention also seemed to considerably change perceptions about social issues such as bullying and teasing, AST being fun,

and crime and neighbourhood safety. Encouragement, along with education strategies, could have been the main drivers for the aforementioned developments by increasing the opportunities for and knowledge of the benefits about AST commuting. It is difficult to decipher from this evaluation what specific effects enforcement and engineering strategies may have had, especially with their primary aim being to support longer-term behaviour change goals.

Like other studies (e.g., Terrón-Pérez, Molina-García, Martínez-Bello, & Queralt, 2018), our findings suggest that future interventions would be prudent to focus on parental education, motivation, and empowerment strategies to successfully achieve AST behaviour change through specifically targeting their attitudes. In particular, emphasis should be placed on strategies that target parental perceptions of their local built environment features (e.g., location of pedestrian crossovers, access points for paths/trails), AST skills (e.g., how to use a crosswalk light, how to cross 4-way intersections), and social cohesion (e.g., walking school buses, walking buddy systems). Put another way, to facilitate the intention change necessary to produce the desired AST behaviour outcomes, future strategies would do well to support parents believing that AST is a relatively facile, accessible, and socially desirable and beneficial way to commute. To this point, Fusco et al. (2012) found that children who commute actively to/from school had greater opportunities to reflect on social interactions, while Ramanathan et al. (2014) found that parents who are involved in AST reported more positive emotions versus passive travelers. Additionally, a recent meta-analysis which included adults found that nearly twice as many people (36%) fail to translate their physical activity intentions into behaviours than simply have no intention to be active (21%) (Rhodes & Bruijn, 2013); therefore, future interventions should seek to empower parents, those who pose more of an obstacle in the interdependent decision making process, by educating them on the accessibility and benefits of AST in furtherance of developing more nuanced attitudes that aid in their intentions manifesting into behaviours.

4.6.4   Study Limitations

Within our novel case study of a regional ASRTS program there are a few limitations to note. Foremost, the use of a serial cross-sectional design limits the ability of this study to identify cause and effect relationships, thus making it difficult to assess if the observed changes in AST perceptions and behaviours reflect a trend or simply the differences between two different groups

of participants. But given that each school's demographics and catchment areas remained relatively unchanged over the two-year time period, this is an acceptable constraint for a study this large in scale. The self-reporting nature of our data collection process also makes this study subject to a level of recall bias. Parents may have inaccurately recalled or assessed their children's average weekly commuting behaviours. Our survey tool was also only offered in English, and as a result we may have lost the input of a small but nevertheless important proportion of families at participating schools who have limited English skills. Finally, most schools that decided to participate in the STP program, and were subsequently evaluated, were mid-high socio-economic status schools which possessed more resources and social capital than their lower socio-economic status counterparts. Conclusions should not be assumed to be representative of the ASRTS program's effectiveness across differently classified SES schools and communities.

4.7 Conclusion

Here we have presented a quantitative case-study evaluation of a regional two-year STP intervention at 13 elementary schools, finding that the program is effective in altering parents' and children's perceptions of AST barriers, but not their commuting behaviours. Within the Theory of Planned Behaviour, our findings suggest that potential next steps for AST intervention programming should be to focus on parental education and empowerment. Another identified area for future stakeholders of AST interventions to focus their efforts is on taking longer-term approaches such as building supportive environments, or pro-AST cultures, in schools to procure meaningful behavioural changes. Future research would be prudent to conduct longitudinal studies focusing on how multiple strategies to support AST can support one another. Understanding the interplay of multiple initiatives holds the potential to provide helpful insights on how intervention facilitators and stakeholders can more appropriately and efficiently spur the development of changing school culture.

4.8 Acknowledgements

4.9   References

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Chapter 5

5   Synthesis and Conclusion

5.1   Summary of Studies

This thesis conducted an examination of the functioning and effectiveness of the STP intervention model. First, a systematic collection and analysis of the state of AST intervention evaluation studies in North America (Chapter 2) was presented, subsequently setting up an investigation of the implementation and sustainability of the STP intervention model (Chapter 3), and then an examination of the effectiveness and impacts of the STP program (Chapter 4). Each of the three integrated manuscripts contributed in separate but complementary ways to the fundamental purpose of this thesis: to advance the knowledge and evidence supporting AST interventions as an effectual and feasible public health collaboration, along with being a desirable strategy for schools and their surrounding communities to pursue to improve children's health and well-being.

The first of three manuscripts integrated in this thesis, the systematic review (Chapter 2), documented and evaluated the state of AST intervention studies in North America. By limiting the scope of literature to a smaller geographic area, this review pointedly set up the contributions of the two following chapters by identifying the relevant research gaps and areas of improvement for future intervention evaluations. From an original search of 9,013 title screens, 22 primary research studies from across Canada and the United States were identified and thematically analyzed using the SRTS 6E's (Safe Routes to School National Partnership, 2017). Findings of note include encouragement, education, and engineering approaches being the most popular strategies of AST interventions, and that there was little description of the supporting partnerships themselves.

John Kingdon's prominent Multiple Streams Approach (MSA) was applied to frame the discussion of the review in a practical fashion for AST intervention stakeholders, facilitators, and evaluators. Using the MSA, the discussion suggested methods by which potential policy windows could be identified and exploited to create change and improve future intervention programming. Importantly, it is recommended that AST partnerships should focus more on better

understanding the levels of support from different institutions (i.e., public health organizations, schools, community non-profits etc.), and that facilitators look beyond solely identifying their school's preferred strategies and desired outcomes and instead assess the perceived urgency of their school's AST issue(s), required resources, available support networks, and community capacity. It is also noteworthy for evaluators to understand which tools are complementary when looking to properly assess interventions.

Having identified a lack of information regarding the partnerships and collaborations which implement AST interventions in the preceding systematic review, the second manuscript of this thesis (Chapter 3) offers a qualitative investigation of the functioning, implementation, and sustainability of the STP model. Key stakeholder (i.e., public health nurses, principals, and STP committee members) perspectives regarding the entirety of the STP intervention process, from setup to evaluation, are examined. Eighteen interviews with program facilitators (i.e., principals and PHNs) and four focus groups with the larger STP committees (e.g., teachers, parents, community enforcement representatives) representing ten schools throughout the ELMO region were completed. During this evaluation several exhaustive conversations were completed which critically interrogated the STP model's structural advantages and shortcomings, and the perceived self-efficacy and sustainability of those who have operated within the program. A process of deductive and inductive coding followed by a thematic analysis was undertaken to investigate participants' perspectives.

The analysis resulted in six themes that spanned across two lines of the STP intervention. With respect to the first category of findings, implementation, it was found that accounting for school context, establishing leadership and committee capacity, and supporting STP action were the overarching trends. For the second category, sustainability, responsiveness to external and internal barriers, engaging schools at the grassroots level, and building future champions were the predominant sentiments expressed. Kurt Lewin's Field Theory was utilized for the discussion and was employed to distinguish the facilitating and constraining forces associated with the STP model. Forces extending from the initial assessment of a school's context and administration through to long-term notions like the building of a school's culture were identified as important concepts relating to improving the intervention's sustainability. In general, results from this study provide evidence to support the notion that to design an AST intervention truly capable of

changing AST behaviours requires a long-term approach, competent and organized facilitators, and a committed collaborative of stakeholders. This study also illuminates the complexity of the intervention-school environment relationship and the importance of group dynamics in successfully navigating barriers and implementing the variety of different intervention strategies.

Building on the qualitative research, the third manuscript in this thesis (Chapter 4) quantitatively evaluated the STP intervention's impact on children's and parent's perceptions of neighbourhood AST barriers and facilitators, as well as children's AST commuting behaviours. Overall, 4,720 family and 2,084 youth surveys were collected and examined from 13 schools across the ELMO region. Mann-Whitney U tests were run to determine the difference in means of the perceived barriers for both groups from baseline to follow-up. The same tests were also run to compare means for AST commuting behaviours; however, subsequent multivariable modelling (i.e., multiple linear regression models) controlling for age, gender, and distance were successively run to better evaluate the commuting behaviour changes. Findings indicated that both parent's and children's perceptions of barriers significantly shifted in favourable directions, but only modest trends were found for AST commuting behaviour changes.

The Theory of Planned Behaviour (TPB) was applied to the results and discussion to interpret the findings from an intention-to-behaviour perspective. Within TPB, it is suggested that STP intervention did a quality job of increasing the intentions to actively commute among children, and to a lesser extent their parents. Parental perceptions of self-efficacy and social norms showed signs of improvement; however, their attitudes appeared to be holding them back from letting these more pro-AST intentions manifest into actual realized increased AST trips among their children. In light of these findings, it was recommended that AST interventions emphasize developing strategies that target parental education and empowerment strategies if they intend to achieve enduring AST behaviour changes. Initiatives that promote awareness of the local built environment, improving AST skills and safety knowledge, and social benefits of AST to parents could be worthwhile endeavors. Like the qualitative analysis, this chapter also reiterates the long-term nature of changing AST behaviours and the need to honestly address and build a more appropriate perspective into future intervention programming.

5.2   Research Contributions of Thesis

This mixed-methods evaluation of the ELMO ASRTS STP program adds an important case study and intervention analysis to the growing literature concerning AST interventions. To date, much of the research on AST interventions has examined one aspect or outcome of an initiative (Larouche, Mammen, Rowe, & Faulkner, 2018), and little work has been done on examining the entirety of a program. Comparing the results of the three articles contained in this thesis reveals a few unique and central findings. Specifically, the findings of this thesis call to attention the significance of themes related to capacity building, empowerment, and program design planning in AST intervention collaborations.

Analysis of the STP model in this thesis found that a wide array of concepts can influence intervention capacity building, which is a key to sustainable programming. While related fields have similarly found that there are a breadth of features connected with capacity building – examinations of building of healthy environments note utilizing several techniques (e.g., courses, workshops, and e-learning) to develop capacity and successful partnerships (Thompson, Kent, & Lyons, 2015) – this thesis expands this notion to AST intervention programming. Chief among all other contributions is the finding that capacity building begins at the earliest stages for intervention partnerships. It is particularly critical to properly measure a community's urgency in the nascent stages of an intervention regarding the specific issues at hand, as thorough assessments can help to maximize capacity through building an integrated network of proper partners. Several other concepts from across chapters 3 and 4 are also important to note in this context such as engaging schools at the grassroots level, identifying and developing AST champions and competent facilitators, ensuring a quality level of responsiveness to external and internal barriers, and improving parental motivation. In sum, capacity building can be critically important to consider at the individual, group, and school community levels as it can help to identify and successfully exploit policy windows and frame the perceived efficacy and sustainability of a program.

A second cross-study research contribution is the notion of empowerment in interventions. Key to building supportive environments or cultures wherein significant and sustained AST may be achieved, is the empowering of stakeholders, children, and parents through the intervention process. While concepts such as identifying champions to improve programming have been

discussed before (e.g., Atteberry et al., 2016), the findings of this thesis extend such ideas from merely the recognition of key individuals to more precise intervention approaches. Program facilitators and AST champions hold the potential to become proactive agents of change by empowering others through their organization methods and promotional techniques. For example, champions and facilitators can be especially critical during the early stages of an intervention where, as discussed in Chapter 2, they are responsible for properly assessing their program's agency to mobilize AST advocates, community partners, officials, and school administrators. With a clearly defined level of agency, partnerships may be better organized to ensure that all stakeholders in the collaboration are truly engaged, have an honest sense of responsibility, and are working to their full potential without feeling overwhelmed. Linking the discussion of Chapter 2 to that of Chapter 3, the notion of empowerment is again realized in the theme of 'active' and 'passive' school environments. School administrations which take initiative and are proactive in their strategic planning can play a pivotal role in empowering the STP partnership at their school by supporting their implementation of different initiatives. Finally, empowering parents is also important as their attitudes regarding AST commuting behaviours are critical (Zuniga, 2012). Chapter 4 encourages future interventions to consider that empowering parents through education and social awareness campaigns, and measures targeted to improve their perceptions about neighbourhood traffic safety, to give them the confidence to let their children actively commute.

The third research contribution is the importance of intervention design planning. Like empowerment, planning a program design is a fundamental aspect of the earliest stages of an AST intervention. Emergent ideas from this thesis include proposing that facilitators and evaluators need to plan ways to: i) successfully frame AST as a priority issue for their school community and relevant community partners and officials; ii) offer contextually appropriate strategies that enmesh local policy and politics in pursuance of creating a favourable intervention opportunity for the partnership to take advantage of; and iii) utilize complementary tools in their evaluation to account for the many different variables that are relevant to AST outcomes. To the first point, while other research has found that the support of the school leaders is imperative to effectiveness (Forman, Olin, Hoagwood, Crowe, & Saka, 2009; Guldager, Andersen, von Seelen, & Leppin, 2018), Chapters 2 and 3 suggest that engaging and receiving support from school administrators and other important stakeholders can also be critical to program sustainability.

Meanwhile, finding contextually appropriate strategies may be best determined by further considering the discussion in Chapter 4 and finding ways to promote AST as a *desirable lifestyle choice* for parents. Obtaining the support of central stakeholders like principals, cultivating strategies to effectively message motivating ideas to parents, and ensuring that proper evaluation tools are being used to maximize the knowledge insights gained from an evaluation, illustrate the potential that thorough program design planning can have in future intervention success.

Given that a number of reviews investigating physical activity interventions have concluded there are still many inconsistencies and uncertainty regarding the conditions of effectiveness (Metcalf, Henley, & Wilkin, 2012; Russ, Webster, Beets, & Phillips, 2015; Van Sluijs, McMinn, & Griffin, 2007), there is a continued need to advance intervention research. Here, in its evaluation of the STP intervention, this these offers several ideas and innovative approaches to AST intervention programming in furtherance of refining design, efficiency, and effectiveness.

5.3   Methodological Contributions

All three of the manuscripts contribute evidence about the importance and role that mixed-methods and particularly theory play in building more comprehensive evaluations of AST interventions. The outcomes and corresponding discussions from each study buttress the complexity of AST as an issue, and the necessity for theory in the conceptualization and comprehension of interventions, their approaches, and their functioning.

Unlike other existing systematic reviews which have investigated AST interventions, the study presented Chapter 2 is the first to apply a theoretical perspective to its discussion. The use of the MSA progressed the contribution beyond being another academic reporting by allowing for the analysis in the review to be interpreted by a wider audience. To this point, the MSA framed the results of the review in a manner that provided theoretical explorations of the key concepts of policy, politics, and problem streams explicitly to an 'on-the-ground' audience. Consequently, for the first time, intervention partnerships are offered an actionable framework that outlines, for example, how to identify and exploit valuable 'policy windows' that would not have otherwise been evident. Understanding AST interventions through the frame of the MSA should help agents of change and intervention stakeholders to more pointedly and efficiently focus their

energy and resources. By using theory in this systematic review, the potential for practical and pioneering insights and nuanced discussions is evidenced.

To the author's knowledge the qualitative evaluation of the STP intervention was potentially the first to apply Field Theory directly to an AST topic. Although organization or social change theories are popular in fields such as business (Aguilera, Rupp, Williams, & Ganapathi, 2007) and psychology (Oreg, Vakola, & Armenakis, 2011), they also hold much potential in physical activity research. By applying one of the more well-known organizational change theories directly to AST research, the qualitative review offers a novel but conceptually rigourous interpretation of an AST intervention partnership's organization and functioning. Similar to Chapter 2, the use of Field Theory resulted in a few important firsts: i) force field analysis of the perceived forces both inhibiting and facilitating a partnership's success and sustainability, and ii) an attempt to map an AST intervention partnership's environment. Ultimately, Field Theory facilitated a group level discussion that provides an original perspective for future intervention facilitators and stakeholders to assist in navigating the many obstacles and influences involved in implementation.

Commonplace in physical activity research is the use of the Theory of Planned Behaviour (Armitage & Conner, 2001), which was featured in Chapter 4. In contrast to a number of studies which use TPB more as an auxiliary consideration for their work, in the quantitative evaluation the utilization of TPB was far-reaching with the theory being used to inform the organization of results, the core content of the discussion, and future recommendations. The application of the three determinants of intentions was key in highlighting the distinct roles that several specific neighbourhood AST barriers and facilitators play in families' final commuting decisions. Furthermore, the depth of discussion provided by the TPB frame brought to light curious notions such as an intention-behaviour gap in the AST decision making process subsequently expanding the conversation and focus of AST study into new areas. Like Chapter 3, the results and discussion of Chapter 4 provide specific strategies that could be implemented to advance future intervention effectuality. Specifically, the application of TPB allowed for the quantitative evaluation's discussion to identify precise issues and hone in on specific strategy recommendations, rather than offer a nonspecific surface level analysis of an STP intervention that records differences in baseline and follow-up results.

Considering the depth and quality of the insights developed from the use of appropriate and thoroughly integrated theories in this these studies, this thesis illustrates the vital role that well-developed theory and complementary studies play in the generation of rigourous and practical AST intervention research. In the absence of theory, the interpretation and future citation of AST findings can be subject to an increased level of inconsistent understanding among readers. In this thesis, the research studies presented illuminate two important methodological contributions: i) that the use of theory to interpret AST results can produce practical, sound, and rigourous discussions that are accessible to a larger AST audience, and ii) that the proper utilization of theories to appropriately answer differing AST research questions is optimal for a truly comprehensive intervention evaluation.

5.4   Limitations

There are a few limitations within this thesis that should be acknowledged in the interpretation of the final synthesis. Recent systematic reviews continue to reiterate that research on AST (Ikeda et al., 2018) and AST interventions (Villa-González, Barranco-Ruiz, Evenson, & Chillón, 2018) deal with a large number of confounding variables, meaning that study on these topics is unlikely to develop an ideal design. Given this reality, the potential of the findings in each of the studies included in this thesis are limited by each study's research priorities and foci.

Perhaps the greatest limitation of the systematic review is the contextual nature of AST intervention research. As AST is very local, the confounding variables that are present in one case may be vastly different in another due to differences that could exist in the built environments, cultures and customs, climates, school zoning protocols, degrees of urbanicity, and school siting policies between two places. Bypassing the option to offer a meta-analysis, the influence of context makes interpreting results – to an extant – an inherently biased practice. Noting this limitation, the review's focus on North American AST literature can be seen as both a strength and limitation of the work: its specific focus is advantageous to a North American audience, however, the scope limits the transferability of its discussion to audiences on other continents. If expanded to a global scale, the diversity of AST intervention approaches, implementation strategies, partnerships, and outcomes documented would have surely expanded the results reported in this review and applicability of the discussion.

Chapter 3 points out that certain community partners were not interviewed, which occurred despite the use of an ASRTS program representative for a second interviewer in the focus groups. Using a program representative in this capacity was deemed important for participant buy-in, but it undoubtedly factored into the focus group discussions. The research group ultimately decided to accept the resulting influence of any related emotion and feeling as part and parcel of the constructed nature of qualitative data (Sergi & Hallin, 2011), and ensured that it critically reflected on differences and contrasts between the focus group and interview data. The second limitation here is the lack of incorporating teacher perspectives. An increased number of teacher perspectives would have been quite beneficial as they are integral parts of the school communities and cultures within which they work. Finally, with the primary focus of the study on facilitators and secondarily on committees, and consequently children were not prioritized. Having prioritized children may have resulted in a more complete view of the program, as the perspectives of those receiving the intervention would also have been captured.

In Chapter 4 there were a few broader limitations of note, particularly the influence of climate and a lack of objective measures. Seasonality has been found to be a predictor of physical activity (Tucker & Gilliland, 2007), but due to the scale of the study and the differing implementation strategies used at each school, it wasn't possible to control for this in the analysis. Meanwhile, objective measures such as GPS tracking units would have also helped to more accurately gauge the effects of the STP program on perceptions and behaviours. Such measures have been utilized in AST research studies before (e.g., Dessing, de Vries, Graham, & Pierik, 2014; Helbich et al., 2016; Voss, Winters, Frazer, & McKay, 2015), but were not feasible due to the scale of the intervention. All told, being able to ideally control for seasonality and use more objective measures may have led to more accurate results, as well as deeper insights about how perceptual and behavioural changes can vary throughout the school year.

5.5 Implications for Policy and Practice

Developing a lifestyle that contains more opportunities for physical activity for and the development of children is a desirable outcome for all Canadian families. This research aimed to explore one method (AST interventions) by which children have more opportunities to engage in daily physical activity and improve their quality of life and long-term health. By regularly participating in AST and raising their physical activity levels, children can increase their MVPA

by up to 17 min per day for primary school students (Martin, Kelly, Boyle, Corlett, & Reilly, 2016), thereby reducing the risk of cardiovascular disease (Andersen et al., 2006) and obesity (Riddoch et al., 2009). An increase in AST can also improve the environments that children live and play in by lessening the number of harmful pollutants in school areas resulting from motorized transports (De Nazelle et al., 2011). Findings from each of the three studies here provide supporting evidence for the realized effects and potential of AST interventions with respect to improving the health of Canadian children through policy and practice.

To begin, from Chapter 2, framing local policy, politics, and problem streams is an important first step in ensuring that the most appropriate approach and set of strategies are utilized during an intervention. Enlisting the support of the most relevant group of stakeholders should help future programs to best understand how to define their local AST issues. Moreover, by assembling a suitable collaboration of stakeholders, future partnerships should be better positioned to advance an agenda that builds supportive environments or cultures within their school community. Building one, or potentially more, program champions to organize and carry out a pro-AST agenda in a school is also important in this regard as they can facilitate improved functioning of the larger partnership through relationship building and good communication.

Secondly, there is no 'ideal' partnership or collaboration structure that can be applied to AST interventions across all contexts. When considering implementation strategies, collaborations must honestly assess the institutional and community support for their program based on their group's networks and capital. The competency of a partnership is also of paramount importance as, for instance, if a school community appears passive or to operate in a post factum manner, support for action plan items or responsiveness to potential barriers may wane or be lackadaisical. Based on the results of Chapter 3, one method collaborations could potentially seek to guard against these obstructions to functioning by seeking to include more teachers, parents, and those involved in the political process (i.e., municipal officials, ward/district councilors) and develop them into program champions. These three groups represent different access points to social support structures that influence AST and increasing their buy-in may have important consequences for future intervention organization, agenda setting, policy influence at the municipal or town level.

Finally, long-term approaches to AST intervention programming should become more of a mainstream perspective in relevant policy discussions to improve program sustainability. Changing commuting culture after decades of AST decline as well as the continued growth of our auto-oriented societies is not a two-year process, but a much longer-term progression (Buttazzoni, Coen, & Gilliland, 2018). School siting and zoning policy domains are obvious settings in this respect. With schoolboards in North America removing traditional zoning boundaries and siting more schools in low-density suburban areas (Beaumont & Pianca, 2002), AST interventions are facing new issues they traditionally have never planned for. In response to this changing of contextual influences, intervention facilitators and stakeholders need to continue to develop innovative strategies that frame the urgency of their issues in engaging ways for children and parents but maintain a long-term perspective. Initiatives such the "drive-to-five" promotion which encourages parents to park 5 minutes away from the school area and walk their children the rest of the way (North Vancouver School District, 2016) exemplify this nuanced approach to intervention programming.

Active school travel is in a new space where less children are engaging, more are being driven, new school siting is heavily oriented to suburbia, and phenomena such as low independent mobility are coalescing at the same time. Understanding the interactions and connections of these several emergent trends and adapting to and reversing many of them will be critical in future intervention policy development. Fundamentally, this thesis posits that at the core of this issue is finding methods to improve children's independent mobility and autonomy, and empowering families. Policy and practice concerned with parental education, supportive environments, and proactive and not reactive intervention strategies are identified in this thesis as ideal tactics for future AST partnerships to consider.

5.6   Recommendations for Future Research

In this final synthesis it is necessary to recognize the areas for future research to improve the robustness of AST intervention programming and study. Particular areas to focus on in the future include equity and AST, strategies to improve AST partnership buy-in and public support, and the identification of which AST strategies are most complementary.

As leading organizations like the U.S.'s SRTS National Partnership increasingly emphasize equity in their initiatives – the partnership recently added equity as the sixth of the 6E's in their program (Safe Routes to School National Partnership, 2017) – it would be prudent for future systematic reviews analyzing school-based AST interventions to examine programs with an equity lens. A review featuring equity in AST programming could help with providing more opportunities for children and families in lower SES neighbourhoods, or those with language and/or physical barriers, to participate in AST and learn safer commuting behaviours. Furthermore, an emphasis on equity would offer school administrators, parents, public health practitioners, local law enforcement agencies, and other stakeholders an often-overlooked perspective when promoting AST as commuting method in their communities. The publication of equity research would also aid AST intervention partnerships with understanding and identifying new obstacles related to AST, therefore helping to engineer nuanced strategies that focus on ensuring more equitable outcomes for traditionally marginalized populations (e.g., children with disabilities, language barriers).

Evaluations of AST intervention should also contemplate investigating strategies to improve AST partnership buy-in and public support. Building off findings from Chapters 2 and 3, a lacking aspect of AST research remains understanding the auxiliary aspects of partnerships or collaborations. Little is known about the motivations and expectations of the various stakeholders typically involved in AST interventions. Future research would do well to investigate stakeholder relationships and perspectives to understand their motivations, institutional supports, and perceived urgency regarding the AST issues at hand.

Notwithstanding its brief mention in the discussion of Chapter 4, the notion of understanding which AST strategies are most complementary likewise engenders further explanation. More thoroughly understanding the complementary aspects of different intervention strategies could help to improve AST intervention efficiency, as well as lower resource demands. When designing an AST intervention, partnerships have a myriad of factors to consider if they wish to see any sort of sustained success, and many of these variables are interconnected. It is imperative that partnerships facilitating AST programs more clearly and thoroughly understand how distinct strategies such as engineering, education, encouragement, enforcement, and equity can support the other strategies' goals. Ascertaining further details may help to streamline approaches,

personnel, resources, strategies, evaluation tools, and timelines in a manner that is both best suited to achieve their desired outcomes, as well as increase program efficiency.

5.7 Conclusion

Over the different chapters of this thesis, the principal objective was to comprehensively evaluate a regional AST intervention with respect to its implementation processes, long-term sustainability, and effectiveness in changing perceptions of AST barriers and commuting behaviours. Before the primary research studies, a systematic review of AST methodologies was conducted and noted, among other findings, information on partnerships supporting AST interventions were lacking. Noting this potential for research, the first primary study focused on examining STP partnerships, while the latter complemented that work by examining the effectiveness of these partnerships. When investigating STP implementation process and future sustainability, the findings of Chapter 3 suggest that to improve the efficiency and longevity of the STP model, broadly, attention should be paid to changing school culture. Apropos of the STP intervention's impact and effectiveness in altering AST perceptions and behaviours, Chapter 4's analysis submits that future programs should emphasize parental education strategies. Taken with the results of the systematic review, the research contents of the primary studies highlight the important role that capacity building, empowerment, proactive planning, directed strategic messaging initiatives (e.g., student education strategies), AST issue framing, and appropriate evaluative methods and theoretical frameworks play in AST intervention design, facilitation, and evaluation. This thesis provides policymakers, public health practitioners, school administrators, parents, and researchers with novel findings and concepts to improve local efforts to facilitate increased engagement in AST, and to improve children's overall health and well-being.

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Appendices

Appendix A Research ethics approval forms (3 forms, redacted)

Western Research

Research Ethics

Western University Non-Medical Research Ethics Board
NMREB Amendment Approval Notice

Principal Investigator: Dr. Jason Gilliland
Department & Institution: Social Science\Geography, Western University

NMREB File Number: 105635
Study Title: Active and Safe Routes to School Committee's School Travel Planning Evaluation

NMREB Revision Approval Date: June 14, 2016
NMREB Expiry Date: September 23, 2016

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Instruments	Focus Group Guide	2016/03/18
Instruments	Interview Guide	2016/03/18
Revised Western University Protocol	Received June 9, 2016	
Revised Letter of Information & Consent	Received June 9, 2016	

The Western University Non-Medical Science Research Ethics Board (NMREB) has reviewed and approved the amendment to the above named study, as of the NMREB Amendment Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

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Ethics Officer, on behalf of Dr. Riley Hinson, NMREB Chair

██

**Western
Research**

**Western University Non-Medical Research Ethics Board
NMREB Annual Continuing Ethics Approval Notice**

Date: August 22, 2017
Principal Investigator: Dr. Jason Gilliland
Department & Institution: Social Science\Geography, Western University

NMREB File Number: 105635
Study Title: Active and Safe Routes to School Committee's School Travel Planning Evaluation

NMREB Renewal Due Date & NMREB Expiry Date:
Renewal Due -2018/08/31
Expiry Date -2018/09/23

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed the Continuing Ethics Review (CER) form and is re-issuing approval for the above noted study.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), Part 4 of the Natural Health Product Regulations, the Ontario Freedom of Information and Protection of Privacy Act (FIPPA, 1990), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Ethics Officer, on behalf of Dr. Randal Graham, NMREB Chair

Western Research

Western University Health Science Research Ethics Board
NMREB Delegated Initial Approval Notice

Principal Investigator: Dr. Jason Gilliland
Department & Institution: Social Science\Geography,Western University

NMREB File Number: 105635
Study Title: Active and Safe Routes to School Committee's School Travel Planning Evaluation
Sponsor:

NMREB Initial Approval Date: September 23, 2014
NMREB Expiry Date: July 31, 2018

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Instruments	Youth Survey for children in Grades 4 to 8	2014/09/01
Caregiver Letter of Information & Consent	Parental Consent for Grade 4 to 8 Students	2014/09/01
Instruments	Parent Survey	2014/09/01
Letter of Information	Cover Letter for Parents with Children in Grades JK to 3	2014/09/01
Western University Protocol		
Assent		2014/09/05
Revised Letter of Information & Consent		2014/09/05

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the HSREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of HSREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Ethics Officer, on behalf of Riley Hinson, NMREB Chair, or Board Member designee

Ethics Officer to Contact for Further Information

This is an official document. Please retain the original in your files.

Appendix B STP evaluation – focus group script (2 pages)

STP Evaluation – Focus Group Script

Setting:

As part of the Evaluation phase, students/staff of the HEALab will conduct focus groups with school STP committees/ facilitators. Consider hosting a celebration with food (contact HEAL or Emily Van Kesteren for funding) where results/outcomes of the STP can be shared, focus groups can be run, and a presentation provided at the closing to inform attendees of how this information, and their contribution will make a difference in the bigger context.

Considerations:

- Does the school want to be kept anonymous?

STP Process Evaluation Focus Group Questions:

Welcome:

Hello, I'm _____ and we'd like to thank you all for coming to talk about the Active and Safe Routes to School (ASRTS) program with us. To begin, we would like to gain an understanding of your school's School Travel Plan (STP); how it started, how it function, what worked well, what didn't, etc.

Guidelines:

Our conversation today should take about 45- 60 minutes and will be audio recorded to make sure any important information shared is not missed and everything discussed today will be kept between us. Is everyone ok with that?

If we could hear from all of you that would be beneficial however, if there is a questions you do not want to answer that is fine. Your opinions will give us critical information from the point of view of a committee member and we would really appreciate your participation, as it will help us understand how to improve the STP process and improve the effectiveness of the program.

Overview of Topic:

1. Name, Organization, and what role did you plan in the STP?

2. Why did this school choose to do a STP and how did it begin?

Main Questions:

3. How did you learn about School travel planning?

4. The **baseline and follow up data collection** involved the process of parent surveys, youth surveys, traffic counts and walkabouts:
   4.1. What went well with the baseline and follow up data collection?
   4.2. What were the struggles?

5. How did you go about developing your Action Plan?
   5.1. How did you find this process?
      - What kind of support were you provided and how could it have been better?
   5.2. How did the results from the data collection help inform your action plan?
      - What did you learn?
      - How did it influence your action plan, if at all?
      - How could the results be more useful to the committee or the school?
      - What other purposes did you use the STP results for?

6. How was the **Action Plan Implemented?**
   6.1. What changes have you seen?
      - Specifically, what benefits have you seen to the STP?
      - Infrastructure? Behaviour or attitude changes? Partnerships?
   6.2. What resources and/or strategies did you use?
      - Did you require outside resources – Information? People? Materials? Ideals? Expertise? If so, who, what or from where?
   6.3. Did you achieve what you hoped to?
   6.4. What do you believe were key success factors?
   6.5. Were there items on your action plan you did not achieve? If so, what were they and what barriers prevented you from achieving them?
Next Steps / **Evaluation phase**

7. Where do you see the STP going from here at this school?
      - How do you think it should proceed? Or do you think it should?
   7.1. If it were to continue, what long-term support would you need?
   7.2. For each of you around the table, what role could you see yourself playing in the future and how is it different from the role you've had these last couple of years?
      - Could you give more? Or would it need to be less?
When only 20 minutes remain, jump ahead to the following questions…

For these final questions, I would like to go around the circle and have everyone share at least one response.

8. In hindsight, would you change anything? Why or why not?
9. Who were the key players or roles for success?
10. Who else would you have included?
11. What did you enjoy most about the STP Process?
12. What do you think would be important for others, who are considering starting an STP, to know?

Appendix C STP evaluation – facilitator script (3 pages)

<u>STP Evaluation – Facilitator Script</u>

Setting:

As part of the Evaluation phase, students/staff of the HEALab will conduct focus groups with school STP committees/ facilitators. Consider hosting a celebration with food (contact HEAL or Emily Van Kesteren for funding) where results/outcomes of the STP can be shared, focus groups can be run, and a presentation provided at the closing to inform attendees of how this information, and their contribution will make a difference in the bigger context.

Consideration:

- Does the school want to be kept anonymous?

STP Process Evaluation Focus Group Questions:

Welcome:

Hello, I'm _____, thank you for coming to talk about the Active and Safe Routes to School (ASRTS) program today. To begin, I would like to gain an understanding of your school's School Travel Plan (STP); how it started, how it functions, what worked well/ what didn't, etc.

Guidelines:

Our conversation today should take about 45- 60 and will be audio recorded to make sure any important information shared today will not be missed and everything discussed today will be kept between us. Are you ok with that?

I am interested in your thoughts and opinions about the STP process. If there is a questions you do not want to answer that is fine. Your answers will give critical information from the point of view of a facilitator/ school contact and it will help us understand how to improve the STP process and improve the effectiveness of the program.

Getting Started:

1. Name, Organization, and what role did you plan in the STP?

2. Why did this school choose to do a STP and how did it begin?

Main Questions:

3. How did you learn about School Travel Planning?
    3.1. Who has been involved in your STP?
        - What organizations or people were a part of the STP committee?
        - What roles did the play?
    3.2. Who coordinated and who facilitated the STP?

      3.2.1.   Do you feel these roles were filled by the appropriate people? Why or why not?

3.3. What was the structure of your STP committee?

      3.3.1.   How often did you meet?

- Who made decision and/or developed the Action Plan?

3.4. What about the STP structure and committee worked well and what would you change about it next time?

Now we are now going to go through the different phases of the STP to understand how it operated at your school; considering, what worked well, what didn't, etc.

4. The first phase of a STP is the **Set Up phase**:

    4.1. How was the school's readiness to undertake a STP gauged or identify?

    4.2. How was the school, school community or partners educated about STP?

    4.3. How could the Set Up phase have been improved?

5. The next step was **Baseline Data Collection** and begins with distributing parent surveys and consent forms:

    5.1. How did the parent surveys and receiving parent consent go at your school?

- What worked well?
- Any lessons learned?
- What was the response rate like – were they what you expected?

    5.2. The next step was using collected consents and conducting youth surveys. Tell me about your experience with the youth surveys.

- Who facilitated the surveys?

      5.2.1.   What are your overall thoughts of the parent and youth surveys? Were there any problems with the survey process?

    5.3. Traffic counts usually take place around the same time as the surveys. Please tell me about your experience with the traffic counts.

      5.3.1.   What time of year were they done? Did you find this a good thing or bad thing and why?

- What was your experience with recruitment?
- Organizing the counting locations?
- Transferring instructions to volunteers?

      5.3.2.   What are your overall thoughts of the traffic counts?

    5.4. After surveys and traffic counts are completed, the 'walkabout' takes place. How did you go about organizing and carrying out the walkabout?

      5.4.1.   How was this experience?

- Who did you have in attendance?
- Was there anyone missing that you thought should be there?

    5.5. Overall, what was your general impression with the baseline and follow up data collection (what went well/ were the struggles) (i.e., parent surveys, youth surveys, traffic counts, walkabouts)?

6. What action items were developed and what were implemented? (Do this with the minutes/notes from meetings and/or action plan)

7. How was the **Action Plan Implemented?**
   7.1. What changes have you seen?
      - Specifically, what benefits have you seen to the STP?
      - Infrastructure? Behaviour or attitude changes? Partnerships?
   7.2. What resources and/or strategies did you use?
      - Did you require outside resources – Information? People? Materials? Ideals? Expertise? If so, who, what or from where?
   7.3. Did you achieve what you hoped to?
   7.4. What do you believe were key success factors?
   7.5. Were there items on your action plan you did not achieve? If so, what were they and what barriers prevented you from achieving them?

Next Steps / **Evaluation phase**

8. Where do you see the STP going from here at this school?
      - How do you think it should proceed? Or do you think it should?
   8.1. If it were to continue, what long-term support would you need?
   8.2. What role could you see yourself playing in the future and how is it different from the role you have had these last couple of years?
      - Could you give more? Or would it need to be less?

When only 20 minutes remain, jump ahead to the following questions…

For these final questions, if you could share just one response.

9. In hindsight, would you change anything? Why or why not?
10. Who were the key players or roles for success?
11. Who else would you have included?
12. What did you enjoy most about the STP Process?
13. What do you think would be important for others, who are considering starting an STP, to know?

Appendix D Research ethics child/student assent form

How Do You Get To School?

Hello! We are researchers from Western University and we are doing a study in your school. We need students in Grades 4 through 8, like you, to help us learn how to make it easier to choose active transportation to and from school!

What are we going to study?
We all know that active transportation is great for the environment and your health. We'd like to know how you get to school or your bus stop and what is making traveling actively difficult in your neighbourhood.

What would you have to do?
If you agree to be in the study, we would like you to fill out a short survey on how you get to and from school, what you like about the journey, and what you would change about it. You will fill out the survey during class time with your peers. It takes about 15-20 minutes to finish but you can take as much time as you need.

Do you have to join this project?
No – you only join if you want to. You can also decide at any time that you would like to stop. We will never share your information with anyone else, even your parents, but you can ask to see it at any time. You can ALWAYS talk to your teacher or the researchers if you have any questions or worries.

I want to participate in this study!
If you would like to join this study, choose one of the following two options:

☐ I want to participate in the study

First and Last Name _____

Sign your name _____   Date _____

Signature of Teacher_____   Date _____

Appendix E ASRTS youth survey (5 pages)

School Travel Planning: Youth Survey

We need your help to better understand how to make your neighborhood safer and encourage active travel (e.g., walking and bicycling). Your honest answers to the items in this survey are very important to us. This will not take long to complete. Remember….

- We want to know what you think,
- There are no right or wrong answers, and
- Everything you tell us will be kept strictly confidential (secret).
- Try to answer all the questions.

Please answer these questions thinking about the house and neighborhood that you live in the most.

A.   General Information

1. I am a   O Girl   O Boy

2. How old are you?   ⑧   ⑨   ⑩   ⑪   ⑫   ⑬   ⑭

3. What grade are you currently in?   ④   ⑤   ⑥   ⑦   ⑧

4. How many people live (including yourself) in your main home?

    ②   ③   ④   ⑤   ⑥   ⊕

5. How many children (including yourself) live in your main home?

    ①   ②   ③   ④   ⑤   ⑥

6. Postal code at your main home (or closest main intersection): ___ ___ ___ ___ ___ ___

7. How many days a week do you live in your main home?

    ①   ②   ③   ④   ⑤   ⑥   ⑦

8. If you have a second home (where you sleep some nights), what is the

    postal code (or closest main intersection): ___ ___ ___ ___ ___ ___

9. Do you have asthma or regularly have breathing problems?   O Yes   O No

    a. If yes, do you use an inhaler?   O Yes   O No

10. Do you have a dog? O Yes   O No

    a. If yes, on how many days <u>last week</u> did **YOU** walk your dog?

      ⓪   ①   ②   ③   ④   ⑤   ⑥   ⑦

11. Have you and your family moved within the last 2 years? O Yes   O No

B.   Your Trip To and From School

The following questions are about how you get to and from school each day. Please <u>check the best answer</u>.

1. Do you own a bike? O Yes   O No

2. Do you live within walking distance of your school? O Yes   O No

3. How often in a normal week do you travel **<u>TO SCHOOL</u>** by:

	Never (0 Days)	Almost never (1 or 2 days per month)	Sometimes (1 to 2 days per week)	Frequently (3 to 4 days per week)	Always (5 days per week)
Walking	O	O	O	O	O
Bicycle/Scooter	O	O	O	O	O
Skateboard/Rollerblades	O	O	O	O	O
Car/Personal Vehicle	O	O	O	O	O
School Bus	O	O	O	O	O
City Bus	O	O	O	O	O

    a. When you travel from home **<u>TO SCHOOL</u>** (or the bus stop if your bused), who do you usually travel with (Check **ALL** that apply)?

      O Nobody   O Parent(s)
      O Brother(s) or Sister(s)   O Other Adult(s)
      O Friend(s)   O Other Student(s)

    b. Do you usually stop on the way to school?

      O No
      O Yes: Please specify (i.e., friend's house, variety store, before school activities)

      _____

4. How often in a normal week do you travel **FROM SCHOOL** by:

	Never (0 Days)	**Almost never (1 or 2 days per month)**	**Sometimes (1 to 2 days per week)**	**Frequently (3 to 4 days per week)**	**Always (5 days per week)**
Walking	O	O	O	O	O
Bicycle/Scooter	O	O	O	O	O
Skateboard/Rollerblades	O	O	O	O	O
Car/Personal Vehicle	O	O	O	O	O
School Bus	O	O	O	O	O
City Bus	O	O	O	O	O

a. When you travel **FROM SCHOOL** (or the bus stop if your bused) to home, who do you usually travel with (Check **ALL** that apply)?

O Nobody O Parent(s)
O Brother(s) or Sister(s) O Other Adult(s)
O Friend(s) O Other Student(s)

b. Do you usually stop on the way home from school?

O No
O Yes: Please specify (i.e., friend's house, variety store, after school activities)

_____

5. If you walk or bike to or from school, how long does it **USUALLY** take you (one way)?

O Between 1 and 10 minutes
O Between 11 to 20 minutes
O More than 20 minutes
O I don't usually walk/bike to or from school

6. If you had **YOUR** ideal choice, how would you **MOST** like to get to school each day **(Choose 1)**?

O Walk O Ride bicycle or scooter
O Ride skateboard or rollerblades O Driven in a car
O Take school bus O Take city bus

5

C.   Barriers to walking and biking to school

1.   Are you allowed to walk to school (some or all days)? O Yes   O No

2.   Are you allowed to bike to school (some or all days)? O Yes   O No

Does this stop you from walking/biking to school or to your bus stop?	Always No	Usually No	Usually Yes	Always Yes
3. It is too far or takes too much time	O	O	O	O
4. There are not enough sidewalks	O	O	O	O
5. There are not enough bike paths / lanes	O	O	O	O
6. The route is too boring	O	O	O	O
7. It feels unsafe due to traffic on the route	O	O	O	O
8. There are too many busy streets to cross	O	O	O	O
9. I get too hot and sweaty	O	O	O	O
10. There is no one to walk or bike with	O	O	O	O
11. It is not fun	O	O	O	O
12. I have too much stuff to carry	O	O	O	O
13. It is easier for someone to drive me	O	O	O	O
14. It feels unsafe because of crime (e.g., strangers, gangs, drugs)	O	O	O	O
15. I might get bullied / teased along the way	O	O	O	O
16. There is nowhere to safely leave a bike if I ride my bike to school	O	O	O	O
17. I don't think I have the skills to ride my bike safely	O	O	O	O
18. Other reason: _____	O	O	O	O

D.   Streets in Your Neighbourhood

Please tell us about your neighbourhood streets.	Completely No	Mostly No	Mostly Yes	Completely Yes
1. There are enough sidewalks on the streets in my neighbourhood	O	O	O	O
2. There are walking trails in or near my neighbourhood that are easy to get to	O	O	O	O
3. There are bicycle lanes or trails in or near my neighbourhood that are easy to get to	O	O	O	O
4. There are lots of trees along the streets in my neighbourhood	O	O	O	O
5. I know a lot of people in my neighbourhood	O	O	O	O

E.   Neighbourhood Safety

Please tell us about your neighbourhood's safety.	Completely No	Mostly No	Mostly Yes	Completely Yes
1. There is so much traffic along the street we live that it is difficult or unpleasant to walk	O	O	O	O
2. There is so much traffic along other streets near my home that it makes it difficult to ride my bike or play on the street	O	O	O	O
3. Most drivers go too fast while driving in our neighborhood	O	O	O	O
4. There is a lot of crime in my neighbourhood	O	O	O	O
5. It feels unsafe to walk by myself around my neighbourhood during the day	O	O	O	O
6. It feels unsafe to walk with friends or siblings in my neighbourhood during the day	O	O	O	O
7. I am worried about being alone or walking by myself in my neighbourhood and local streets because I am afraid of being taken or hurt by a stranger	O	O	O	O

You're finished! Thank you for all your help!

Appendix F Research ethics letter of information for parents (2 pages)

Research Project To Evaluate The Impact Of School Travel Planning on Children's Use Of Active Travel To And From School

Dear parent or guardian,

Dr. Jason Gilliland and his research team from Western University invite you and your child to participate in a study aimed at understanding how School Travel Planning may impact your child's use of active transportation to and from school. The study involves students from grades 4 through 8 at participating elementary schools across the counties of Elgin, Middlesex, Oxford, and the cities of London and St.Thomas.

What is being studied?

Our team is studying the barriers to active transportation to and from school, and the effectiveness of the School Travel Planning program in increasing the number of children and their families who choose active transportation. Through the distribution of family and youth surveys, we aim to learn what concerns you and your child(ren) have with the journey to and from school, and how that journey changes after action is taken to address identified concerns.

What will happen in this study?

If your child agrees to participate in our project, **your child will be asked to:**

Complete the *School Travel Planning Youth Survey*. Only children in grades 4 through 8 are invited to participate in the Youth Survey. This survey primarily asks children about the nature of, and how they feel about their travel to and from school. Surveys usually take about 15-20 minutes to fill out and will be done in their classroom at a time decided by their teacher. (Note: students not filling out the survey will be given quiet activities by their teacher to do at their desks).

As the child's parent/guardian, **you will be asked to:**

Complete the *School Travel Planning Family Survey*. The survey asks many of the same questions as the Youth survey, as well as questions about your household and your child's physical activity schedule. It usually takes about 10-15 minutes to fill out. The Parent Survey is completely voluntary – your child can still join the study themselves even if you decide not to fill out the Parent Survey. However, as the survey gives us critical information from the point of view of parents, we would really appreciate your participation. Family surveys will be sent home with each child in grade 4-8 and the youngest (or oldest) child in JK-Grade 3. If you receive more than one family survey, fill out a survey for each child in Grade 4-8, and only fill out a survey for your child(ren) in JK-Grade 3 if the walk to and from school is different from your child(ren) in Grade 4-8.

Do we have to participate in this study?

Your participation in this study is completely voluntary. You and your child do not have to

participate. You can each refuse to answer any survey questions, and can choose to leave the study at any time.

What are the benefits and risks if my child participates?

Research shows physical activity through active transportation to and from school can; improve physical and mental health, improve traffic and safety around your school, improve air quality and help the environment, have students arrive at school alert and ready to learn, and increase community connectivity. This study will help us to better understand the barriers of active transportation to and from school. The results will allow your School Travel Planning committee to develop an action plan to remove existing barriers to active transportation.

There is little risk to your child if he/she participates in this study, but there is a slight chance that you or your child may be uncomfortable sharing details of your family, such as economic status, to the researchers, which may be seen by your child's teacher while the survey is being collected. This is being minimized as follows. You or your child will not be personally identified or identifiable by name in any of the documents related to the study. All of the information collected in this study is kept strictly confidential. You and your child will be assigned a unique identification code – your name will not appear on any materials or data files except for this consent form. We will also be collecting postal codes to estimate the path your child(ren) take to and from school. The postal codes will be stored separate from other survey data. Furthermore, materials and data files will ONLY be viewed by members of the research team and will be stored in a locked filing cabinet until transferred onto a password protected computer in a secure facility at the University of Western Ontario. The results of this study will only be presented for groups so that children will never be individually identifiable.

If you or your child decides to leave the study at any time (even up to 30 days AFTER the study has been completed), any data collected from you or your child will be immediately destroyed and excluded from the analysis.

You do not waive any of the legal rights you would otherwise have as a participant in a research study.

Who do I contact if I have any other questions?

Should you have any questions or concerns about participating in this project, you can contact the lead researcher, Dr. Jason Gilliland, at the University of Western Ontario.

If you have any further questions regarding your rights as a study participant, please contact the Office of Research

This letter is for you to keep. Please complete the research registration section on the School Travel Planning Consent form for you and your child(ren).

Appendix G Research ethics survey front page and parent consent form (2 pages)

February 8, 2016

School Travel Planning – Family Survey

Dear Parent/Guardian:

Our school is taking part in a School Travel Planning (STP) project. STP promotes a healthy and safe school environment through the use of active transportation - walking and cycling to and from school. This project aims to do the following:

- Improve physical and mental health
- Improve traffic and safety around your school
- Improve air quality and help the environment
- Have students arrive at school alert and ready to learn
- Feel more connected to your community

School Travel Planning is an Active and Safe Routes to School program supported by many community partners including Western University, boards of education, parent and school councils, public health units, municipalities, police services and community organizations. In order to find out the concerns you have about your child's journey to and from our school, please take 10 minutes to complete this survey. Before you complete the survey, please review the Letter of Information attached to the back of this survey.

Family surveys will be sent home with each child in grade 4-8 and the youngest (or oldest) child in FDK-Grade 3. If you receive more than one family survey:

- Fill out a survey for each child in Grade 4-8 to match the youth survey they will fill out at school. Please complete the consent form (attached) to let them take part.
- Only fill out a survey for child(ren) in FDK-Grade 3 if the walk to and from school is different from child(ren) in Grade 4-8.

Please do not write your child's name on the survey.

Completed surveys (and youth survey consent for those in Grades 4-8) should be returned to the school with the child who brought it home by **Due DATE**.

If you have any questions, please contact: STP Facilitator: _____

We appreciate you taking the time to complete this survey.

_____

Principal

A note about privacy: To protect your privacy, this survey does not require you to provide your name. The mapping information will be used to establish which routes are the most common and where the key obstacles/barriers are along these routes. All information collected will be kept strictly confidential by researchers at Western University and all participants will remain anonymous.

If you would like to help with the School Travel Planning (STP) Committee at your school or help put STP plan ideas into action, please provide your name, email and telephone number below.

Name(s) _____

Email: _____   Phone: _____

active safe
routes to school
www.activesaferoutes.ca

Western

Parent / Guardian Consent Form (Grades 4-8)

To learn the concerns your child(ren) have with the journey to and from school, we ask that you allow your child(ren) in grades 4-8 to complete a *'youth survey'* during class time. The surveys are coded to match the parent and youth surveys together and to keep your names unknown. Please review the **Letter of Information** found at the end of the survey before providing your child consent.

**WE NEED YOUR PERMISSION TO HAVE YOUR CHILD
FILL OUT THE SURVEY AT SCHOOL**

I agree for my child _____ *(please print child's full name)* to fill out the youth survey.

_____
Teacher's Name

_____   _____
Parent / Guardian's signature   Date

Completed consent forms should be returned to the school with the child who brought it home by **April 13, 2016.**

If you have any questions, please contact: █████████████████████
████

Appendix H ASRTS family survey (10 pages)

Answer Selection: Correct = ● Incorrect = ⊠ ☑ ⊖

School Travel Planning: Family Survey

We need your help to make the School Travel Planning a success and to learn how to make your neighbourhood safer for walking. Your honest answers to the items in this survey are very important to us. This will not take long to complete.

A.   Household Information

1.   Please provide the following information for **each** child attending this school.

	Age					Grade				Sex	
										Male	Female
Child 1	③	④	⑤	⑥		Ⓚ	①	②		O	O
	⑦	⑧	⑨	⑩		③	④	⑤			
	⑪	⑫	⑬	⑭		⑥	⑦	⑧			
Child 2	③	④	⑤	⑥		Ⓚ	①	②		O	O
	⑦	⑧	⑨	⑩		③	④	⑤			
	⑪	⑫	⑬	⑭		⑥	⑦	⑧			
Child 3	③	④	⑤	⑥		Ⓚ	①	②		O	O
	⑦	⑧	⑨	⑩		③	④	⑤			
	⑪	⑫	⑬	⑭		⑥	⑦	⑧			
Child 4	③	④	⑤	⑥		Ⓚ	①	②		O	O
	⑦	⑧	⑨	⑩		③	④	⑤			
	⑪	⑫	⑬	⑭		⑥	⑦	⑧			

2. What is your relationship to the child (taking part in the study)?

    O   Mother

    O   Father

    O   Primary caregiver/Guardian

    O   Other: _____

3. Postal code of your child's primary home: ___ ___ ___ - ___ ___ ___

    a. How many days a week do they live at this address?

    ① ② ③ ④ ⑤ ⑥ ⑦

4. Postal code of your child's secondary home (if applicable): ___ ___ ___ - ___ ___ ___

5. How many motor vehicles in working order (cars, vans, trucks, and motorcycles) are there at your household?

    ① ② ③ ④

6. Do any of your children have any medical or physical limitation which prevents them from engaging in physical activity?

    O   Yes   O   No

B.   Additional Household Information

1. Please select the highest level of education the **child's mother** has completed.

    Grade: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

    College/University   O

    Graduate School   O

    Not applicable   O

2. Please select the highest level of education the **child's father** has completed.

    Grade: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

    College/University   O

    Graduate School   O

    Not applicable   O

3. Which of the following best describes the current work status of the **child's mother**?

   O   Employed full-time   O   Employed part-time

   O   At home with children   O   Unemployed

   O   Student   O   Other _____

   O   I prefer not to answer   O   Not applicable

4. Which of the following best describes the current work status of the **child's father**?

   O   Employed full-time   O   Employed part-time

   O   At home with children   O   Unemployed

   O   Student   O   Other _____

   O   I prefer not to answer   O   Not applicable

C.   School Travel Planning

1. Do you support ongoing School Travel Planning efforts to make the school area safer, healthier and better connected to the community, by focusing on ways to reduce the number of children travelling to and from school by car?

   O   Yes   O   No

D.   Your Child's Trip To and From School

The following questions are about how your child gets to and from school each day. Please <u>check the best answer</u> for your child and his/her school.

1. Does your child live within walking distance of their school (from their primary residence)?

   O   Yes   O   No

2. Is your child eligible to take a school bus to and from school (i.e., live in an area with a school bus)?

   O   Yes   O   No

3. Number of days per week your child **usually** travels **to** school by:

> For example, if your child always rides a school bus to school, check the 5 box in the row 'School Bus.'

	0	1	2	3	4	5
Walking	⓪	①	②	③	④	⑤
Bicycle/Scooter	⓪	①	②	③	④	⑤
Skateboard/Rollerblades	⓪	①	②	③	④	⑤
Car/personal vehicle	⓪	①	②	③	④	⑤
School Bus	⓪	①	②	③	④	⑤
City Bus	⓪	①	②	③	④	⑤

a. When your child travels **to** school (or the bus stop if bused), who do they travel with (Check **all** that apply)?

- O   Nobody
- O   Parent(s)
- O   Brother(s) or Sister(s)
- O   Other Adult(s)
- O   Friend(s)
- O   Other Student

b. If **your child is bused**, how does your child get **to** the bus stop (Check **all** that apply)?

- O   Not Bused
- O   Walking
- O   Car/personal vehicle
- O   Other (Please specify): _____

c. If you **drive your child** to school, where do you go after you **drop them off**?

- O   Not driven
- O   Go to work
- O   Go home
- O   Go to other destinations (please specify): _____

4. Number of days per week your child **usually** travels **from** school by:

> <u>For example</u>, if your child always rides a school bus from school, check the 5 box in the row 'School Bus.'

Walking	⓪	①	②	③	④	⑤
Bicycle/Scooter	⓪	①	②	③	④	⑤
Skateboard/Rollerblades	⓪	①	②	③	④	⑤
Car/personal vehicle	⓪	①	②	③	④	⑤
School Bus	⓪	①	②	③	④	⑤
City Bus	⓪	①	②	③	④	⑤

a. When your child travels home **from** school (or the bus stop if bused), who do they travel with (Check **all** that apply)?

O   Nobody   O   Parent(s)

O   Brother(s) or Sister(s)   O   Other Adult(s)

O   Friend(s)   O   Other Student

b. If **your child is bused**, how does he/she travel home **from** the bus stop (Check **ALL** that apply)?

O   Not Bused

O   Walking

O   Car/personal vehicle

O   Other (Please specify): _____

c. If you **drive your child** home **from** school, where are you coming **from** before you pick them up?

O   Not driven

O   Go to work

O   Go home

O   Go to other destinations (please specify): _____

d. If you **drive your child** home **from** school, where do you go after you **pick them up**?

    O   Home

    O   After school activities

    O   Go to other destinations (please specify): _____

5. If your child walks or bikes to or from school, how long does it **usually** take him/her (one way)?

    O   Between 1 and 10 minutes   O   Between 11 to 20 minutes

    O   More than 20 minutes   O   My child does not walk/bike to/from school

6. How long does it **usually** take your child to get to/from school each day (one way)?

    O   Between 1 and 10 minutes   O   Between 11 to 20 minutes

    O   More than 20 minutes

7. If you had your ideal choice, how would you most like your child to get to and from school each day?

    O   Walk   O   Driven in a car

    O   Ride bicycle or scooter   O   Take school bus

    O   Ride skateboard or rollerblades   O   Take city bus

8. When you were a child, how did you typically travel to school?

    O   Walk   O   Driven in a car

    O   Ride bicycle or scooter   O   Take school bus

    O   Ride skateboard or rollerblades   O   Take city bus

E. Barriers to walking and biking to school

1. Is your child allowed to walk to/from school (some or all days)?

    O   Yes   O   No

2. Is your child allowed to bike to/from school (some or all days)?

     O   Yes   O   No

It is difficult for my child to walk or bike to school or their bus stop because…	I strongly disagree	I disagree a little bit	I agree a little bit	I strongly agree
3. It is too far or takes too much time	O	O	O	O
4. There are not enough sidewalks	O	O	O	O
5. There are not enough bike paths / lanes	O	O	O	O
6. The route is boring	O	O	O	O
7. It feels unsafe due to traffic on the route	O	O	O	O
8. There are too many busy streets to cross	O	O	O	O
9. They get too hot and sweaty	O	O	O	O
10. There is no one to walk with	O	O	O	O
11. It's not fun for them to walk	O	O	O	O
12. They have too much stuff to carry	O	O	O	O
13. It is easier to drive them there	O	O	O	O
14. It feels unsafe because of crime (example: strangers, gangs, drugs)	O	O	O	O
15. They might get bullied or teased along the way	O	O	O	O
16. There is nowhere to leave a bike safely at school	O	O	O	O
17. They are too young to walk/bike to school	O	O	O	O
18. They don't have cycling skills to ride a bike safely on the street	O	O	O	O
19. Other reason: _____	O	O	O	O

F. **Streets in our neighbourhood**

Please check the answer that <u>best applies</u> to you and your neighbourhood	I strongly disagree	I disagree a little bit	I agree a little bit	I strongly agree
1. There are enough sidewalks on the streets in our neighbourhood	O	O	O	O
2. There are walking trails in or near our neighbourhood that are easy to get to	O	O	O	O
3. There are bicycle lanes or trails in or near our neighbourhood that are easy to get to	O	O	O	O
4. There are lots of trees along the streets in our neighbourhood	O	O	O	O
5. We know a lot of people in our neighbourhood	O	O	O	O

G. **Neighbourhood Safety**

Please check the answer that <u>best applies</u> to you and your neighbourhood	I strongly disagree	I disagree a little bit	I agree a little bit	I strongly agree
1. There is so much traffic along <u>the street we live on</u> that it makes it difficult or unpleasant for my child to walk.	O	O	O	O
2. There is so much traffic along <u>other streets near our home</u> that it makes it difficult or unpleasant for my child to <u>ride their bike or play on the streets</u> in our neighbourhood.	O	O	O	O
3. Most drivers go too fast while driving in our neighbourhood.	O	O	O	O
4. There is a lot of crime in our neighbourhood.	O	O	O	O
5. If feels unsafe to let my child walk <u>alone</u> around our neighbourhood <u>during the day</u>.	O	O	O	O
6. It feels unsafe to let my child walk around <u>with friends or siblings</u> in our neighbourhood <u>during the day</u>.	O	O	O	O
7. I am worried about my child being or walking <u>alone</u> in my neighbourhood and local streets because I am afraid of him/her being taken or hurt by a stranger.	O	O	O	O

H.   Mapping Areas of Concern

Please complete the following map by drawing and labeling (or describing in words) the route your child takes between home and school. If your child is bused, please indicate the route from home to your child's bus stop. Please indicate their mode of travel (i.e. walking, car/personal vehicle, etc.). Identify any locations that are of concern to you with a number (e.g. 1, 2, 3) and describe these in the table on the following page. If you run out space or the map is too small, please use the back of the survey to include any additional information you wish to share.

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Describe any areas of concern in this table.

Location (e.g., nearest intersection)	What do you think is unsafe in this area?
E.g. on ___Rd near ___St	E.g. Cars turn right without looking for pedestrians.
1.	
2.	
3.	

Other Comments:

Curriculum Vitae

Name: Adrian N. Buttazzoni

Post-secondary   The University of Western Ontario,
Education and   London, Ontario, Canada
Degrees: Sept 2016 – August 2018 (Conferred Fall 2018) M.Sc.
                      Health and Rehabilitation Science (focus: Health Promotion)

                      The University of Western Ontario
                      London, Ontario, Canada
                      2012 – 2016 B.A. (Hons) *with distinction*
                      Geography, Political Science

Honours and   Certificate of Merit for Academic Excellence (Department of Geography,
Awards: University of Western Ontario) (2016)

                      Canadian Association of Geographers – Ontario (CAGONT) Conference,
                      Best Student Paper in the Undergraduate Category. (2015)

                      Huron University College Entrance Award Scholarship (2012 – 2016)

                      Dean's Honour List (2012 – 2016)

                      Principal's Scholarship (Huron University College) (2012)

Related Work   Human Environments Analysis Laboratory Project Coordinator,
Experience: Elgin-St. Thomas-London-Middlesex-Oxford Active and Safe Routes to
                      School Program
                      March 2017 – February 2018

                      Research Associate,
                      Human Environments Analysis Laboratory
                      January 2016 – August 2018

                      Research Assistant,
                      The University of Western Ontario (Occupational Science)
                      January 2016 – December 2017

                      Teaching Assistant
                      The University of Western Ontario (Health Science)
                      January 2017 – December 2017

Conference and Community Presentations:	Buttazzoni A, Coen SE, and Gilliland J. Supporting Active School Travel: A Qualitative Analysis of Implementing a Regional Safe Routes to School Program (Poster Presentation). London Health Research Day, May 10, 2018, London, ON.
	Buttazzoni A. ELMO ASRTS Program Evaluation (2016-2018). Elgin-St.Thomas-London-Middlesex-Oxford Active and Safe Routes to School 2nd Annual Knowledge Exchange, April 10, 2018, London ON.
	Buttazzoni A, Shah T, and Gilliland J. The Use of GIS and Spatial Methods in Active School Travel Research: A Rapid Review. ESRI: GIS in Education and Research Conference, October 11, 2017, Toronto ON.
	Guest presenter in 'Geography 3465' on the topic "Comparing In-house vs Arms-length models of economic development delivery". Course Instructor: Dr. Godwin Arku. Date: Oct 23, 2016.
	2015 Canadian Association of Geographers – Ontario (CAGONT) Conference at Carleton University, Ottawa.
	Title of Paper: "*In-house vs Arms-length? A Comparative Analysis of Economic Development Models in Ontario, Canada*". October 23-24, 2015.
	Guest presenter in 'Geography 3465' on the topic "Comparing In-house vs Arms-length models of economic development delivery". Course Instructor: Dr. Godwin Arku. Date: Oct 15, 2015.
Publications	Buttazzoni, A. N., Van Kesteren, E. S., Shah, T. I., & Gilliland, J. A. (2018). Active school travel intervention methodologies in North America: A systematic review. *American Journal of Preventive Medicine, (55)*1, doi:10.1016/j.amepre.2018.04.007.
	Buttazzoni, A. N., Coen, S. E., & Gilliland, J. A. (2018). Supporting active school travel: A qualitative analysis of implementing a regional safe routes to school program. *Social Science & Medicine, 212*, 181-190. doi:10.1016/j.socscimed.2018.07.032