
The influence of school choice policy on active school commuting: a case study of a middle-sized school district in Oregon

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Abstract. School choice policy has implications for school travel as it allows students to attend schools farther from their residence than their neighborhood schools. This paper uses a case study from Oregon to investigate how school choice affects parents' school travel decision making and the degree to which school choice affects children's walking or biking to school. The research shows that school choice is associated with lengthened school travel distance and parents' greater willingness to drive their children to school even within a short distance. The research suggests that school choice could hinder the effectiveness of such programs as Safe Routes to School.

Keywords: active school travel, school choice policy, Safe Routes to School Program

1 Introduction

Active school commuting (ASC) refers to children walking or biking to school. Over forty years, the US has witnessed a precipitous decline in ASC rates among all student age groups (Booth et al, 2003; McDonald, 2007; McDonald et al, 2011). Increased reliance on automobiles for school travel has led to concerns over such environmental consequences as greenhouse gas emission, air and water pollution, and traffic congestion (Dubay, 2003; EPA, 2003; Ewing et al, 2004). There are also likely adverse health impacts on children from a reduction in physical activities and limiting effects on children's social and cognitive development from car travel (Mackett et al, 2005; O'Brien and Gilbert, 2003; Sallis and Owen, 1999; Strauss and Pollack, 2001). These concerns have prompted calls for public interventions to increase rates of ASC and investigations of factors contributing to the observed school travel behavioral change.

While school travel research has revealed many environmental factors that help explain the decline in children's rates of ASC, studies show that some of these environmental conditions (eg, long distance school travel and poor neighborhood walkability) exist partly as an outcome of policy decisions. For example, many local-level and/or state-level policies guiding school siting, sizing, and design promote construction of large schools at the urban fringe, making school trips longer and areas surrounding school sites unsupportive of walking or biking (McDonald, 2010).

School choice, a policy that allows students to attend schools not nearest to their residence, is widely adopted in many countries. This policy may have implications for ASC. Discussion of the relationship between school choice and school travel has focused on the obvious observation that school choice allows students to attend schools farther from their residence than neighborhood schools, resulting in longer travel distances and greater demand for automobile travel (Steiner et al, 2006). The available empirical research, although limited, suggests that

the connection between school choice and school travel cannot be completely explained by the long travel distance typically associated with school choice (Wilson et al, 2010).

There is a need for systematic research investigating how school choice affects parents' school travel-mode decision and the degree to which school choice affects active school travel. Our study aims at filling these gaps. We report on a case study; a school district in Oregon that implemented a school choice policy but that does not provide transportation for students who avail themselves of that choice. Analyses using GIS and survey data were enriched by qualitative information collected from parent focus groups, school board members, and local planners. Our study contributes to the literature by connecting school choice with important aspects of parents' decision-making process. By examining school travel in the context of school choice, this study also illuminates the challenges facing public interventions, such as the Safe Routes to School programs, in achieving the goal of increasing the rates of ASC.

This paper is organized in eight parts. Following the introduction, we briefly describe the background of school choice policy, and summarize evidence from existing school travel research. We discuss a conceptual framework that integrates this policy with other factors in predicting children's walking or biking to school before presenting our case study. We conclude with a discussion of research findings and policy implications.

2 Policy background

School choice refers broadly to various policies and programs related to enrolment and funding of schools, both public and private. Choice, in this context, refers to policies that allow students to attend schools other than the school in the neighborhood in which they reside. In the US this policy has historical associations with various social agendas, from racial desegregation to school funding and bureaucratic reform (Ryan and Heise, 2002). With the ascendance of conservative government in the 1980s, in both the US and the UK, school choice justification expanded to include 'free market' economic theories introduced by Milton Friedman in 1955 (*The Economist* 2007). The goal, broadly stated, is to increase parents' control over their child's education, increasing 'school quality' by employing a 'free market' competition between schools (Forman, 2005; Teelken, 1999). Parents' right to choose an education type for their children is recognized by several international treaties⁽¹⁾ and exists in countries around the world (Teelken, 1999), though policy mechanisms vary widely. Since the 1970s public funds have increasingly supported private schools in Australia (Cahill and Gray, 2010); Chile adopted a national voucher plan in 1980 (McEwan and Carnoy, 2000); the Education Reform Act of 1988 altered school funding and structure throughout the UK (West and Pennell, 1997), to cite just a few examples.

Federal legislation has increasingly defined policies for US schools for decades, beginning with Ronald Reagan's Educational Reform, later codified by the "G.I. Bill for Children" (Cookson, 1994; Maddaus, 1990; Scott, 2005). The No Child Left Behind Act of 2001 (NCLB, 2003) allows choice of alternative schools when neighborhood schools do not meet defined performance metrics (McDonald, 2010). By 2007, 15% of US school children attended public schools of choice and nearly every state had some form of school choice option.⁽²⁾

⁽¹⁾The UN adopted Universal Declaration of Human Rights for example (Article 26, paragraph 3, 1948).

⁽²⁾Obtained from http://nces.ed.gov/programs/digest/d09/tables/dt09_039.asp

Generally, school choice programs include three types of choices: alternative public schools such as charter⁽³⁾ and/or magnet⁽⁴⁾ schools, neighborhood schools outside one's neighborhood (intradistrict), or public schools outside the school district (interdistrict). Some students attend private schools that are publicly funded, or for which some financial support exists such as vouchers or tax credits. (McEwan and Carnoy, 2000; Scott, 2005; Teelken, 1999; Tice et al, 2006; Young and Clinchy, 1992).

Debate over school choice policy implementation has evolved around several themes, ranging from its effectiveness in reducing segregation (Allen, 2007, Frankenberg et al, 2010; Garcia, 2008; Renzulli and Evans, 2005), encouraging 'market mechanisms' and educational innovation (Ledwith, 2010; Miller-Kahn and Smith, 2001; Teelken, 1999), and improving student performance (McEwan and Carnoy, 2000). Equitable access, however, has emerged as an unintended policy consequence. Critics see school choice as favoring those with time, money, and information resources, and as widening the divide between privileged and disadvantaged families (Burgess and Briggs, 2010). School transportation, in particular, can be a barrier to school choice among low-income families (Teske et al, 2009).

Related to equity concerns, and extending to environmental and health issues, are effects of school choice on transportation. Such effects are evidenced where school choice exists without school bussing, making parents who exercise choice responsible for their children's transportation. Increased travel distance can make walking or biking to school impractical. School choice, with its possible influences on redefining the social functions of school and the meaning of school travel, encourages the use of personal automobiles for school trips. This transportation theme has received inadequate attention and is understudied both in the school choice debate and in the school travel literature.

3 Research on active school commuting—a brief summary

3.1 Environmental-level and individual-level determinants

Studies of factors potentially affecting parents' use of ASC have informed the development of strategies to increase rates of ASC. Environmental-level and individual-level determinants have been identified, and can be summarized as related to built environment conditions (eg, distance to school, walkability, and land-use mix), social context (eg, safety, sense of community, and socioeconomic status), parental/family characteristics (eg, car ownership, family income, and employment status), and children's characteristics (eg, gender and age). An extensive literature review of active school travel can be found in Sirard and Slater (2008), McMillan (2005), and Wilson et al (2010).

Sirard and Slater (2008) noted that prominent psychological constructs such as attitudes, expectancies, beliefs, and social norms have been insufficiently explored in school travel research. Few studies have addressed the important role played by parents' preferences and attitudes in predicting their decision to allow children to walk or bike to school. These studies show that parents' environmental attitudes (Black et al, 2001), their beliefs regarding health and environmental benefits associated with ASC (Yang and Markowitz, forthcoming), and the perceived value of their children's socialization with others (McMillan, 2007) increase parents' incentives to use active school travel. Rodriguez and Vogt (2009) explored children's attitudes, measured as semantic differential scales (ie, fun/boring, safe/not safe), in their decision to walk or bike to school.

⁽³⁾ Charter schools are a form of alternative public school. They are publicly funded but are organized to achieve a unique set of accountabilities and are thus exempt from some of the statutes that apply to other schools.

⁽⁴⁾ Magnet schools, which began in the late 1960s in the US as counter to segregation, have continued as alternative public schools offering a technical or specialized curriculum.

3.2 School-level characteristics affecting school travel

Recent studies have also examined school-level characteristics, such as school age, size, and location. Most school-level conditions are considered to impact on school travel via their connection with environmental characteristics. Thus when environmental characteristics such as home–school distance or walkability are taken into consideration, the direct impacts of school-level characteristics do not appear discernible. For example, Ewing et al (2004) suggest no direct effects of school size on ASC after school environmental characteristics have been controlled for.

School policies, such as start/end time, parking, school choice, and policies against/encouraging walking/biking, also affect school travel. Some impacts are obvious—policies that prohibit or discourage children from walking or biking to school lead fewer children to do so. The National Center for Safe Routes to School (no date) has launched an effort to identify and overcome those ‘barrier’ policies. School choice policy effects are most likely explained through many aforementioned environmental conditions or characteristics.

We are aware of only one research project in the US that has studied the impacts of school choice on school travel. Using data collected from schools in St Paul and Roseville, MN, multiple publications based on this research project suggest that school choice increased travel distance and reduced ASC by encouraging bus or auto transport (Wilson et al, 2008); transportation costs were significantly higher and rates of active school travel lower when the school choice scenario was modeled versus a scenario in which all students attended their neighborhood school (Marshall et al, 2010); and school choice could significantly reduce the impact that Safe Routes to School programs might otherwise have on increasing levels of active school travel (Marshall et al, 2010).

Findings from the Minnesota study, however, suggest that school choice may affect travel-mode choice independent of school travel distance. Regression models indicate that, after controlling for variables such as school-trip distance, car ownership, and other environmental conditions, discouraging impacts on children walking or biking to school are still discernible (Wilson et al, 2010). The authors stopped short of providing an explanation. School choice policy may possibly be associated with other factors relevant to active school travel. Our goal is to fill the research gap by examining the role of school choice in parents’ school travel decision-making process.

4 Studying the effects of school choice policy on ASC

4.1 A conceptual framework

We start by developing a conceptual framework that comprehensively outlines possible pathways from school choice to school travel behavior. We build our framework on the basis of the *Ecological and Cognitive Active Commuting Framework* (ECAC) developed by Sirard and Slater (2008). According to the ECAC model, policies operate at the first level; their impacts on the frequency of ASC are mitigated via their influences both on physical conditions and on social contexts encompassing school and residential environments (neighborhood level), which then influence parental perceptions and school travel decision-making processes (parent/family level). Family sociodemographic characteristics, such as income and education level, not only can affect the use of ASC directly but also may moderate relationships between school policies and physical and social environmental characteristics.

We summarize the effects of school choice policy on school travel behavior via two paths—first, the policy affects school travel via its connection with such environmental factors as home–school distance, social qualities (eg, safety and sense of community), and neighborhood walkability; second, school choice could affect parents’ school travel decision-making process, and may even influence parents’ internal desire to use active school travel

such as their attitudes or preferences. The first pathway appears intuitive, and has been the only pathway considered in the current research. The second pathway is subtle, and has not been elaborated and empirically examined.

We hypothesize that school choice could affect the more subtle, psychological factors (such as preferences, attitudes, and intentions) in parents' decision-making dynamics. School choice was "designed to put parents in the role of educational consumers, shopping for the best 'product' from among a variety of public schooling options" (Dodenhoff, 2007). It may encourage parents to treat school as a place for education consumption and school travel as a means only to reach the educational goal. This potentially reduces the perceived local interaction, health, and environmental values associated with school travel. Findings from several empirical studies suggest that parents' perceived value of school travel as a mechanism for local social interactions and getting to know their neighborhoods motivates them to allow their children to walk or bike to school (eg, McMillan, 2007; Yang and Markowitz, forthcoming). We thus contend that school choice may reduce parents' desire to use ASC. Some researchers call for a 'community school' that focuses on local service as a strategy for increasing active school travel (McDonald, 2010).

4.2 Research questions

In the following section, we present a case study to improve our understanding of how school choice affects ASC—especially to detect psychologically related effects. We use the case study to answer the following questions:

- (1) To what degree does school choice contribute to an increase in school travel distance?
- (2) How is school choice policy associated with parents' consideration of ASC upon their housing location choice and attitude toward ASC?
- (3) How are the effects of school choice policy on ASC indirectly caused by the environmental (external) and attitudinal (internal) factors?

5 Research design

5.1 A case-study approach

Given the complexity of the issue in question and the fact that our conceptual framework attempts to integrate multiple evidence sources in its conceptualization of school choice policy effects on ASC, we adopt a case-study approach, making our research illustrative and exploratory. While single case studies may present problems of generalizability, they do offer several advantages over research design involving multiple research sites. These advantages include easy access to research subjects, use of multiple data sources, and opportunities to develop a good understanding of the context (Campbell, 2003).

We used the 4J School District, a mid-sized district in Eugene, OR, as our study area. We limited our study population to those families living in the city of Eugene, focusing on parents of young children attending elementary schools.⁽⁵⁾ This decision was based on our belief that the process of moving 'for schools' is likely to start when a family chooses an elementary school and that environmental conditions impose greater impacts on children's ability to use ASC at younger ages. These conditions together provide an opportunity to investigate the effects of school choice policy on ASC through its impact on school travel distance and parents' attitude.

⁽⁵⁾Elementary school (also known as primary school) in the US generally refers to kindergarten (a year of schooling that precedes compulsory grades) through grades 5 (roughly ages 5 to 10 years).

Table 1. Elementary school types in city of Eugene, OR.

Type of school	Number of schools (2007–08 enrollment)	Attendance boundary	Attendance method	School transportation
Neighborhood school by residence	18 (3526)	yes	assigned based on residence	available for students living 1 mile and beyond from school
Choice school				
Neighborhood school by choice	18 (840)	outside one's neighborhood	school-districtwide lottery process, limited by space availability	no school bus provided (exceptions can be made)
Alternative school	8 (1231)	no	school-districtwide lottery process, limited by space availability	no school bus provided (exceptions can be made)

There are twenty-six public elementary schools in the District; eighteen neighborhood schools with assignment/attendance boundaries, and eight alternative (magnets, language immersion, charter)⁽⁶⁾ schools without defined attendance boundaries. A lottery-based school choice program began in the early 1970s (Lawson, 1985).⁽⁷⁾ Students may attend any of the eight alternative schools, or any neighborhood school not associated with the student's neighborhood, by choice, if space is available.

Approximately 6000 students enrolled in the twenty-six elementary schools for the 2007–08 school year. Of our study population, 2071 students (37%) exercised school choice. The majority (22%) attended alternative schools. The rest (15%) attended neighborhood schools not connected to their geographic residence. Only students who attend their neighborhood school, and live more than 1.6 km from school, are eligible for the bus service.⁽⁸⁾ Students attending schools through the choice program must provide their own transportation. Table 1 describes the school types available in the study area, and figure 1 displays the geographic distribution of all twenty-six schools in our study.

⁽⁶⁾ Language immersion school refers to schools where students learn a second language in an 'immersion' environment, namely the target language is used as a teaching tool, surrounding or 'immersing' students in their learning experience.

⁽⁷⁾ Should transfer requests exceed openings at a school then student transfer requests are pooled for a 'lottery drawing'. Students that live in a school's zoned attendance area have a higher priority to attend a school than those living outside the area. Other factors are considered as well for establishing priority. These may include the fact that a student's sibling(s) already attend the school of choice, the proximity of parents' workplace, childcare arrangements, or special or bilingual educational needs of the student.

⁽⁸⁾ The School district transportation policy has some nuance. In general, elementary students are eligible to use the school bus only if they live within the neighborhood boundary of the school they attend, and live more than 1.6 km from the school. The actual written policy reads that "parents will be responsible for transportation to and from school unless space is available on a district bus traveling to that school", so it seems that there is flexibility. Exceptions can also be made to the 1.6 km rule if it is deemed unsafe to walk, or if the child has special needs. The special needs exception also applies to special needs students who attend schools outside of their neighborhood boundary. These students may ride the bus to their school of choice, and a sibling of an IEP (Individualized Education Program) student who rides the bus to a school of choice is also eligible to ride the bus to the same school, subject to space availability.

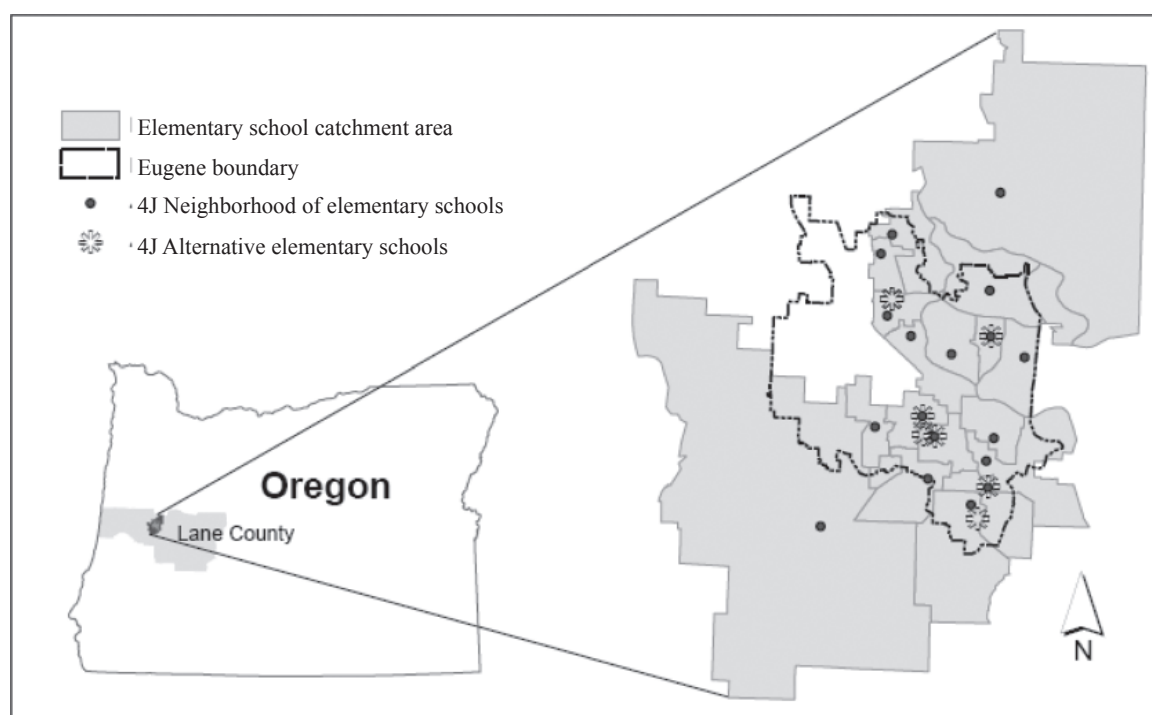


Figure 1. Location of elementary schools in 4J District, Eugene, OR.

5.2 Data sources

We utilize two data sources in our quantitative analysis. One is a GIS database that maps the location of each of 5597 students in city of Eugene, the student's school of actual attendance, and the student's residence-based neighborhood school. The other data were collected from a survey sample of 1123 families of elementary school students, sent to all 5597 families in 2008. The eight-page survey includes questions about school travel/commuting patterns, about location choice in the context of school choice program availability, important factors that parents consider in their location choice, and a series of questions aimed at assessing parents' attitude toward ASC. Parents returned 1197 surveys. Discounting 126 nondeliverable surveys, the response rate was 21%. While not high, this return rate is comparable with other school travel studies (eg, Wilson et al, 2010). Of the returned surveys, 1123 cases have valid information for most variables or measures for this study.

Additionally, before and after conducting our survey, we carried out formal and informal interviews with parents, school officials, and local real estate agents that helped us design and interpret our survey. We collected rich qualitative information from three focus groups with parents regarding school travel habits, parents' reasoning behind such habits, and residential location decisions. We also conducted separate interviews with thirteen key informants knowledgeable about schools, residential location decisions, and transportation, including real estate professionals, planners, school administrators, and community members. Text, comprising 20 000 words transcribed from comments to an open-ended survey question, afforded us content analysis. This information enriched our interpretation of analysis findings and enlightened our policy-related discussion.

5.3 Analysis plan

As described earlier, this research explores the mechanism by which school choice may influence parents' decisions to use ASC. We analyzed the two datasets in three steps to answer our research questions.

First, for the entire school district, and using the GIS dataset, we investigated the degree to which an increase in commute distance is attributable to school choice. We compared two

types of distances computed for each of the students in the study population. One distance is between a student's home and attended school. The other is between a student's home and 'neighborhood' school. Both distances were computed, using GIS, along the street network. In the absence of a school choice option these two distances should be the same. We expect to see that school choice has, for some students, resulted in lengthened home-school distance.

Second, using the survey data, we conducted analyses examining parents' consideration of school location and school travel in relation to their knowledge and use of a school choice option. We examined correlations between school choice and parents' school travel considerations and attitudes. The construction of attitudinal measures is described below, with the analysis results.

Finally, we ran a series of logistic regression models to assess the direct effects of school choice policy on ASC after controlling for important environmental and attitudinal factors.

6 Findings

To gauge the representativeness of our survey sample, we compare the sample with our study population along several dimensions (see table 2). This comparison suggests that our sample was reasonably representative of our study population. However, students from the alternative schools were overrepresented. Alternative school students are 30% of the sample, compared with 23% in the population.⁽⁹⁾ Families with children attending choice schools have higher family income and higher educational attainment levels. Median family income for the three school types is US \$60 000 for neighborhood school, US \$69 065 for neighborhood choice schools, and US \$78 399 for alternative schools. The percentage of families with postgraduate education is 32% for neighborhood school, 48% for neighborhood choice school, and 46.8% for alternative school.

Table 2. Demographic comparison between population and sample.

Demographic	GIS data (<i>N</i> =5597)	Survey sample (<i>N</i> =1123)
Type of school (%)		
Neighborhood	63	55
Neighborhood by choice	15	15
Alternative	23	30
Family income: median (US \$)	60 157	62 500
Race/ethnicity: white (%)	71	78
Housing type: own (%)	74	75

6.1 Active school commuting by school types

Sample rates of walking or biking to school are as follows (see table 3): about 33% of students (32.9%) walked or biked to school at least one day a week, and nearly 14% (13.5%) did so at least three days a week. Children walked or biked when leaving school, at least one day a week, more frequently than for trips to school, consistent with other studies (Wilson et al, 2007). ASC use as the primary travel means (ie, walking or biking to school more than three days a week) showed similar frequency for trips arriving and leaving schools.

A closer look at ASC rates by school type reveals interschool discrepancies in travel modes. ASC use as the primary mode is 17.3% for neighborhood residence schools, compared with 6.4% for neighborhood choice schools, and 8.0% for alternative schools. The dominance

⁽⁹⁾To correct the oversampling of the alternative school families, we constructed a weight variable and applied it to analysis with the sample data. The analysis findings reported in the subsequent tables, unless otherwise noted, are computed based on weighted values.

Table 3. School travel mode and frequency by school type.

School travel model and frequency, %	Overall	School type		
		neighborhood	neighborhood by choice	alternative
<i>Arriving school</i>				
Walk/bike at least 1 day a week	32.9	39.2	21.4	23.9
Walk/bike >3 days a week	13.5	17.3	6.4	8.0
Ride bus >3 days a week	25.6	37.7	12.1	2.3
Ride car >3 days a week	57.2	42.5	77.5	83.3
<i>Leaving school</i>				
Walk/bike at least 1 day a week	43.9	49.4	35.8	34.8
Walk/bike >3 days a week	13.0	16.5	5.8	8.3
Ride bus >3 days a week	28.2	40.3	18.5	2.6
Ride car >3 days a week	49.2	36.9	60.1	74.4

of driving as the primary travel mode to and leaving school is apparent for the two types of choice schools. More than 80% of alternative school students and more than 77% of children attending neighborhood school by choice were driven to school more than three days a week. This number was only 42% for neighborhood school students.

6.2 Effects of school choice on school travel distance

The average home–school distance for the 5597 elementary students in our study population is about 2.8 km. Slightly more than 60% of students live beyond 1.6 km from school. But home–school distance varies greatly by school types. The average home–school distance for students attending their own neighborhood schools is 1.9 km. The numbers for choice schools are much higher—4.15 km for alternative school students and 4.49 km for students attending other neighborhood schools of choice.⁽¹⁰⁾

Figure 2 shows that, while the proportions of students living very close to their schools (eg, <0.40 km) did not vary dramatically among the three school types, substantial interschool-type disparities exist in the proportions of students living far from schools (eg, >1.6 km). Nine out of ten students who opted to attend neighborhood schools other than their own lived beyond 1.6 km from their schools. Alternative school students fared slightly better, with eight of ten students living beyond 1.6 km from their schools. The majority (52.9%) of students attending their own neighborhood school lived within 1.6 km.

These distance estimates suggest that parents who used the school choice option for their children traveled substantially farther than those who sent their children to neighborhood schools. If every family drove to school, the choice-school families would drive 25% more in total distance than all those neighborhood-school families, even though the choice-school families only account for a third of the population. We calculated school travel distance for a scenario in which all students attended neighborhood schools associated with their current

⁽¹⁰⁾ It should be noted that school choice policy potentially enables school trips of shorter distances as well. This is because school boundary delineation sometimes assigns students to schools that are not the one closest to their home. In delineating school service zones, school districts often face the need to balance facility capacity, student body diversity, feeder pattern, school bus route effectiveness, and proximity. It should be noted that not every student who exercised school choice went to a school that was farther from his or her residence than his or her assigned neighborhood school. Slightly less than 13% (12.8%) of alternative students and about 20% (20.7%) of students would have traveled a longer distance if they had to attend their assigned neighborhood schools. In fact, in some places, attending a closer school is a driving force for some parents' use of the school choice option, and 'shorter distance' is one of criteria determining school choice admissions (eg, some school districts in State of Montana).

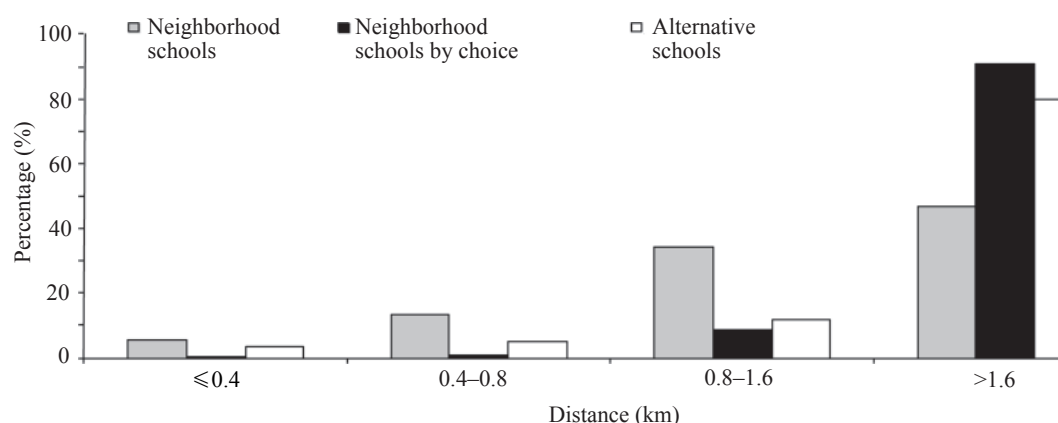


Figure 2. School travel distance by school types.

residence. Our analysis shows that, for the whole district, average school travel distance would be 1.9 km under this scenario. In other words, without the school choice option total school travel distance would be reduced by nearly 32%.⁽¹¹⁾

6.3 Effects of school choice on travel mode consideration and parent attitudes

Parents' initial consideration of active school travel and their attitude toward this travel means both have important influence on their choice of ASC (Yang et al, 2011, Yang and Markowitz, forthcoming). These are subtle psychological effects that are difficult to detect and verify. We explored these effects through a series of analyses. First, we examined how parents considered different school travel means upon their residence choice in relation to school types. Second, we investigated whether parents using different schools assigned differing weights to aspects concerning ASC in their housing location choice. Third, we compared parents' attitude toward ASC vis-à-vis school types directly. Since information used in the first and second analyses mainly came from retrospective answers, we included in these analyses only those families who had moved to their current residence in the past two years (ie, recent movers).

Of 346 recent mover families, 75% indicated that they were aware of the school choice option when making their location decision, 40% indicated that school choice had influenced their decision-making process, and 27% answered that they would not have chosen their current residence had the choice policy not been in effect.

Our survey asked parents to report any school travel means they had considered when choosing their current residence, regardless of what travel mode they later adopted. Compared among the three types of schools, the difference in percentages of parents who considered ASC is not distinctive—35.1% for neighborhood schools, 33.3% for neighborhood schools by choice, and 33.3% for alternative schools. Parents of alternative school students were far more likely to consider using car travel alone for school trips (40.0%), compared with parents of own-neighborhood school students (15.2%).

Recognizing that consideration of travel means may be made after a housing location decision, and may be affected strongly by parents' perceived school travel distance and also various kinds of resources available to them (eg, number of cars owned), we computed partial correlations between school travel means considered and different school types, controlling for school travel distance and number of cars owned. Table 4 reports the partial correlation coefficients. There is no statistically significant correlation between the consideration of ASC and school type. Parents using alternative schools were clearly more likely to consider car

⁽¹¹⁾Of course, this estimation does not consider the possibility of residential relocation as a result of policy change. Our survey indicated that a sizeable portion of parents would not have chosen their current location had the school choice option not been available. More research in this area is needed.

travel ($r = 0.203, p < 0.001$), compared with those opting for their own neighborhood schools ($r = -0.234, p < 0.001$) in the context of comparable travel distance and number of cars owned by a family.

Our survey asked parents to assess the importance level of twenty-one factors related to housing, neighborhood, and accessibility to various services that they were likely to consider in their housing choice. Four of these factors are environment/neighborhood elements closely related to ASC—proximity to school, walkability of the neighborhood, pedestrian and biking safety of the environment, and suitability for a child to walk or bike to school. We compared parents' answers and the ranking of these elements among all factors by school type. Figure 3 shows the mean importance scores for the four elements by school type. And again, the analysis focuses on recently moved families (ie, moved within the past two years).

No statistically significant difference exists among the mean importance scores for two elements—neighborhood walkability and safety for walking and biking. For all three school types, the mean importance scores are close to or above 3, meaning parents on average considered these environmental conditions as being important when choosing their residence. What distinguishes these three types of schools was parents' assessment of the importance of the element “proximity to school”. Parents of neighborhood-residence school students assigned much higher importance level to this element (mean = 3.24) than parents of neighborhood-choice school students (mean = 2.70) and of alternative school students (mean = 2.61). Similarly, the neighborhood quality captured in “ability for my child to walk/

Table 4. Partial correlation (controlling for school travel distance and number of cars owned by household) between school type and school travel means considered ($N=338$).

School type	School travel means considered when choosing current residence			
	walk/bike	bus	car	did not think
Neighborhood schools	−0.023	0.351***	−0.234***	−0.092**
Choice school				
Neighborhood schools by choice	−0.053	−0.077	0.060	0.011
Alternative schools	0.069	−0.316***	0.203***	0.091*

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

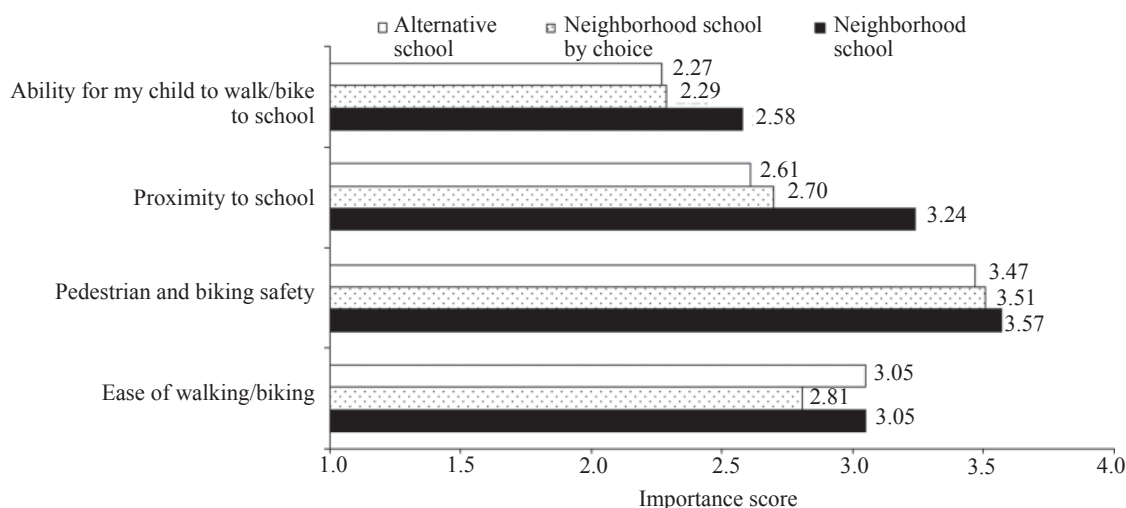


Figure 3. Average importance scores for factors related to active school commuting in residential location choice.

Table 5. Mean comparison of attitudinal factor across school types.

	School type		
	neighborhood school (reference)	neighborhood choice school	alternative
<i>Mean answers to questions assessing attitude toward active school commuting</i>			
<i>N</i>	618	168	337
Walk/bike demonstrates commitment to protect environment	3.99	4.25*	4.16*
Kids walking or biking is good way to increase physical activity	4.35	4.58*	4.43*
Children may develop autodependent habit	3.58	3.69	3.70
Children walk/bike good way to know neighborhood	3.83	3.91	3.77
Driving to school contributes to environmental pollution	3.94	4.25	4.04
Mean factor score	-0.08	0.17*	0.05
<i>Mean answers to questions assessing attitude car use</i>			
<i>N</i>	618	168	337
Driving is more comfortable than walk/bike	3.84	3.53*	3.58*
Prefer driving whenever I need to go places in this area	3.65	3.49	3.39*
Owning a car contributes to a comfortable lifestyle	4.01	4.02	4.01
I drive my car as much as others	3.11	3.21	3.12
Traffic congestion does not bother me	2.84	2.91	2.92
Mean factor score	0.07	-0.06	-0.09*

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

bike to school” was on average considered to be of higher importance level by neighborhood residence school parents. But the mean score for this element was below 3 for all three school types.

We examined whether parents’ attitudes toward travel modes were associated with school types. Informed by previous studies investigating attitudinal factor in travel behavior (Black et al, 2001), we developed five questions to assess ASC attitudes and five questions to assess car-use attitudes. We asked respondents their level of agreement with a series of Likert-scale questions, whose answers ranged from 1 (strongly disagree) to 5 (strongly agree). We derived from these answers a factor scale to measure ASC attitude and car-use attitude, respectively. 5 reports the mean comparison among three types of schools for the attitude component questions and the factors.

Our analysis shows a lack of statistically significant differences in the answers to attitude questions across the three school types. There are only four component questions for which statistically significant mean differences were observed. The mean differences appear to suggest that parents of choice school students had a more positive attitude toward ASC and a weaker car-use attitude than those of neighborhood schools. This apparently contradicts our expectation. We think this is probably related to the fact that parents who decided to use school choice in our sample also tended to have higher education levels, and that these family characteristics were positively correlated with greater awareness of the health and

environmental benefits associated with ASC [correlation coefficients not reported here, but see Yang and Markowitz (forthcoming)].

6.4 Effects of school choice on ASC behavior

To examine the direct effects of school choice on ASC, we ran three logistic regression models. First, we examined how school type indicators would directly predict ASC as the primary school travel means while controlling for household background characteristics. Second, we examined how environmental characteristics, particularly the home–school distance, would help explain the effects of school choice policy. Finally, we looked for any still independent effects of school type on ASC after controlling for the effects from attitudinal factors.

The first model contains only school type indicators and household background variables; the second model includes environmental variables; and the third model attitudinal variables. In all models, the dependent variable was a dummy variable indicating whether a child walked or biked to school at least three days a week. We focused on whether a family's primary school travel mode is ASC in our regression analyses as we believe this was a better indicator of a family's school travel pattern and likely to have a more distinguishable relationship with the policy, and with environmental and attitudinal factors we wanted to examine. We had 986 valid cases after excluding missing-value cases for any of the variables included in the model.

Results from the three logistic regression models are reported in table 6. Output from the first model shows that, after controlling for household background characteristics, school type indicators still registered statistically significant impacts on the likelihood of using ASC. Compared with students attending their own neighborhood schools, those who attended the neighborhood choice school were less likely to use ASC as a primary travel means by a factor of 0.33 [$B = -1.1$, $p < 0.01$, $\exp(B) = 0.33$]. Attending an alternative school had a similar effect of reducing the odds of using ASC.

Some family characteristics register as statistically significant predictors in the model. A child being of older age and parents with postgraduate education level increase the odds of using ASC, while a household having more cars was associated with lowered odds of using ASC. These findings are consistent with previous studies (eg, Ewing et al, 2004; McMillan, 2007). Compared with other income groups, the \$60 000–\$99 999 income group stood out as the most likely to use ASC as a primary means, suggesting a lack of a simple relationship between income and ASC.

Results from the second model suggest that adding the environmental variable improves model fit significantly as indicated by the increase in the Nagelkerke R^2 . While school type variable effects remain statistically significant ($p < 0.05$), their magnitude becomes weaker in the second model, which contains several environmental measures including a travel distance variable. These findings support the hypothesis that the effect of school choice on ASC is explained partially by environmental conditions (especially longer home–school distance). That school type variables remain a statistically significant predictor of the use of ASC, suggests that other factors could help explain the effects of school choice policy on ASC.

Results from the third model indicate an even better model fit after including attitudinal variables in the model. The Nagelkerke R^2 increased from 0.313 in model 2 to 0.498 in model 3. Both the attitudinal variables and the variables indicating school travel means intention were statistically significant predictors of ASC. The school type variables became either statistically insignificant (neighborhood choice school) or marginally significant (alternative school). The size of school type variable impacts (ie, the alternative school) also became smaller in the full model, compared with the second model. This suggests that effects of school choice on ASC are further explained by the attitudinal variables.

Table 6. Predicting children walking or biking to school at least three days a week.

Variable	Model 1		Model 2		Model 3	
	<i>B</i>	<i>exp(B)</i>	<i>B</i>	<i>exp(B)</i>	<i>B</i>	<i>exp(B)</i>
Constant	-1.982***	0.138	-3.974***	0.017	-3.974***	0.019
<i>School type</i>						
Neighborhood school by choice	-1.115***	0.328	-0.836*	0.434	-0.765	0.47
Alternative school (reference: own neighborhood school)	-1.111***	0.329	-0.587**	0.556	-0.725*	0.48
<i>Family characteristics</i>						
Child's age	0.199***	1.221	0.238***	1.268	0.197*	1.22
Household income less than \$30 000	-0.672**	0.511	-0.640*	0.527	-0.796*	0.45
Household income \$30 000 to \$59 999	-0.529*	0.589	-0.517*	0.596	-0.579*	0.56
Household income above \$100 000 (reference: income above \$60 000–\$99 999)	-0.690**	0.501	-0.626**	0.535	-0.933***	0.39
Number of cars owned	-0.612***	0.542	-0.494***	0.610	-0.381**	0.68
Race/ethnicity (1 = white)	-0.37	0.964	-0.073	0.930	0.153	1.16
Highest education is postgraduate	0.803***	2.233	0.655***	1.925	0.655***	1.92
<i>Environmental conditions</i>						
Travel distance			-0.988***	0.372	-0.988***	0.37
Perceived neighborhood walkability (1~5)			0.323***	1.381	0.172	1.19
Total street length within 0.4 km of school			2.426***	11.314	1.706**	5.51
Percentage of residential land within 0.4 km of school			0.340	1.404	0.433	1.54
Average lot size within 0.4 km of school			2.181	8.856	1.929	6.88
<i>Attitudinal factor</i>						
Car attitude factor					-0.326**	0.72
ASC attitude factor					0.391***	1.48
Car travel in mind					-1.874***	0.15
ASC in mind					1.929***	6.88
<i>N</i>	986		986		986	
-2 log likelihood (constant-only mode)	760.33					
-2 log likelihood	682.68		573.068		448.51	
Model improvement test (χ^2)		(model A, B)	109.609	(model B, C)	124.56	
Nagelkerke R^2	0.130		0.313		0.498	

Note: ASC=active school commuting.
 * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

6.5 Summary of findings

Our study findings are summarized into three main points. First, we identified substantial increase in home–school distance for our study case as a result of the school choice option. This increase can be attributed to school transfers allowed by school choice options, and is also helped by the fact that school choice affects where parents choose to live in relation to the school they choose for their children.

Second, in addition to distance increase, school choice also appears to affect parents' consideration of school travel mode. We found that, compared with parents who send their children to neighborhood schools, parents of choice school students tended to give less consideration to travel mode in their housing choice; they also were more likely to consider using car travel for school commuting despite having more positive attitudes toward ASC. This suggests that, in the context of school choice without provision of school bussing, the positive ASC attitude had a weaker impact on parents' intention to pursue ASC behavior.

Finally, effects of school choice policy on ASC behavior appear to be mostly explained by its connection with travel distance and by parents' consideration of (or attitude toward) ASC. The regression models provide support for the two pathways of influences that school choice can impose on the use of ASC presented in our conceptual framework.

7 Discussion

While fully embracing important social and educational goals of school choice policies, our study illustrates that those goals may involve other unforeseen costs, including the cost associated with school transportation. Our Oregon case may not fully represent other contexts and the generalization of our research findings may be limited. The connection between school choice and school travel merits future research and further case studies to provide additional evidence.

Several main points can be summarized from these findings. First, while they confirm the perception that school choice is associated with increased travel demand, our study provides some behavioral explanation for such outcome by illuminating the weight of school transportation in parents' decisions about their children's school choice/selection and in their housing choice. The discouraging findings are that school transportation was not among the important factors, and school choice in fact aggravated that tendency. In the context of school choice, when choosing where to live, parents assigned diminishing importance to environmental qualities considered important for ASC and exhibited a greater willingness to consider car use for school travel.⁽¹²⁾

Indeed, what frequently surfaced in the interviews with parents and in the comments offered in survey returns is a theme indicative of choice-school parents' belief that "getting the right school or education for my child" is worth driving for. In a way, school choice motivated by parents' desire for better 'educational quality' appears to reinforce the notion that school travel is just a means to achieving an explicit goal of obtaining education. While parents are rightly entitled to this view, this reasoning could constrain the formation of a more complete view of school travel incorporating all environmental and health implications.

Second, we had suspected that school choice may affect parents' attitude toward ASC. Our findings did not appear to suggest choice-school parents had lower or weaker attitudes. Instead, as the choice-school families had relatively higher education achievements, parents tended to be more aware of the environmental consequences of driving and likely possessed

⁽¹²⁾ Note that in the 4J district, entry to a choice school is determined mainly through a lottery process because of space limitation. A family is not guaranteed success for its school choice application. It is interesting to discover that, for parents whose children did attend choice schools through the lottery process, important aspects related to ASC (eg, proximity to school, school travel means) were given inadequate consideration in their housing decision.

more positive attitudes toward ASC. Our findings point to an awkward choice some parents face in their school choice decision; that of choosing the right education for their children while performing behavior inconsistent with their environmental attitude. In focus groups, some parents expressed 'feeling bad' about driving to alternative schools and frustration that the school district does not provide transportation for students attending schools by choice.

These findings appear to support, albeit indirectly, the suggestion made by Wilson et al (2008), that school choice could hinder the effectiveness of Safe Routes to School Programs. Yang and Markowitz (forthcoming) suggests that parents who possess positive attitudes toward ASC are likely to respond to environmental interventions intended to change behavior. Yet, in the context of school choice, this very group of parents is given the opportunity to send their children to schools based on desirability unconstrained by proximity. The likely result is a school so distant from the residence that many environment-based interventions (eg, sidewalk and street crossing improvements) become ineffective for these parents.

8 Policy implications

This study broadens the debate about school choice policy by connecting unintended impacts on school travel with the intended educational benefits and addressing such connections from an equity perspective. We do not argue for limiting school choice for the sake of reducing travel demand. Rather, our hope is that an improved understanding of the connection between school choice and school transportation will guide policy debates.

Increasing ASC in the context of school choice requires more systematic and districtwide approaches to school improvement, as the emergence of school choice is rooted in the spatial inequality of schools, which is itself linked with many other issues such as inequality in resource distribution and the socioeconomic fabric embedding the schools. A helpful policy response would be a reduction in the quality gap between schools, reducing the incentive for parents to choose alternative schools over neighborhood schools.

While we acknowledge the societal benefits of school choice, it is important to evaluate these benefits in a full accounting of the societal costs incurred as a whole and through a fairness lens. Our research highlights added environmental costs associated with school choice, and also suggests a lack of accountability mechanism for sharing those costs in current school choice programs. Many well-to-do parents who use the school choice option and choose to drive their children to school over long distances and more frequently, have not been required to pay a fair price for the environmental impacts associated with this behavior. A policy response that assures people fairly pay for the environmental costs (eg, paying driving-distance-based fees for using school choice) appears socially just, and may reduce the demand for school choice that is to a certain degree inflated by the 'free' use.

It also should be noted that the relationship between school choice and transportation goes another way. For some parents, especially those of lower income, school transportation costs create an affordability barrier to school choice. For all families to have equal access to the benefits of school choice, public policy solutions may be needed to reduce that barrier by providing assistance to those families (eg, transportation vouchers). Other policies that encourage ride-sharing and use of public transportation will be beneficial to all families exercising school choice.

While the above policy discussion focuses on inducing changes in individual- or family-level decision-making processes, institutional-level policy solutions could significantly affect school travel outcomes by changing the context in which travel decisions are made. Our research shows that many families who would like to live close to a school, so that ASC can be an option, expressed frustration with the lack of housing opportunities close to the school of their desire. This confirms the notion that the spatial structure of schools in relation

to land uses has direct impacts on the demand for school travel. Yet in many US communities, including our study-area city, school planning and land-use planning remain disconnected.

Ultimately, promoting active school travel requires coordinating efforts among institutions in the context of competing social goals and a fragmented institutional landscape. In the city of Eugene, for example, while land-use planning has responded to the state's call to reduce vehicle miles travelled and greenhouse gas emissions by promoting infill and compact and mixed-use urban development, schools have not been given any references in the city's plan for such development. On the other hand, school board decisions on school siting and planning, often justified on fiscal concerns and economic reasons, give little consideration to transportation outcomes. Facing the common challenge of climate change, to which transportation-related greenhouse gas emission is a major contributor, coordinated decision making between school planning and city planning is necessary to achieve a spatial outcome that better balances various goals.

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