Built Environment and Walking to School

Findings from a Student Travel Behavior Survey in Massachusetts

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Thousands of communities across America now promote walking and biking (active commuting) to school as a mechanism to increase physical activity, reduce traffic congestion, and improve air quality. Distance to school and attributes of the built environment are crucial factors in a child's mode choice, and some of the most difficult determinants to influence with programmatic interventions. Further understanding the built environment's role may help in assessing a school's mode shift potential and more effectively planning and implementing strategies that increase walking and biking to school. Based on a student travel behavior survey of 18,713 responses from 105 schools in Massachusetts, a multilevel model was used to investigate the effects of route, neighborhood, and school characteristics on walking to school. The model results indicate that the built environment affects the odds of walking to school. Specifically, short routes along less-trafficked streets with mixed land use are associated with the increased odds of children walking to school. Investigating these built environment characteristics of the route, neighborhood, and school through a multilevel model, the study created a framework for examining between-school differences in walk-to-school rates, while controlling for built environment factors of the school and student body. A potential application for this work is to compare walk-to-school rates across heterogeneous schools and contextualize schools' baseline walk share, set appropriate and measurable mode shift goals, and track their progress over time.

The percentage of children who walk or bike (active commute) to school in the United States has dropped from 48% in 1969 to only 13% of students in 2009, while the percent of kindergarten through Grade 8 students driven to school increased to 45% (*1*). At the same time, there have been declining levels of physical activity, a rise in childhood obesity, and growing car dependence across the country (*2–5*). Evidence suggests that active school commuters engage in more physical activity than passive commuters do, and are more likely to meet the recommendations for daily physical activity (*2, 6*).

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Most walking and biking programs in the United States fall under the umbrella of Safe Routes to School (SRTS). SRTS seeks to promote activities that reduce traffic and air pollution around schools and make walking and biking to school an easier, safer choice (*7*).

The SRTS program faces multiple challenges. SRTS interventions can only affect the mode choice for children who live close enough to walk or bike to school. Across most studies, distance to school is a crucial factor in a child's mode choice (*2, 8–10*), so a school's mode shift potential and actual impacts can only be properly understood by controlling for the distance and attributes of the built environment. SRTS programs must work within the context of the school's built environment—not a factor that can easily be changed by an SRTS program. Therefore, by further understanding the role of the built environment, SRTS programs and school administrations may more effectively implement strategies that increase walking and biking to school, and more accurately evaluate the success of those strategies. However, less is known about the influences of the built environment on mode choice among children, particularly along the route to school (*10, 11*), compared with evidence on the built environment and adult walkability (*10*).

This analysis used a Massachusetts student travel behavior survey to investigate the role of the built environment as a determinant of walking to school. Specifically, the study investigated route-, neighborhood-, and school-level characteristics associated with walking to school. The study used a data set of 18,713 geocoded student travel behavior survey responses from 105 schools (an average of ~178 survey responses per school). The results of the model suggest evidence that the built environment affects the prevalence of walking to school. Short routes along less-trafficked streets with mixed land use are associated with increased odds of children walking to school. Moreover, the model provides a useful method for comparing walk-to-school rates over time and among heterogeneous schools, and can provide performance metrics that control for built environment factors beyond the control of the SRTS program.

FACTORS AFFECTING SCHOOL TRAVEL

Much of the literature on active commuting to school focuses on individual and social characteristics. Male, Latino, and black children, and those of lower socioeconomic status, are more likely to engage in actively commuting to school (*2*). Having siblings is also associated with higher rates of walking and biking for high school students, but there is no significant effect for elementary students (*12*). Internationally, evidence suggests that car ownership is associated with less walking and more driving to school (*13*). However, studies in the United States are less uniform. Some studies have found a negative association between car ownership and walking to school (*11, 13*); others have found no statistically significant relationship with household vehicle availability (*14, 15*). Whether children engage in active commuting to school is consistently associated with parental perceptions. Common parental concerns include neighborhood safety, traffic, distance to school, and busy schedules (*2, 8, 9*).

Children have fewer transportation options and are generally more dependent on their parents and household context (*10*). Consequently, the evidence in child-focused studies is more mixed than in adult studies. Intersection density, a common measure of network connectivity, has been found in some studies to be positively associated with walking and biking to school (*16–18*), but negatively associated with active school commuting in other studies (*13*). Another built environment route measure used in previous studies is the directness of the route. Route directness is typically measured as the ratio of the straight-line distance from home to school to the network distance from home to school (*17*). Three studies have found that more indirect pedestrian routes were associated with walking to school (*13, 17, 19*). Although adult commuting may be strongly influenced by travel time, children's travel may be more strongly influenced by traffic safety concerns; therefore, parents and children may seek less trafficked routes that are less exposed to traffic (*13*).

Children who live in urban areas are more likely to commute actively to school than children living in rural areas (*2*). However, there is no clear connection between mixed land use and children's commuting to school (*10*), although increased land use mix—which increases the number of potential destinations accessible by foot—is commonly associated with higher rates of walking among adults. Timperio et al. (*13*) and Schlossberg et al. (*17*) excluded land use mix from their studies due to its weak connection to school commuting. McMillan (*15*) and Frank et al. (*18*) found that the land use mix around the school was a positive predictor of walking, and Larsen et al. (*10*) found that the land use mix along the route to school was a negative predictor of walking; however, these studies defined land use mix in different ways.

Real and perceived traffic safety risks are important in shaping child commuting behavior. Perceived traffic safety is commonly cited as one of parents' primary concerns about whether children can take an active form of transportation, especially young children (*20*). Despite this perception, for actual crashes, McDonald et al. found that riding with a teenage driver is the most dangerous mode on a per trip basis (*21*). Several previous studies have examined the presence of major roads as a proxy for real and perceived traffic safety (*13, 17, 22*). In general, crossing or walking along major roadways is negatively associated with walking to school (*13, 17, 19*). Thus, some previous school commuting route studies have used pedestrian networks comprising on- and off-road facilities (*10, 19, 23*).

Finally, the relative location of the school, as measured by indicators such as shorter distances to school and greater population density in the immediate area of the school, have been linked with higher active commuting rates (*2*). However, the research on school enrollment appears to be mixed. Braza et al. (*16*) found a negative association between school size and active commuting; Ewing et al. (*11*) found no significant relationship.

DATA

Student Travel Behavior Survey

This analysis used data from an SRTS student travel behavior survey developed by the Metropolitan Area Planning Council (MAPC) in 2011, which is now administered by MassRIDES, a division of the Massachusetts Department of Transportation (DOT). The survey was administered to schools with an SRTS program. Schools distributed the survey to parents online, on paper, or both. The online version of the survey is available at www.masaferoutessurvey.com. From 2011 to October 2015, there were 24,571 survey responses from 185 pre-kindergarten to Grade 12 schools in Massachusetts.

The survey collected the following information from parents about each student in the home: grade enrolled in school, nearest street intersection to the home, travel mode to school on most days, and travel mode from school on most days. If respondents commuted by car, they were asked whether the driver continued to (or was returning from) work or another destination (a chained trip). Respondents provided information about the number of vehicles in the household and the number of licensed drivers. Based on these data, the ratio of cars to licensed drivers in the household was calculated. Google drive distances were also provided with these data.

The study investigated the built environment characteristics of the route, neighborhood, and school that were associated with walking to school. The analysis was constrained to responses within a 2 mi walking distance of the school, which was consistent with past research as a typical distance threshold for active commuting. The analysis was also constrained to schools that had more than 35 survey responses. In addition, the study excluded responses from parents reporting children in Grades 9–12, due to the low proportion of the sample coming from this grade category (164 responses, or <1% of the survey responses). Finally, due to a low sample size of bicyclists (148 bicyclists, or ~3% of active commuters), the analysis was limited to only walkers. The final analysis was conducted on the remaining sample of 18,713 survey responses obtained from 105 schools.

School and Neighborhood Data

The American Community Survey 2010–2014 five-year block group estimates were used to estimate average population density and median household income for the school neighborhood. For the route to school, an area-weighted average population density and median household income were calculated by estimating the area of the block groups that intersected the 50-m buffer around the route.

Massachusetts Department of Elementary and Secondary Education school and district profile data were used to find the overall school enrollment for the year the survey was administered, proportion of low-income students, race or ethnicity of the student body, and proportion of English language learners for each school. School demographic data were from the academic year 2013–2014, because this was the most recent year for which data on all variables were available.

METHODS

Geographic Information Systems Neighborhood and Route Delineation

There are relatively few route-based SRTS studies. Therefore, the study drew from methods from Timperio et al. (*13*) and Schlossberg et al. (*17*), two of the seminal articles on a geographic information system (GIS) approach to the shortest travel route along the street network in the walk-to-school literature. Both studies used GIS to map the shortest route via the street network and examine variables based on these routes, assuming the child took the shortest route. However, neither study investigated land use mix along the route. Larsen et al. (*10*) built off this methodological foundation and created a 50-m buffer around the routes to calculate an entropy measure of land use mix within this buffer.

The survey data were geocoded to the nearest intersection to the home with ArcGIS 10.3. The network analyst extension was then used to find the shortest route to school for each survey response. The underlying network used in this study was a pedestrian network comprising roadways with sidewalks on one or both sides of the road, low-volume residential roads (< 1,000 vehicles per day), and off-road facilities. This network was also used to create half-mile school walksheds (the walking distance via the network) to define the school environment or neighborhood. These geographic units (route and school walkshed) were used to calculate neighborhood and route characteristics for the analysis.

Land Use Measures

To explore land use mix, the study used the Massachusetts Land Parcel Database developed by the MAPC. The Massachusetts Land Parcel Database is a statewide atlas of more than 2.1 million land parcel boundaries and associated tax assessor data (*24*). The database was used to calculate an entropy measure of land use mix between four land uses: residential, commercial, recreational, and institutional land. Land use mix was calculated along a 50-m buffer corridor along the route with the following equation:

$$\left[\text{LUM} = \frac{-\sum_{u}(\rho_u \ln \rho_u)}{\ln n}\right]$$

where

u = land use classification,
ρ = proportion of land area dedicated to the particular land use, and
n = total number of land use classifications.

Scores range from zero to one, with zero representing all land in a corridor as a single land use and one representing an even distribution of all four land use classifications. In addition to land use mix, the percentage of industrial land use was calculated separately along the route, to explore land use preferences along the route. Approximately two-thirds (12,562) of the routes did not have industrial land use.

Road Measures

Several measures of network connectivity were used. The number of intersections and number of intersections with major roads along the route were calculated, as well as intersection density per kilometer squared of the school neighborhood. Data on road intersections came from the 2013 Massachusetts DOT roads layer. Major roads are defined by the Massachusetts DOT as roads with a functional classification of 1-4 (i.e., highways, major arterials, and collector roads).

The study also used the directness of the pedestrian route as another measure of network connectivity. For this analysis, this measure was defined as the ratio of the pedestrian route distance to the Google driving distance. There were some differences between the pedestrian route distance and the Google driving distance. Google driving directions provide drivers with the fastest route, which may route them more on major roads, while the pedestrian routes only include off-road facilities, low-traffic-volume streets, and streets with pedestrian infrastructure. The ratio was standardized so that ratios where the drive distance was greater than the walk distance (or ratios less than 1) were the same distance from 1 as ratios where the walk distance was greater than the drive distance. In addition, any ratios between 1.1 and 1/1.1 were considered to be the same distance (pedestrian route distance = drive route distance). The majority of data were the same distance (57% had the same distance, 32% had shorter pedestrian distance, and 11% had longer pedestrian distance than driving distance). The ratio was restricted to double the ratio in either direction. Approximately 2% (325 responses) were outside this range (−2 to 2). Finally, the study calculated the percentage of major route mileage to the total route mileage.

Data Analysis

A multilevel model was useful in estimating active travel, because the survey responses were socially and spatially grouped within schools (Figure 1). The null model had a between-school variation of approximately 1.401 and a variation partition coefficient of nearly 30%. Therefore, a single-level model would violate the independence assumption of standard ordinary least-squares regression models. Multilevel models can handle individual explanatory variables and school-level explanatory variables, by allowing the residual variance to be partitioned into between-group and within-group components (*25, 26*). Therefore, the study used the binomial glmer command to predict walking to school (1) or not (0), to fit a two-level random intercept logistic model (individuals within schools). The study used R to conduct the analyses.

Partially adjusted models and a fully adjusted model were estimated. The partially adjusted models were used to examine the effects of the built environment measures separately, while adjusting for the hypothesized confounding effects of grade, year, household cars per driver, and distance to school. Then a fully adjusted model was constructed where variables were retained in the model based on a statistical significance of ≤0.05 and if the direction of the effect was expected and consistent between the partially and fully adjusted models. The study also examined the correlations between the model variables, and all associations were less than 0.55. Two models were created for walking to school and walking from school.

After constructing the final fully adjusted model, the authors conducted a sensitivity analysis of the fully adjusted model, by removing the school with the most responses (841 responses), to see whether schools with large survey responses were skewing the model results.

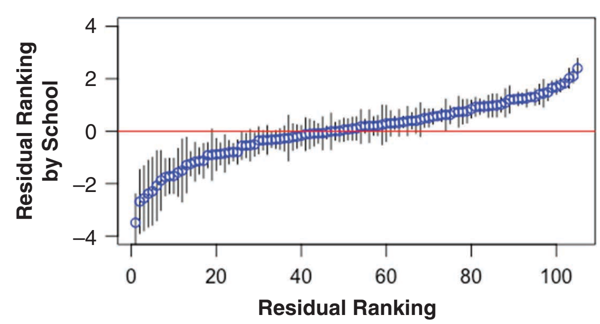

FIGURE 1 Null model caterpillar plot.

TABLE 1 Descriptive Statistics

	Number (%)	
Variable	Walk to School	Walk from School
Mode to school		
Walk	4,835 (26)	5,032 (27)
Bike	148 (1)	146 (1)
Family vehicle	8,692 (46)	7,617 (41)
Drop-off	5,803 (67)	na
Pickup	na	4,568 (60)
Carpool	750 (4)	766 (4)
School bus	4,043 (22)	4,820 (26)
Transit	173 (1)	196 (1)
Other	72 (0)	136 (1)
Grades pre-K–1	6,148 (33)	6,148 (33)
Grades 2–4	8,359 (45)	8,359 (45)
Grades 5–8	4,206 (22)	4,206 (22)
Carless households	2,513 (13)	2,513 (13)
More drivers than cars	3,135 (17)	3,135 (17)
At least one car per driver	13,065 (70)	13,065 (70)

NOTE: na = not applicable.

RESULTS

Descriptive Statistics

Table 1 shows the descriptive statistics of the survey responses by the travel mode to and from school from 18,713 survey responses from 105 schools. The mode splits to and from school were similar. Approximately 4,835 respondents (26%) walked to school and 5,032 (27%) walked from school. There were very few bicyclists in the sample. Biking accounted for approximately 1% of the sample to and from school. Consequently, children bicycling to school were not analyzed further. Personal vehicles were the dominant mode share to and from school. Of the 46% of respondents who drove to school, 67% were dropped off on the parent's route to work or at another destination. Of the 41% who drove home, 60% were picked up. The average distance to school was approximately ¾ mi. Finally, approximately 45% of the respondents had children in Grades 2 to 4, and 70% owned at least one car per licensed driver.

Most survey responses came from the Boston metro region, New Bedford, and Worcester areas (Figure 2). Survey responses by school ranged from 35 to 841 responses, with an average of 178.5 responses per school. Approximately half of those living within a half-mile of the school walked. However, those who were driven in personal vehicles made up a large portion of the mode share across all half-mile distance categories. Approximately 82% of the survey responses were paper responses.

Partially Adjusted Models

Partially adjusted models were estimated to ascertain the magnitude and direction of effect for each indicator individually (Table 2). All indicators were tested in the partially adjusted models while adjusting for the hypothesized confounding effects of year, grade, distance, and household cars per driver. Similar to previous research, distance and walking along major roads were significantly negatively

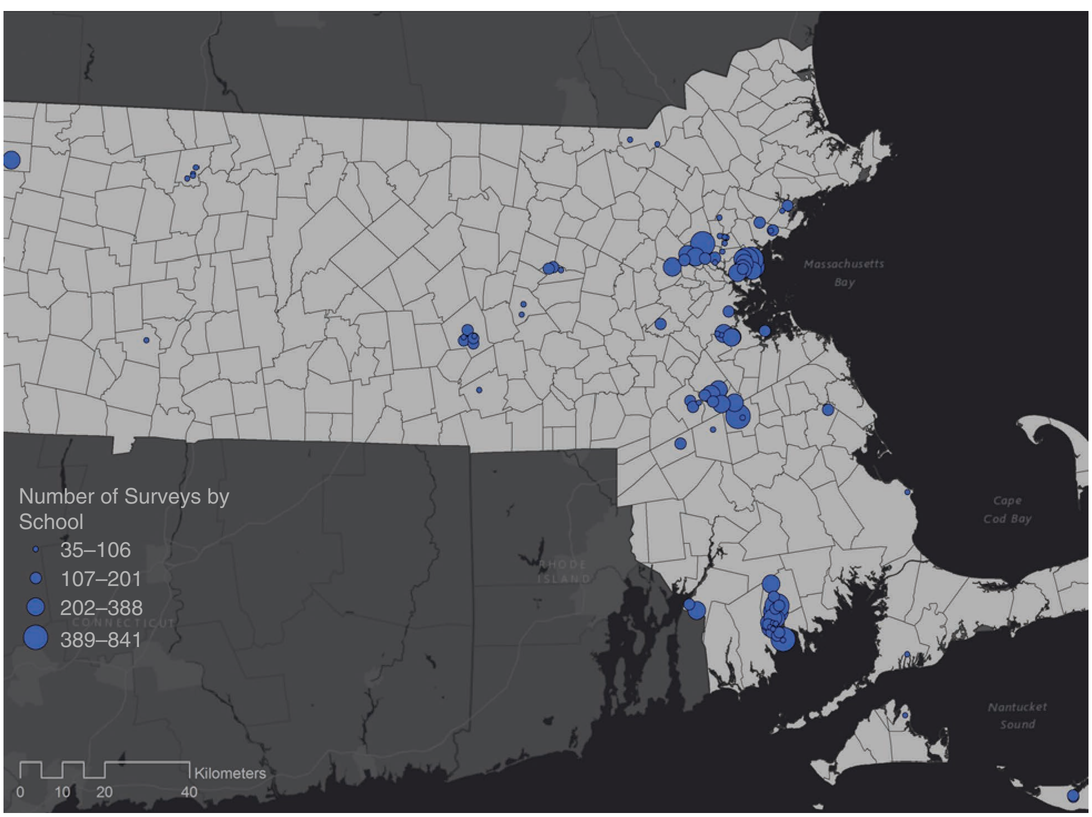

FIGURE 2 Number of survey responses, by school.

TABLE 2 Partially Adjusted Models with Odds Ratio and Statistical Significance

Variable	Odds Ratio
Route	
Population density	0.99
Median household income[a]	1.02
Land use mix	2.58**
Industrial land use percent	0.26
Number of intersections	1.00
Number of major intersections	1.00
Proportion of major road miles	0.66**
Indirect pedestrian route	1.12**
School	
Population density	1.03
Median household income[a]	1.05
Intersection density	1.00
Percent not white	1.00
Percent English language learners	1.01
Percent low income	1.00
Residential land use percent	1.13
School enrollment[b]	1.20**

NOTE: Adjusted for grade, year, distance, and cars per driver.
[a]In $10,000s.
[b]In 100s of students.
*$p < .05$; **$p < .01$.

associated with walking, and indirect pedestrian routes and intersection density around the school were significantly positively associated with walking. Land use mix along the route, a less commonly explored indicator, was also significantly associated with walking. In addition, school enrollment was positively associated with walking. The number of intersections along the route; percentage of industrial land use along the route; population density along the route and in the school neighborhood; and school-level measures of the proportion of low-income students, race or ethnicity of the student body, and the proportion of English learners were not significant predictors.

Fully Adjusted Model

Table 3 summarizes the results of the final, fully adjusted multilevel model predicting whether children walked to school. With the partially adjusted model as a guide, measures of interest were added and examined for a statistical significance of $p \leq .05$ and a consistent direction of the effect between the partially and fully adjusted models. On average, students whose route had greater land use mix and a more indirect pedestrian route compared with a driving route had greater odds of walking to school, compared with more uniform land use and a more direct driving route, adjusting for all other factors. Routes with a greater portion of major roads decreased the odds of walking to school, adjusting for all other factors.

The fully adjusted model explained about half of the residual variance in the propensity to walk to school at the school level, compared with the null model. After adjusting for the covariates, the model had a variance partition coefficient of approximately 15%. Thus, 15% of the residual variation in the propensity to walk to school is attributable to unobserved school characteristics.

TABLE 3 Fully Adjusted Multilevel Model

	Odds Ratio (95% CI)	
Variable	Walk to School	Walk from School
Individual Level		
Grades 2–4[a]	1.10 (1.00, 1.21)*	1.15 (1.04, 1.26)**
Grades 5–8[a]	1.59 (1.39, 1.81)**	1.92 (1.69, 2.19)**
Distance (mi)	0.04 (0.03, 0.05)**	0.05 (0.04, 0.05)**
More drivers than cars[b]	0.2 (0.17, 0.23)**	0.25 (0.22, 0.29)**
At least one car per driver[b]	0.17 (0.15, 0.19)**	0.22 (0.19, 0.25)**
Route land use mix	5.34 (2.92, 9.76)**	4.31 (2.41, 7.72)**
Major road on route	0.59 (0.49, 0.70)**	0.6 (0.51, 0.71)**
Indirect pedestrian route	1.15 (1.08, 1.23)**	1.12 (1.05, 1.19)**
School Level		
School enrollment[c]	1.13 (1.05, 1.22)**	1.19 (1.10, 1.28)**
School neighborhood intersection density	1.01 (1.01, 1.02)**	1.01 (1.00, 1.01)**
School neighborhood median household income[d]	1.15 (1.08, 1.21)**	1.09 (1.03, 1.16)**
Constant	0.29 (0.12, 0.71)**	0.44 (0.18, 1.06)
Marginal r^2, conditional r^2	.47, .55	.44, .52

NOTE: All adjusted for year.
[a]Reference = Grades pre-K–1.
[b]Reference = carless households.
[c]In 100s of students.
[d]In $10,000s.
*$p < 0.05$; **$p < 0.01$.

DISCUSSION

This analysis investigated a unique data source to add to the relatively few studies that have simultaneously analyzed route, neighborhood, and school characteristics associated with walking to school. The study found evidence that built environment features of the neighborhood, route, and school affect walking behavior to school. In particular, short routes along less-trafficked streets with mixed land use were associated with increased odds of children walking to school.

Consistent with previous research, the study found that older children, especially those in Grades 5 to 8, were more likely to walk to school (*27*), and that greater distance to school, vehicle ownership, and higher proportion of major roads on the route were negatively associated with walking to school (*10, 13, 17, 19, 23, 27*). Moreover, this analysis demonstrated that busy roads were a barrier to walking to school even if pedestrian infrastructure was present. This finding suggests that even if pedestrian facilities are present, the parent or child still may prefer to avoid busy roads. Furthermore, the study investigated a novel measure of route directness, by examining the ratio of walking distance to the Google driving directions, to examine a network-based measure of directness. This investigation found that less-direct pedestrian routes were positively associated with walking to school. Previous studies reported the same finding (*13, 17, 19*). Combined with the finding of the effect of major roads on odds of walking to school, it is possible that children and parents may go out of their way to seek out a less-trafficked route to walk to school (*13*).

Although this study had many similarities to previous research, the analysis investigated some measures that are unique or seldom looked at in the literature. Contrary to some previous studies, the land use mix along the shortest walking route to school was a positive predictor of walking to school. At first glance, this finding is surprising, because the literature on walking to school has found that correlates of adult walking behavior, such as population density and land use mix, are unlinked to school travel behavior (*11*). Therefore, few studies have investigated this measure, and they have reported mixed findings (*10, 15, 18*). Moreover, the entropy measure of land use mix is a crude measure that depends on the land use categories used to define it. Nevertheless, land use mix, as defined in this study, had a modest positive effect on walking to school. This finding could be indicative of living in a more walkable environment. The finding provides new evidence and warrants further study.

Surprisingly, school enrollment was the only significant and influential school-level predictor. The study found that larger schools were associated with walking to school. Larger schools may be sited in urban or densely populated areas of communities, where walking is more feasible. Other studies have found that schools with a greater percentage of students in the free and reduced price meals program were associated with a greater likelihood of walking to school (*28*). However, this indicator, along with the proportion of students who were English language learners and the proportion of the student body that was not white, were not significant in the model, even after the study looked specifically at the 2013–2014 school year. This finding may indicate a lack of heterogeneity in these variables among the schools, and represent a common feature of schools that opt into the SRTS program in Massachusetts.

LIMITATIONS

The study analyzed a large cross-section sample of survey responses from a unique student travel behavior survey. The survey is administered to SRTS programs in Massachusetts, to investigate route, neighborhood, and school characteristics associated with walking to school in a school with an SRTS program. Because of the cross-section design, the study could not infer causality to the observed relationships. The study assessed the usual travel mode to and from school, so the findings do not elucidate any temporal or weather-related relationships.

The analysis was limited to survey responses within 2 mi of school. Approximately 20% (4,880) of the survey respondents lived beyond that cutoff point. However, the mode shift goal for those who live more than 2 mi from school may be different (i.e., encouraging bus ridership, carpooling, or remote drop-off zones).

The data contained an unknown number of sibling pairs, which threatened artificially shrinking confidence intervals around the parameter estimates. To assess the potential for this limitation to bias the results, the study ran a sensitivity analysis on online survey responses, which had the added benefit of capturing whether the child had a sibling. The results were consistent with the main findings.

School administrators administered the surveys. Therefore, there was variability in the survey response rate by school, which affected the representativeness of the survey of the school as a whole. Furthermore, the school student body changes from year to year. Although the study controlled for year in the model, the analysis used all the data from 2011 to 2015, and there may have been changes in the students and schools during that time.

The routes used in this study were generated from responses from the travel behavior survey. These routes were based on the shortest-path algorithm on a pedestrian network comprising roadways with sidewalks on one or both sides of the road, low-volume residential roads (< 1,000 vehicles per day), and off-road facilities. Thus, it was assumed that the child's probable route may have been the shortest route with some pedestrian infrastructure; however, this may not have been the child's actual route. This pedestrian network also would not include all shortcuts, such as routes that cut through properties. Furthermore, the route was based on an intersection near the home, and not the actual home location. In addition, route directness has not been calculated with network-based distances. The drive distance was based on Google driving directions. Because only the Google drive distance was reported in the survey data, the study did not determine what the actual network route was. In future studies, the Google drive route could be compared with the pedestrian network route, to explore what is truly being captured in this measure.

There are strong influences on children's walking-to-school behavior that were not included in this analysis. This was apparent in the model, in which approximately 15% of the residual variation in the propensity to walk to school was attributable to unobserved school characteristics not in the model. Therefore, although it is important to understand the built environment context, additional study is required to understand why schools, after one controls for the built environment context of the school and its survey responses, have high or low walking rates.

NEXT STEPS

This analysis provides evidence that built environment features of the route, neighborhood, and school affect walking to school. The study found that short routes along less-trafficked streets with mixed land use were associated with increased odds of children walking to school. With a multilevel model, the study was able to parse out individual built environment predictors of walking to school, while controlling for school differences. Although the study confirmed that the built environment has a strong effect on walking to school, there are many influences on children's walking-to-school behavior that were not included in this analysis. Still, it is important to control for built environment characteristics, to understand what types of SRTS interventions may be effective.

An application of this analysis is to evaluate Massachusetts SRTS programs. This framework could be used to compare and contextualize schools' baseline walk share, set appropriate and measurable mode shift goals, and track their progress over time. This is an exciting prospect, because there has been little evaluation of SRTS programs across the country (*6*). After accounting for route, neighborhood, and school environment variables in a multilevel model, the study saw a significant improvement in prediction, compared with the null model. In other words, accounting for built environment variables helps make schools more comparable, but there are still other random effects (nonbuilt environment factors) that make schools different from one another (e.g., school programs and policies). With this study as a framework, a potential application of this work would be to create built environment benchmarks that could be integrated into the student travel behavior survey to contextualize and understand why schools, after one controls for the built environment context of the school and its survey responses, have high or low walking rates.

These findings should encourage schools to engage in additional infrastructure (i.e., traffic calming and complete streets policies) and noninfrastructure strategies (i.e., walking school bus programs). Such strategies would aim to improve the real and perceived route environment, by slowing and reducing traffic and incentivizing more children to commute actively. The data source and methods explored in this study provide a framework that could be used to compare and contextualize Massachusetts SRTS schools' baseline walk share, set appropriate and measurable mode shift goals, and track their progress over time.

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