SHIFTING MODES

A Comparative Analysis of Safe Routes to School Program Elements and Travel Mode Outcomes

Prepared by the National Center for Safe Routes to School

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Executive Summary

This study explores school-level dynamics that underlie SRTS planning and program implementation and their relationship with the percentage of students who walk and bicycle between home and school. Using student travel data and interviews with local Safe Routes to School coordinators, this report presents a case study of six schools with SRTS programs. Three schools that had significant increases in the percentage of students walking and bicycling to/from school from fall 2007 to fall 2009—called "high performing" schools—were matched with three schools where the percentage of students walking and bicycling to/from school did not increase over the same three-year period—called "reference" schools.

Considering that the federal SRTS program was created in 2006, very few schools were participating in SRTS and collecting school travel mode data in 2007. Therefore, because this study explores school travel trends over a three-year period (from 2007 to 2009), only those schools that were early to adopt SRTS programs and met stringent data collection criteria were examined. Many other SRTS programs have successfully increased walking and bicycling to school among students both during and since the time of this study. Although the study's sample is small, the combination of structured interviews with local SRTS program coordinators and student travel mode data offers insights into ways that local SRTS programs can increase the percentage of students who walk and bicycle to/from school.

The study aims to understand whether and how high performing schools and reference schools differ in the ways they established their SRTS programs. It describes how the schools implemented and maintained SRTS programs aimed at increasing the percentage of students who walk and bicycle to/from school. It also identifies some enabling and inhibiting conditions that may have influenced changes in the prevalence of students walking and bicycling. All program contacts indicated that there were suitable walking and bicycling routes for students who lived nearby, but that only a subset of students were using these modes before the SRTS programs began.

KEY FINDINGS OF ANALYSES INCLUDE:

- The three high performing schools documented a major shift away from the car in both morning and afternoon school trips between fall 2007 and fall 2009. These changes were mostly due to increases in walking and bicycling between home and school. In less than three years, the percentage of students who walked and bicycled to/from high performing schools doubled.
- The three reference schools showed a shift away from the car and toward the school bus in the morning between fall 2007 and fall 2009, but this change was not seen in the afternoon, nor was it due to greater levels of walking and bicycling.
- Compared to schools that did not see increases in walking and bicycling, schools where walking and bicycling increased over time were more likely to have strong program leadership established by the schools' principals. The most successful schools conducted SRTS activities focused directly on increasing walking and bicycling more frequently, and maintained consistent support for the SRTS program from parent groups. These schools also tended to implement school policies that supported walking or bicycling between home and school.

Study results support the conclusion that program leadership, SRTS activity frequency, supportive policies and parent group engagement play key roles in encouraging more students to walk and bicycle to/from school. These findings are potentially useful for SRTS practitioners, State SRTS Program Coordinators and other funders and researchers. Future research should extend and enrich these findings by collecting data as SRTS programs are implemented over time.

Introduction

Interest in evaluating Safe Routes to School (SRTS) program outcomes has existed for the past decade. Prior to the enactment of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU, 2005) legislation—which created the Federal SRTS program administered by the Federal Highway Administration (FHWA)—in 1998, the National Highway Traffic Safety Administration (NHTSA) funded an evaluation of two SRTS pilot programs (NHTSA, 2002). The experiences of the pilot sites highlighted the potential for SRTS programs to increase walking and bicycling to school. NHTSA also funded a project that examined the safety-related outcomes of legacy SRTS programs—those programs that existed roughly five years before the establishment of the Federal SRTS program (see Blomberg, Cleven, Thomas, & Peck, 2008). Project authors concluded that given the infrequency of child pedestrian/bicyclist crashes near schools and the lack of reliable exposure data, SRTS-oriented safety benefits were not yet known.

Guidance for the Federal SRTS program included recommendations to conduct evaluation of the program's safety benefits, behavioral changes (i.e., student travel modes), and other potential benefits such as measurements of air quality and student health (FHWA, 2006). In January 2008, the National Center for Safe Routes to School (the National Center) established an FHWA-funded research program to track and examine program outcomes (National Center, 2011a). Soon thereafter, in July of 2008, the United States Government Accountability Office (GAO) issued a report that acknowledged many of the Federal SRTS program's accomplishments, including its establishment of a national clearinghouse (i.e., the National Center); development of a structured system of program assistance; method of tracking state-level implementation of the program; creation of standardized data collection instruments (e.g., Parent Surveys and Student Travel Tallies); and formation of a centralized data collection and reporting system. The GAO report also recognized a need to monitor and evaluate program outcomes (GAO, 2008). Interest in evaluating the SRTS program extends beyond the Federal government to include states, foundations and other agencies and entities that seek to understand the potential benefits of SRTS programs.

More recently, the National Center, under direction from FHWA, developed a national evaluation plan that outlines the implementation of future measures designed to assess the safety of students who walk and bicycle to/from schools, and the percentage of students who walk and bicycle as a result of participating in the Federal SRTS program (National Center, 2011b). In crafting the national evaluation plan, the National Center convened an expert roundtable of researchers and practitioners with expertise in evaluation. The National Center also developed a feasibility report that describes the

requirements for a safety outcomes evaluation, and identifies methods for measuring program impacts on walking and bicycling safety. As is evident, evaluation of the SRTS program has been, and continues to be, a priority.

This study examines a small sample of six SRTS programs. It is likely that many SRTS programs around the country beyond those discussed here have increased walking and bicycling to school among students. This report focuses on a limited number of SRTS-participating schools for three reasons. The first two reasons involve the time this study was conducted and the requirement that study-eligible schools must have collected student travel mode data over a three-year period. Limiting the sample to those schools that had documented student travel over three years allowed the research team to identify student travel trends. Given that this study was conducted in the spring of 2010 means that to be included in this study, schools must have started collecting student travel mode data in 2007 or early 2008. In other words, study-eligible schools were those few early adopters of the federal SRTS program. A third reason this study's sample is small involves the research team's use of additional sampling restrictions. For example, as discussed in the Methods section, SRTS programs that collected student travel mode data during the week of International Walk to School Day were excluded from further consideration. Together, the study timeframe (i.e., 2007 to 2009) and additional sample restrictions served to limit the pool of study-eligible schools. Both during and since the time of this study, many more schools had collected and continue to collect student travel mode data over time. Although the study's sample is small, the research team has learned that combining structured interviews with local SRTS program coordinators with student travel mode data offers insights into ways that local SRTS programs can encourage more students to walk and bicycle to/from school.

This report begins with an overview of the study's design and methods. It then describes a conceptual model that depicts relationships among SRTS program elements and the percentage of students who walk and bicycle between home and school. The model is followed by a general discussion of the similarities and differences between high performing (those schools where walking and bicycling increased significantly) and reference schools (those schools where walking and bicycling did not increase). The report concludes with recommendations for conducting future research on SRTS programs and the potential for SRTS programs to increase walking and bicycling to school.

Study Overview

The present study explores school-level dynamics that underlie SRTS planning and program implementation and their relationship with walking and bicycling to school. This evaluation starts with an original sample of 12 schools—eight elementary and four middle schools—that had documented student travel mode patterns over a three-year period. It then focuses on five schools drawn from the original pool of 12 schools, and another school that collected student travel mode data during the same month in 2007 and 2009. Three of these six schools documented significant increases in the percentage of students who walked and bicycled to/from school over a three-year period. These schools were called "high performing" schools in the analysis. The other three schools did not document increases in the percentage of students who walked and bicycled to/from school over the same three-year period. These were called "reference" schools. Each high performing school was matched with a reference school according to various socio-demographic variables (see Table 1). This sample of six SRTS-participating schools allowed for the development of a case study of program implementation and student travel mode outcomes. In carrying out the case study, interviews were conducted with local SRTS program coordinators to get a sense of how each of the schools implemented SRTS programs and the events that occurred in the broader school communities that may have influenced public perceptions about walking and bicycling to school. All program contacts indicated that there were suitable walking and bicycling routes for students who lived nearby but that only a subset of students were using these modes before the SRTS program began. In sum, this study sought answers to the following research questions:

1. Do high performing schools and reference schools differ in how they established their SRTS programs?

2. Do high performing and reference schools differ in how they conducted SRTS activities aimed at increasing walking and bicycling to school?

3. What enabling and inhibiting conditions may help to explain the relationship between program activity and changes in the percentage of students who walked and bicycled to school over a three-year period?

Methods

Sample

As of the end of March 2010, there were a total of 6,836 schools that had created accounts in the National Center's online data collection and reporting system; 3,539 (51.8 percent) of these schools had submitted student travel tally data using the National Center's student travel tally forms (see Appendix A). Of the 3,539 student travel data-submitting schools, 526 (or 14.9 percent) submitted data that reflected student travel patterns at more than one time period. Considering only schools that had submitted data three or more times to the National Center, the number fell to 195 (5.5 percent). That total was further limited by considering only those schools that had submitted data during the same 30-day period over three consecutive years to get student travel mode information that was uncompromised by seasonal variation. A total of 21 schools (0.59 percent) met these criteria. Finally, the sample was limited to those schools that had not collected student travel data during the week of International Walk to School Day—since data collected during this week may have captured atypical student travel patterns. These sampling procedures yielded at a total of 12 schools (0.3 percent). These 12 schools were examined to determine if any had documented significant increases in the percentage of students who walked and bicycled to/from school over a three-year period.

Data Collection

The data associated with the 12 schools examined in this study were standardized according to each school's grade distribution during its first year of data collection (i.e., 2007). Standardizing outcome data by students' grade is important because children's motor, cognitive, and psychosocial abilities develop and mature as they age (Maddux, Roberts, Sledden, & Wright, 1986). Considering that school travel often occurs in complex traffic environments which place demands on children's cognitive and motor skills (Sarkar, Kaschade, & de Faria, 2003), it would be inappropriate to compare students of different ages (or grade levels in this case).

After standardizing the 2008 and 2009 data based on 2007 data, the distribution of students' morning and afternoon travel modes were tabulated for all schools in the study. Schools initially were divided into elementary (n = 8) and middle school (n = 4) groups. Schools in the highest quartile within each group based on increased percentages of students walking/bicycling were identified as "high performing" schools. These were then matched with three "reference" schools along dimensions outlined below (see Table 1). Two of the three schools in the reference group also came from the original pool of 12 schools, yet had not documented significant increases in walking/bicycling between fall 2007 and fall 2009. To match a third reference school with a high performing school, one additional school that had collected student travel data on two

occasions within the same 30-day period in 2007 and 2009 was added to the analysis. This third reference school was added because all other reference schools were not similar enough to one of the study's high performing schools to justify comparison. Wherever possible, high performing and reference schools were matched on measures of:

1. Population density—persons per square mile in the schools' zip code in 2000; U.S. Census Bureau (2010). Population density is a significant predictor of walking and bicycling to school, even after controlling for socio-demographic and other built environment predictors of walking and bicycling (e.g., student ethnicity; the percentage of students receiving public welfare; intersection density) (Braza, Shoemaker, & Seeley, 2004).

2. Walkability—a qualitative assessment of the walkability of each school environment within a one-mile radius of each school (using a Google Earth® interface). The method used is in keeping with Charlier and Associate's definition of pedestrian realms, which places pedestrian environments on a scale from one ("pedestrian intolerant") to four ("pedestrian place"); see Appendix B.

3. Percentage of enrolled students who received free and reduced price meals during the 2007-2008 school year—a measure of socio-economic status (National Center for Education Statistics, 2010).

4. Percentage of non-white students attending the school during the 2007-2008 school year (another indicator of SES) (National Center for Education Statistics, 2010).

5. The range of grades (e.g., K through 6th) targeted by the schools' SRTS programs in 2007 (as reported to the National Center).

6. The size of school attendance boundaries in square miles (Minnesota Population Center, 2004).

Table 1. School characteristics used in matching procedures.

School	Performance Category	Rural - Urban	Population Density	% Free/reduced Price Meals	% Non-White	Grades Levels	Walk-ability	School Boundary Size
A	Reference	Suburban	98	88.3	81.7	K - 5th	2	3.1
B	High	Suburban	108	61.4	53.8	K - 4th	3	3.3
C	Reference	Urban	2477	12.3	39.1	K - 5th	2	2.4
D	High	Urban	2853	8.6	3.7	K - 5th	2	2.5
E	Reference	Rural	57	44.2	24.6	5 - 8th	2	6.2
F	High	Rural	58	29.7	20.8	5 - 8th	2	7.1

The final stage of data collection involved conducting seven telephone interviews with SRTS program coordinators at six schools. Interviewees held positions as local SRTS program coordinators within county health and transportation departments, as well as school transportation coordinators. Interviews were conducted during the summer of 2010 and ranged from 25 to more than 60 minutes in length. Interview responses informed the development of tables to show the range of SRTS programs and activities the schools had conducted between fall 2007 and fall 2009 (see Appendix C). The tables also captured when activities began; the number of times per school year activities were conducted; and the estimated proportion of students exposed to the activities each time they were conducted. Additionally, during the interviews information was requested about the following:

1. What school policies may have influenced student travel mode choices?

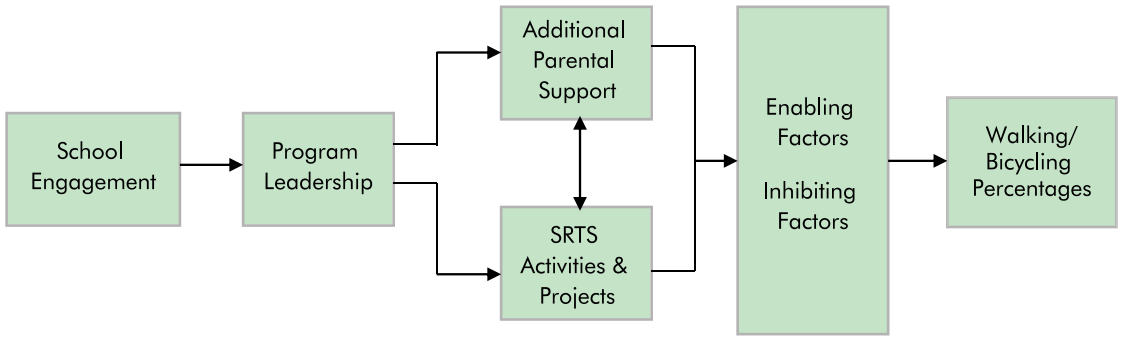
2. What events had occurred in the communities and/or schools that may have encouraged or discouraged walking/bicycling?

3. In what ways have the programs' SRTS activities been put into practice over time (see Interview Protocol in Appendix D)?

Conceptual Model Development

The conceptual model depicted in Figure 1 is based on social-ecological models of behavior change, which indicate that behavioral outcomes are a product of interactions between people and their social and physical environments (Sallis, Bauman, & Pratt, 1998). Content analysis of interview responses and an examination of interview results by a panel of National Center staff validated the model's appropriateness in this study. The model in Figure 1 and its accompanying text illustrate hypothetical relationships among SRTS program elements. Interview responses suggested that school engagement and program leadership influence the strength of additional parental support for walking and bicycling. Parent groups support the program by planning and doing SRTS activities. Then, when parents personally witness the positive results of doing SRTS activities—or perceive the benefits of supportive infrastructure like secure bicycle parking—they become increasingly committed to the SRTS program. Finally, the momentum generated by program leaders and parent groups interacts with enabling (e.g., sidewalks) and inhibiting (e.g., high speed traffic along routes to school) factors to influence the percentage of students who travel between home and school on foot or bicycle. Table 2 provides examples of each of the conceptual model's elements.

Figure 1. Conceptual model of SRTS program operation.



School Engagement refers to a process in which a group of stakeholders (e.g., parents, teachers, school administrators and public health and transportation professionals) determine that SRTS would benefit a school community by increasing the percentage of students who walk and bicycle to/from school. This process typically begins by gauging or confirming SRTS-related interest within the school community and is usually followed by efforts to secure SRTS funding.

Program Leadership refers to a process in which SRTS stakeholders appraise the community's interest in starting an SRTS program and then identify and support SRTS program leaders. These leaders explicitly endorse SRTS and work collaboratively with parent groups and SRTS coordinators to make SRTS programming part of the schools' institutional framework (e.g., incorporating bicycle safety training into a school's physical education curriculum).

Additional Parental Support refers to support that is generated after program leadership has been identified and organized. Over time, if program leadership is consistent and effective, greater numbers of parents get involved with SRTS programming. They take ownership of the SRTS program and assist program leaders in designing and conducting SRTS activities.

SRTS Activities and Projects refer to those actions taken by SRTS program organizers to advance the objectives of the schools' SRTS programs. SRTS activities and projects vary along lines of (a) intensity: the proportion of students they reach each time they are conducted; (b) frequency: the number of times they are conducted in a given school year; and (c) principal aim: to either increase the percentage of students walking and bicycling, improve the safety of those students who already walk and bicycle, or both. By engaging parents' time and energy, these activities and projects reinforce parents' support for and commitment to the SRTS program.

Enabling and Inhibiting Factors refer to elements of the physical environment such as sidewalks, multi-use paths, and high-speed roadways that either enable or inhibit students' ability and/or motivation to walk and bicycle between home and school . Other factors could include the school communities' social/political environments, such as whether or not there are early dismissal policies for students who walk, or if schools are located in high crime areas.

Walking/Bicycling Percentages refer to the percentage of students who arrive at and depart from school either on foot or bicycle.

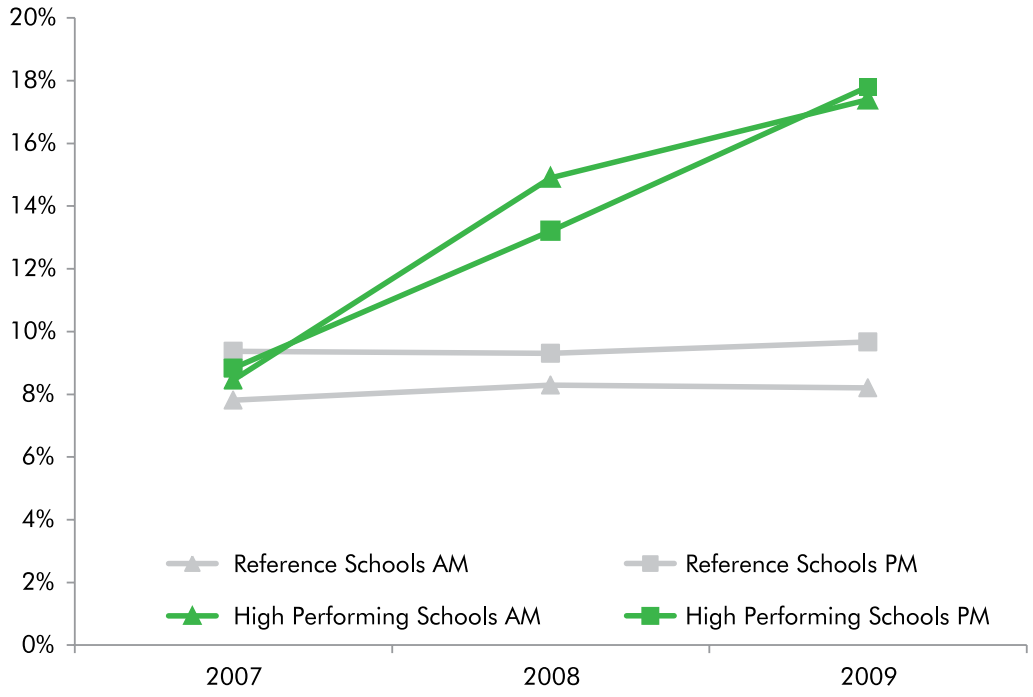
Table 2. SRTS program elements and examples from schools in study.

Program Element	Illustrative Example
School Engagement	*"The fall of 2007 is when we [members of the County Health Department] approached Middle School F about doing SRTS activities. Folks at the school thought it [implementing a SRTS program] was a great idea."* — Middle School F Coordinator
Program Leadership	*"The [school's] principal is the leader behind the program. She is in contact with state DOT staff for support as needed and for review meetings. She organizes activities, such as International Walk to School Day, a state-wide Walk and Bicycle to School Day initiative, pedestrian safety training for 2nd graders, and parent surveys."* — Elementary D Coordinator
Additional Parental Support	*"We need more consistent support from the PTA. People have to see parents' involvement happening year after year. Changes are not something that will happen overnight."* — Middle School E Transportation Coordinator *"Parents have completed walkability checklists of area streets as a resource for the school. The school has a regular group of students walking and bicycling to school and those that can get to school using these modes are supported by their parents."* — Elementary D Coordinator
SRTS Activities & Projects	• Walk to school day • Classroom pedestrian safety training • Frequent walker/rider program • Student-led safety patrols • School zone speed enforcement • Park-and-walk program Representative of activities/projects from all schools in this study
Enabling Factors	*"The town [in which Elementary A is located] is densely populated, and the school offers a prime location to be able to walk to school."* — Elementary A Coordinator *"The crossing guards at the remote drop-off point make it more comfortable for students who ride the bus to walk at least part of the way. Many of the children really like the crossing guards."* — Elementary B Coordinator
Inhibiting Factors	*"I started in this position inJanuary of 2010 on a temporary basis. No one wants the job because it is grant-funded. There has been a lot of [coordinator] turnover."* — Elementary C Coordinator *We did a survey of the barriers to walking/bicycling to school, and parents said that one [dangerous] intersection in front of the school was the largest barrier to walking to school - that is was too scary for their children to walk there."* — Middle School F Transportation Coordinator

Results

The first step of data analysis involved performing Kolmogorov-Smirnov (K-S) tests to determine whether the distribution of morning and afternoon student travel patterns at each school shifted away from, or toward, the car between 2007 and 2009. It was theorized that more students walking and bicycling to/from school would result in fewer students traveling to school by car. The second step involved conducting likelihood ratio chi-square tests to determine whether schools documented significant increases in walking and bicycling between 2007 and 2009. These likelihood ratio chi-square tests were performed because K-S tests examine changes in travel mode distributions, but do not identify which travel mode choices shifted the most over time. In this analysis, the K-S and likelihood ratio chi-square tests complemented each other by providing a more comprehensive picture of students' travel mode behaviors across time than was possible using only one type of test.

Figure 2. Mean percentage of walking and bicycling trips in the morning and afternoon across time among high performing and reference schools (n = 6).



The next step was to examine student travel patterns among the high performing schools and their reference counterparts. The study's three reference schools showed an interesting pattern of student travel over time, as shown in Table 3. Although these schools documented a shift away from the car in the morning between fall 2007 and fall 2009, this change was not seen in the afternoon, nor was it due to greater levels of walking and bicycling (Figure 2). Instead, students attending reference schools shifted away from the car and toward the school bus between 2007 and 2009 (Table 3).

Table 3. Travel mode in the morning and afternoon across time among reference schools.

Year	Time of Day	Total trips	Travel Mode					Test Results	
			Walk	Bicycle	Bus	Transit	Car[a]	K-S	χ^2
2007	AM	1,229	6%	2%	63%	0.1%	29%	0.082*	0.164
2009	AM	1,915	6%	2%	71%	0%	21%		
2007	PM	1,036	8%	2%	70%	0.1%	20%	0.041	0.210
2009	PM	1,685	8%	2%	74%	0%	16%		

*$p < 0.05$.

[a] The "Car" travel mode category is a composite measure of "family vehicle" and "carpool" travel modes; collapsing these modes into one category is consistent with past work which highlights the questionable validity of acquiring carpool information from children (see Mendoza, et al., 2009; McDonald, et al., 2011).

Note. "K-S" refers the Kolmogorov-Smirnov test of two samples; "χ^2" refers to the Likelihood Ratio Chi-square test with one degree of freedom.

On the other hand, as anticipated, the three high performing schools documented a shift away from the car in both the morning and afternoon between fall 2007 and fall 2009. These changes were mostly due to increases in walking and bicycling to and from school.

In less than three years, the percentage of students who walked and bicycled to/from high performing schools doubled. More specifically, in 2007, approximately nine percent of students attending high performing schools walked or bicycled to school; by 2009, about 18 percent were walking and bicycling (Table 4; Figure 2).

School engagement, program leadership, parent group involvement, SRTS activity frequency, and supportive school policies all represent program elements that play key roles in encouraging more students to walk and bicycle to/from school. Each of these program elements are discussed in the following section.

Table 4. Travel mode in the morning and afternoon across time among high performing schools.

Year	Time of Day	Total trips	Travel Mode					Test Results	
			Walk	Bicycle	Bus	Transit	Car[a]	K-S	χ^2
2007	AM	1,515	7%	1%	47%	0%	45%	0.078*	36.780*
2009	AM	1,148	15%	2%	43%	0%	39%		
2007	PM	1,435	8%	1%	47%	0%	44%	0.085*	41.200*
2009	PM	1,163	16%	2%	42%	0%	40%		

*$p < 0.05$.

[a] The "Car" travel mode category is a composite measure of "family vehicle" and "carpool" travel modes; collapsing these modes into one category is consistent with past work which highlights the questionable validity of acquiring carpool information from children (see Mendoza, et al., 2009; McDonald, et al., 2011).

Note. "K-S" refers the Kolmogorov-Smirnov test of two samples; "χ^2" refers to the Likelihood Ratio Chi-square test with one degree of freedom.

School Engagement and Program Leadership

Initial school engagement with SRTS progressed in similar ways across schools in the study. At five out of six schools, county health and/or transportation officials approached school leaders in their communities about implementing SRTS programs. One high performing school was the exception: this school's administrators contacted its state department of transportation (DOT) to assess whether SRTS could address the school's goal of increasing the percentage of students who walked and bicycled.

Efforts to start programs were also driven by concerns about student health and safety. For instance, county health officials serving one reference school were concerned about the percentage of overweight students at the school and wanted to encourage more students to walk and bicycle. These officials discovered that school administrators felt similarly and worked with them to set up an SRTS program. At another reference school, county health officials applied for SRTS funding that would allow them to set up a school zone speed enforcement program because walking and bicycling near the school were deemed unsafe due to speeding motor vehicle traffic. The extent to which the professionals in that community successfully addressed the issue of speeding traffic has yet to be determined.

According to local program contacts, school administrators across all schools in this study were excited about starting SRTS programs, but the administrators' level of commitment varied among the schools. In two of the three reference schools, the SRTS coordinators, who worked outside of their school communities, described themselves as their schools' SRTS leaders. One reference school's coordinator took responsibility for ensuring consistent, timely data collection from the six county schools she served.

In contrast, at one high performing school, the principal and several other school administrators acted as the SRTS leaders by encouraging teachers to collect student travel data each semester, and emphasizing the importance of monitoring the school's progress toward achieving its goal of increased walking and bicycling. Across all high performing schools in this study, program contacts identified the school principals as the schools' SRTS leaders. Being insiders of the school system, principals may have been able to get activities done more often and more consistently.

> *"[Elementary D] parents and the PTO [Parent Teacher Organization] have been involved with the SRTS program since the beginning [in 2006]. Parents are supportive of the program—they volunteer to do pedestrian safety trainings led by the principal, and they are supportive of efforts to make the school safer for walking and bicycling."*
>
> **- SRTS Coordinator for Elementary D (a high performing school)**

Additional Parental Support and SRTS Activities

Additional parental support is generated after program leadership has been established. According to program coordinators across the three high performing schools, parental support maintained the motivation of SRTS leadership and increased the frequency with which SRTS activities were conducted. At one high performing school for instance, the school's Parent-Teacher Organization (PTO) worked with its principal each month to design and conduct SRTS activities. In contrast, program coordinators at reference schools indicated that parental support was either sporadic or difficult to detect at all.

An examination of the actions taken by high performing and reference schools reveals two major differences. First, as a group, high performing schools conducted a greater number of total activities over the three-year period than reference schools (51 vs. 35, respectively) (see Appendix E). Second, a higher percentage of the SRTS activities conducted at high performing schools focused explicitly on increasing the percentage of students walking or bicycling. More than 90 percent (46 of 51) of the SRTS activities conducted at high performing schools focused directly on increasing walking/bicycling.

In contrast, a little more than 60 percent (22 of 35) of activities at reference schools had such a focus. Examples of activities designed to increase walking/bicycling included frequent walker/rider programs, walk to school day events, and park-and-walk programs. Activities not explicitly designed to increase student walking and bicycling percentages included safety assemblies, speed enforcement in school zones, and classroom-based pedestrian safety trainings.

> *"We see more children riding bicycles, something the parents have really supported. I think that the bicycle racks we installed helped to get more kids bicycling."*
>
> **- Transportation Coordinator for Middle School F (a high performing school)**

The Role of Enabling and Inhibiting Factors

Enabling factors. The presence of adult supervision along routes to school was identified as facilitating walking and bicycling. This was achieved using both professional groups such as crossing guards, as well as less formal groups, such as adult walking and bicycling clubs. Adult supervision of student travel within the school community may free some parents from time constraints associated with accompanying their children to school (McDonald & Aalborg, 2009). Other facilitating factors include supportive infrastructure, such as bicycle racks and walking/bicycling-supportive school policies, such as earlier dismissal for walkers.

Inhibiting factors. Unpredictable events that had occurred in the broader community may have discouraged walking or bicycling. For example, in one reference school community, two students were hit by motor-vehicles within a two-year period (2008 and 2009). Concerns about students' safety as a result of these incidents could have counteracted efforts to promote walking and bicycling. These incidents do not automatically stymie programs, however. Some schools have been able to use them as a catalyst to address problems and advance their SRTS programs.

On the other hand, organizational factors, like coordinator turnover, lack of time to devote to SRTS-related planning, and unstable funding, all seemed to have disrupted reference schools' SRTS-focused efforts.

Importantly, but not surprisingly, high performing schools were characterized by a greater number of enabling factors and fewer inhibiting factors than reference schools.

> *"The school dismisses walkers five minutes earlier than other students and the crossing guards start [their shifts] early to help the walkers."*
>
> **- SRTS Coordinator for Elementary B (a high performing school)**

> *"Over time I have learned that there's a lot of work and not a lot of time to get projects done; it's difficult when I only work on SRTS projects half time."*
>
> **- SRTS Coordinator for Elementary A (a reference school)**

Discussion

This study began by identifying three schools where the percentage of students walking and bicycling between home and school increased significantly over a three-year period. These "high performing" schools were then matched with three "reference" schools (i.e., schools that had not documented increases in walking and bicycling over the same three-year period) according to various socio-demographic and geographic variables (see Table 1). To get a sense of how each of the schools implemented SRTS programs and the events that occurred in the broader school communities during this period, interviews were held with local SRTS program coordinators.

It was discovered that relative to reference schools, high performing schools were more likely to (1) have strong program leadership, (2) frequently conduct SRTS activities focused directly on increasing walking and bicycling, (3) have consistent support for the SRTS program from parent groups, and (4) have school policies that reinforced children to walk or bicycle to school (see Table 5). As an illustration, the highest performing school, Elementary D, conducted the greatest number of activities designed to increase walking and bicycling. The frequency with which Elementary D's SRTS activities were conducted appeared to be propelled by enthusiastic program leaders and parent groups. The school's Parent-Teacher Organization (PTO) worked with the school's principal on a monthly basis to develop and conduct SRTS activities. Such interactions likely produced synergistic effects.

Table 5. Presence of program elements across schools in study.

School	In-School Leadership	Frequent Walking and Bicycling Activities	Parental Support	Supportive School Policies	Walking and Bicycling Percentages
High Performing Schools					
Elementary School B	*		*	*	+ 13% (14 – 27%)
Elementary School D	*	*	*	*	+ 12% (5 – 17%)
Middle School F	*	*	*		+ 5% (11 – 16%)
Reference Schools					
Elementary School A	*				0% (2 – 2%)
Elementary School C					- 1% (11 – 10%)
Middle School E		*			+ 1% (24 – 25%)

Across all three high performing schools in this analysis, program leadership was established by the schools' principals rather than outside professionals. This finding is consistent with the results of a recent meta-analysis of interventions designed to promote active transportation to school (see Chillon, Evenson, Vaughn, & Ward, 2011). This meta-analysis cited strong involvement of school principals as a primary means of enhancing program effectiveness. In addition to school principals, it is likely that other school insiders can assume leadership roles in encouraging more students to walk or bicycle to school.

The current study's findings and conceptual model depicted in Figure 1 are potentially useful for three main audiences: SRTS practitioners, State SRTS Coordinators, and other funders and researchers. Practitioners can use the conceptual framework to allocate resources to those activities that focus directly on promoting walking and bicycling where safe conditions support these activities. For example, funding and staff time could be used to set up and operate incentive-based walking/bicycling programs. Other resources may be used to introduce walking/bicycling-supportive school policies, such as early dismissal for walkers and bicyclists. Though this study did not examine the programs' safety impacts, it seems logical to assume that the conceptual model could also guide decision-making about enhancing the safety of the school trip for those students who walk or bicycle. School-based leadership is

likely needed to engage traffic engineers in conducting an infrastructural assessment of home-school routes, or to ensure that a traffic speed enforcement program is implemented consistently. Drawing from the conceptual model, State SRTS Coordinators could require SRTS applicants to collect student travel data at about the same time each year and to document when, where, and how SRTS activities were done. With these data, State SRTS Coordinators and researchers could then relate specific SRTS interventions to any changes in the prevalence of students walking and bicycling.

Limitations

Although this investigation provides some insight into issues that appear to enhance or inhibit efforts to increase walking and bicycling, it has several limitations. First, the limited availability of student travel mode data collected across time reduced the number of schools that were eligible for inclusion in this study. There are many more schools that have seen increases in walking and bicycling than have been described here. Second, coordinator turnover in three of the six profiled schools made it difficult to obtain precise accounts of relevant community and school-level conditions. Third, more generally, the retrospective study design may have relied too heavily on coordinators' memory as well as the thoroughness of previous coordinators' record keeping. Fourth, because it was difficult to obtain precise estimates of the percentage of students who lived within a walkable/bikeable distance of the studied schools, the study did not fully incorporate the effect of distance on student travel behavior, a major determinant of this behavior (McDonald, 2008).

However, all program contacts indicated that there were substantial numbers of students who lived sufficiently close to safely walk or bicycle to school, but for various reasons, did not do so at baseline . Further, the size of the attendance boundaries of each of the three high-performing schools was larger than the boundaries of the matched reference schools' attendance boundaries. As such, any increase in the amount of walking and bicycling in the high-performing schools was not thought to be affected by the influence of shorter walking/bicycling distances than the reference schools. Fifth, as seen in Table 1, according to a few socio-economic indicators (i.e., percentages of non-white students and students eligible to receive free and reduced price meals) schools that were matched in this study were not entirely similar. This limitation was a direct function of the small pool of eligible schools (i.e., N = 12). As greater numbers of schools collect student travel mode data over time, matching procedures should become increasingly robust. Finally, this study's small sample size (i.e., n = 6 schools) limits the generalizability of its findings.

Conclusion

The detailed information investigators were able to collect from the six SRTS-participating schools in this study highlighted the central role of in-school program leadership in encouraging greater percentages of students to walk and bicycle to school. Furthermore, schools where walking and bicycling increased over time were also more likely to encourage students to walk and/or bicycle on a frequent basis, to garner support for SRTS programs from parent groups, and to institute policies that supported walking and bicycling compared to those schools that did not see such increases in walking and bicycling. Impressively, at high performing schools the percentage of students who walked and bicycled between home and school doubled within a three-year period.

Future research should extend and enrich these findings by collecting data as SRTS programs are implemented across time. One primary goal of the federal SRTS program is to encourage and enable more children to walk and bicycle between home and school (SAFETEA-LU, 2005). As such, guiding documents that support the efforts of state and local practitioners should be widely disseminated. Trips to and from school provide stepping stones for broader student engagement in physical activity, community involvement and personal growth, all of which are required for the health and well-being of children and their communities.

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Appendix

Appendix A. Student Arrival and Departure Tally Sheet

Go to www.saferoutesinfo.org/data/ to learn more about the National Center's data collection process and to download the Student Travel Tally.

Safe Routes to School Students Arrival and Departure Tally Sheet

+ CAPITAL LETTERS ONLY – BLUE OR BLACK INK ONLY +

School Name: | Teacher's First Name: | Teacher's Last Name:

Grade: (PK,K,1,2,3...) 0 2 | Monday's Date (Week count was conducted) M M D D Y Y Y Y | Number of Students Enrolled in Class: 1 5

- Please conduct these counts **on two of the following three days Tuesday, Wednesday, or Thursday. (Three days would provide better data if counted)**
- **Please do not conduct these counts on Mondays or Fridays.**
- Before asking your students to raise their hands, please read through all possible answer choices so they will know their choices. Each Student may only answer once.
- Ask your students as a group the question **"How did you arrive at school today?"**
- Then, reread each answer choice and record the number of students that raised their hands for each. **Place just one character or number in each box.**
- Follow the same procedure for the question **"How do you plan to leave for home after school?"**
- You can conduct the counts once per day but during the count please ask students both the school arrival and departure questions.
- Please conduct this count regardless of weather conditions (i.e., ask these questions on rainy days, too).

Step 1. Fill in the weather conditions and number of students in each class

Step 2. **AM – "How did you arrive at school today?"** Record the number of hands for each answer. **PM – "How do you plan to leave for home after school?"** Record the number of hands for each answer.

Key	Weather	Student Tally	Walk	Bike	School Bus	Family Vehicle	Carpool	Transit	Other
	S= sunny R= rainy O=overcast SN=snow	Number in class when count made	-	-	-	Only with Children from your family	Riding with children from other families	City bus, subway, etc.	Skate-board, scooter, etc.
Sample AM	S N	2 0	2	3	8	3		3	1
Sample PM	R	1 9	3	3	8	1	2	2	
Tues. AM									
Tues. PM									
Wed. AM									
Wed. PM									
Thurs. AM									
Thurs. PM									

Please list any disruptions to these counts or any unusual travel conditions to/from the school on the days of the tally.

+ +

Appendix B. Walkability Assessment Scale

Walkability assessment scale used in the present study.

	Pedestrian Intolerant (1)	Pedestrian Tolerant (2)	Pedestrian Supportive (3)	Pedestrian Place (4)
Sidewalk Presence	Local streets have no sidewalks Arterial streets have sidewalks on only one side of street	Local streets have sidewalks on only one side of street Arterial streets have sidewalks on both sides	All streets have sidewalks provided on both sides	All streets have sidewalks provided on both sides with supplemental traffic-calming measures
Sidewalk Location and Width	Sidewalks lacking, or provided immediately back of curb Walkway width < 5′	Sidewalks provided immediately back of curb Walkway width 5′ min	Walkway separated from vehicular traffic by a 5′ sidewalk planting strip Sidewalk 6′ -8′ wide to accommodate passing and pairs of pedestrians walking side by side Next to transit stops, sidewalks are 10′ wide and extend to street at boarding spot	The pedestrian realm includes a sidewalk planting strip/pedestrian furnishings zone next to street, a walk/talk zone, and a shy zone next to buildings
Sidewalk Planting Strip	None	None	5′ minimum, ideally with overstory street trees 20′-30′ on center sight distance triangles at intersections and crossings	5′-10′ with overstory street trees in parkway planting strips, or none if tree wells and supplemental planters are provided within wide sidewalks, with clear sight distance triangles
Pedestrian Furnishings	None	No furnishings along streets not on transit routes	Pedestrian furniture groupings located intermittently along non-transit streets Pedestrian wayfinding provided	Pedestrian furniture groupings, sculpture, drinking fountains, decorative fountains, wayfinding, etc. are located throughout
Lighting	None	High angle highway lamps, such as cobra heads	Commercial districts have both: High angle lamps Additional low angle street lamps for improved lighting at ground level	Pedestrian places have: Overall street lighting Low placement of tungsten lamps Additional light emitted from stores that line the street

Note. Adapted from Charlier and Associates (2005, p. 23).

Appendix C. Example Activity Table

Example of an activity table used in this study.

Activities	School-wide Safety Assemblies	Speed Humps	Walk-and-Wheel program	School zone speed enforcement
2007				
When activity began				
Times per school year				
Month(s) during year				
Approx. percent of all school's students who had participated				
2008				
When activity began				
Times per school year				
Month(s) during year				
Approx. percent of all school's students who had participated				
2009				
When activity began				
Times per school year				
Month(s) during year				
Approx. percent of all school's students who had participated				

Note. "When activity began" refers to the month the activity was conducted; "Times per school year" refers to the number of times an activity was conducted in a given school year; "Month(s) during year" refers to the months an activity was conducted during a particular school year; and "Approx. percent of all school's student who had participated" is an estimate of the percentage of students who had participated in an activity each time it was conducted.

Appendix D. Interview Protocol

Background

1. What is your role with your school's Safe Routes to School (SRTS) program?
2. When did you start in your current position?
3. About when did your school start its SRTS program?
4. Why do you think your school started a Safe Routes to School program?
   a. To increase the safety of students who had already been walking/bicycling to school?
   b. To increase the number of students who walk and/or bicycle to school?
   c. Both?
5. Have the main goals changed over time?
   a. If yes…how have they changed?
   b. About when did the goals of your program change?

School Policies, Type and Implementation of SRTS Programs

6. During the same time period, has there been any town/city-wide event(s), program(s), or policy(ies) that were undertaken to draw attention to the benefits or walking/bicycling?
7. Does your school have any rules or policies that would make it difficult for students to walk/bicycle to school (for example, a school-wide ban on bicycling to school)?
   a. Has your school's SRTS program reversed or addressed these rules in any way?
8. Does your school have any rules or policies that might get more students walking/bicycling to school (for example, a school rule that allows walkers to leave a little earlier than other students)?
   a. Has your school's SRTS program helped put these rules into place?
9. Could you think back to the Fall of 2007 and try to tell me which SRTS programs and activities your school did, or started doing between then and the Fall of 2009?

Community-wide Influences

10. Again, I'm going to ask you to think back to 2007. Has there been anything in the media since then about an incident or incidents that drew the public's attention to children's safety (for example, a student was hit; a child was kidnapped, etc.)?

Wrap-up

11. We're very interested to learn what you think about your school's SRTS program. In your opinion, how do you think your school's SRTS program has gone since 2007?
    a. Why do you think it has gone that way?
12. Are there any last things you'd like to share with us?

Appendix E. SRTS Activities Conducted by Study Schools

The types (and number) of SRTS activities conducted per year by each school in study.

Group	School	2007 Activities	2008 Activities	2009 Activities	Total Activities
Reference	Elementary A	Walk at school (1) Classroom ped. safety trainings (2) Speed enforcement in school zone (2)	Walk at school (1) Classroom ped. safety trainings (2) Speed enforcement in school zone (2)	Walk at school (1) Classroom ped. safety trainings (2) Speed enforcement in school zone (2)	15
	Elementary C	None.	None.	Walk to School Day (1)	1
	Middle School E	None.	Literature re: benefits of walking/bicycling to/from school (1)	Literature re: benefits of walking/bicycling to/from school (1) Walk and Wheel Wednesdays (8) Park-and-Walk Wednesdays (8) Safety Assembly w/ helmet fitting (1)	19
				Group Total	**35**

Appendix E. SRTS Activities Conducted by Study Schools (Cont'd)

The types (and number) of SRTS activities conducted per year by each school in study.

Group	School	2007 Activities	2008 Activities	2009 Activities	Total Activities
High performing	Elementary B	None.	Walk to School Day (1) Literature re: benefits of walking/bicycling to/from school (1)	Walk to School Day (1) Literature re: benefits of walking/bicycling to/from school (1) Safety Assembly w/ helmet fitting (1)	5
	Elementary D	Walk to School Day (2) Classroom ped. safety trainings (1)	Walk to School Day (2) Classroom ped. safety trainings (1) Frequent walker program w/ traveler tickets (9)	Walk to School Day (2) Classroom ped. safety trainings (1) Frequent walker/rider program w/ traveler tickets (9)	27
	Middle School F	None.	Literature re: benefits of walking/bicycling to/from school (1)	Literature re: benefits of walking/bicycling to/from school (1) Walk and Wheel Wednesdays (8) Park-and-Walk Wednesdays (8) Safety Assembly w/ helmet fitting (1)	19
				Group Total	**51**

Note. All displayed activities were discrete events. Activities that were conducted on a daily basis, (e.g., "student-led safety patrols"; "crossing guard program" and "bicycle rack installation") were classified as "facilitating factors" in this analysis.

Appendix F. Study Schools' Student Travel Modes between 2007 and 2009

High performing and reference schools' student travel modes in the morning and afternoon between 2007 and 2009.

School	Year	Time of Day	Total trips	Travel Mode					Test Results	
				Walk	Bicycle	Bus	Transit	Car[a]	K-S	χ^2
A	2007	AM	455	0.7%	0.4%	66%	0.2%	33%	0.057	0.013
	2009	AM	419	1%	0%	71%	0%	28%		
	2007	PM	300	0.9%	0.2%	78%	0.2%	21%	0.090	2.492
	2009	PM	200	0.2%	0%	87%	0%	13%		
B[1]	2007	AM	260	13%	0%	54%	0%	33%	0.122	8.879*
	2009	AM	144	25%	0%	54%	0%	21%		
	2007	PM	247	14%	0%	44%	0%	38%	0.156*	4.486*
	2009	PM	176	27%	0%	43%	0%	30%		
C	2007	AM	555	7%	0.2%	68%	0%	25%	0.085*	0.514
	2009	AM	1278	6%	2%	75%	0%	16.2%		
	2007	PM	526	11%	0.2%	70%	0%	19%	0.068	1.138
	2009	PM	1271	7%	2%	76%	0%	14%		
D[1]	2007	AM	704	4%	1%	23%	0%	72%	0.142*	38.379*
	2009	AM	597	15%	0.2%	27%	0%	58%		
	2007	PM	695	5%	0.9%	24%	0%	69%	0.136*	42.494*
	2009	PM	588	17%	0.1%	26%	0%	55%		
E	2007	AM	217	16%	8%	46%	0%	30%	0.014	0.005
	2009	AM	228	17%	6%	46%	0%	31%		
	2007	PM	208	16%	8%	54%	0%	22%	0.098	0.107
	2009	PM	224	21%	5%	45%	0%	30%		
F[1]	2007	AM	546	10%	2%	75%	0%	14%	0.048	4.618*
	2009	AM	406	10%	6%	70%	0%	14%		
	2007	PM	526	8%	2%	76%	0%	11%	0.041	3.442
	2009	PM	387	9%	5%	66%	0%	16%		

[1]Indicates a high performing school.

[a] The "Car" travel mode category is a composite measure of "family vehicle" and "carpool" travel modes; collapsing these modes into one category is consistent with past work which highlights the questionable validity of acquiring carpool information from children (see Mendoza, et al., 2009; McDonald, et al., 2011).

*$p < 0.05$.

Note. "K-S" refers the Kolmogorov-Smirnov test of two samples; "χ^2" refers to the Likelihood Ratio Chi-square test with one degree of freedom.