

How is Framing active school travel framed in Ontario, Canada? or how spinach is good for you

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Abstract

Active school travel (AST) ~~has been increasingly encouraged by various stakeholders in~~ is promoted in many jurisdictions, including Ontario, Canada ~~through efforts such as~~, where there is provincial support for school travel planning. ~~Education strategies like workshops or resources that promote AST are commonly implemented. The framing of AST through such strategies may influence how walking and bicycling to school are perceived by parents. It may also draw attention to AST as an issue affecting children's health which could motivate behaviour change. We used (STP) efforts. Two pillars of school travel plans in the province are education and encouragement. For these pillars to stand, relevant stakeholders must be cognizant of and understand the issues and stakes. For this reason, we deem it important to understand how AST is communicated. In this research we adopt framing analysis to investigate the ways in which various organizations communicate to the public around AST. A frame is a central organizing idea or story line that provides meaning to a particular phenomenon, and thus helps to set the parameters for conversations about policy. In the case of AST, framing can influence what policy alternatives are perceived as available by children, parents, and their wider communities. The research is supported by natural language processing~~, including topic modelling, to examine how AST is framed in techniques applied to publicly available documents from Ontario stakeholders involved in school travel planning. We then compared compare the findings from these documents to a selection of academic studies on AST and explored similarities between the two. We found that AST is framed in two ways: i) as a health and environmental issue; and ii) as an accessible and feasible transport option for children and parents. The frames encourage children and parents to adopt AST given its health and environmental benefits by providing resources to support behaviour change. The benefits of AST and strategies to support AST that are communicated by stakeholders are consistent with the evidence from academic research. While these frames present AST in a positive light, they may not encourage parents to view current household travel behaviours as unhealthy for their children or their community. Stakeholders promoting AST in Ontario should further problematize the decline of AST and challenge the norm of driving children to school. We conclude that framing of AST in Ontario is mostly empirical-scientific in style, and largely in agreement with academic research on AST. However, it is essentially conservative and does challenge to the status quo of motorized travel. Furthermore, the frames tend to download responsibility for change to households, which limits the scope of policy alternatives by keeping collective action out of the frame.

Keywords: active school travel, school travel planning, natural language processing, framing analysis

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1. Introduction

Walking and bicycling to school, commonly known as active school travel (AST), have declined in North America for decades (Rothman et al., 2018), but the appetite for these modes is beginning to rise in many Canadian communities. For instance, research in Toronto, Ontario found that 40% of children who were driven to school would like to travel by bicycle instead (Larouche et al., 2016). Another study in London, Ontario, reported similar findings with respect to children’s preference for active travel (Larsen et al., 2012). From a public ~~health-policy~~ perspective, increasing active travel to school ~~represents a major opportunity~~ presents major opportunities to improve children’s health and wellbeing (Faulkner et al., 2009), to mitigate traffic and improve perceptions of safety (Rothman et al., 2015), as well as to reduce emissions and other forms of pollution (Bearman and Singleton, 2014; Goodman et al., 2019).

To promote this trend, in 2017 the Government of Ontario began to support communities develop AST initiatives through a program called *Ontario Active School Travel* (OAST). By 2021, the program, run by ~~Green Communities Canada~~ Green Communities Canada had awarded over CAD 2 million and provided resources to over 25 projects across Ontario (Canada, 2020). A popular intervention in many communities is school travel planning (STP) (see Canada, 2021). In this context, STPs are “school-specific” interventions led by a facilitator who works with a committee of stakeholders from diverse sectors including education, planning, transportation, and public health to develop action plans (Buliung et al., 2011; Mammen et al., 2014a). The five-step process involves identifying barriers to AST and implementing solutions or activities to make AST safer and more convenient: 1) setup of the program; 2) data collection and problem identification; 3) action planning; 4) implementation; 5) monitoring and evaluation (~~Buliung et al., 2011; Lang et al., 2014~~) (Hinckson and Faulkner, 2018).

~~Framing AST by STP stakeholders~~ How AST is presented to a target audience (e.g., parents or the general public) ~~can raise awareness of the relevant issues and influence how active travel to school is perceived~~ is essential to define the parameters of what is possible policy-wise. Drawing from concepts in communication studies, the objective of this paper is to investigate how AST is framed in Ontario. Gamson and Modigliani (1987) define a frame as a “central organizing idea or story line that provides meaning” to a particular phenomenon. A frame can enable individuals “to locate, perceive, identify, and label” information pertaining to various dimensions of an issue (Goffman, 1974). ~~Therefore~~ From this perspective, stakeholders involved in STP efforts ~~can play a~~ play an important role in shaping public ~~perception about AST to attract greater~~ perceptions about AST by generating frames that create meaning, and thus influence the degree of attention and recognition ~~as of~~ a “problem” that needs to be addressed through ~~behaviour~~ behavior change or new policies.

~~After significant investment of human and financial resources to boost rates of AST in Ontario over the past few years, in this paper we ask this central question: How is AST framed to the public in Ontario? The following questions are subsidiary and help us address this main question: What benefits of AST are communicated to the public? What solutions are proposed to increase AST?~~

~~We approach this question by means of~~ Our research is supported by natural language processing ~~, and examine how~~ techniques, applied to the analysis of documents produced by three STP stakeholder groups in Ontario (municipalities, school boards, and transportation consortia) ~~frame~~ AST. We assemble a corpus of texts from public sources that present information for the general public or parents who are interested in AST ~~. We and~~ examine word frequency, bigrams, and concordances in these selected documents, ~~and also identify key topics~~. Furthermore, we use topic analysis to identify themes presented by each stakeholder group. We then compare the findings from these documents to a selection of studies on AST and explore the extent to which there is concordance between the scholarly literature on AST and materials shared with the public. The results of this analysis, along with manual checks of the corpus by the authors, lead us to conclude that AST is framed as a matter of individual choices instead of collective action. The message is reasonable but inherently conservative and it fails to communicate a sense of urgency about health and environmental issues, which may help to explain the modest success of related policies (Buliung et al., 2011; Mammen et al., 2014a,b).

2. Literature Review: AST

The desire to increase AST in Canada is warranted given its potential physical and mental health benefits. Faulkner et al. (2009) concluded from their systematic review that children who travel on foot or by bicycle to school generally have higher levels of physical activity than their peers who are driven to school. This relationship could be dose-dependent, and contingent on sufficiently long trips to school to accumulate physical activity. A walking distance of 1000-1600 metres to school has been found to contribute to overall levels of physical activity for boys (Faulkner et al., 2013). The daily routine of travelling to school can be a good opportunity for children to regularly build physical activity into their schedule (Mitra, 2013).

More recently, the link between transport and children's wellbeing has attracted interest too (Waygood et al., 2020). Being driven to school reduces community interactions for children, which may negatively impact their social wellbeing (Waygood and Friman, 2015). In contrast, walking and bicycling give children opportunities to socialize (Michail et al., 2021) and increase positive emotions that contribute to wellbeing (Ramanathan et al., 2014), a feeling that children seem to value (Zwerts et al., 2010). AST can also provide opportunities for children to engage with natural environments (Fusco et al., 2012; Romero, 2015).

~~Factors that influence AST have been presented and organized using a socio-ecological model (SEM) (Mitra, 2013) or systems model (?) whereby children's travel behaviour is understood within the context of household, social, neighbourhood, and policy environments. The SEM helps to identify multiple determinants that need to be addressed by school-based interventions to increase AST, with the consensus being that interventions should target multiple levels (Mitra, 2013).~~ Rather than describing an extensive list of factors that influence AST and mode choice for travel to school in Canada (e.g., Mammen et al., 2012; Mitra, 2013; Rothman et al., 2018; Wilson et al., 2018), we ~~discuss a few potentially modifiable determinants~~ focus on two key aspects that may be targeted ~~for change through STP, from a policy perspective: built environmental factors and perceptions and behaviors of parents.~~

~~Children's mode choice to school is strongly influenced by their parents' travel behaviours and the complexity of their household's travel needs (Buliung et al., 2021), as well as daily parental support (Mah et al., 2017). This indicates that shifting parental perceptions and habits is important. Convenience and inclement weather have been cited by parents as barriers to AST (Buliung et al., 2011). Parental perceptions of the built or school environment (De Meester et al., 2014; Panter et al., 2010) and their children's skills (Mammen et al., 2012; Faulkner et al., 2010) also influence mode choice to school.~~

~~Distance~~ The built environment is a key factor for physical planning, and in this respect distance between home and school is the factor most negatively associated with AST (Ikeda et al., 2018; Mammen et al., 2012; Pont et al., 2009; Rothman et al., 2018) with less AST reported among children who have to travel farther to school. Many studies have also found that the quality of the built environment along the route to school and around the school site (Ikeda et al., 2018; Rothman et al., 2021) and provision of active travel infrastructure (Chen et al., 2018; Pont et al., 2009) facilitate AST. Canadian youth report that they feel most safe bicycling on streets in their neighbourhood or that have low volumes of traffic (Transportation Association of Canada, 2020). Finally, concerns about traffic and strangers have been reported by parents who drive their children to school (Mammen et al., 2012), ~~which highlights that the volume and speed of cars can be a concern or deterrent for AST.~~ ironically, concerns about the dangers of traffic become a vicious cycle (Rothman et al., 2017).

Secondly, research has found that parents are key decision-makers with respect to children's mode of travel to school (Rothman et al., 2015). Particularly, after distance (?), parental perceptions of the built or school environment, as well as of their children's skills, have been found to be key in influencing mode choice to school (De Meester et al., 2014; Panter et al., 2010; Mandic et al., 2020; Mammen et al., 2012; Faulkner et al., 2010). For example, Ramanathan et al. (2014) found that parents and children who perceived active travel as beneficial for health and wellbeing benefits were more likely to use active modes to get to school. Furthermore, children's mode choice to school is strongly influenced by their parents' travel behaviors, the complexity of their household's travel needs (Buliung et al., 2021), as well as daily parental support (Mah et al., 2017). This suggests that shifting parental perceptions and habits is important.

~~School-~~

3. School travel planning in Canada and relevance of frames

AST has become a policy issue on the education and public health agendas in Ontario, and is supported, albeit in a modest way, by financial contributions from the provincial government. Still, endorsement from a range of municipal representatives (see Buttazzoni et al., 2018; Mammen et al., 2015) demonstrates that the AST issue is on the political agenda. One of the main vehicles to promote AST is school travel planning (STP), which has been implemented in Canada since at least the late 2000s. Within the STP process, facilitators establish multi-sector committees which intervene at the participating school through a range of activities—four pillars—consisting of [E]ducation strategies, [E]ncouragement through in-person events or programs, [E]ngineering improvements to or around the school site, and [E]nforcement of traffic speeds around schools (or 4Es, Lang et al., 2011; Mammen et al., 2014b). Following the first large-scale evaluation of STP as an intervention in Canada, AST rates increased and 14% of parents reported a perceived reduction in traffic outside the school (Buliung et al., 2011). Assessments of the efficacy of STP (Buttazzoni et al., 2019; Mammen et al., 2014b) indicate its potential to encourage behaviour change and adoption of AST. Of the 4Es, [E]ngineering targets the first set of factors discussed in the preceding section (the built environment), whereas [E]ducation and [E]ncouragement target perceptions.

By providing a “central organizing idea or story line” (Gamson and Modigliani, 1987) framing of AST seems particularly important to shift parental attitudes and perceptions. The relevance of policy frames with respect to education and encouragement is highlighted by Béland (2014), who remarks “framing processes as public relations are central to policy issues related to sustainable transportation”. Seeing how influential parental perceptions are to AST, it is important to understand AST-related communications, given their reported influence on children’s travel mode to school. Scholars in the field of political communications have proposed that communicators, such as the media or institutions, construct the narrative of a frame since the construction of frames for policy positions or public issues in order to can activate or restrict a particular response in the intended audience (Pan and Kosicki, 1993). Organized groups of stakeholders can employ similar methods to attract attention to particular issues. Framing can be used to position existing solutions as suitable to address particular issues (Mah et al., 2014), which may prevent the public from being aware of other policy approaches that challenge the status quo. The way policy issues are framed is ultimately important to understand because it plays a role in either altering or preserving the existing social perceptions. Finally, the ideas that are communicated by a particular frame can be either positive or negative (Waygood and Avineri, 2018). There is evidence that negative framing may be more effective at motivating individuals, for example, to change transport modes to reduce CO₂ emissions (Waygood and Avineri, 2018).

Framing of AST could Besides parents and children, framing can also affect broader support policy support for AST in the community. Municipal representatives are perceived to be instrumental but the involvement of other stakeholder groups (e.g., busing consortia representatives and local residents) can be lacking (Buttazzoni et al., 2018). In Ontario, it is reasonable to say that AST has become a policy issue on the education and public health agendas, supported, albeit in a modest way, by financial contributions from the provincial government. Still, the support from a range of municipal representatives (see Buttazzoni et al., 2018; Mammen et al., 2015) demonstrates that the AST issue is on the political agenda. In this sense, framing can be used to position existing solutions as suitable to address particular issues (Mah et al., 2014), which may prevent the public from being aware of other policy approaches that challenge the status quo. Contrariwise, framing can be instrumental to revealing more diverse policy options than conventional wisdom would have (Bosomworth, 2015). Ultimately, it is important to understand framing of policy issues because creating meaning through frames contributes to the constant process of shaping of our collective understanding of issues, uncovering what we collectively find (un)acceptable and why (Béland, 2014).

Since STP activities heavily focus on education or encouragement (Buliung et al., 2011; Mammen et al., 2014b; Buttazzoni et al., 2019), it is important that parents and communities are receptive to the goals of STP (Buttazzoni et al., 2018). Parents for the issues to be effectively framed. In the past, parents have been found to express different understandings, language, and perceptions than planners of how regarding the influence of the built environment can influence school travel (Buliung et al., 2021). This is also true when it comes to other factors like on school travel that markedly differ from those of planners:

while parents tend to view mixed land use as conducive for driving, transport planners see mixed uses as a key for encouraging more active travel (Buliung et al., 2021). Similarly mismatched understandings have been detected with respect to factors like the convenience of different modes to school (Lang et al., 2011). As a consequence, STP stakeholders must pay special attention to parents' and communities' understanding of the decline of AST as a problem, which may affect their receptivity to proposed solutions (Buttazzoni et al., 2018).

~~The success of STP interventions would likely depend on parental judgments of factors that are related to school travel, as well as support from key policy makers.~~ Framing is important, but not all frames are equally effective. Frames can appeal to economic reasons, to science and logic, or to moral obligation. For example, ~~parents have been found to view mixed land use as conducive for driving, despite transport planners viewing neighbourhoods with mixed uses as key for encouraging more active travel (Buliung et al., 2021).~~ Therefore, Severson and Coleman (2015) report that overall support for climate change policy increases more when scientific frames, secular moral frames, and economic equity frames are used, compared to economic efficiency or religious moral frames. Frames can also be positive or negative, and there is evidence that negative framing may be more effective at motivating individuals, for example, to change transport modes to reduce CO2 emissions (Waygood and Avineri, 2018). As well, the effectiveness of the framing depends on the psychological distance to the relevant issues: how socially, temporally, geographically, or hypothetically close an individual perceives themselves to the issues can affect their support for various policies (Maiella et al., 2020). For this reason, stakeholders involved in STP must make conscious choices about ~~the proposed solutions and potential benefits of AST that are communicated to parents and the general public through publicly available content to convey its importance as a policy issue and to facilitate adoption of AST~~ how issues surrounding AST are communicated if the goal is to increase support for and buy-in of AST policies.

4. Data

4.1. Data retrieval

4.1.1. Policy documents

We assembled a collection of publicly available documents that were sourced online from the main stakeholder groups involved in STP initiatives in Ontario: i) school boards (public or Catholic and English-speaking only); ii) municipal governments; and iii) transportation consortia. The latter involve ~~a collaboration~~ collaborations between municipal regions and school boards to deliver more efficient and timely regional transportation services to schools ~~in each region~~. Non-profit organizations, police services, and advocacy groups are other stakeholders who often play a role in supporting AST and/or STP, but this study does not include any documents from these groups because they do not consistently participate in STP initiatives in Ontario.

The search was guided first by a list of all English public and Catholic school boards across Ontario. The websites of each school board were manually searched for pages related to school transport or travel. Any pages relevant to these topics were downloaded. Next, we searched municipal government and transportation consortia websites. These were identified based on geographic area. Likewise, webpages related to active transport or school travel were downloaded.

Webpages from STP stakeholder groups were included in our analysis if they were findable. This primary criterion was important since our analysis pertains ~~to how such issues are framed~~ communication of issues to the general public. Thus, we included only webpages that were readily accessible, which we defined as requiring no more than four links from the initial Google search to reach.

The initial corpus of documents from STP stakeholder groups included 69 relevant webpages. We refer to these as policy+practice documents throughout the paper. It is important to note that school boards, municipalities, and transportation consortia may or may not publish information about their involvement in AST and STP efforts on their respective websites or in policy documents. Search results are summarized in Table 1.

Table 1: Search results from the main STP stakeholder groups.

Stakeholder	Total	Retrieved
School boards	62	32
Municipalities	62	28
Transportation consortia	39	9

4.1.2. Academic papers

We conducted a search on Web of Science for scholarly papers on the topic of school travel ~~– We limited our search to using Web of Science’s Core Collection.~~ The search was conducted in the Winter of 2021 and the parameters used were {active OR walk* or cycl* or bicycl*} AND {“school travel”}. Initially, we found 322 papers, which we reduced to 250 after selecting only papers in the fields of ~~public health,~~ transportation, planning, urban studies, ~~and geography.~~ ~~This initial corpus was~~ geography, and public health. These fields were chosen because they had the greatest volume of documents and/or were of disciplinary interest to the authors. This list with 250 documents was then manually curated by the authors to ensure that all documents were relevant. ~~After this step,~~ This was done by checking the title and reading the abstract of the papers. For example, a paper with the title “Impact of automated photo enforcement of vehicle speed in school zones” (Quistberg et al., 2019) was excluded as being tangential to our research; the abstract of another paper revealed that it was mainly concerned with survey methods: “Common methods for measuring mode share include Hands Up surveys and family surveys, but these require teacher and parental involvement.” (Sersli et al., 2019). After this process, our academic corpus comprised 227 journal articles that were readied for analysis.

4.2. Data cleaning

A multi-step process was conducted to ensure that the analysis captured as much text as possible from both the policy documents (n = 64) and academic papers (n = 227). Webpages were manually downloaded in portable document format (PDF) and trimmed so that pages that only consisted of tables, figures, or references were removed. After converting into txt files and importing for analysis, we manually removed any remaining tables, figures, references, headers/footings, and captions that could not be trimmed. We also manually removed any extraneous material that did not pertain to AST specifically (e.g., references, footnotes, weblinks, etc.). In the final step, we removed all blank spaces, punctuation, capitalization, and numbers. English stop words (i.e., words such as *and* or *the*) and other frequent terms in the documents like “school” and specific location names were removed from the corpora.

5. Methods

5.1. Process of Framing Analysis

~~We use topic modelling~~ Topic modelling was used to analyze the documents retrieved. ~~Topic modelling~~ This is a natural language processing technique used to analyze text to identify the language and concepts being communicated. This method is practical for researchers working with large amounts of text because it ~~replaces can assist and complement~~ the manual coding of topics that would normally take place to analyze or summarize textual data (Jacobi et al., 2016). We primarily use the following ~~software~~ R packages: tidytext (?) (Silge and Robinson, 2016), topicmodels (?) (Grün and Hornik, 2011), word2vec (?) (Wijffels, 2021), and wordcloud (?) (Fellows, 2018).

We estimate latent Dirichlet allocation (LDA) models to identify topics contained in both the STP and academic documents. The model’s output is “a set of topics consisting of clusters of words that co-occur in these documents according to certain patterns” (Jacobi et al., 2016). Researchers must then interpret the identified topics, as done after other methods of manual coding.

5.2. Reproducibility

This paper is an example of open and reproducible research that uses only open software. [The source document is an R markdown document.](#) Following best practices in spatial data science (Brunsdon and Comber, 2020), the code and data needed to reproduce our research or conduct a similar analysis for other regions are available [for download upon request in a publicly available repository](#)².

6. Results

6.1. Word and document frequency

We analyzed word and document frequency for each corpus of text. Table 2 shows the most frequent terms found in the municipal, transportation consortia, school board, and academic documents. Policy documents and academic papers reference *active*, *travel*, *walking*, *biking* or *cycling*, and *students* more than other terms. Each corpus also has *safety* and *traffic* as common words, which suggests that these are common concerns for parents. The word *physical* is present in each corpus, but ~~it's not clear what this refers to (e.g., this could refer to physical activity, or the physical environment)~~. Furthermore, documents from STP stakeholder groups discuss *resources*, *information*, and *services* about school travel. Unlike the academic papers, policy+practice documents [frequently](#) include the words *route* or *routes* ~~as frequent terms~~. This could indicate the role of STP stakeholder groups in identifying safe routes to school to share with parents or families. In the section below, the context in which these terms are used is explored further.

The academic corpus differs from the policy documents in that *parents* and *distance* are the second and third most common terms. In addition, *time*, *factors*, *environment*, and *age* are also identified in the academic papers. The prevalence of these terms is consistent with an academic focus on exploring the variables that influence ~~mode choice~~ [travel to school](#). These words are absent from the list of common words in policy+practice documents. Table 2 indicates that the academic corpus discusses a broader range of determinants of AST than the policy documents. The number of references for each term in the academic papers is also substantially higher due to the inclusion of more documents.

Examination of document frequency reveals terms that are not present in all policy documents. This suggests that although documents pertain to ~~the subject of~~ school travel, not all stakeholders across Ontario disseminate information about AST. We manually searched the policy+practice corpus and found that 48% of documents mention AST and 16% mention STP. In contrast, inclement weather and its impacts on busing is a common topic addressed in school board and transportation consortia documents.

6.2. Bigrams and concordances

Bigrams refer to ~~a pair~~ [pairs](#) of consecutive words. We combined all municipality, school board, and transportation consortia documents into the policy+practice [corpus](#). Figure 1 shows all of the bigrams that occur more than 10 times in ~~the policy+practice this~~ corpus. This figure highlights the main ideas that are presented to the public in each of the policy corpora. The directional arrows indicate the arrangement of the words (e.g., active travel and not travel active) and the colour gradient of the arrows corresponds to the most frequently mentioned pairs (e.g., bigrams with darker arrows are found in the corpus more often).

STP stakeholders discuss *physical activity* and *public health* in the context of AST. In addition, *travel planning*, *bike lanes*, and *safe routes* are also identified, conceivably as either proposed solutions or built environment factors that support AST. Key issues related to transport such as *traffic safety*, *air quality*, and *greenhouse gases* are conveyed to the public through these policy documents. It is not surprising to find this focus given that municipalities in Ontario are concerned about climate change and have increasingly looked to active travel to offset transport-related emissions in urban areas. We also found *mental health*, *walk zone*, and *green communities* as common pairs of consecutive words. [The latter makes sense given the involvement of Green Communities Canada](#) ~~is a non-profit organization that has significantly supported AST initiatives through the Ontario Active School Travel program so the high frequency of this term in the policy+practice~~

²<https://github.com/desjae/AST-Framing-Analysis-Ontario>

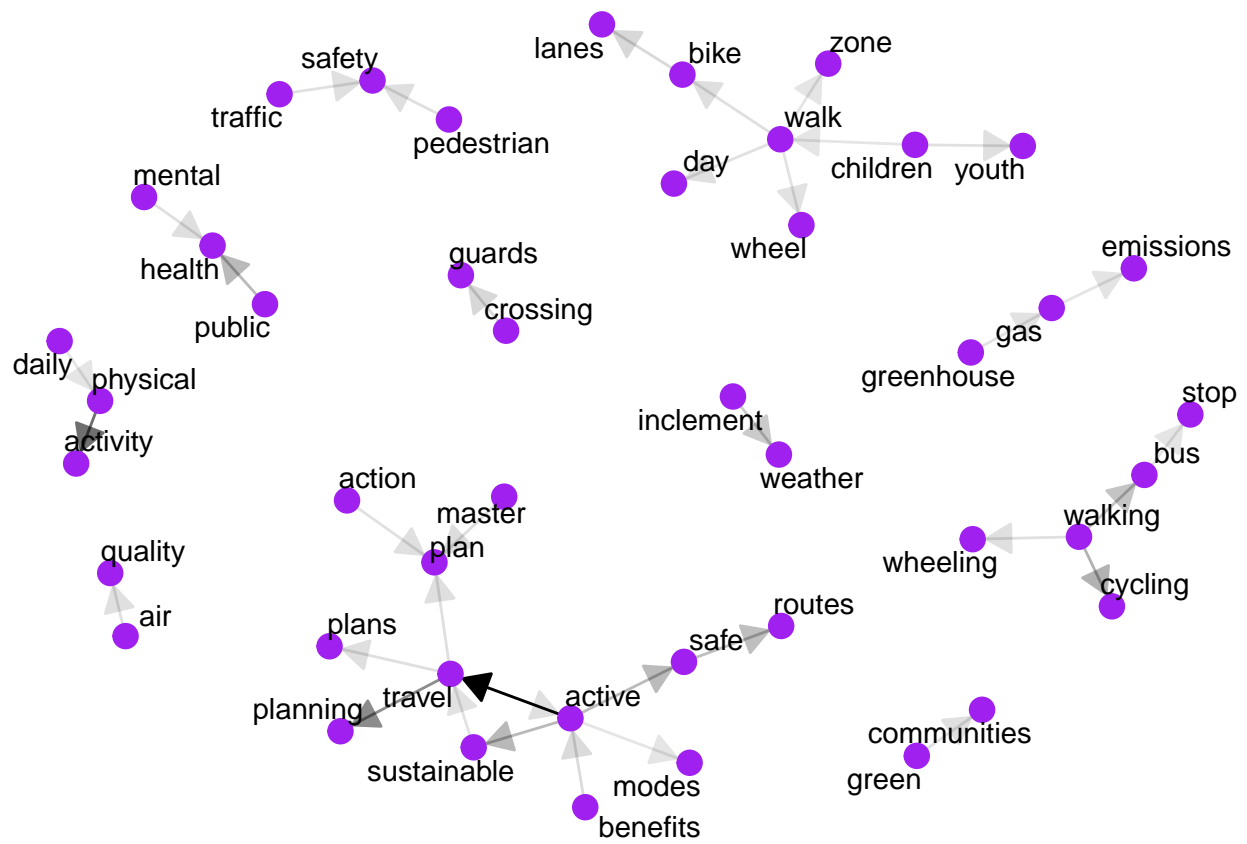


Figure 1: Most common bigrams found across all policy documents (i.e., school board, municipality, and transportation consortia combined).

Table 2: Top 25 terms identified in each corpus. Document frequencies are also indicated.

Municipalities			School Boards			Transportation Consortia			Academic Papers		
Term	Count (n)	Documents (n)	Term	Count (n)	Documents (n)	Term	Count (n)	Documents (n)	Term	Count (n)	Documents (n)
active	248	26	active	124	13	active	67	7	walking	5059	220
travel	126	20	bus	120	20	walking	55	8	parents	3927	209
walking	90	25	travel	103	11	walk	49	8	distance	3252	203
bike	87	15	information	65	21	travel	41	8	students	2956	171
cycling	78	22	walking	57	17	students	39	9	cycling	2739	170
safety	71	21	walk	53	13	safety	32	6	environment	2585	200
health	65	21	weather	40	11	help	29	9	traffic	2334	206
physical	63	18	safety	40	19	schools	25	9	choice	2295	167
traffic	59	20	safe	39	19	children	25	6	activity	2265	207
road	56	13	services	37	17	community	24	7	physical	2238	213
activity	55	14	planning	37	7	bus	18	4	trips	2164	168
schools	52	14	parents	32	17	route	17	5	car	2140	193
children	47	15	sustainable	31	8	zone	16	6	safety	2111	202
plan	45	16	children	31	14	resources	16	6	time	2091	216
students	44	14	child	31	12	day	16	4	factors	2083	214
walk	43	18	day	29	13	safe	15	5	child	2060	185
public	39	15	routes	28	14	planning	15	4	walk	1985	198
community	37	19	physical	28	11	physical	15	7	public	1973	206
safe	34	16	health	28	11	healthy	14	6	age	1774	209
benefits	32	17	inclement	25	11	traffic	13	6	urban	1749	198
play	31	2	eligibility	24	11	support	13	6	different	1695	213
resources	30	13	consortium	24	9	families	13	5	home	1691	197
healthy	29	16	region	23	10	way	12	5	social	1672	189
routes	27	13	service	22	11	student	12	5	significant	1644	206
lanes	26	3	•	21	1	region	12	4	mobility	1634	136

Note:

^a Count (n) refers to the total number of times the term is found in the corpora

^b Documents (n) refers to the total number of documents that feature the term

~~corpus is not surprising~~ AST initiatives in Ontario. Overall, the policy documents from STP stakeholder groups seem to focus on four key areas: i) benefits or impacts of AST; ii) mechanisms of intervention; iii) concerns or barriers; and iv) supports for AST. This interpretation indicates that the general public accessing information about AST in Ontario is informed about a wide range of content related to this issue.

Next, we analyzed bigrams in the academic corpus separately to ~~make comparisons~~ compare with the policy+practice corpus. Figure 2 indicates that academic papers include several common bigrams that were also found in the policy documents including *physical activity*, which is the top bigram, as well as *traffic safety* ~~and~~ *safe routes*. However, many other factors are identified in the ~~research literature~~ academic corpus that are not presented to the general public through policy documents. Terms like *built environment*, *independent mobility*, and *urban form* are ~~other frequent pairs of consecutive words~~ examples of these factors. Academic papers also often discuss *distance home*, *car ownership*, *household income*, and *population density*, which are factors that have been found to influence AST. Finally, the presence of *statistically significant* among the top bigrams indicates that researchers often aim to identify associations using statistical measures. We found that the academic corpus focuses on a greater range of topics than found in the policy+practice documents.

We interpreted the most common bigrams from the policy+practice corpus (see Figure 1) as the main ideas that STP stakeholder groups focus on and communicate to the public about AST. We then examined the context of these key ideas by extracting words-in-context from the corpora. Table 3 presents some examples from select policy documents that illustrate how the most common bigrams are communicated to the public.

6.3. Topic modelling

We conducted topic modelling to examine the different topics found in the policy+practice and academic corpora. We estimated Latent Dirichlet Allocation (LDA) models for each corpus. Parameter tuning suggests that the policy+practice corpus has between 9 and 13 topics and the academic corpus has between 17 and 25 topics. After running the LDA model for the academic corpus, we realized the difficulty of interpreting as many as 17 topics based on the clusters of words that were identified. We experimented with the model by adjusting the number of topics and evaluating the output of terms in each topic. We found that there were 9

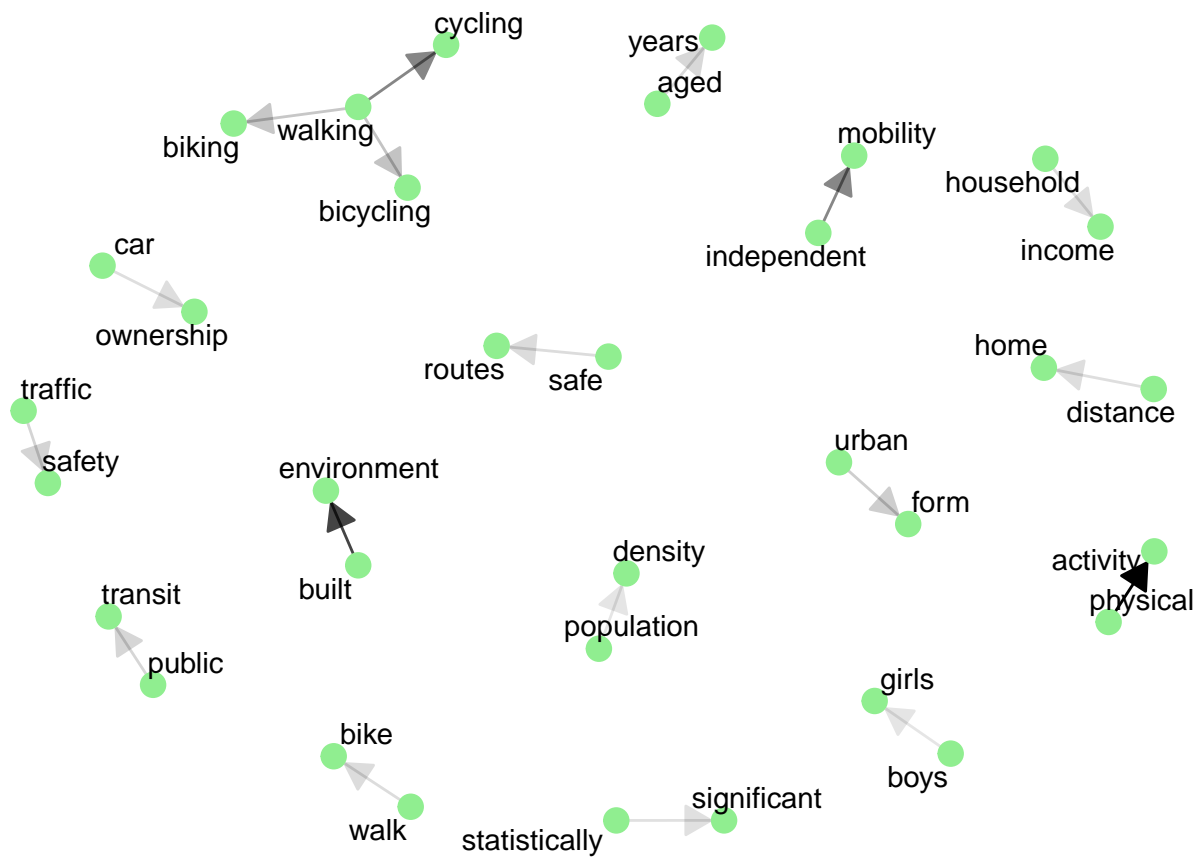


Figure 2: Most common bigrams found in the academic papers.

Table 3: The context of key terms that were identified as common bigrams.

Terms	Stakeholder	Context
Air Quality Benefit	School Board Municipality	Active transportation [...] improves air quality. Stronger bones and muscles, improved self-esteem and sense of well-being while reducing stress and risk of chronic disease all benefit those who use active transportation.
Walking School Bus	School Board	While taking part in a walking school bus, your child will enjoy seeing friends on the way to school. They will be active more often. This is also a great opportunity for your child to socialize with school friends in a monitored and safe way where they can practice social distancing, modelled by a leader.
Community	School Board	Help your students get started on the right foot - encourage them to walk or bike to school when possible. Even leaving the car a block or two and walking the rest of the way helps. It's good for the environment and your health, and teaches your child independence and community awareness.
Emissions	Consortia	An active school commute also reduces congestion in school zones and contributes to reducing greenhouse gas emissions – it's a win-win for everyone!
Health	Municipality	Active School Travel allows school-aged children the chance to participate in moderate to intense physical activity. This is linked with lower body mass index and improved cardiovascular health.
Lanes	Municipality	We are continuing to build on the cycling and pedestrian network by adding more bike lanes, building multi-use paths and encouraging developments to provide better pedestrian/cycling environments.
Mental Health	Municipality	Active and Sustainable School Travel (ASST) not only improves physical and mental health but contributes to a healthier environment and safer streets.
Physical Health	Municipality	Encouraging Active Transportation promotes physical health and recreation, helps manage congestion, reduces emissions and supports municipal objectives for efficient land use.

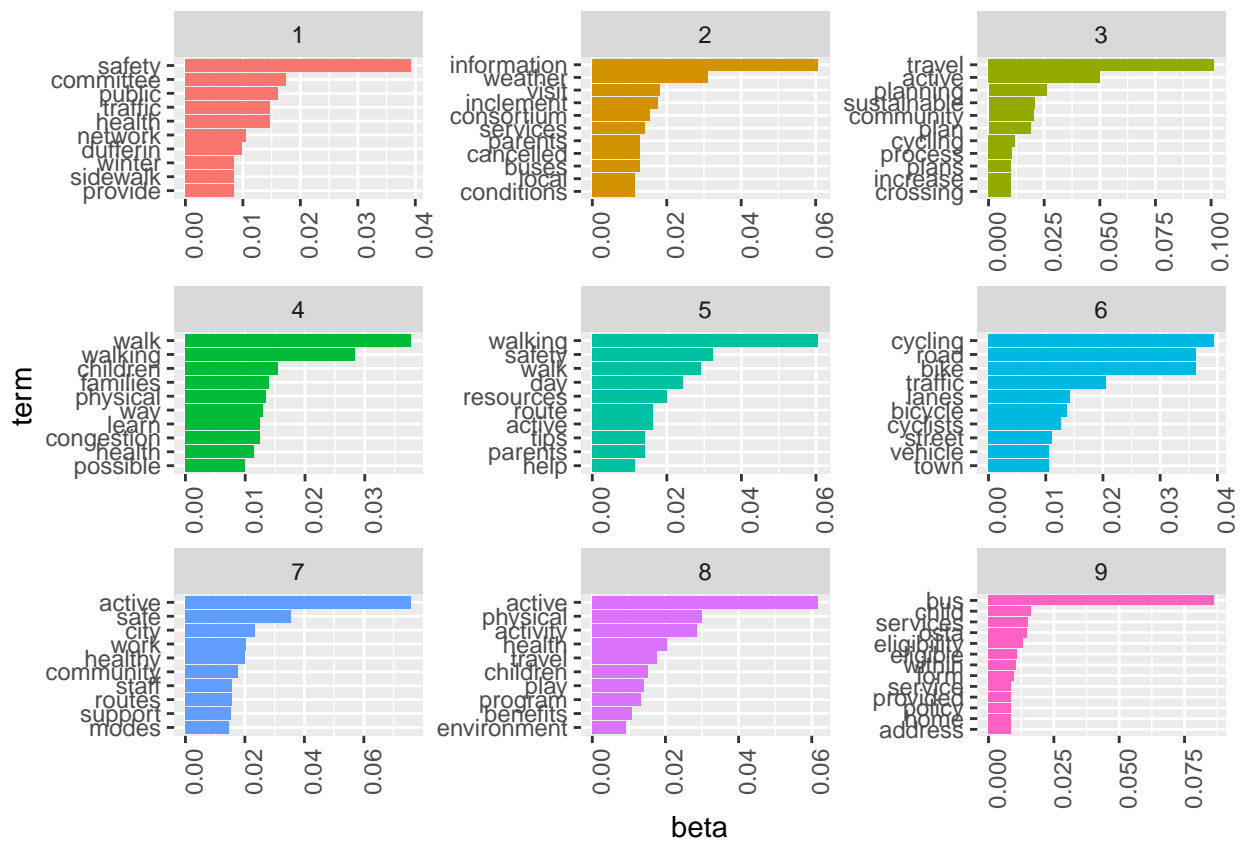


Figure 3: Topics identified in the policy+practice corpus according to clusters of words. The per-word-per-topic probabilities are shown by beta.

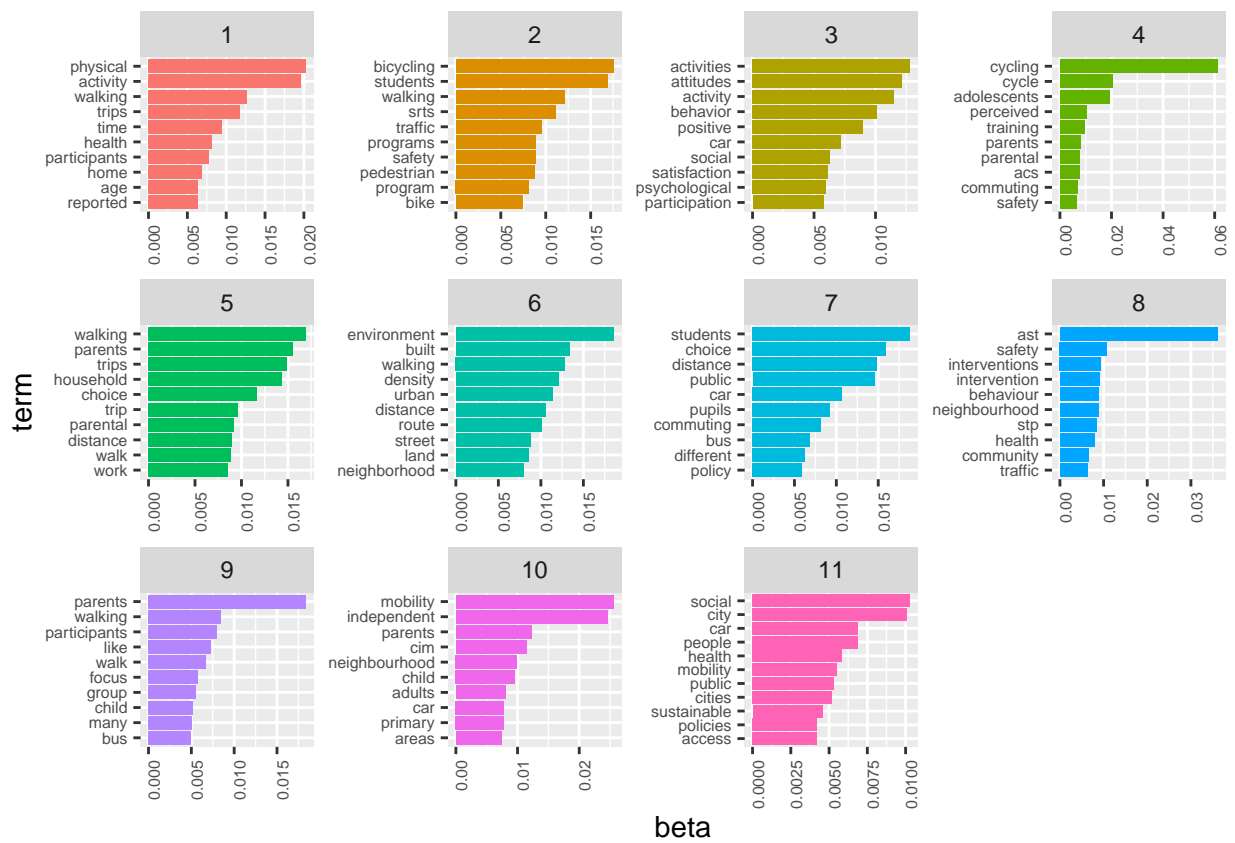


Figure 4: Topics identified in the academic corpus according to clusters of words. The per-word-per-topic probabilities are shown by beta.

distinct topics that could be interpreted in the policy+practice corpus and 11 topics in the academic corpus, after which there was too much overlap for the clusters to be meaningfully ~~interpreted~~distinguished. Figures 3 and 4 present the main terms ~~that are~~ associated with the topics found in each corpus.

In the policy+practice corpus, we identified the following topics based on the cluster of words: (1) safety; (2) weather and busing; (3) active travel planning; (4) walking; (5) resources for walking; (6) bicycling; (7) active travel concerns; (8) benefits of active travel; and (9) busing logistics. These topics indicate that STP stakeholder groups are sending the message that walking and bicycling to school are healthy travel modes for students, particularly in terms of physical activity. We also found that information is shared to support parents and students in using active modes to school, for example regarding the availability of bicycling lanes and tips for route choice for walking.

The academic corpus has a higher number of topics likely due to the volume of papers included. The following topics were identified based on the clusters of words: (1) physical activity; (2) safe routes to school for active travel; (3) ~~behaviours~~behaviors and attitudes; (4) bicycling; (5) walking; (6) built environment; (7) trip choice; (8) active school travel interventions; (9) parents; (10) children's independent mobility; and (11) public health and policies. This corpus reflects a broader range of topics than the policy+practice corpus.

6.4. Frames

Based on the identified bigrams and topics, we determined that the policy+practice corpus primarily frames AST as a health and environmental issue. STP stakeholder groups appear to position walking, bicycling, or rolling to school as beneficial to individual health, via physical activity and improved mental health, and to the broader community through a reduction in traffic and vehicle emissions. Here, we present an example that illustrates how the health and environmental frame is communicated:

Active school travel is a great way for children to be physically active, which is associated with improved physical and mental health, while making school zones safer, by reducing traffic volumes at and around schools.(Region of Leeds, Grenville and Lanark)

Furthermore, we found that policy documents make claims about the benefits of AST that are consistent with the findings of academic research and evaluation.

There are lots of benefits in the classroom for children that walk or cycle to school on a regular basis. Some of these benefits include improved concentration and better coping with stress. Being outside helps to prevent feelings of isolation and increases their social interactions. Walking and biking to school can also save you money and lead to fewer cars on the road. (City of Ottawa)

The secondary frame in policy documents is that AST is accessible and feasible for children and parents. Despite the emphasis on the logistics of busing in the topic modelling, the documents indicate that there is an opportunity for or prospect of ~~behaviour~~behavior change. Some cities and schools explain how children and parents can leave the car at home and make the journey to school on foot or by bike. This frame encourages the public to evaluate their own travel decisions and to access resources (e.g., walking skills checklist) that will help them make AST a first choice. Examples of this secondary frame include:

Help your students get started on the right foot - encourage them to walk or bike to school when possible. Even leaving the car a block or two and walking the rest of the way helps. It's good for the environment and your health, and teaches your child independence and community awareness. (Halton District School Board)

Finally, both ~~AST frames present solutions to encourage~~frames present the benefits of AST. STP stakeholder groups seem to be communicating that AST is a healthy and ~~easy-accessible~~easy-accessible option as a result of ~~policy changes (e.g., available resources for parents and children) and~~school travel plans and improvements to the built environment. This could include examples of various efforts that are underway to support AST including route planning.

School Travel Planning is a community-based approach that aims to increase the number of students and adults choosing active and sustainable travel to get to and from school. This approach addresses concerns about safety, physical activity, and the environment. (City of Hamilton)

Beyond supporting communities to develop STPs, these frames tend to place responsibility for change squarely on the members of the community:

A way to make sure your child is safe while walking to school is with a ‘walking school bus.’ Here are some tips for a walking schoolbus... [tips]... Have fun! (City of Ottawa)

7. Discussion

7.1. Current AST frames in Ontario

In Ontario, municipalities, school boards and transportation consortia do not consistently include AST in their public communications. Indeed, as noted above, less than 50% of documents from these organizations discuss AST. Interpretation of the text assisted by natural language processing reveals that ~~AST in Ontario is primarily framed when~~ AST is discussed, the primary frame emphasizes its benefits to the health and wellbeing of both children and the environment. In the rest of the documents, the primary way AST is framed tends to emphasize the benefits to ~~parents as beneficial to~~ the health and wellbeing of children and to ~~environmental sustainability~~ the environment. The policy documents reflect the evidence that AST contributes positively to children’s physical health (see Faulkner et al., 2009; Schoeppe et al., 2015), although the statements regarding the benefits of AST to children’s school performance are less well-supported in the extant literature (Westman et al., 2020). STP stakeholder groups also communicate that increasing AST may reduce traffic near and around schools. This is conveyed presumably to alleviate parental concerns about traffic and safety (Evers et al., 2014; Mammen et al., 2012; Rothman et al., 2015; Wilson et al., 2018) or to reduce the frequency of risky ~~behaviours~~ behaviors from drivers around schools (Rothman et al., 2017).

In the secondary frame, AST is presented as an accessible and feasible way for children to travel to and from school. Children and parents are encouraged to adopt new travel ~~behaviours~~ behaviors. STP stakeholder groups identified different ways that parents could encourage or support their children to commute to school by using active modes (e.g., walking tip sheets, walking school buses, etc.). The general emphasis of this frame is communicating information that could change parental perceptions about the ease of their children using active modes to school, which may be seen by STP stakeholder groups as a “modifiable” factor (see Riazi et al., 2019). In turn, this could encourage parents to modify their routines and incorporate opportunities for their children to use active modes to school.

Both frames present ~~the AST issue~~ AST in a positive light. ~~Neither, by highlighting the potential benefits. However, neither~~ frame appears to explain why declining rates of AST are a problem or convey any urgency to this issue so that it attracts the attention of parents, the general public, or policy makers. ~~Communicating the potential outcomes of increased AST may be persuasive arguments to motivate behaviour change, but these frames do not seem to encourage parents or the general public to view their current behaviour as problematic or unhealthy for their children’s development and their community. Thus, behaviour change is presented as an option for some but not an imperative for all.~~ For example, parents who drive their children to school have reported concerns about traffic volume around schools (Mammen et al., 2012), but may not recognize that their own ~~behaviour~~ behavior contributes to the problem that is perceived to prevent their child from safely walking or bicycling to school (~~Collins and Kearns, 2001~~). (Collins and Kearns, 2001; Rothman et al., 2017). There is evidence that negative framing is more effective at eliciting responses than positive framing (e.g., Kahneman and Tversky, 1979; Waygood and Avineri, 2018). In this case, the frames emphasize the positive side of active travel but leave the negative impacts of behaviors such driving children to school out of the frame.

Further, behavior change is mainly presented as an option for some but not an imperative for all, which keeps collective action through government entities out of the frame. This echoes the findings of Reynard et al. (2021) similarly, who found in their analysis of Canadian municipal documents that one of the dominant frames ~~presented the adoption of behaviours to~~ was to present behaviors that help mitigate the climate crisis

as ~~a~~-an individual choice but not “the expected norm”~~—, or what society approves of, i.e., an injunctive norm~~ (Lapinski and Rimal, 2005). In this case, a stronger case of society’s disapproval remains to be made.

~~We found~~ Overall, we find that the proposed solutions in the secondary frame ~~to increase AST align with different levels of the SEM~~ reinforce some of the same ideas: 1) ~~behaviour~~-behavior change from households making different travel decisions (~~individual responsibility~~); 2) policies that create resources for AST (~~mainly through education and planning~~); and 3) engineering solutions like bicycle lanes. This reflects findings from the AST literature that a range of solutions are needed to address different factors that influence AST (*inter alia*, see Mitra, 2013; Panter et al., 2010). The recognition of engineering changes may reflect the strong engagement of engineering staff and municipal representatives in the Canadian STP process (Buttazzoni et al., 2018; Mammen et al., 2015), as well as the evidence that the built environment influences mode choice to school. However, ~~it is beyond the scope of this paper to assess whether the proposed solutions are perceived to be sufficient by parents for increasing AST~~ these measures tend to support the desired behavior without confronting the problem behavior with interventions such as forbidding drop-off within 100 m of the school, restricting vehicular traffic to only local traffic around schools at school-commute times, such as found in countries where nearly no children die while going to school (Waygood and Taniguchi, 2020).

As well as what is *in* the frame, it is also interesting to look for what is *not* there. The conservative orientation of the frames does not fundamentally challenge the status quo: not surprisingly, the frames advocate the option of active travel for those who are interested in realizing its benefits, but do not make a case for fundamental changes to the local environment, and also do not present a moral imperative for change (Severson and Coleman, 2015). The individualistic approach also means that a call for collective action tends to be missing.

7.2. Implications for school travel planning

~~STP stakeholders should problematize the significant decline in AST that has occurred over recent decades in Canada and emphasize that this issue merits urgent behaviour change. A negative framing that challenges the social norm of driving could be more motivational to shift transport modes, which would be consistent with other findings (see Waygood and Avineri, 2018). Policy documents should make it clear that~~ As we noted in Section 3 above, STP in Ontario relies heavily on education and encouragement. From the get-go, these are not the strongest tools of government action [compared to, say, regulation and transfers; see O’Hare (1989)]. The conservative framing used further dilutes the force of STP interventions. If we had to paraphrase the way AST is framed across the province, it would be like this: “eating spinach is good for you; here are some tips to help you choose spinach.” The issues are presented as a matter of personal choice, purely optional, and without a sense of urgency. While emphasizing the risks may seem counterproductive, this approach has been found to be effective at motivating change (e.g., Lawlor and Crow, 2018; Waygood and Avineri, 2018). Accordingly, communications with the public ~~could emphasize the risks associated with continued use of nonactive modes to school~~ can deprive children of opportunities to increase physical activity and to gain health and social benefits.

~~There is a noticeable lack of focus on certain~~ In addition to privileging choice, the frames tend to leave out a number of household determinants of AST ~~in the two frames that needs to be addressed. For example,~~ There was little discussion of socio-economic and demographic attributes associated with AST, such as age of children, parental education, income, and ethnicity (Rothman et al., 2018). Similarly, there was no discussion about the role of convenience and inclement weather in shaping household travel decisions (Buliung et al., 2011) and the complexity of travel arrangements that must be coordinated by households (see Buliung et al., 2021) ~~were not found to be discussed~~. The desire to escort children to school, which has been noted by parents as a reason to continue driving (Westman et al., 2017), is also not adequately addressed by STP stakeholders. Parental assessment of a child’s ability to undertake the journey to school was likewise overlooked despite its role in decision making for mode choice to school (Faulkner et al., 2010). Framing AST as a developmental opportunity or a rite of passage that children have been denied could challenge the prevailing culture of risk avoidance which discourages parents from letting their children use active modes to school.

~~Future research and evaluation by STP stakeholders should investigate how~~

8. Conclusion

In this paper we examined how AST is framed in Ontario. Our analysis was supported by the use of natural language processing techniques, and revealed that STP stakeholders frame AST as an accessible and feasible way to travel to school that is valuable to children’s health and to the environment. STP stakeholders are communicating that this issue can be addressed through household behavior change and policy solutions. Policy documents reveal that STP stakeholders are focusing on “modifiable factors” such as parental perceptions or micro-scale elements in the built environment to increase rates of AST. However, AST may not be framed sufficiently as a “problem” that requires urgent intervention, which may impact how parents respond to behavior change initiatives and limit awareness in the general public. In their public materials about AST, STP stakeholders should emphasize why AST rates should increase in local communities and how the negative effects of nonactive modes to school may impact children’s health and wellbeing. In summary, AST is presented in terms of potential benefits, but there is no real discussion whether they can be realized with only modest adjustments to the status quo.

In terms of future research, we suggest the need for further investigation into how parents or the general public respond to messages or information that encourages the adoption of AST and evaluate which are most effective. It would be helpful to understand which frames would most encourage ~~behaviour~~ behavior change or increase political support for interventions that address barriers to AST. This type of information could ensure that educational strategies and promotional materials increase buy-in for their target audience. If Canadian STP stakeholders wish to involve more local residents in their efforts (Buttazzoni et al., 2018), it would also be worthwhile for them to produce different materials that communicate why this issue is important to the general public, regardless of whether they currently have children commuting to/from school.

A It is pertinent at this point to note that a limitation of this study is that we only analyzed English-language texts that were easily accessible to the general public on the websites of STP stakeholders in Ontario. We did not include French-language materials from Ontario’s 12 French school boards (a mixture of public and Catholic schools). Parents likely receive information about AST directly from schools, which may contain more content that reflects the local barriers to AST, but these materials were not used in our analysis.

In this paper we examined how AST is framed in Ontario. Our analysis was supported by the use of natural language processing techniques, and revealed that STP stakeholders frame AST as an accessible and feasible way to travel to school that is valuable to children’s health and to the environment. STP stakeholders are communicating that this issue can be addressed through household behaviour change and policy solutions. Policy documents reveal that STP stakeholders are focusing on “modifiable factors” such as parental perceptions or micro-scale elements in the built environment to increase rates of AST. However, AST may not be framed sufficiently as a “problem” that requires urgent intervention, which may impact how parents respond to behaviour change initiatives and limit awareness in the general public. In their public materials about AST, STP stakeholders should emphasize why AST rates should increase in local communities and how the negative effects of nonactive modes to school may impact children’s health and wellbeing. Finally, we would like to close with a brief note on the methodology. Natural language processing and analysis of frames are still not widely adopted in transportation research. Based on our experience, we tend to see computer-assisted text analysis as a complement to rather than a substitute for expert reading of the documents. We would not recommend to proceed to interpretation without reading the documents, but the supervised automation helps to detect patterns that can be validated by an expert based on spot checks or more in-depth reading of the original sources. Like with any qualitative research, interpretation of the frames may differ by expert; in this research we aimed to develop a consensus interpretation by involving all authors in the discussion of the results. Furthermore, since the research is an open, reproducible project, all our assumptions are open to scrutiny and others use the data to check and/or expand the analysis presented here.

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