Environment and Planning A 2010, volume 42, pages 2168 – 2185

doi:10.1068/a435

By foot, bus or car: children's school travel and school choice policy

Elizabeth J Wilson
Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Ave S., Minneapolis, MN 55455, USA; e-mail: ewilson@umn.edu
Julian Marshall
Department of Civil Engineering, University of Minnesota, 301 19th Ave S., Minneapolis, MN 55455, USA; e-mail: julian@umn.edu
Ryan Wilson
Active Communities/Transportation (ACT) Research Group, Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Ave S., Minneapolis, MN 55455, USA; e-mail: wilson903@umn.edu
Kevin J Krizek
Active Communities/Transportation (ACT) Research Group, Environmental Design Building, University of Colorado, Campus Box 314, Boulder, CO 80309-0314, USA; e-mail: krizek@colorado.edu
Received 7 January 2010; in revised form 24 March 2010

Abstract. Many school districts in the United States allow parents to choose which school their child attends ('school choice' or 'magnet schools') while other school districts require students to attend their nearest ('neighborhood') school. Such policies influence children's transportation. We survey elementary-school parents in St. Paul and Roseville, Minnesota, to discover how children travel to school and underlying factors influencing parent's choice of their child's travel mode. From this information we develop a statistical model of travel mode choice. We find that children's commute mode and parental attitudes towards school selection differ by school type (magnet versus neighborhood), income, and race. Relative to neighborhood schools, magnet schools draw from broader geographic regions, have lower rates of walking, bicycling, and commuting by automobile, and higher busing rates. Parent attitudes towards transportation also differ by race and school type. For example, parents of nonwhite and magnet school students placed greater-than-average importance on bus service and quality. This paper highlights the potentially unintended influence of school district policy on school commute mode.

1 Introduction

Recent policy attention and research have focused on children's school commuting. Concerns include children's health and safety, traffic congestion, environmental impacts of transportation, and parents' time chauffeuring children. Popular responses aim to increase rates of commuting by bicycle and walking (Rosenthal, 2009), but rarely do these initiatives directly account for other policies, such as school choice, that also impact school transportation. School travel is intricately tied to geography (eg urban, suburban, or rural environments), state and district school bus policy, school quality, extracurricular activities of children, and other factors. School travel policies differ among and within states; for example, some but not all states require that districts provide bus service for students.

In the United States, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) aims to create and augment school travel programs under the banner of Safe Routes to School (SR2S). Such initiatives often address physical infrastructure, improvements to street design, volunteer opportunities, and educational activities to encourage bicycling and walking. Assessing the effectiveness of SR2S is difficult in part because other factors (eg educational policies) affect children's commute patterns.

Historically, children typically attended the school closest to their home ('neighborhood school'). Today, in some US school districts, children can enroll in a school choice program, attending a 'magnet school' instead of the closest neighborhood school. We aim to explore interactions between school choice and school commute mode, especially walking and cycling. Given the increasing prominence of both types of initiatives (school choice and SR2S), improved understanding of this topic can help researchers, practitioners, government and school officials, and the general public understand the impacts of specific school policies on transportation. This topic is set against a backdrop of declining school budgets, rising transportation costs, and heightened attention worldwide to greenhouse gas emissions.

To our knowledge, only one previous effort (Wilson et al, 2007) explicitly studied school travel in light of school choice. There, we found that school choice led to longer school commute distances (because children attend schools across the district rather than in their neighborhood) and reduced levels of walking and bicycling to school (because longer commutes are less amenable to walking or bicycling). The current study strengthens and expands earlier research. We survey parents to determine attitudes that affect school choice and school travel mode. Rather than rely on national data, we analyze differences at the local level between an urban and a suburban school district and investigate how parents' school transportation mode choices and attitudes differ by ethnicity, school type, and income. Using the survey data, we develop a statistical model of the factors that determine school travel mode.

After the introduction (part 1), in part 2 we provide background, the context of the study, and review relevant literature. Part 3 describes the study locations and the survey and part 4 presents survey results and the multinomial logistic regression model. In part 5 we discuss implications for school policy.

2 Background

The US youth population (53 million people in 2007, aged 5 – 17 years) is larger than most nations. Concerns about school commuting include traffic congestion, safety, environmental impacts, and direct and indirect costs. Increasing obesity and decreasing physical activity among children have led to federal (Centers for Disease Control and Prevention, 2005; Federal Highway Administration, 2006) and state (Boarnet et al, 2005; Butcher, 2006; Staunton et al, 2003) projects to increase walking and cycling to school (Krizek et al, 2004). The US SR2S program, funded through SAFETEA-LU (Section 1404), is a well-known example and source of funding (McDonald and Howlett, 2007).

2.1 School choice

School choice allows a child to attend a school other than the one closest to home. A single school district may include school-choice (magnet) schools and non-school-choice (neighborhood) schools—as is the case for both of the cities we surveyed—and choice can be solely within district (as with the two cities we surveyed) or between districts.

Two main aims of school choice are (1) enhanced educational performance and (2) racial and socioeconomic diversity in each school, owing to greater mixing among segregated neighborhoods ('voluntary desegregation') (Gorard et al, 2001; Schellenberg and Porter, 2003; Schneider et al, 1997; Whitty, 1998). A study in St. Paul, Minnesota, found that the dominant motivation for school choice has shifted over time, from voluntary desegregation previously to, at present, improved educational performance (Schellenberg and Porter, 2003). The 2002 "No Child Left Behind" Act encourages school choice by (1) allowing students whose school has not maintained adequate progress for two years to attend a school with better test scores and (2) encouraging the funding of magnet schools (Part B, Voluntary Public School Choice Program 115 Stat. 1803). We do not take a position in favor of or against school choice—legitimate arguments exist on both sides of this debate—and instead note that school-choice programs are more common today than a decade or two ago; both support and criticism for school choice can be found throughout the political spectrum (Gorard et al, 2001). At issue for this work is that school choice has important implications for school commuting and especially for walking and bicycling.

2.2 Factors that determine mode choice

Table 1 summarizes literature-identified factors that influence school travel mode. Travel distance has the greatest impact: at distances greater than 0.8 km from the school, walking ceases to be the most common travel mode; at 1.6 km walking rates decrease to near zero (DiGuiseppi et al, 1998; McDonald, 2007a). One study found

Table 1. Example factors that can influence school travel mode.

Factor	Effect	Mode [a]	Association [b]
Trip			
Type	from-school (vs. to-school)	w	(+) McMillan (2003), Schlossberg et al (2005)
			(0) DiGuiseppi et al (1998), Sirard et al (2005a)
		b	(+) McMillan (2003), Sirard et al (2005a), Schlossberg et al (2005)
Travel distance	increase	w/b/a	(−)/(+) McMillan (2007), Schlossberg et al (2005; 2006), Wen et al (2007)
School attribute			
Choice	magnet (vs. neighborhood)	w/b/a	(−)/(+) Wilson et al (2007)
Enrollment	increase	w	(−) Kouri (1999), Braza et al (2004); (0) Ewing et al (2004)
Child characteristic			
Grade	elementary (vs. secondary)	w	(0) Dellinger and Staunton (2002)
Sex	female (vs. male)	w	(−) Evenson et al (2003), McMillan et al (2006); (0) McDonald (2007b)
Household characteristic			
Vehicle	increase	w/a	(−)/(+) Ewing et al (2004), Wen et al (2007)
Sibling	presence	w	(+) McDonald (2007a)
Income	increase	w/a	(−)/(+) California Department of Health Services (2004), Ewing et al (2004)
Urban form			
Population density	increase	w	(+) McDonald (2007a), Braza et al (2004); (0) Ewing et al (2004)
Walkability index	increase	w	(+) Kerr et al (2006)
Sidewalk connectivity	increase	w	(+) Ewing et al (2004)
Street connectivity	increase	w	(+) Schlossberg et al (2006)

[a] w—walk, b—bike, a—auto.

[b] (+) increase in travel mode; (−) decrease in travel mode; (0) no effect on travel mode.

that a child has nearly three times greater odds of walking or bicycling within 1.6 km than outside 1.6 km (McMillan et al, 2006). Even within 1.6 km, as few as 31% of students walk or bicycle to school (Dellinger and Staunton, 2002).

School location influences travel distance, which in turn influences travel behavior (McDonald, 2005; 2008; McMillan, 2005; McMillan et al, 2006). School commuting via walking and bicycling decreased from 41% in 1969 to 13% in 2003, with the largest decreases among nonwhite elementary students; roughly half (47%) of the decline was explained by the increased distance between home and school (McDonald, 2008). Changes in the school-age population, including race and child age, and changing attitudes towards school travel likely explain some of the decline as well. Decreasing residential density and increasing number of students per school generally result in fewer children living near their school. McDonald estimates that a residential density of nearly 400 people per square kilometer is necessary to sustain a 300-student community school in which all students could commute by walking or cycling (assumed maximum travel distance: 1.6 km). Roughly two thirds (64%) of US households with school-age children currently live in locations at or above this level of residential density (McDonald, 2008).

SR2S programs often focus on a third factor influencing active-travel rates: urban form. Relative to travel distance and demographic characteristics, urban form has been found to play a smaller but still important role in school commute mode (McMillan, 2007). One study found that infrastructure constructed through SR2S programs increased walking (Boarnet et al, 2005) and suggested further evaluation in multiple locations to help generate firm conclusions.

Parental concerns and preferences about school travel are often identified as important factors, but many studies do not explore or quantify how this factor influences travel mode choice. This gap in the literature is noteworthy because parental attitudes may be at least as influential as urban form, especially perceptions about safety, social interaction, and convenience (McMillan, 2007). Common concerns include traffic, bullies, and strangers (DiGuiseppi et al, 1998; Hillman et al, 1990; Kerr et al, 2006; Martin and Carlson, 2005). Concerns about traffic may prevent up to 40% of children from walking or bicycling (Dellinger and Staunton, 2002). Parents have stated that a walking escort may increase their willingness to allow their child to walk to school (Schlossberg et al, 2005), perhaps helping to explain a British study that estimated 84% of parents accompanied their children when they walked to school (DiGuiseppi et al, 1998). A parent might also prefer to drop their child off at school separately or as part of another trip regardless of bus availability or school proximity (Schlossberg et al, 2006).

Whether mode choice yields expected impacts on daily activity level remains an open question. Available research confirms declining activity levels for children (Dietz and Gortmaker, 2001; Trost et al, 2002) and adolescents (Sallis, et al, 2000). However, studies evaluating the role of walking to school have been mixed in finding statistically significant increases in children's daily activity level (Krizek et al, 2004). For example, one study found no effect on total activity for five-year-olds driven to school (Metcalf et al, 2004); another found increased total activity correlated with walking to school, yet with statistical significance only in boys (Cooper et al, 2003). More recent studies *have* found increased total activity for children walking to school (Cooper et al, 2005; Sirard et al, 2005a; 2005b).

3 Research approach

3.1 Survey administration and study area

We surveyed parents of students in grade K-6 in two Minnesota school districts: St. Paul (the state capital) and Roseville Area Schools (a group of suburbs bordering St. Paul[(1)]. The survey was developed in concert with the school districts (Roseville Area Schools, 2009; Saint Paul Public Schools, 2009). Our survey questions were informed by several sources, including the Marin County Safe Routes to School Parent Survey, the New York City Walk to School Parent/Guardian Survey, and the Michigan Fitness Walk to School Day Parent Survey (Marin County Safe Routes to School Program, 2009; New York City Department of Transportation, 2009; Safe Routes to School Michigan, 2009). The survey consisted of twenty-two questions to measure students' school commute modes and route, and parent attitudes about school choice and their respective transportation choices. The communities were selected to explore variations in urban form (urban versus suburban; see table 2) and school-choice policy. St. Paul and Roseville provide bus services to students living more than 1.6 km and 0.8 km, respectively, from the school they attend. In St. Paul approximately 5% of the school district budget is for transportation (School Choice Taskforce, 2005). Figure 1 shows the school district boundaries and identifies the location and type of each elementary school.

Roseville's post-war development pattern is typical of US suburban development. In contrast, St. Paul was largely developed before World War II, and displays attributes of a walkable community (sidewalks, local streets, relatively high density). In St. Paul 91% of elementary school students live within 1.6 km of an elementary school, which suggests that, in the absence of school choice and with the current bus policy, only ~9% of school children would need a bus service.

Table 2. Description of case-study school districts.

Characteristic	St. Paul	Roseville area
Area (km^2)	145	53
Number of municipalities served	1	7
Year(s) incorporated	1854	1948 – 1974
Year-2000 population	287 151	52 143
Dominant urban form	urban	suburban
Number of children in public schools	40 543	6 396
Number of children in public elementary schools	21 766	3 222
Number of 'neighborhood' public elementary schools	21	6
Number of 'magnet' public elementary schools	34	1
Median enrollment per school (neighborhood/magnet)	392/324	412/703
Percentage of students living within 0.8 km of an elementary school [a]	52	19
Percentage of students living within 1.6 km of an elementary school [a]	91	53
Number of respondents (percentage of respondents)	1264 (58)	861 (40)
Number of respondents included in the analyses (percentage of sample)	917 (58)	516 (42)
Attend neighborhood school (percentage of sample)	34	80
Attend magnet school (percentage of sample)	66	20

[a] Network distance.

[(1)] The Roseville Area School District serves Roseville plus the municipalities of Arden Hills, Falcon Heights, Lauderdale, Little Canada, Maplewood, and Shoreview (all of which are too small to have their own school districts).

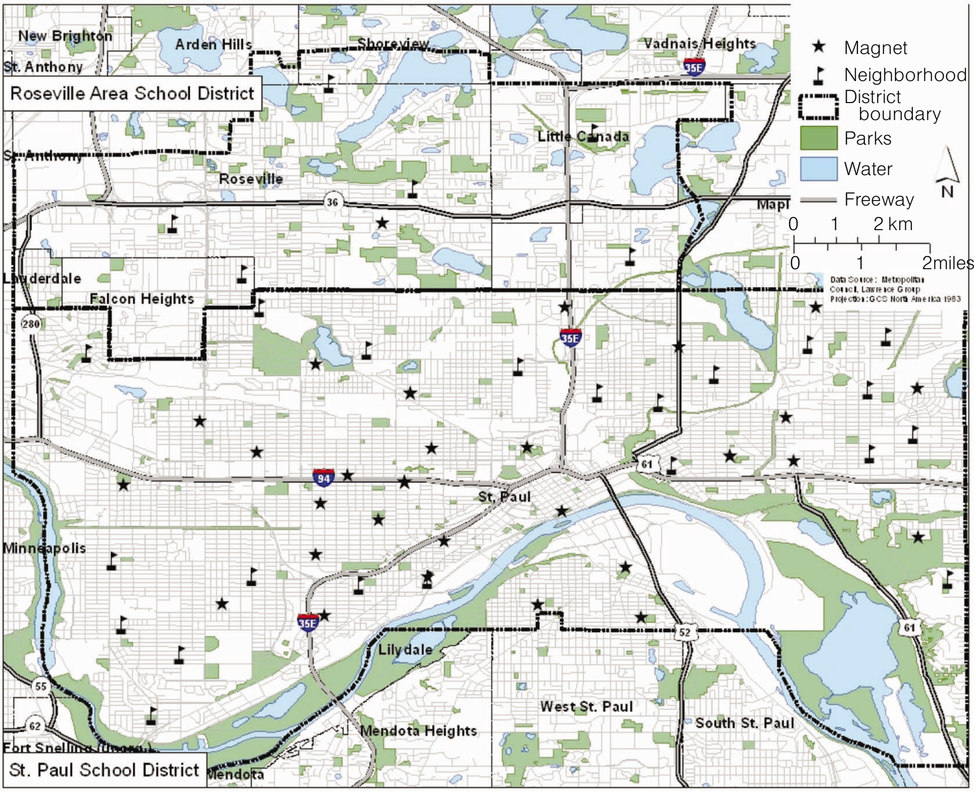

Figure 1. [In color online, see http://dx.doi.org/10.1068/a435] Location of St. Paul and Roseville Area elementary schools.

To increase school diversity, geographic boundaries for St. Paul's neighborhood schools are not always contiguous; magnet schools include socioeconomic status (specifically, whether a student qualifies for reduced-cost or free lunch programs) among their selection criteria (Schellenberg and Porter, 2003). In 1974 almost all students in the St. Paul school district attended a school located in or near their neighborhood. Today, any public school student [in the US, 'public schools' refers to schools receiving most of their funding from public government (tax-based) monies] in St. Paul is eligible to attend a 'choice' school; an estimated 67% of students attended a school that is not their neighborhood school (School Choice Taskforce, 2005). Roseville has one 'choice school' which any student in the district is eligible to attend.

Surveys were mailed in late May 2007 to 8744 households with children in grade K-8 (St. Paul: 6000, Roseville: 2744). School districts provided home addresses for mailings. We maintained confidentiality by using an off-site mailing service; investigators never saw home addresses. The survey was translated into Hmong, Somali, and Spanish for households with dominant languages other than English. One week later, we followed up with reminder postcards. Approximately 215 surveys were returned undeliverable by the post office and we received 2185 completed surveys. The response rate (25%) is similar to previous mail surveys by St. Paul School District (Schellenberg, personal communication, 2007). Of the completed surveys, 1835 (84%) provided their home location and school name, which were necessary to calculate distance to school. Analyses here focus on primary-school children (grade K-8) who made five to-school and five from-school trips, resulting in a final sample of 1433.

3.2 School travel model

Only a few previous studies have developed statistical models to predict school commute modes. Existing models employed logistic regressions, such as binary (McMillan et al, 2006; Wen et al, 2007), nested (Ewing et al, 2004), and multinomial (McDonald, 2007a). We use the survey data to develop a multinomial logistic regression model that describes the likelihood a child will travel via auto, bus, or walk, as a function of continuous and categorical independent variables (school attributes, distance, child and household characteristics, and commute-route urban form).

We measured and tested whether the following variables affect walking (basis: 200 m buffer around each child's shortest walking path): number of busy intersections crossed, intersection and street density, total daily vehicle-miles traveled, average vehicle speed along the route, population density, and land use (R Wilson, 2008). Sidewalk coverage data do not exist for Roseville and could not be tested in the model. We refined the model through systematic testing of independent variables as the difference in log-likelihood ratios. Violating independent irrelevant alternatives is not a large concern: the travel survey sample has known travel choices and school district officials confirmed that nearly all children travel to school via auto, school bus, or walking (Schellenberg, personal communication, 2007).

In developing the school travel model, we eliminated the 217 students who live outside of their school district boundary or are missing variable information, yielding a sample of 1216 used for model development. We calculated distance to school as the shortest road network travel distance, using ArcGIS v.9.2. We weighted the travel survey sample against the Census 2000 population residing in the school district, accounting for differences in race and income (MetroGIS DataFinder, 2009). Weighting to census data rather than specifically to the school population is imperfect, but is the best approach available (household income data are not available for the Roseville Area School District) (Kennedy, 2007; Saint Paul Public Schools, 2005).

4 Results

4.1 Demographic comparison

Compared with the overall school district population, our survey sample is both whiter and wealthier, an occurrence similar to previous surveys conducted in these school districts (Schellenberg, personal communication, 2007). The greater affluence in our sample may represent a response bias (if higher income parents are more likely to respond to the survey) or an accurate reflection of the sampled populations [if parents of elementary-age children are more affluent than the general public—a plausible scenario because college students and retirees have lower-than-average incomes and are included in census data but not heavily represented in our survey population (US Census Bureau, 2006)]. Our survey results indicate that the Roseville magnet school has a higher median household income (\$90 000) than Roseville neighborhood schools (\$75 000), St. Paul neighborhood schools (\$70 000), and St. Paul magnet schools (\$60 000).

4.2 Comparison of to-school and from-school trips

Consistent with previous investigations, (McMillan, 2003; Schlossberg et al, 2005), we find that travel mode may differ during the week and between to-school and from-school commutes: in our data 35% of students rely on different modes to-school versus from-school and 40% of students used at least two different modes during the week. Considering separately the five to-school and five from-school trips per week, 77% of respondents used one travel mode for all five to-school trips; 78% used only one travel mode for the five from-school trips; 99% of students have a dominant (between three and five trips per week) mode for to-school and a dominant mode for from-school commutes. Furthermore, 89% have a dominant mode when all ten weekly trips (ie six or more trips by one mode) are considered collectively. We conclude that employing dominant mode is a useful and appropriate simplification for our logistic model, and that incorporating to-school versus from-school differences strengthens the model.

4.3 Travel for magnet schools versus neighborhood schools

We examined relationships between dominant travel mode and distance, stratified by school type and show St. Paul school district in table 3. As an illustration, figure 2 displays the locations of one neighborhood and one magnet school in St. Paul and the home locations of respondents who attend the respective schools. The data show similarities in travel mode between magnet and neighborhood schools for similar distances to school. The percentage of St. Paul children who walk or bicycle is similar for neighborhood and magnet schools at distances less than 0.8 km, though the percentage of students walking is nearly two times greater at neighborhood schools than magnet schools in the 0.8 – 1.6 km interval. For commute distances greater than 1.6 km, walking is nearly zero and busing is more common than automobile, with the proportion of students being bused being greater at magnet than at neighborhood schools. As St. Paul only offers a bus service at distances greater than 1.6 km, the findings are expected and appear to reflect school policy. For Roseville there is more bus and auto use and less walking at both short distances and more busing at longer distances (0.8 – 4.8 km), highlighting the effect of district busing policy.

Comparing total trips (ie, not stratifying on travel distance), walking and driving are less common for magnet than for neighborhood schools. Relative to neighborhood schools, magnet schools walk three times less (27% neighborhood; 9% magnet), drive 1.4 times less (42%; 30%), and use the bus twice as much (30%; 61%). For both types of school, driving represents the largest share for the 0.8 – 1.6 km distance (50% and 54% of trips for neighborhood and magnet schools, respectively), highlighting the low number of elementary school children who walk at this distance. Roseville magnet school students lived farther from school and fewer walked at all distances. Compared with Roseville neighborhood schools, magnet school students were nine times less likely to walk or cycle (9.7% for neighborhood; 1.1% for magnet), 8 percentage points higher for busing (63.4% to 55.5%) and comparable in auto use (35% to 34.5%).

Table 3. Comparison of St. Paul neighborhood and magnet school student travel mode.

	Distance to school (km)							
	<0.4 (%)	0.4 – 0.8 (%)	0.8 – 1.6 (%)	1.6 – 3.2 (%)	3.2 – 4.8 (%)	>4.8 (%)	Percentage of total	Total trips n
St. Paul neighborhood school								
bus	6.9	3.7	16.3	41.3	51.4	60.3	30.4	954
auto	15.8	27.7	51.1	55.0	48.6	37.6	42.2	1 324
walk/bike	77.3	68.6	32.5	3.7	0.0	2.1	27.3	856
St. Paul magnet school								
bus	6.4	10.3	29.8	67.3	74.2	69.0	61.1	3 684
auto	21.6	21.0	53.3	30.5	24.6	30.2	30.1	1 812
walk/bike	72.0	68.7	16.9	2.2	1.2	0.8	8.8	529
Difference (magnet-neighborhood)								
bus	−0.5	6.6	13.5*	26.1**	22.8	8.7	30.7	
auto	5.8	−6.7	2.2	−24.5**	−24.0**	−7.4	−12.2	
walk/bike	−5.3	0.1	−15.6**	−1.5	1.2	−1.3**	−18.5	

* Significant at $p < 0.05$, ** significant at $p < 0.01$.

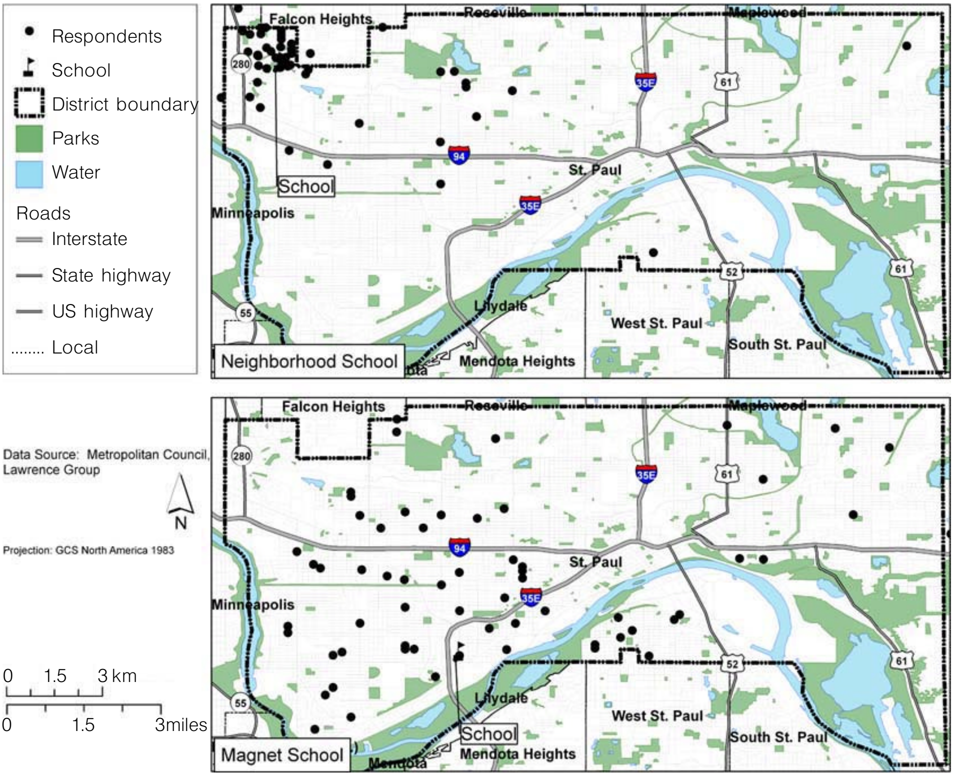

Figure 2. [In color online.] Location of one neighborhood and one magnet school in St. Paul and the home locations of respondents who attend the respective schools.

Children who attend a magnet school often have a longer commute distance. Figure 3 compares travel distance for neighborhood and magnet schools in St. Paul and illustrates this finding: a greater percentage of neighborhood school students live closer to the school they attend (results for Roseville are similar). Median travel distance is 2.7 times greater for magnet than for neighborhood schools (4.3 km versus 1.6 km). The portion of students commuting more than 3.2 km is 2.5 times greater for magnet than for neighborhood schools (43% versus 17%).

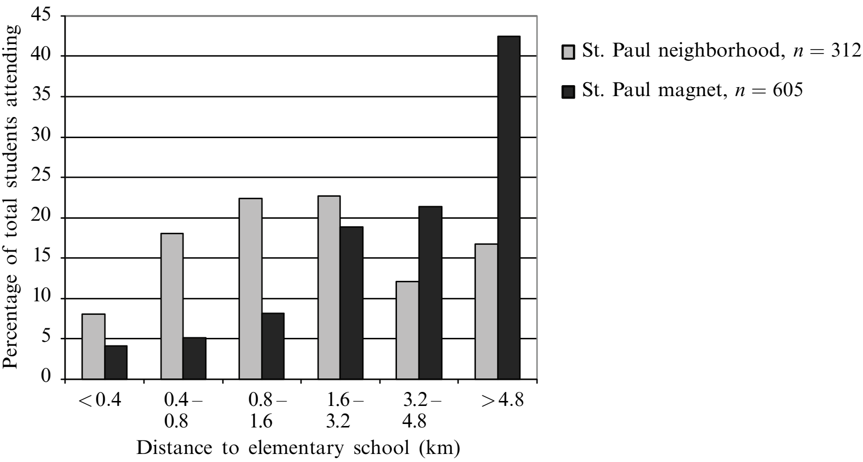

Figure 3. Travel distance by school type for St. Paul.

4.4 Explaining school selection and travel

Parents' school selection decisions influence child travel mode and in this section we examine reasons parents choose their child's schools and explore differences by race, sex, and income. Table 4 compares survey respondent attitudes on school selection between neighborhood and magnet school parents, showing data for St. Paul. When parents were queried about the reasons underlying their choice for their child's school, three criteria (of ten[2] listed in the survey) were very or somewhat important for most parents: quality of teachers, size of class, and curriculum. This was the same for Roseville.

Among St. Paul magnet school parents, 85% ranked curriculum as very important compared with 75% of neighborhood school parents (statistically significant at $p < 0.01$)—not surprising considering most magnet schools offer a specialized curriculum (eg language, math and science, arts, and others). More parents of children attending neighborhood schools ranked the school being close to home as very or somewhat important (49% versus 31%), while more magnet parents valued availability of a bus service (56% versus 33%). One St. Paul parent wrote,

> "Our child's school is 5 minutes (walking) and 1 minute (drive) away. The most important benefit is he can either sleep more or play more or study more."

Writes a St. Paul magnet school parent,

> "Safe and reliable bus service is an integral part of the school choice program. Our neighborhood school was an unacceptable option for us, so going 'further afield' to a magnet school was the best choice for us, but wouldn't have been feasible without bus transportation."

Roseville neighborhood and magnet school parents were similar (neighborhood parents value school proximity to home more than magnet school parents: 52% to 29%), but not statistically significant, relating in part to the smaller sample size and lack of statistical power.

Survey responses are different for white and nonwhite parents, with responses from St. Paul parents shown in table 5. Compared with the survey median, nonwhite respondents are, on average, poorer and live farther from school ($p < 0.01$). Nonwhite children are also more likely to take the bus and attend a magnet school (71% nonwhite versus 63% white); 72% of nonwhite parents ranked the availability of a school bus service as very important, versus 37% of white parents ($p < 0.01$). For Roseville 60% of nonwhite parents versus 43% of white parents ($p < 0.05$) scored bus availability as 'very important'. There were also some differences between white and nonwhite parents' responses to important factors in determining whether their child rides the bus: 81% of nonwhite parents placed safety at the bus stop as 'very important', versus 63% of white parents ($p < 0.05$). Nonwhite parents were more concerned about cold temperatures at the bus stop ('very important': 66%) than white parents ('very important': 21%) ($p < 0.01$). Nonwhite parents also placed greater importance on diversity and on the school being close to home ($p < 0.01$). Responses were similar for Roseville.

Overall, among the eight reasons offered for why children did *not* recently walk or bicycle to school, distance was the primary reason (66% of the sample) followed by difficult crossings (40%). These results were similar for Roseville. This finding suggests that school choice and the popularity of magnet schools strongly affect children's tendency to walk or bicycle to school.

[2] The ten factors are: school bus services available, close to home, quality of teachers, size of class, diversity, curriculum, close to work, school start time, distance from your other child's school, and other factors.

Table 4. Parent's responses of school attributes by St. Paul neighborhood versus magnet school.

School attribute	Neighborhood school (%)[a] ($n = 314$)					Magnet schools (%) ($n = 603$)					Difference statistic[b]
	very	somewhat	not very	not at all	does not apply	very	somewhat	not very	not at all	does not apply	
School bus service available	33.1	23.2	13.4	22.9	5.7	56.1	24.5	8.0	8.6	2.2	−6.23**
Close to home	49.4	40.1	8.3	0.6	0.6	30.8	46.3	16.1	4.5	1.0	−6.01**
Quality of teachers	94.9	3.5	0.6	0.0	0.3	95.5	3.3	0.5	0.0	0.2	−0.16
Size of class	71.3	25.8	1.6	0.0	0.0	64.7	29.7	4.1	0.5	0.0	−2.16*
Diversity	33.1	46.8	13.4	2.9	1.3	45.6	40.6	9.6	2.3	0.2	−3.17**
Curriculum	75.2	20.4	1.6	0.0	0.6	84.9	13.1	0.5	0.2	0.3	−3.28**
Close to work	5.1	17.2	33.4	33.4	8.9	6.6	20.9	34.5	29.5	6.3	−0.69
School start time	20.7	37.6	29.0	11.1	0.6	20.2	37.5	28.2	12.8	0.3	−0.49
Distance from other child's school	9.9	19.1	18.5	10.5	39.8	11.8	20.2	18.6	11.4	36.3	−0.77

$^{*}p < 0.05$, $^{**}p < 0.01$. [a] Percentages may not add up to 100% due to missing values. [b] Reporting Z-statistic from Mann–Whitney U-test (2-tailed significance).

Table 5. Comparison of St. Paul white and nonwhite parent importance of school attribute in selecting school.

School attribute	White students (%)[a] ($n = 626$)					Nonwhite students (%) ($n = 291$)					Difference statistic[b]
	very	somewhat	not very	not at all	does not apply	very	somewhat	not very	not at all	does not apply	
School bus service available	37.0	28.8	12.5	17.4	3.3	71.8	14.4	4.5	5.2	3.4	−9.30**
Close to home	32.6	47.9	15.0	3.2	0.6	47.1	36.1	10.0	3.1	1.4	−3.76**
Quality of teachers	97.1	2.6	0.0	0.0	0.2	91.4	5.2	1.7	0.0	0.3	−3.61**
Size of class	67.3	29.9	1.9	0.2	0.0	66.3	25.1	6.2	0.7	0.0	−0.92
Diversity	35.0	50.2	12.1	1.8	0.3	55.0	26.8	8.2	4.1	1.0	−4.02**
Curriculum	81.6	16.8	0.8	0.0	0.3	81.4	13.1	1.0	0.3	0.7	−0.07
Close to work	2.9	16.3	35.8	37.9	6.2	13.1	26.8	30.6	15.8	9.3	−6.91**
School start time	10.1	39.9	34.2	14.9	0.2	42.6	32.3	16.2	6.5	1.0	−10.00**
Distance from other child's school	6.1	20.1	18.4	12.3	41.9	22.0	19.2	18.9	8.6	28.2	−1.45

$^{*}p < 0.05$, $^{**}p < 0.01$. [a] Percentages may not add up to 100% due to missing values. [b] Reporting Z-statistic from Mann–Whitney U-test (2-tailed significance).

Differences in income and sex are as follows: (1) when a child was driven to school, 66% of drivers were female in both neighborhood and magnet schools; (2) roughly 42 – 47% of children (neighborhood – magnet) who were driven to school did so as part of a parent's trip to work, while 42 – 45% of children (neighborhood – magnet) were driven in a separate single-child trip; (3) only 12% of neighborhood and 7% of magnet school children travel to school in a carpool; (4) the sex of the child did not have a significant effect on mode choice. Those with an income below the county median level lived slightly farther away from school: at a median distance of 2.8 km, compared with above-median income families at a distance of 2.4 km.

4.5 School travel model analysis

Using the survey data, we constructed a weighted multinomial logistic regression model to estimate the odds of (1) bus and (2) walk relative to the reference mode auto. The model has a pseudo r^2 of 0.53 and correctly predicts travel mode for 74% of the travel survey sample. Notable statistically insignificant variables include child sex, parent attitudes towards school and travel mode, school enrollment, and school-specific test scores.

Results from the logistic model (table 6) suggest that, relative to the reference mode (auto), the odds are greater that a student will: (1) walk at the shortest travel distances, (2) bus when service is available, (3) walk and bus more when traveling from-school than to-school, (4) bus more in Roseville than St. Paul, (5) bus more for magnet schools than for neighborhood schools, (6) walk or bus more if they are older, (7) walk or bus more if they are from a larger household, (8) bus if they are nonwhite, (9) ride more frequently in an auto as household income increases, and (10) are more likely to be driven by female drivers.

Travel distance has the largest effect on school travel mode, suggested by the large odds ratio compared with other variables. The output from the model reflects the descriptive statistics well: busing odds are greater at most distances outside 1.2 km; walking odds decrease markedly outside 0.8 km and are nearly zero outside 1.6 km; and, the odds of walking are higher traveling from-school than to-school, though trip type is not a statistically significant predictor of bus relative to auto. Possible explanations for greater from-school walking include more daylight, warmer temperatures, more 'eyes on the street' (ie general activity and awareness by the public), challenges getting children off to school on time, or parents better able to coordinate morning work and school start times.

Magnet school students are more than twice as likely to take the bus as neighborhood school students (odds: 2.4), likely attributable to more students living near their neighborhood school and traveling by walking or auto since a bus service is unavailable at shorter distances. School type is not predictive of walking odds on its own. However, total walking rates are 2.3 times greater for neighborhood schools than for magnet (18% and 8%, respectively), as mentioned above. Such a finding reflects the shorter travel distances for neighborhood schools: 46% of neighborhood versus 17% of magnet students travel less than 1.6 km.

Examining school location, we find that busing is less likely among St. Paul than Roseville students (odds: 0.155), reflecting the different district bus policies. Despite initial expectations, after controlling for other variables, the odds of walking relative to auto are not significantly higher in St. Paul than in Roseville. However, total walking rates are 1.9 times greater for St. Paul compared with Roseville (15% versus 8%). School siting alone cannot explain this finding as 28% of St. Paul students and 39% of Roseville students travel less than 1.6 km. Further analysis to isolate the influence of urban form or other factors would be fruitful.

Table 6. Multinomial logistic regression model estimating elementary-age school travel mode.

Variable	Bus [a]				Walk [a]			
	coef.	std. error	$P > \lvert z \rvert$	odds	coef.	std. error	$P > \lvert z \rvert$	odds
Intercept	−2.51	0.55	0.000		−4.12	0.77	0.000	
Trip type								
To-school (0 = from-school)	−0.21	0.11	0.061	0.81	−0.47	0.19	0.014	0.63
School attributes								
Travel distance, 0.4–0.8 km	0.31	0.43	0.475	1.36	−0.37	0.35	0.284	0.69
Travel distance, 0.8–1.2 km	0.28	0.41	0.497	1.32	−1.68	0.35	0.000	0.19
Travel distance, 1.2–1.6 km	1.07	0.41	0.009	2.92	−2.17	0.40	0.000	0.11
Travel distance, 1.6–2.4 km	0.93	0.39	0.017	2.54	−3.83	0.46	0.000	0.02
Travel distance, 2.4–3.2 km	1.68	0.41	0.000	5.38	−4.64	0.81	0.000	0.01
Travel distance, 3.2–4.8 km	1.69	0.40	0.000	5.41	−5.94	1.10	0.000	0.00
Travel distance, >4.8 km	1.85	0.40	0.000	6.33	−4.67	0.59	0.000	0.01
Travel distance, <0.4 km	0.00				0.00			
Type, magnet (0 = neighborhood)	0.88	0.14	0.000	2.41	−0.09	0.23	0.697	0.91
City, St. Paul (0 = Roseville)	−1.87	0.21	0.000	0.15	0.29	0.34	0.388	1.34
Child characteristics								
Child grade, 1	0.57	0.18	0.001	1.76	0.18	0.35	0.602	1.20
Child grade, 2	0.09	0.19	0.616	1.10	0.09	0.35	0.793	1.10
Child grade, 3	1.02	0.21	0.000	2.78	0.04	0.40	0.924	1.04
Child grade, 4	0.47	0.21	0.028	1.60	0.24	0.37	0.514	1.27
Child grade, 5	0.98	0.21	0.000	2.66	0.95	0.38	0.013	2.60
Child grade, 6	1.49	0.23	0.000	4.44	2.15	0.38	0.000	8.62
Child grade, kindergarten	0.00				0.00			
Household characteristics								
Size (1 member)	0.41	0.05	0.000	1.50	0.59	0.08	0.000	1.81
Race, white (0 = nonwhite)	−0.56	0.16	0.000	0.57	0.15	0.27	0.589	1.16
Income, \$0–19 999	2.17	0.25	0.000	8.79	0.01	0.58	0.993	1.01
Income, \$20 000–39 999	1.46	0.22	0.000	4.30	0.99	0.38	0.009	2.70
Income, \$40 000–59 999	0.98	0.22	0.000	2.67	0.95	0.37	0.010	2.58
Income, \$60 000–79 999	0.56	0.25	0.023	1.75	0.76	0.39	0.053	2.14
Income, \$80 000–99 999	0.20	0.24	0.399	1.23	0.66	0.40	0.101	1.94
Income, \$100 000–119 000	−0.14	0.31	0.650	0.87	0.30	0.50	0.547	1.35
Income, >\$120 000	0.00				0.00			
Route urban form (per km^2)								
Local street length (km)	0.05	0.03	0.100	1.05	0.17	0.05	0.000	1.18
Log-likelihood with constants only	4142.50							
Log-likelihood at convergence	2766.15							
Likelihood ratio (50 df)	1376.34							
Prob > χ^2	0.00							
Nagelkerke pseudo r^2	0.53							
Number of observations	1216							

[a] Car is the reference mode.

Child and household characteristics also impact mode selection. Busing and walking are more likely among older children than among the youngest children (grades 3–6 busing odds relative to kindergarteners range from 1.6–4.4; grades 5 and 6 walking odds relative to kindergarteners are 2.6 and 8.6, respectively). Parents might be more confident that older children can travel without them, though the survey does not discern if the child travels alone or in a group [for example, for the walking school bus had varied success in New Zealand (Kingham and Ussher, 2007)]. Students from households with income levels below \$80 000 are more likely to ride the bus than ride in an auto (odds ranging from 1.8 to 8.8). Students with household-income levels between \$20 000 and \$60 000 are more likely to walk than ride in an auto (odds: 2.6 – 2.7). One possible explanation is that households with higher income have greater vehicle ownership(3) on average, and may prefer to drive their children. Alternatively, lower income households might not have the means or available time to drive their child; instead relying on walking or busing. Each additional household member increases the odds that the child will bus or walk (busing odds of 1.5 with each additional household member, walking odds of 1.8). Students from larger households may have older siblings with whom to walk or ride the bus. Finally, white students are less likely to ride in a bus than nonwhite students (odds 0.57), though race is not predictive of walking odds.

The model found only one measure of urban form significant among the ten tested; kilometers of local (ie noncounty, highway, or interstate) streets per square kilometer is positively correlated with the odds of walking relative to riding in an automobile. This measure reflects street connectivity: greater street connectivity means more local streets and possibly lower vehicle speeds, making walking potentially safer. Finding only one significant urban form variable has one of two implications: either local urban form is not a large factor in determining school travel mode, or, alternatively, local urban form does matter and the right measures have not yet been found and modeled.

5 Conclusions and policy implications

We find that school choice substantially influences school commuting travel behavior, mainly by increasing travel distance, and subsequently, mode choice. School commute mode may also be influenced by urban form (specifically, local road density), demographics, and parent mode choice. Our findings have direct implications for school district transportation budgets and parents, but also speak to local traffic congestion, childhood exercise levels, urban air pollutants, and greenhouse gas emissions.

Magnet schools draw from broader geographic regions than neighborhood schools, so students are less able to walk or bicycle to school. Our survey results suggest that the underlying reason for this difference is not different parent choices towards mode selection, but simply because children live too far from their schools to walk or bicycle. The higher proportion of magnet school students busing than being driven by auto increases transportation costs for the district, but likely reduces air pollution emissions than if more students commuted via automobile.

These results highlight the interplay between district policy, socioeconomic factors, parental behavior, and attitudes in determining school mode choice. To the extent that school-choice programs increase students' commute distance, such programs may dramatically reduce opportunities for active school commuting. Policies focused on improving active travel or implementing effective SR2S initiatives would benefit from incorporating such knowledge into their project selection, analysis, and planning.

Not surprisingly, a greater proportion of magnet school students rely on a school bus service. As service cost becomes an increasingly important issue, especially given declining state and school district budgets, school-choice policy may require more fully considering travel demand, racial and economic equity issues, trade-offs between public and private costs, and environmental implications of any system changes.

(3) Vehicle ownership and household income share a significant bivariate correlation (0.437); thus testing only one variable is necessary. Household income improved overall model fit more than vehicle ownership.

The policy implications of this work span several distinct decision-making areas; we focus on three. The first, and most general, is the need to evaluate policies within a larger system perspective. For school choice, the environmental, budgetary, and mode choice implications of the policy on school transportation are important yet often fall outside of the traditional decision-making framework of school districts. While any school district transportation analysis will include direct costs, an accounting of environmental emissions, children's activity, or total system costs, including private car operation and transportation infrastructure considerations falls outside of traditional analytical boundaries. Including and quantifying these 'second order effects' highlight the broader policy implications and impacts on other seemingly unrelated sectors and policies.

Our parent survey data revealed different concerns for white and nonwhite parents. In particular, nonwhite parents surveyed are more likely to have a child who rides the bus and are more likely to attend a magnet school. This could be due to residential segregation and the fact that many magnet schools are located in neighborhoods with higher concentrations of nonwhite residents. However, because of this, any change in district-level bus policy would disproportionately impact nonwhite parents. Parental concern about availability of bus service and safety while waiting for and riding the bus is greater for nonwhite than for white parents. Policies to encourage nonwhite children to walk or bicycle should be sensitive to different nonwhite parental concerns. Additionally, families below the poverty line live farther away from school than wealthier ones, though this may be in part an artifact of school choice.

All of these issues affect the success of SR2S projects and addressing these factors could allow for better project prioritization and design to manage equity concerns. The interplay between school policy and travel behavior—in this case SR2S and school choice—is likely to have an impact both on programs and on their eventual success.

Parents would likely prefer to send their children to nearby schools, but magnet schools may offer dimensions (curricular, quality, or other factors) that subsume the desire to send their children to the nearest school. These choices have important policy implications beyond school transportation and begin to ask questions about neighborhood school quality and equality and approaches for school improvement. For instance, a strategy to increase walking might be to strengthen an existing or add a new curriculum to a neighborhood school or make a declining school more desirable through capital investments.

5.1 Future implications

Several factors, including the 'No Child Left Behind Act' in the US which (1) allows students in underperforming schools to switch to a school with better test scores, and (2) encourages the funding of magnet schools, suggest that school choice may become increasingly prevalent. St. Paul may be indicative of future conditions for an increasing number of US school districts. The analyses presented here capture only the first-order effects of school choice; the total impacts may be greater and must be viewed within a larger context of school and individual child performance, and larger societal goals.

Our model can be adapted to evaluate different school district choice policies by creating scenarios in terms of mode share, cost (public and private), and environmental emissions. It also would allow school boards, district transportation planners, and other policy makers to estimate the mode choice, transportation, environmental, and fiscal impacts of different educational policies.

Tackling issues of children's school transportation highlights the need to evaluate school policy on transportation and SR2S initiatives in light of policies about school choice—undoubtedly areas where state and city governments, school districts, and parents are engaged and passionate. This work uncovers and frames some of the difficult issues facing parents when deciding where to send their child to school and how to get them there; furthermore, it highlights some of the challenges school districts face in designing safe, equitable, and affordable transportation systems to transport children to school.

Acknowledgements. We thank Emily Polak, Katie Meyer, and Melisa Pollak for their research assistance, and David Levinson for his role as reader of Ryan Wilson's MS thesis and the anonymous reviewers. The State and Local Policy Program, the Intelligent Transportation Systems Institute, and the Center for Transportation Studies at the University of Minnesota provided financial support for this research. Thanks also to Chrissy Rehnberg and Jan Vanderwall at Roseville Area School District and Steve Schellenberg of St. Paul Public Schools. We are grateful to the parents who filled out our survey.

References

Boarnet M G, Anderson C L, Day K, McMillan T, Alfonzo, M, 2005, "Evaluation of the California Safe Routes to School legislation, urban form changes and children's active transportation to school" *American Journal of Preventive Medicine* **28**(2S2) 134 – 140

Braza M, Shoemaker W, Seeley A, 2004, "Neighborhood design and rates of walking and biking to elementary school in 34 California communities" *American Journal of Health Promotion* **19** 128 – 136

Butcher H L, 2006, "Safe routes to school in Superior, WI and Duluth, MN", paper presented at the 10th National Conference on Transportation Planning for Small and Medium-Sized Communities, Nashville, TN, Transportation Research Board, http://pubsindex.trb.org/view.aspx?id=804982

California Department of Health Services, 2004, California Children's Healthy Eating and Exercise Practices Survey 1999 Data Tables (Table 56), http://www.dhs.ca.gov/ps/cdic/cpns/research/calcheeps.htm

Centers for Disease Control and Prevention, 2005, "Kids walk-to-school", http://www.cdc.gov/nccdphp/dnpa/kidswalk/

Cooper A R, Page A S, Foster L J, Qahwahi D, 2003, "Commuting to school: are children who walk more physically active? *American Journal of Preventive Medicine* **25** 273 – 276

Cooper A R, Andersen L B, Wedderkopp N, Page A S, Froberg K, 2005, "Physical activity levels of children who walk, cycle, or are driven to school" *American Journal of Preventive Medicine* **29** 179 – 184

Dellinger A M, Staunton C E, 2002, "Barriers to children walking and biking to school—United States, 1999" *Journal of the American Medical Association* **288** 1343 – 1344

Dietz W H, Gortmaker, S. L, 2001, "Preventing obesity in children and adolescents" *Annual Review of Public Health* **22** 337 – 353

DiGuiseppi C, Roberts I, Li L, Allen D, 1998, "Determinants of car travel on daily journeys to school: cross sectional survey of primary school children" *British Medical Journal* **316**(7142) 1426 – 1428

Evenson K R, Huston S L, McMillen B J, Bors P, Ward D S, 2003, "Statewide prevalence and correlates of walking and bicycling to school" *Archives of Pediatrics and Adolescent Medicine* **157** 887 – 892

Ewing R, Schroeer W, Greene W, 2004, "School location and student travel: analysis of factors affecting mode choice" *Transportation Research Records* number 1895, 55 – 63

Federal Highway Administration, 2006, "Safe routes to school", http://safety.fhwa.dot.gov/saferoutes/

Gorard S, Fitz J, Taylor C, 2001, "School choice impacts: what do we know?" *Educational Researcher* **30**(7) 18 – 23

Hillman M, Adams J, Whitelegg J, 1990 *One False Move ...: A study of Children's Independent Mobility* (Policy Studies Institute, London)

Kennedy P, 2007 *Ethnic Diversity Data: School Year 2006 – 2007* Roseville Area School District, Roseville, MN

Kerr J, Rosenberg D, Sallis J F, Saelens B E, Frank L D, Conway T L, 2006, "Active commuting to school: associations with environment and parental concerns" *Medicine and Science in Sports and Exercise* **38** 787 – 793

Kingham S, Ussher S, 2007, "An assessment of the benefits of the walking school bus in Christchurch, New Zealand" *Transportation Research, Part A* **41** 502 – 510

Kouri C, 1999, "Wait for the bus: how Lowcountry school site selection and design deter walking to school", http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/16/ef/b5.pdf

Krizek K J, Birnbaum A S, Levinson D M, 2004, "A schematic for focusing on youth in investigations of community design and physical activity" *American Journal of Health Promotion* **19**(1) 33 – 38

McDonald N C, 2005, *Children's Travel: Patterns and Influences* PhD dissertation, Department of City and Regional Planning, University of California, Berkeley, CA

McDonald N, 2007a, "Children's mode choice for the school trip: the role of distance and school location in walking to school" *Transportation* **35**(1) 23 – 35

McDonald N C, 2007b, "Active transportation to school: trends among U.S. schoolchildren, 1969 – 2001" *American Journal of Preventive Medicine* **32** 509 – 516

McDonald N C, 2008, "Children's mode choice for the school trip: the role of distance and school location in walking to school" *Transportation* **35** 23 – 35

McDonald N C, Howlett M A, 2007, "Pupil transportation funding: a framework for analysis" *Transportation Research Board* number 2009, 98 – 103

McMillan T, 2003 *Walking and Urban Form: Modeling and Testing Parental Decisions about Children's Travel* PhD dissertation, Department of Urban and Regional Planning, University of California, Irvine, CA

McMillan T E, 2005, "Urban form and a child's trip to school: the current literature and a framework for future research" *Journal of Planning Literature* **19** 440 – 456

McMillan T E, 2007, "The relative influence of urban form on a child's travel mode to school" *Transportation Research, Part A: Policy and Practice* **41**(1) 69 – 79

McMillan T, Day K, Boarnet M, Alfonzo M, Anderson C, 2006, "Johnny walks to school—does Jane? Sex differences in children's active travel to school" *Children, Youth and Environments* **16**(1) 75 – 89

Marin County Safe Routes to School Program, 2009, "Safe routes to schools: parent survey", http://www.surveymonkey.com/s.aspx?sm=GCvKJQvYuoY6WVfmzOp0qA_3d_3d%22%3E

Martin S, Carlson S, 2005, "Barriers to children walking to or from school—United States, 2004" *Morbidity and Mortality Weekly Report* **54** 949 – 952

Metcalf B, Voss L, Jeffery A, Perkins J, Wilkin T, 2004, "Physical activity cost of the school run: impact on schoolchildren of being driven to school" *British Medical Journal* **329** 832 – 833

MetroGIS DataFinder, 2009, DataFinder Catalog, http://www.datafinder.org/catalog/index.asp

New York City Department of Transportation, 2009, "New York City walk to school—parent/guardian survey", http://www.nyc.gov/html/dot/html/sidewalks/walktoschool.shtml

No Child Left Behind Act of 2001 20 USC 6301 C.F.R (2002)

Rosenthal E, 2009, "Students give up wheels for their own two feet" *New York Times* 26 March, http://www.nytimes.com/2009/03/27/world/europe/27bus.html?_r=1

Roseville Area Schools, 2009, "Roseville area schools", http://www.roseville.k12.mn.us/

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) 23 USC 101 C.F.R (2005)

Safe Routes to School Michigan, 2009, "Michigan fitness walk to school day parent survey", http://www.michiganfitness.org/WalkToSchool/documents/parentsurvey.doc

Saint Paul Public Schools, 2005, "Racial/ethnic student count by school or program", Saint Paul Public Schools, St. Paul, MN

Saint Paul Public Schools, 2009, "Saint Paul Public Schools", http://www.spps.org/

Sallis J F, Prochaska J J, Taylor W C, 2000, "A review of correlates of physical activity of children and adolescents" *Medicine and Science in Sports and Engineering* **32** 963 – 975

Schellenberg S J, Porter C, 2003, "School choice in established magnet school systems: voluntary desegregation after thirty-five years", paper presented at Symposium "Are School Choice and Charter Schools Resegregating Public Schooling?" at Annual Meeting of the American Educational Research Association, Chicago, IL, 24 April, http://datacenter.spps.org/All_Topics_SPPS

Schlossberg M, Phillips P, Johnson B, Parker B, 2005, "How do they get there? A spatial analysis of a sprawl school in Oregon" *Planning Practice and Research* **20** 147 – 162

Schlossberg M, Greene J, Phillips P, Johnson B, Parker B, 2006, "School trips: effects of urban form and distance on travel mode" *Journal of the American Planning Association* **72** 337 – 346

Schneider M, Teske P, Marschall M, Mintrom M, Roch C, 1997, "Institutional arrangements and the creation of social capital: the effects of public school choice" *The American Political Science Review* **91**(1) 82 – 93

School Choice Taskforce, 2005 *The Report of the School Choice Taskforce* School Choice Taskforce, St. Paul, MN
Sirard J R, Ainsworth B E, McIver K L, Pate R R, 2005a, "Prevalence of active commuting at urban and suburban elementary schools in Columbia, SC" *American Journal of Public Health* **95** 236 – 237
Sirard J R, Riner W F J, McIver K L, Pate R R, 2005b, "Physical activity and active commuting to elementary school" *Medicine and Science in Sports and Exercise* **37** 2062 – 2069
Staunton C E, Hubsmith D, Kallins W, 2003, "Promoting safe walking and biking to school: the Marin County success story" *American Public Health Association* **93** 1431 – 1434
Trost S G, Pate R R, Sallis J F, Freedson P S, Taylor W C, Dowda M, et al, 2002, "Age and gender differences in objectively measured physical activity in youth" *Medicine and Science in Sports and Exercise* **34** 350 – 355
US Census Bureau, 2006, "2000 Census of Population and Housing", http://www.census.gov/main/www/cen2000.html
Wen L M, Fry D, Rissel C, Dirkis H, Balafas A, Merom D, 2007, "Factors associated with children being driven to school: implications for walk to school programs" *Health Education Research* **23** 325 – 334
Whitty G, 1998, "School choice policies in England and the United States: an exploration of their origins and significance" *Comparative Education* **34** 211 – 227
Wilson E J, Wilson R, Krizek K J, 2007, "The implications of school choice on travel behavior and environmental emissions" *Transportation Research, Part D: Transport and Environment* **12** 506 – 518
Wilson R, 2008, "Effect of Education Policy and Urban Form on Elementary-age School Travel", unpublished master's thesis, Department of Civil Engineering, University of Minnesota, Minneapolis, MN