

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



Adrian N. Buttazzoni, BA,<sup>1,2</sup> Emily S. Van Kesteren, RN, MA,<sup>3</sup> Tayyab I. Shah, PhD,<sup>1,4</sup>  
Jason A. Gilliland, PhD<sup>1,2,4,5,6,7</sup>

**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:** This systematic review developed a key word search and applied it 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.

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### CONTEXT

Obesity rates among children aged 3–19 years in Canada and the U.S. have more than doubled since the late 1970s.<sup>1</sup> Although childhood obesity is a complex issue, one important contributing factor has been physical inactivity.<sup>2</sup> 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.<sup>3</sup> Similarly, more than 80% of adolescents in the U.S. do not meet their recommended guidelines for aerobic physical activity.<sup>4</sup>

From the <sup>1</sup>Human Environments Analysis Laboratory, Western University, London, Ontario, Canada; <sup>2</sup>Faculty of Health Sciences, Western University, London, Ontario, Canada; <sup>3</sup>Middlesex-London Health Unit, London, Ontario, Canada; <sup>4</sup>Department of Geography, Western University, London, Ontario, Canada; <sup>5</sup>Department of Paediatrics, Western University, London, Ontario, Canada; <sup>6</sup>Department of Epidemiology and Biostatistics, Western University, London, Ontario, Canada; and <sup>7</sup>Children's Health Research Institute/Lawson Health Research Institute, London, Ontario, Canada

Address correspondence to: Jason Gilliland, PhD, Western University, Social Science Centre, 1151 Richmond Street, London, Ontario, Canada, N6A 5C2. E-mail: [jgillila@uwo.ca](mailto:jgillila@uwo.ca)  
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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.<sup>5</sup> 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.<sup>6–8</sup> Concurrently, parental perceptions of safety have also limited children's opportunities to participate in AST.<sup>9</sup> 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.<sup>10</sup> 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.<sup>11</sup> 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,<sup>12</sup> as well as academic performance and preparedness.<sup>13</sup> 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,<sup>14</sup> and build richer social lives.<sup>15</sup> To increase participation levels, several different AST intervention models have been implemented throughout North America.

### 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.<sup>16</sup> Interventions to address AST, however, can take many forms. Intervention models include health promotions (e.g., walk to school days), community enforcement/safety initiatives (e.g., walking school bus), and infrastructure changes (e.g., building of sidewalks).<sup>17</sup> Although all forms have potential, there is still uncertainty over which AST intervention designs may be the most effective.<sup>18,19</sup> 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<sup>20</sup> will be used to categorize and analyze the interventions in this review.

### Current State of Reviews and Justification

There are a few reviews covering active transportation, with Chillón et al.<sup>9</sup> providing the first review on this specific topic of AST interventions. Pang and colleagues<sup>21</sup> 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,<sup>22</sup> environments,<sup>23</sup> and policy<sup>24</sup> have been suggested to influence AST behavior. 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,<sup>25</sup> programming,<sup>26</sup> and collaboration<sup>27</sup> 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<sup>20</sup> to organize findings thematically, whereas the subsequent discussion is framed in Kingdon’s agenda-setting multiple streams approach (MSA).<sup>28</sup>

### 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 and Roberts<sup>29</sup> “PICOC” model was applied. The question breaks down as follows:

- population: school-aged children (generally aged  $\leq 14$  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.

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. In addition, this

review assesses the various AST interventions according to the SRTS 6E's framework to create a thematic analysis.

## EVIDENCE ACQUISITION

### 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.

### Eligibility Criteria

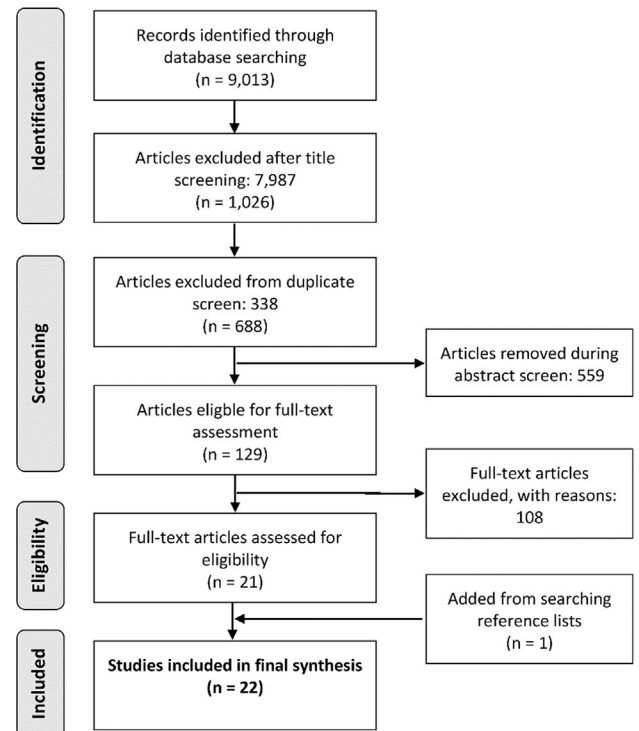
Articles included in this review were required to meet eight specific criteria. These criteria were that each study: (1) focused on an AST intervention; (2) contained a significant focus on, or presented a contribution toward understanding, the AST intervention, thus was an evaluation; (3) contained 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.

### Study Selection and Review Process

The initial search of the six databases resulted in 9,013 articles (Figure 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.

### Data Extraction

Specific data extracted from the articles (Appendix Table 1, available online) was carried out by intervention phase. Background information, such as study design, region, sample details, and year of publication, were extracted first. Extracted next were organization and structure data, including theoretic background (if applicable) and available intervention methodology characteristics



**Figure 1.** Summary of the database search and the process of study selection.

(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.

### Quality Assessment and Risk of Bias in Individual Studies

Quality assessment (QA) was conducted using the Effective Public Health Practice Project's<sup>30</sup> QA tool (Table 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.<sup>53</sup> 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 toward 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

**Table 1.** Quality Assessment of North American AST Interventions (n=22)

Variable	QA						Global rating
	Selection bias	Study design	Confounders	Blinding	Data collection method	Withdrawals and dropouts	
Bovis et al. (2016), <sup>31</sup> U.S.: Miami-Dade County, Florida	1	2	NA	2	1	2	1
Buckley et al. (2013), <sup>32</sup> U.S.: Moscow, Idaho	2	2	1	2	1	NA (CS)	1
Buliung et al. (2011), <sup>33</sup> Canada: Alberta, British Columbia, Nova Scotia, Ontario	2	2	2	2	1	2	1
Bungum et al. (2014), <sup>34</sup> U.S.: Henderson, Nevada	2	2	1	2	1	NA (QE)	1
Cuffe et al. (2012), <sup>35</sup> U.S.: Boulder, Colorado	2	2	NA	2	2	NA (observation; ITS)	1
DiMaggio et al. (2013), <sup>36</sup> U.S.: New York City, New York	2	2	2	2	1	NA (RCS)	1
DiMaggio et al. (2015), <sup>37</sup> U.S.: Texas	2	2	NA	2	1	NA (RCS)	1
Faulkner et al. (2014), <sup>38</sup> Canada: Toronto, Ontario	1	2	2	2	1	NA (serial Cr-S)	1
Gutierrez et al. (2014), <sup>39</sup> U.S.: Miami, Florida	1	2	1	2	1	NA (QE)	1
Harvey et al. (2015), <sup>40</sup> U.S.: Franklin County/ Chattanooga, Tennessee	1	1	1	2	1	2	1
Hoelscher et al. (2016), <sup>41</sup> U.S.: Texas	1	2	1	2	1	NA (QE)	1
Lachapelle et al. (2013), <sup>42</sup> U.S.: Northern New Jersey and Ocean Township, New Jersey	1	2	2	2	1	2	1
Livingston et al. (2011), <sup>43</sup> U.S.: Newark, New Jersey	1	2	NA	2	1	1	1
Mammen et al. (2014), <sup>44</sup> Canada: National.	1	2	NA	2	1	2	1
Mammen et al. (2014), <sup>45</sup> Canada: National	2	2	NA	2	1	NA (serial Cr-S)	1
McDonald et al. (2013), <sup>46</sup> U.S.: Eugene, Oregon	1	2	1	2	1	NA (QE)	1
McDonald et al. (2014), <sup>47</sup> U.S.: California, Washington DC, Florida, Texas	2	2	2	2	1	NA (serial Cr-S)	1
Mendoza et al. (2011), <sup>48</sup> U.S.: Houston, Texas	1	1	1	1	1	1	1
Ragland et al. (2014), <sup>49</sup> U.S.: California	2	2	1	2	2	NA (RCS)	1
Sayers et al. (2012), <sup>50</sup> U.S.: Columbia, Missouri	2	2	1	2	1	2	1
Sirard et al. (2015), <sup>51</sup> U.S.: Minneapolis, Minnesota	1	2	2	2	1	1	1
Stewart et al. (2014), <sup>52</sup> U.S.: Florida, Mississippi, Washington, Wisconsin	2	1	NA	2	1	1	1

Note: QA tool accessible at [https://merst.ca/wp-content/uploads/2018/02/quality-assessment-tool\\_2010.pdf](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).

AST, active school travel; CS, case study; Cr-S, cross-sectional; ITS, interrupted time series; NA, not applicable; QA, quality assessment; QE, quasi-experimental; RCS, retrospective case study; (U)CBA, (un) controlled before–after.

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.

## EVIDENCE SYNTHESIS

### General Characteristics of Reviewed Studies

A total of 22 articles were systematically reviewed (Table 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  $\leq 14$  years) were the focus of 17 studies, whereas adolescents (aged  $\leq 19$  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 South/Southeast (8/18=44.4%) and 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 1 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, one author was in another discipline, and one was unclear.

### Approaches, Stakeholders, and Theoretic Frameworks

Of the 6E's, five (not including Evaluation) were represented in the approaches of the included articles. Encouragement (63.6%), Education (50%), and Engineering (45.4%) were the most common foci (Table 3), with several studies containing multiple approaches. Of such multi-focused studies, many were often either the comprehensive, multi-year 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,

**Table 2.** General Characteristics of the Papers Reviewed ( $n=22$ )

Characteristic	Articles, Canada/U.S.,	
	<i>n</i>	<i>n</i>
Total sample size		
1–499	4	0/4
500–999	2	1/1
1,000–1,499	3	½
1,500–1,999	0	0/0
$\geq 2,000$	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 <sup>a</sup>		
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

<sup>a</sup>Same first author on multiple articles counted twice in their respective discipline (see DiMaggio et al. in Appendix Table 1, available online).

Equity appears to represent more of a lens that facilitators can consider applying to their initiatives, rather than being a robust strategy itself.

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



**Table 3.** Design and Methodology Characteristics (n=22)

Characteristic	Articles, n	Canada/U.S., n
Intervention approaches <sup>a</sup>		
Education	11	2/9
Encouragement	14	3/11
Enforcement	8	2/6
Engineering	10	2/8
Equity	4	0/4
Evaluation <sup>b</sup>	22	4/18
Outcome measure <sup>a</sup>		
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) <sup>a</sup>		
Awareness/safety	6	2/4
Behavioral	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

<sup>a</sup>Several articles utilized multiple measures and examined interventions that contained multiple approach characteristics and reported outcomes.

<sup>b</sup>The nature of this review (requiring an assessment) by default ensures all included articles contain an evaluation. AST, active school travel; ID, identification.

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,<sup>54,55</sup> 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<sup>41</sup> noting both.

**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 (Appendix Table 1, available online).

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).

**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, behavioral, 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%<sup>54</sup> to 333%.<sup>29</sup> Despite their initial successes, interventions with shorter-term follow-up periods (11/22=50%, ≤6 months) often noted post-intervention results that were generally ephemeral in nature.<sup>46,56</sup> Among these articles, the need for more time to create significant change was also discussed often.<sup>37,38,53,57</sup> Papers with longer-term follow-up (6/22=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.).

## 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 MSA<sup>28</sup> was adapted for AST, primarily because of its well-documented history of being applied in health domains.<sup>58</sup> Broadly, the MSA suggests that policymaking and change is primarily the result of three distinct streams: problem, policy, and politics.<sup>59</sup> 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 (behavior 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.

### 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.

### 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 presents 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.,<sup>46</sup> where survey data assess school trip travel mode, school and district report cards provided school characteristics information, and 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 that more effectively influence change, as well as create an increased sense of urgency among officials or potential funders.

### 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<sup>60</sup> and Coordinated School Health in the U.S.<sup>57</sup> The core philosophy of these frameworks generally holds that a population's health is the result of the social and physical environments, skills, behaviors, social networks, and public policy relevant to a population.<sup>56</sup> Consequently, a greater variety of socio-ecologic 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 favorable 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.

### Limitations

This review is not without limitations. First, as alluded to previously, 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.

### CONCLUSIONS

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.



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## SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at <https://doi.org/10.1016/j.amepre.2018.04.007>.

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