THE JOURNEY TO SCHOOL:
A CASE STUDY AT MISSION HILL SCHOOL

A thesis submitted by

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Abstract

This research study is based on a survey of parents at Mission Hill School, a Boston K-8 school, about the factors that inform decisions about their children’s transportation. This research contributes to the existing literature with additional evidence of parents’ travel mode choices for their children, and extends the literature by distinguishing between escorted and independent travel. The survey found that only about 15% of students regularly walk to school. Distance and the need for adult escorts for children younger than 10 or 11 are major obstacles. About 40% of students regularly take the school bus; however, parents expressed significant dissatisfaction with the school buses. Only half of eligible students take the bus, and the rest are generally driven to school by their parents. Overall, about half of the parents drive their children to school regularly. The data from this survey will help identify parental concerns that should inform new school transportation policies. Further research will add to this analysis and allow planners and policy makers to make Boston schools more accessible for children.
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INTRODUCTION

The trip to school is a key aspect of a child’s day. Transportation to school impacts students’ health, safety, and access to education. It is important to understand how families make decisions about how their children get to school. This understanding is vital to inform the location of schools, school transportation policies, and efforts to encourage walking and biking to school.

Children and youth face many potential obstacles to walking and biking to school. These factors may include weather, distance, unsafe streetscapes, and crime. In addition, younger children may be considered less able than adults to navigate these challenges independently. An adult escort may allow children additional opportunities to walk or bike, but most studies of children’s active transportation have not distinguished between independent and escorted travel. If children must be escorted, then parental time constraints become another obstacle to walking and biking.

Societal norms about children walking and biking to school (independently or with an escort) vary greatly over time and across cultures. Over the past few decades, the rates of children walking or biking, independently or with an adult, have dropped precipitously. For example, in 1969 in the United States, 85.9% of children who lived within one mile of school walked or biked versus only 49.9% in 2001 (McDonald 2007). In the past decade, studies have found that only 11-17% of schoolchildren in the US walk or bike to school at least once a week (McDonald 2007; CDC 2005; Sirard et al. 2005; Evenson et al. 2003;
Yarlagadda & Srinivasan 2008). Many other countries have higher rates of walking or biking to school than the US (Fyrhi et al. 2011; Hillman et al. 1990).

This decline is concerning because walking and biking provide natural ways for children to integrate physical activity into their daily lives. Children in the United States do not get adequate physical activity and this contributes to childhood obesity and other health problems. Most children do not meet the US Department of Health and Human Services recommendation of 60 minutes of physical activity per day (CDC 2012). The prevalence of obesity among children and adolescents in the United States has tripled since 1980 to 17% (CDC 2012). Increasing physical activity can help young people maintain a healthy weight, avoid chronic diseases such as diabetes and health diseases, and improve academic achievement.

In order to encourage more walking and biking among children, one must first understand the concerns of their parents. Particularly when considering whether to allow their children to travel independently, parents must carefully weigh the benefits against their perception of the risk involved. Planners and policy makers poorly understand the factors that go into parents’ calculations. This research study is based on a survey of parents at Mission Hill School, a Boston K-8 school, about the factors that inform decisions about their children’s transportation. This research contributes to the existing literature with additional evidence of parents’ travel mode choices for their children, and extends the literature by distinguishing between escorted and independent travel. This research is particularly timely because the Boston Public School district has
announced plans for a new school assignment plan whose stated goal is “quality schools, closer to home” (BPS 2013b). The new plan will be gradually implemented starting with the 2014-2015 school year. Boston Public School students will attend schools closer to their homes under the new assignment plan, so distance will be less of an obstacle. The transition period provides a unique opportunity for schools and parents to work together to help children to be able to walk or bike to school. The data from this survey will help identify parental concerns that should inform new school transportation policies.
LITERATURE REVIEW

Over the past 40 years, the rate of parents driving their children to school in the United States has increased while the rates of children walking or biking to school has decreased. This trend has raised concerns for both health and environmental reasons. To understand this temporal shift in school transportation, some studies have attempted to determine the personal and environmental factors that correlate with active commuting (walking or biking) to school. This review highlights key research studies that have examined the predictors of active commuting as they may impact future public policies.

PREVALENCE OF ACTIVE COMMUTING

Current Prevalence of Walking and Biking

The prevalence of walking and biking to school at least once a week in the United States has been estimated by many studies. McDonald found that in 2001, 12.9% of all school children in the United States walked and biked to school (McDonald 2007). Other studies found a 17% prevalence nationwide, an 11.61% prevalence in San Francisco, and a 13.6% prevalence in North Carolina (CDC 2005; Yarlagadda and Srinivasan 2008; Evenson et al. 2003). A lower prevalence (5%) was found in Columbia, South Carolina (Sirard et al. 2005). Higher estimates were found in Seattle (25.1%) and in Marin County, California where a walk-to-school initiative led to an approximate 30% rate of walking or biking to school (Kerr et al. 2006; Staunton, Hubsmith, & Kallins 2003). Since these numbers only represent those who walk or bike at least once a week, the literature
indicates that the vast majority of children are not actively commuting most of the time.

International studies found higher rates of walking and biking to school. A study from Norfolk, England found that 49% of students usually walked or biked to school (Panter et al. 2010). In Melbourne, Australia, 66.7% of 10-12 year olds walked or biked to school at least once a week (Timperio et al. 2006) and 38.5% walked or biked to school five days per week. In Sydney, Australia, 33% of students walked or biked to school more than half the time (Wen et al. 2008). While these studies also come from industrialized English-speaking countries, significant differences in prevalence from the US studies suggest that their findings may not be applicable to the US context. Despite this limitation, useful generalized information may be gained from these studies.

*Changes in active commuting over time*

Walking or biking to school has declined significantly over the past 40 years in the United States. Noreen McDonald used National Personal Transportation Survey data from 1969, 1977, 1983, 1990, 1995, and 2001 to study the long terms trends in active commuting to school (McDonald 2007). In 1969, walking or biking accounted for 40.7% of all school trips. Active commuting declined sharply to 23.5% in 1977 and to 12.9% in 2001. However, these percentages did not take changing distance to school into account. In 1969, 66.1% of children lived <1 mile from school, compared to 49.5% in 2001. School consolidation and changing patterns of residential development increased the average distance from home to school. For students who do walk to school, average walk times (10-12 minutes) have remained relatively constant in surveys
since 1969. Families may not be willing to allow their children to walk if their school is further from home. McDonald estimates that the change in distance to school can account for 47% of the total decline in active commuting since 1969. However, since 1969 there has also been a significant change in the commuting behavior of children who live close to school. In 1969, 85.9% of children who lived within one mile of school walked or biked. In 2001, only 49.9% did (McDonald 2007).

**FACTORS CORRELATING WITH ACTIVE COMMUTING TO SCHOOL**

*Effect of Distance on Travel Mode*

Distance from home to school is consistently cited as a major barrier to walking or biking to school. In the 2004 Consumer Styles Survey, distance to school was the barrier most commonly reported, cited by 55% of parents (CDC 2005). In Melbourne, Australia, children whose route to school was less than 0.5 miles were five times more likely to actively commute (Timperio et al. 2006). Some studies have measured the prevalence of active commuting by distance from school as noted in Table 1.
Table 1: Percentage of Active Commuters by Distance from School

<table>
<thead>
<tr>
<th>Location</th>
<th>&lt;0.5 mile</th>
<th>0.5-1 mile</th>
<th>1-1.5 miles</th>
<th>1.5-2 miles</th>
<th>2-2.9 miles</th>
<th>&gt;3 miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Francisco, CA¹</td>
<td>75%</td>
<td>~45%</td>
<td>~25%</td>
<td>18%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States²</td>
<td>48.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States³</td>
<td>49.9% *</td>
<td></td>
<td>~10%</td>
<td>~3%</td>
<td>~1.6%</td>
<td></td>
</tr>
<tr>
<td>Sydney, Australia⁴</td>
<td>66.2% **</td>
<td>44.5%</td>
<td>37.9%</td>
<td>34.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Includes all <1 mile  
** Includes all non-car travelers, may include bus or train transportation  
¹McDonald & Aalborg 2009, ²Martin et al. 2007, ³McDonald 2007, ⁴Wen 2008

Studies suggest that in the past decade, 11-17% of U.S. schoolchildren nationwide have been walking or biking to school at least once a week. However, the percentage is significantly higher for children who live close to school. Approximately 45-50% of children living within one mile of school actively commute. Within half a mile of school, the percentage may be as high as 75% (McDonald & Aalborg 2009). Less than 5% of children are actively commuting more than two or three miles to school. The literature suggests that students will walk about 0.5 miles to school; however, a 2004 U.S. nationwide survey found that the mean distance to school was 3.9 miles. Of the children in this study, 51.3% lived within 2 miles of school, and only 34.7% lived within 1 mile of school (Martin, Lee, & Lowry 2007). These numbers suggest that many American schoolchildren are unlikely to actively commute to school, given the distances involved.
The effect of distance to school dwarfs the effects of other environmental factors on the choice of travel mode. A systematic literature review by Pont et al. (2009) looked at 38 different studies of the environmental correlates of children’s active transportation. Of the many possible factors studied, only one factor in the physical environment – distance – was found to be clearly significant by five or more studies. Increased distance between destinations was negatively correlated with active transportation. Urban form factors such as block length are overwhelmed by the effect of distance between destinations. Another literature review by Wong et al. (2011) looked at 14 studies that used GIS to measure aspects of the built environment that might correlate with active school transport. The studies looked at factors such as distance to school, density, diversity of land use, street design, connectivity, sidewalks, safety, walkability, and demographic factors. However, the only factor that consistently showed a correlation with active school transportation was distance to school. Distance from school is clearly the major factor in determining whether or not children can walk to school.

Effect of Environmental Characteristics

However, for children who live close to school, aspects of the built environment may encourage or discourage walking. Twenty-five percent of children who live less than a 0.5 miles from school do not walk, and 50% of children who live less than a mile from school do not walk (McDonald & Aalborg 2009; Martin et al. 2007). Environmental factors such as perception of traffic risk may influence the travel mode choice of these children who live within potential walking distance of school.
There is a strong correlation between living in an urban environment and walking/biking to school, when considering only children who live within a mile of school (Martin et al. 2007). Several studies (Timperio et al. 2006; Panter et al. 2010; Yarlagadda & Srinivasan 2008; McMillan 2007; Kerr et al. 2006) have attempted to examine the effect of urban form variables such as road and sidewalk infrastructure on children’s rates of active commuting. The results have been quite mixed. Diverse land uses within the neighborhood (McMillan 2007) with more stores within a 20-minute walk of home (Kerr et al. 2006) are correlated with more walking and biking. Biking facilities and infrastructure have been associated with more biking to school (Kerr et al. 2006; Panter et al. 2010). More streetlights are associated with more walking (Timperio et al. 2006) but less cycling (Panter et al. 2010). A higher density of streets in a neighborhood is associated with more walking (Panter et al. 2010). Busy road barriers correlate with less walking and biking (Timperio et al. 2006). However, all of these effects are small by comparison with the effect of distance to school. Several of the studies only look at urban form variables within a small area such as within 0.25 miles of home (Yarlagadda & Srinivasan 2008) or within 0.25 miles of school (McMillan 2007). Since most U.S. schoolchildren live much further from school, the effect of the urban form of 0.25 miles of the journey is not likely to be significant for most children.

Several studies have found correlations between a walkable street network with low exposure to traffic and more walking to school. For example, Pont et al. (2009) identified multiple studies that found a possible positive correlation
between walk/bike paths or park/recreation areas and children’s active transportation. The authors of an Oregon study looked at four middle schools and asked about the students’ mode of travel to school (Schlossberg et al., 2006). They then looked at aspects of the urban form along the route from the student’s home to school. The study considered distance to school, intersection density, dead-end density, route directness, major roads and railroads. They found that, in addition to distance, intersection density, and dead-end density were also significant predictors of travel mode. Giles-Corti et al. (2011) used GIS to measure walkable street connectivity around schools by creating a “PedShed”. The PedShed is the ratio of the area of the pedestrian network to the total area within a 2-kilometer radius of the school. The authors then calculated the traffic exposure within the pedestrian network by creating a ratio of major roads to minor roads. These measures were combined to make a walkability index for the school neighborhood. The paper found that high walkability was associated with more walking and that short distances were associated with more walking; both relationships were observed to be statistically significant.

*Effects of Socio-economic and Demographic Factors*

Many studies have found that certain socio-economic and demographic factors correlate with active commuting. Foreign-born immigrant status, lower household income, and lower parental levels of education are all associated with more walking and biking to school (McMillan 2007; Martin et al. 2007). These correlations may be confounded by residential patterns (i.e. these factors are associated with an increased likelihood of living in dense urban neighborhoods close to schools). These correlations may also reflect lower levels of car
ownership (see next section). Some studies have found that non-Whites are more likely to actively commute (McDonald 2007) but this effect may disappear when adjusted for other variables, such as household income (Martin et al. 2007). The Southern region of the United States has the lowest rates of active commuting (Martin et al. 2007). Children of divorced parents (Martin et al. 2007) and children from families with more children in the household (McMillan 2007) are more likely to walk or bike to school. Boys ages 11 and up are most likely to actively commute, perhaps reflecting more protective parental attitudes towards girls and younger children (Yarlagadda & Srinivasan 2008; McDonald 2007). Rigorous research is needed to determine the underlying explanations of these correlations.

Effect of Transportation Options

McDonald (2007) found that living in a zero-vehicle household greatly increased the likelihood of children walking or biking to school. This may explain some of the long-term trends, since in 1969, 79% of U.S. households owned at least one car, but in 2001, 92% owned a car, according to the National Personal Transportation Survey. However, a 2007 California study found that the number of cars per driver in the household did not affect travel mode choice to school (McMillan 2007). In this case, almost all households had at least one car, and the study did not find significant differences in the active commuting of children based on the number of additional cars in the household.

Most studies have simply looked at active commuting compared to all other modes of transportation. Few studies have specifically looked at school
buses or public transit as separate from car travel. This is an important gap in the literature, as school buses and public transit could be considered active commuting if students must walk a significant distance to the bus stop. Buses may provide a way to allow children who live far from school to walk part way and ride the bus the rest of the way. A San Francisco study found that 6% of students rode the school bus and 2% used public transit (Yarlagadda & Srinivasan 2008). However, another San Francisco study found the percentage of transit or school bus riders rose to almost 20% among those two or more miles from school (McDonald & Aalborg 2009). A South Carolina study found that 39% of students took the school bus (Sirard et al. 2005). Nationwide, the percentage of children riding the school bus has declined from approximately 38% in 1969 to 30% in 2001 (McDonald 2007). The use of public transit rose to a peak of about 8% in 1977, then declined to about 2% in 2001. Over the same period, the use of private vehicles has risen from 17% to 55%. It is unclear from the literature whether these changes result from cutbacks in the provision of school or public buses or from a change in demand for public transportation. Future research may inform policies aiming to provide more active and environmentally friendly transportation options to the majority of U.S. schoolchildren who live more than a mile from school.

The majority of studies have not distinguished between walking and biking as forms of active commuting. Those that have made the distinction have found much higher rates of walking than biking (Yarlagadda & Srinivasan 2008; Wen 2008; Temperio et al. 2006). In the U.S., walking accounts for 90% of active travel to school (McDonald 2007). This is an important distinction to make.
because the factors that facilitate walking may not be the same as those that facilitate bike travel. None of the studies asked questions such as “does your child own a bike?” or “does your child know how to ride a bike?” Without answers to these questions, urban form questions about the presence of bike lanes (Yarlagadda & Srinivasan 2008) are of limited usefulness. Biking may be a way for students who live further from school to actively commute without taking as much time as walking.

Effect of Weather

The research studies have failed to fully account for the possible effects of weather on active commuting. A study from Columbia, South Carolina found no correlation between weather and rates of walking or biking to school (Sirard et al. 2005). However, since this study was conducted in South Carolina in the fall, it did not measure the effects of severe winter weather. A North Carolina study avoided the issue of weather by phrasing the survey question as “When the weather permits, on how many days per week do you usually walk to school?” (Evenson et al. 2003). However, in many northern regions of the United States, the weather may not permit walking or biking much of the school year. A nationwide U.S. survey found that among students who sometimes walk to school, weather was the most commonly reported barrier to walking to school every day (CDC 2005). This suggests that children who generally walk to school may not when the weather is bad.

Correlation with Parental Employment

One possible factor in the downward trend in walking and biking to school
is the change in the percentage of mothers who work outside the home. In 1969, 56% of married mothers with children under the age of 15 in the U.S. worked outside the home. By 2009, the percentage had risen to 74% (Kreider & Elliott 2010). Children are less likely to actively commute to school when both of their parents work (Ziviani et al 2004), especially when their mothers work full-time (Yarlagadda & Srinivasan 2008). However, an Australian study found that the mother’s employment status was less important than the mother’s mode of commute in predicting active commuting to school. In Sydney, Wen et al. (2008) found that in 79.3% of the households, the mothers were the main overseers of the children’s travel to school. In Wen’s survey, 64.6% of the parents with childcare responsibilities drove to work and they were significantly more likely to drive their children to school than those who did not drive to work (51.7% of their children were car travelers). In the UK, Panter et al. (2010) similarly estimated that 60.6% of mothers commute to work by car. The strong correlation of students’ car travel to school and parents’ car travel to work suggests that walk to school initiatives need to also encourage and facilitate parents’ commuting to work without automobiles.

*Differences between Morning and Afternoon Commutes*

Several studies only considered the commute to school, and some studies did not distinguish between morning and afternoon trips to school. However, the studies that did consider morning and afternoon trips separately found some significant differences. In San Francisco, Yarlagadda and Srinivasan (2008)
found that if the mother worked on a particular school day, she was more likely to drive her children to school, but less likely to drive her children home from school. McDonald and Aalborg (2009) also found that fewer students were driven and more walked with friends or siblings in the afternoon than in the morning. A possible explanation for this finding is the closer alignment of the start of the school day and the start of the workday than is found at the end of the day. Yarlagadda and Srinivasan (2008) also found that the impact of the distance between home and school on the choice of travel mode was stronger in the morning. They suggested that one factor might be more time pressure to get to school and work on time. In Columbia, South Carolina, Sirard et al. (2005) observed fewer automobile trips and greater use of school buses and childcare transportation in the afternoon. A Wake County, North Carolina study found the same result of more school bus travel, walking, and biking in the afternoon than in the morning (Rhoulac 2005). Schlossberg et al. (2006) also found that children were more likely to be driven to school than home from school. These findings suggest that “walk from school” programs may be more successful than “walk to school” initiatives.

Escorted vs. Independent Travel

An important factor in parental decisions about their children’s travel mode is whether the child is able to make the trip independently or whether the child must be escorted. Further decisions about travel mode follow from this initial determination. Faulkner et al. (2010) conducted structured interviews with 37 parents of children in four Toronto elementary schools, 17 of whom had
children who walked to school and 20 of whom drove their children to school.

The parents described the travel mode choice as consisting of two decisions: 1.) the determination of whether the child was able to travel independently or not, and 2.) the selection of a travel mode among available options based on that determination. The Toronto study found that if parents decided that their children had to be escorted, parental time constraints led to driving to school unless the distance to school was very short (average less than 0.5 miles).

Despite the importance of the question of children’s independence, many studies of children’s travel have failed to distinguish between active modes of transportation and independent mobility. Active modes of transportation include walking, biking, or taking another human-powered vehicle such as a scooter or skateboard. Taking public transportation or a school bus may be partially active if the child must walk to the bus stop. Independent mobility for children is any travel accomplished without an adult escort. Independent car travel is generally legally prohibited for children under the age of 16, but walking, biking, and public transportation can either be independent or escorted. One Norwegian study so muddled this distinction that it called all walking and biking “independent mobility” and public transportation “somewhat independent” (Fyrhi & Hjorthol 2009). Understanding the factors behind parental decisions to grant children the freedom to go about independently is important to inform public policy and planning decisions.

The majority of studies do not consider whether children were walking or biking to school by themselves or with an adult escort. However, this important
distinction was considered in two studies from the San Francisco Bay Area. Yarlagadda and Srinivasan (2008) found that mothers accompanied 10-20% of the children who walked to school. In a separate study, McDonald and Aalborg (2009) specifically chose to study 10-14 year olds because previous research had found that in the United States children begin to travel independently around the age of 10 (Matthews 1992). They found that children were accompanied by a parent for 1/3 of walking trips and by a sibling or friend for an additional 1/3 of walking trips. The need to escort children on the walk may increase the impact of distance as parents may need to travel the entire distance both ways, taking up to twice the time.

McDonald and Aalborg (2009) then looked at the children who were driven despite living within two miles of the school. Parents gave open-ended responses to the question of why they drove their children to school and whether or not their children were allowed to walk without adult supervision. About 75% of parents cited convenience as a reason for driving their children to school. However, 46% of these same parents did not allow their children to walk alone. This restriction and need for parental/adult escort would greatly increase the inconvenience of the child walking. Among the 30% of parents who cited safety as a reason, 75% did not allow their children to walk to school without adult supervision. Many of these 10-14 year olds were not allowed to leave the house at all without adult supervision.

These findings suggest different policy interventions to target different groups. Overall, half the parents who drove their children less than 2 miles to
school did not allow them to walk places without an adult. Programs such as walking school buses or crossing guards may allow some of these children to walk to school. On the other hand, nearly 40% of the children who were allowed to walk alone were driven for convenience. These families may be convinced to have their children walk to school by campaigns promoting the health benefits of walking. These families may also be open to biking, since this would take less time than walking. The issue of independent vs. escorted travel deserves further study as it may explain some of the decline in active commuting since 1969 as societal norms about children’s independent travel may have changed.

Independent mobility is correlated with significant benefits for children. Since children cannot drive, their independent mobility must be at least somewhat active. A 2009 English study found that children’s level of independent mobility was significantly correlated with their level of physical activity (Page et al. 2009). An Italian study found that higher levels of independent mobility were significantly associated with more peer interaction (Prezza et al. 2001). Children who have greater freedom for independent mobility also engage in more weekend activities than other children their age (Hillman et al. 1990). Children’s ability to be independently mobile also reduces the burden on parents to escort children where they need to go. Hillman et al. (1990) found that parents on average took 4-5 round trips per week to escort their children just to non-school activities.

Just as the government issues driver’s licenses, parents implicitly grant their children “licenses” to achieve certain independent mobility privileges.
Hillman et al. (1990) identified six different milestones for activities a child might be allowed to do independently:

1.) cross roads
2.) walk somewhere other than school (friend’s house or nearby shop)
3.) come home from school
4.) ride a bus
5.) ride a bicycle on the main road
6.) go out after dark

Hillman and his colleagues used these licenses to measure changes in parental attitudes over time in England and in comparison to German parents. The authors found that English children in 1990 had less freedom than children in the same neighborhoods in 1971. The children also had less freedom than German children in similar neighborhoods. For example, only 11% of the English 7 year olds were allowed to come home from school independently in 1990. However, 85% of German 7 year olds in 1990 and 71% of English 7 year olds in 1971 were allowed to come home from school on their own. Several subsequent studies also used these licenses as a framework for measuring parental tolerance for children’s independent mobility (Prezza et al. 2001).

Parents generally grant their children more independence as they mature and are perceived as better able to handle any difficulties that may arise while being out on their own. In terms of the child’s individual characteristics, age is the greatest determining factor for level of independence (Hillman et al. 1990). However, several studies also found that at any given age, boys were given
greater freedom and independence than girls (Prezza et al. 2001; Fyrhi and Hjorthol 2009; Hillman et al. 1990). Another individual factor is the parent’s perception of the child’s reliability. Parents must weigh their child’s maturity and reliability versus a number of external factors.

Perception of risk from traffic and mal-intentioned people is another major factor in the degree of mobility freedom a child is given. Alparone et al. (2003) developed a Traffic Danger Perception Scale and a Social Danger Perception Scale to measure parental concerns about these risks. Not surprisingly, the more risky a parent perceives the neighborhood to be, the less likely the child is to be allowed to move about independently.

Positive perceptions, as well as perceptions of risk, impact parents’ decisions. Prezza et al. (2001) showed that mothers who had closer neighborhood relations gave their children more independence to move about the neighborhood on their own. Parents who had positive perceptions of the benefits of outdoor autonomy also gave their children greater license for independent mobility (Prezza et al. 2005).

LESSONS FROM THE LITERATURE

Only 13% of U.S. schoolchildren walk or bike to school, down from about 41% in 1969 (McDonald 2007). Many studies have explored the factors behind the low rate of walking and biking to school in the United States. Distance is a major obstacle since only about half of U.S. schoolchildren live within a mile of their school (McDonald 2007). Children who walk to school walk an average of
10-12 minutes, suggesting that about 0.5 miles is considered a feasible walking distance (McDonald 2007). Studies have attempted to determine the influence of the “walkability” of the neighborhood on rates of walking or biking to school. The results suggest that, although “walkability” is dwarfed by the effect of distance, a more walkable neighborhood may encourage students who live nearby to walk or bike to school. There is no clear consensus among the studies that walking or biking to school is more prevalent among any one demographic group, when controlling for distance from school and automobile ownership. However, some of the literature has found that boys are more likely than girls to be independent walkers (Yarlagadda & Srinivasan 2008, McDonald 2007).

There were several noticeable gaps in the literature. Most studies did not distinguish between walking and biking, although the policy recommendations might be quite different to encourage biking. Most studies also did not distinguish between the morning and afternoon commute, but those that did found that children were more likely to be driven by their parents in the morning than in the afternoon. The most important omission is that few of the studies asked whether students were walking or biking to school independently or being escorted by a parent. The current study aims to fill in some of these gaps in the literature and better understand parental concerns regarding their children’s commute to school.
METHODS

A PARENTAL SURVEY AT MISSION HILL SCHOOL IN BOSTON

This study seeks to understand the factors that inform parents’ decisions about their children’s independent and escorted transportation at a local Boston public school. The research is based on a survey of parents at Mission Hill School, a Boston Public Pilot School in Jamaica Plain, Massachusetts serving 214 children, ages 3-14 in K0 (pre-kindergarten) through eighth grade. This school was selected in part because my daughter attends fourth grade there and I was able to use personal connections to implement the survey. The demographics of Mission Hill School are similar to those of the Boston Public Schools with 40% Black, 35% Hispanic, and 17% White students (BPS 2013a). However, Mission Hill School draws students from a wider area than most Boston elementary schools due to its complex history. Mission Hill School was a citywide school until 2010 and moved from Mission Hill to its current location in Jamaica Plain in 2012.

The survey was developed in consultation with Mission Hill School principal Ayla Gavins and several parents from the school. The Tufts Institutional Review Board granted the survey exemption from full review. ESL teacher Joel Webb translated the survey into Spanish, and the paper surveys included both Spanish and English versions. See Appendix A for text of the survey. As a small incentive to complete the survey, I offered to donate $1 to the school for every completed survey.
Survey distribution and collection ran from March 1st to April 12th 2013. Paper surveys were sent home with all students in the school along with the Friday newsletter on March 1st. Parents were requested to complete the surveys anonymously and return to the child’s teacher. I established a basket in the school office to collect surveys from teachers. The survey was advertised through posters in the school hallways. On March 2nd, an online version of the survey went live and was advertised through the parent Yahoo group. On March 8th I attended the 7th and 8th grade parent breakfast to speak to parents about the survey, although attendance was small due to a snowstorm. The March 8th school newsletter also included a reminder to parents to complete and return the surveys. I provided teachers with additional copies of the survey and asked them to have parents complete the surveys when they came to school for parent conferences on March 14th and 15th. On March 22nd, I attended the school movie night to ask parents to complete the survey. On March 28th, I attended a family breakfast to collect more surveys, although most of the attendees had already completed the survey. Out of concern that the school bus riders whose parents do not come to the school often were underrepresented in responses, I distributed an additional paper survey to each child in the school bus waiting area on April 5th. On April 10th, I sent reminder emails to the teachers at the school and to the parent Yahoo group. Survey collection wrapped up on April 12th prior to the April spring
To provide context for the survey results, I gathered information about the school population from other sources. The school directories provided information about where students live, and the class lists showed how many boys and girls were in each class. School staff provided information about how many children are eligible to ride the school bus and how many typically ride the bus on a given day. The Boston Public Schools website provided general demographic information for the school and the district. These data helped me evaluate how representative the survey population was of the school population as a whole.

**ANALYSIS OF DATA**

*Geographic Context*

In order to understand the spatial context of transportation decisions at Mission Hill School, I made the following maps in ArcGIS 10.1 (ESRI, Redlands, CA):

1. Student addresses (aggregated by BPS geocode to protect privacy)
2. Distance from school along the street network (0.5, 1, 1.5, and 2 miles radii)
3. Walkability Analysis – a comparison of the one-mile “as the crow flies” radius of the school with the one-mile street network radius of the school
4. Likely recruitment area for Mission Hill School under proposed new school assignment plan
5. Requested locations for crossing guards

Statistical Analysis

I used the statistical package, Stata 11.0 (College Station, TX), to analyze the survey data. First I used a two-sample test of proportion to test if the proportion of students using each of the major travel modes was different for the morning and the afternoon.

Next I used chi-square tests to look at the following:

1. **Morning travel mode and walk zone status.** Respondents were asked how they usually get to school in the morning, including private car, carpool, school bus, public transit, bicycle, or walking. Some respondents indicated more than one usual mode of travel. For the purposes of this test, multiple responses were condensed into one “multi-modal” category. Respondents were also asked whether or not they live within the walk zone (one-mile radius) of the school. Walk zone status is a proxy for distance from the school, a prime consideration in travel mode choice. The chi-square test indicates whether the differences between morning travel mode choices of those within the walk zone are statistically significant from the morning travel mode choices of those living outside the walk zone.

2. **Walking to school in the morning and walk zone status.** This chi-square test looks specifically at the morning walking rates of those living inside and outside of the walk zone of the school. For the purposes of this test, I created a variable that indicated whether or not the respondent mentioned walking as a usual mode of travel to school (as the only mode or as one of several modes).

3. **Driving to school in the morning and walk zone status.** This chi-square
test compares children inside and outside the walk zone based on whether they are driven to school (as a sole mode or as one of several modes of transportation).

4. Gender and walking independence. I performed a chi-square test comparing the rates of independent walking across boys and girls.

5. Walking independence and walking to school in the morning. I hypothesized that children who are independent walkers may be more likely to walk to school since they would not need an adult escort. To test this, I did a chi-square test comparing the rates of walking to school of children who were independent walkers and those who were not. However, experience and the literature suggest that distance from school would overwhelm the effect of independence on walking to school. So I tried the same chi-square test only looking at families that live within the walk zone.

6. Bus ridership and car ownership. Available transportation options influence the travel mode choices of families. I did a chi-square test to compare the school bus riding rates of bus-eligible families who own 0, 1, 2, or 3 cars. I hypothesize that families that have a private car available are less likely to use the school bus.

I also performed the following t-tests:

1. Age by independence as a walker. Older children are probably more likely to be independent walkers than younger children.

2. Age by independence as a transit rider. Similarly, older children are probably more likely to ride public transit independently than younger children.
3. **Age by gender.** I ran a t-test of age by gender to see if the mean age of the girls and the mean age of the boys in the survey were statistically significantly different.

4. **Age of walking independence by gender and age of predicted walking independence by gender.** The survey asked parents whether their children are allowed to walk independently and the age at which they attained that independence. If the child is not yet an independent walker, the parent was asked to predict when the child might be allowed to walk independently. To further examine the possible connection between gender and independence as a walker, I did t-tests to see if the mean age of independence (actual or predicted) differed for boys and girls.

I compared the results of the survey with those reported in the literature. Finally, I presented the results of the survey to the administration and parents at Mission Hill School in order to begin a discussion about how the school community can facilitate the safe and independent mobility of children.
SURVEY RESULTS

REPRESENTATIVENESS OF SURVEY RESPONSE

There were 112 completed surveys – representing about 50% of all students. The survey respondents may have differed in significant ways from the parents who did not participate in the survey. Therefore, I compared the survey population with information about the school population from other data sources to assess the representativeness of the survey sample in terms of location of residence, age of students, and language background.

Where Students Live

Mission Hill School is public school currently located in the Jamaica Plain neighborhood of Boston. It serves approximately 214 students in K0 (pre-kindergarten for three year olds) through grade 8. Due to the nature of school assignment in the Boston Public Schools, children at Mission Hill School come from all parts of the city of Boston. Mission Hill School draws students from a wider area than most Boston elementary schools due to its complex history. Mission Hill School was a citywide school until 2010 when the assignment policy was changed so that the school would take new students only from the “North Zone”, the zone in which the school was located. The current school assignment policy divides the city up into three zones: North, West, and East. Elementary school families enter a lottery for one of the 20+ schools in their zone. In 2012, the school moved from Mission Hill to its current location in Jamaica Plain. At that time, the policy was revised to allow the school to accept new students from
the North and West Zones. At each transition point, all current students were
allowed to continue attending the school.

Figure 1: Where MHS Students Live

Bar chart created by first and second-grade students at Mission Hill School in the Fall of
2012.

Figure 1 is a bar chart made by Mission Hill School students showing
where some of them live. Figure 2 is a map of where all MHS students live
according to school information. To protect student privacy, Figure 2 shows
student addresses consolidated to a several block area. The addresses are
aggregated by the 863 geocodes that the Boston Public Schools uses to report
student data. Mission Hill School students come from all over the city of Boston,
but the majority of students live in Jamaica Plain and Roxbury.
Figure 2: Aggregated MHS Student Addresses

Data Sources: Mission Hill School attendance roster 2012-2013, Boston Public Schools geocodes
For privacy reasons, the transportation survey did not ask for student addresses, only zip codes and whether the family lives within the walk zone of the school. The Boston Public Schools refers to the one-mile radius around an elementary school as the “walk zone” for the school. According to GIS analysis, 20% of the students in the directory live within a one-mile radius of the school. By comparison, 36% of the survey respondents said they live within the walk zone of Mission Hill. Students who live within the walk zone may have been over-represented in the survey sample or respondents may have over-reported being in the walk zone.

Figure 3 compares zip code data from the school directory and the survey. It shows the percentage of survey respondents from each zip code with the percentage of students living in each zip code according the school directories. Jamaica Plain was relatively over-represented among survey respondents. Thirty-six percent of survey respondents live in Jamaica Plain, but only 27% of all Mission Hill School students live there. The Fenway, the South End, Hyde Park, Mattapan, and parts of Dorchester were relatively under-represented among survey respondents. Since these neighborhoods have a higher percentage of low-income residents, it is likely that poor students are also under-represented in the survey.
Data Sources: MHS attendance roster September 2012 (n = 214), Completed surveys March 2013 (n = 112)

*Age of Students in Survey*

Figure 4 shows the percentage of the survey respondents from each of the grade groupings (with the exception of K0, all classrooms contain two grades). The representation of each grade group in the survey is compared to the actual percentage of the students in the school. The chart demonstrates that the younger grades are relatively over-represented in the survey and the older grades are relatively under-represented.
**Figure 4: Survey Respondents by Grade**

![Bar chart showing survey respondents by grade]

Data Sources: MHS attendance roster 2012-2013 (n = 214), MHS Transportation Survey (n = 112)

**Language Issues**

All paper surveys were distributed with both an English and a Spanish version. However, only one Spanish version was filled out, despite the fact that, according to the school profile on the Massachusetts Department of Education website, 41% of the students at MHS are Hispanic. Twenty-one percent of students have a first language other than English, and 16% of students have limited English proficiency. Although some Spanish-speaking parents may have filled out the survey in English, it seems likely that the Spanish-speaking parents, as well as other non-native English speakers, are under-represented in the survey.
Despite efforts to reach out to all members of the school community, the completed surveys are somewhat more heavily weighted towards families who live closer to the school, speak English, and have younger children.

**Summary of Survey Results**

*Mode of Travel to and from School*

Survey respondents indicated their children’s usual means of getting to and from school. Unlike some of the studies in the literature (Yarlagadda & Srinivasan 2008, McDonald & Aalborg 2009, Sirard et al. 2005, Rhoulac 2005, Schlossberg et al. 2006), there were no statistically significant differences in the proportion of each travel mode in the morning and the afternoon. I conducted a two-sample test of proportion for each of the travel modes, morning vs. afternoon, and p-values greater than the selection criteria of 0.05 emerged. Therefore, for simplicity later analysis will focus on the morning commute. Figure 5 shows the percentage of survey respondents indicating that they use each travel mode regularly in the morning and in the afternoon. The sum of the transport mode categories is more than 100% because some respondents stated more than one regular mode of transportation.
Interestingly, the percentage of children who walk to school regularly is consistent with other studies nationwide and from other parts of the country. Multiple studies have estimated that 12-17% of school children in the United States walk to school, and 15% of students reportedly walk to the Mission Hill School (McDonald 2007, CDC 2005).

**Duration of Commute**

The length of reported commutes varied widely. The range is from 5 minutes to 1.5 hours each way. Not surprisingly, walkers have the shortest commutes, and school bus riders have the longest commutes. Figure 6 shows the average length of commute by travel mode. These data give an indication of the length of time parents and students travel by each mode.
Figure 6: Length of Commute by Travel Mode

![Bar chart showing the length of commute by travel mode: All Modes, School Bus, Private Car, Walking.]

Data Source: MHS Transportation Survey, April 2013 (n = 112)

An average walking commute of 12 minutes is consistent with long-term data that indicate for students who do walk to school, average walk times (10-12 minutes) have remained relatively constant in surveys since 1969 (McDonald 2007). A walk time of 12 minutes also suggests that walkers commute on average about 0.5 miles to school.

The Effect of Distance on Choice of Travel Mode

The literature is clear that distance is the most important factor in the choice of travel mode. From school information on the entire student body, I used ArcGIS 10.1 to calculate the distance along the street network from each student’s home to MHS. The range of distances was 0.15 miles to 7.3 miles with a mean distance of 2.19 miles. Only 16% of students live within one mile of the school along the street network, and only 5.5% live within 0.5 miles of the school along the street network.
In order to protect students’ privacy, survey respondents were not asked to provide their exact addresses. However, the survey asks several questions that estimate the student’s distance from the school. Parents are asked their zip code, whether they live within the walk zone of the school, and whether they are eligible for school bus transportation. School bus transportation is provided for children who live outside the one-mile walk zone, as well as for some children who live on the outer edges of the walk zone. As described in the previous section, survey responses may under-represent students who live further from school. Nevertheless, survey respondents confirm that distance is an important factor in the choice of travel mode to school.

Figure 7 examines the different transportation choices of survey families who live inside and outside the walk zone. Clearly there are significant differences in morning travel mode choice depending on whether the family lives within the walk zone of the school. A chi-square test showed that families who live within the walk zone use statistically significantly different travel modes than those who live outside the walk zone (p<0.01). Of families who live within the one-mile walk zone, 37.5% state that they regularly walk to school in the morning, compared to only 3% of families who live outside the walk zone. Of kids who walk regularly, 88% live in the walk zone. Interestingly, approximately half of families drive to school regularly, regardless of whether they live within the walk zone or not. There is no significant difference in driving rates whether the family lives in the walk zone or not.
In addition to asking about the family’s usual means of transportation, the survey also asked if the child ever walked to school. Thirty-three percent of children have ever walked to school. Of the families who never walk to school, distance was cited by all but two respondents as a main reason the child does not walk. Approximately 73% of families within the walk zone have ever walked to school, but only 3% of families who live more than one mile (straight-line distance) from school ever walk. Distance was a concern even for families within the walk zone, suggesting that a mile is further than many families want (or have time to) walk.

Data Source: MHS Transportation Survey, April 2013
Effect of Environmental Characteristics on Travel Mode

Street Connectivity

The literature suggests that distance is the primary consideration, but that other environmental characteristics are important for children who live within walking distance of school. For example, a well-connected street network with few dead ends promotes walking (Panter et al. 2010, Schlossberg et al. 2006). To explore this factor for the Mission Hill School, I measured the walkability of the street network surrounding MHS using the method described in Giles-Corti et al. (2011). I calculated the ratio of the area of the one-mile street network buffer around the school to the area of the one-mile Euclidean buffer. If there is a well-connected street network, these areas will be similar and their ratio will be close to one. Giles-Corti et al. determined that a ratio of at least 0.6 was desirable for walkability.

The ratio for the Mission Hill School neighborhood is 0.54, slightly less than the minimum desirable ratio. As the Figure 8 shows, there are many dead-end streets and large areas of open space that undermine the walkability of the MHS neighborhood. The area that is reachable in a one-mile walk along the street network is considerably smaller than the circle formed by a straight-line one-mile radius from the school. The lack of street connectivity forces pedestrians to walk further distances.
Figure 8: Walkability of One-Mile Radius around MHS

Data Sources: MassGIS
Traffic Danger

Ten percent of parents cited traffic danger as a reason for not walking to MHS. To assess the exposure to traffic danger, I conducted an analysis similar to one done in Giles-Corti et al. 2011. I used ArcGIS to calculate the ratio of the total length of roads within the street network one-mile buffer to the total length of small residential roads (MassDOT road categories 5 & 6). Seventy-eight percent of the road length within the one-mile network is made up of small residential streets. These streets typically have sidewalks and low traffic volumes and speeds, which makes them potentially safer and more pleasant for pedestrians. However 12% of the road length within the street network one-mile buffer is made up of larger streets, such as the Jamaica Way and South Street that have high traffic volumes and speeds. Parents may have serious concerns about their children crossing these streets.

Other Environmental Factors

Other environmental factors mentioned by parents were concerns about crime and the weather. Less than 10% of parents cited fear of crime as a reason their child does not walk to Mission Hill. Other parents volunteered that the weather impacts their travel decision. One family bikes in the fall and spring, and drives in the winter. Another family only walks in warm weather because the cold air exacerbates the child’s asthma.

Independence of Children’s Travel

The survey asked parents if their children are allowed to walk places within their neighborhood without an adult, and whether they are allowed to take public transportation independently. One parent explained that she allows her
daughter to walk to school independently because it “gives her a sense of freedom, yet is a clear activity A-B.” The following sections outline the results of the independent versus escorted travel section of the survey.

Age

Not surprisingly, the older children in the survey were given more independence than the younger children. Ninety percent of survey parents who do not allow their children to walk independently mentioned that the child was too young. Figure 9 shows the percentage of children at each age who are allowed to walk independently, based on parental report and parental prediction.
Figure 9: Percentage of Children at each age Allowed to Walk Independently

Data Source: Survey results, April 2013

Thirty-two of the survey respondents indicated that their children were independent walkers. These parents were asked to report at what age their children were first allowed to walk independently. The red line in Figure 9 looks at parents’ reports of when their independent walkers gained their independence. About 27% of current independent walkers gained their independence by age eight, and about 77% by age 10 (mean 9.7).
Seventy-seven of the survey respondents indicated that they do not currently allow their children to walk independently. The survey asked these parents to predict when they might allow their children that freedom. The green line on the chart shows what percentage of these children would have their independence by each age if their parents’ predictions were implemented. The green line shows the same progression towards independence as the red line, but shifted a year or two older. About 24% of these children would have their independence by age 9, and about 76% by age 12 (mean 11.4). Parents in this group may be more cautious or may be more likely to have children with disabilities. For parents of very young children it may also be difficult to imagine, let alone accurately predict, when their children will be walking around the neighborhood by themselves.

Not surprisingly, older children are statistically significantly more likely to be independent walkers. A t-test of age by walking independence yielded a p-value<0.001. Age is a proxy for a level of maturity and ability that parents must evaluate on an individual basis. Some children may need longer to develop the skills needed to be independent. As one parent described, “she's old enough but her social skills deficits = lack of maturity & street smarts make us hesitant.” The survey did not ask about disabilities that children have, so it is not possible to differentiate these responses. It seems likely that children whose parents predicted that they would be allowed to walk independently at 18 or 20 or “never” may be dealing with some kind of disability.
The survey also asked whether children are allowed to take public transportation without an adult. Not surprisingly given the young age of many of the children, 92% of respondents said no, because the child is too young. Figure 10 indicates the cumulative percentage of each age group that is allowed to take public transportation independently. Older children are statistically significantly more likely to ride public transportation independently. A t-test of age by transit independence yielded a p-value<0.0001. The red line looks at when parents reported that the children had gained this license. The children who currently are allowed to take public transportation independently gained that freedom at a mean age of 11.8.
Figure 10: Age of Independence for Public Transit

Data Source: MHS Transportation Survey, April 2013

The green line indicates when parents predict their children who do not yet have this freedom will gain it. As with walking, these parents predict that their children will gain transit independence at a slightly older age (mean 13).

Gender

The literature suggests that boys may be given independence at younger ages than girls (Yarlagadda & Srinivasan 2008; McDonald 2007; Prezza et al. 2001; Fyrhi and Hjorthol 2009; Hillman et al. 1990). However, that does not
appear to be the case at Mission Hill School. A chi-square test of gender and walking independence yielded a p-value<0.05, implying that girls were more likely to be independent walkers than boys. However, age is a crucial factor in children’s independence. A t-test of the age at which children gained independence by gender yielded an insignificant p-value (p>0.05) implying that the mean age of independence for girls (9.22) was not statistically significantly different from the mean age of independence for boys (10.67).

Of the children who do not yet have permission, on average parents predicted that their children would be allowed to walk independently at age 12.84 years for boys and 11.47 years for girls. However, a t-test of predicted age of independence by gender showed that this difference was statistically insignificant (p>0.05). In order to explain the significant chi-square result, I tested to see if the girls in the survey were statistically significantly older than the boys. A t-test of age by gender yielded a significant p-value of p<0.05, so the girls in the survey were probably more likely to be independent walkers because they were, on average, older than the boys. The survey does not show differences in parental attitudes towards the walking independence of boys and girls.

*Effect of Children's Independence on Travel Mode Choice*

If children are allowed to walk independently, parents are freed from the need to escort the children. This may make walking a more convenient option for families. Figure 11 shows the percentage of children who live within the walk zone who regularly use various modes of transportation to get to school. The chart compares children who are independent walkers with those who must always be escorted when walking.
Figure 11: Travel Modes for Escorted and Independent Children within the Walk Zone

Data Source: MHS Transportation Survey, April 2013

All of the independent walkers who live within the walk zone (n=12) have walked to school, but only 58% regularly walk to school. According to a chi-square test, independent walkers who live within the walk zone are no more likely to walk to school than children who may not walk independently (p>0.05).

Thirty-three percent of the independent walkers are regularly driven the short distance to school. Among the children who live within the walk zone and must be escorted in order to walk (n=27), only 29% regularly walk to school, and 55% are regularly driven. For these children, the increased parental time needed to escort the child on foot is a likely barrier to walking.

Analysis of Transportation Options

Private Cars
Forty-eight percent of students are regularly driven in a private car to school. Surprisingly this percentage is similar for families within the walk zone (47.5%) and families outside the walk zone (51%). Only 1% of respondents regularly participate in a carpool. Driving is the most convenient option for many families, but it is not an option for all families. Respondents have an average of 1.2 cars per household, but 13% of households have no car.

*School Buses*

Mission Hill is served by ten yellow school buses in the morning and in the afternoon. Figure 12 shows some of the buses lined up outside the school. Eighty-three percent of all students at the school are eligible for school bus transportation. All students who live outside the walk zone, plus some students on the outer edges of the walk zone, are eligible to ride the bus. Seventy-six percent of survey respondents stated that their child is eligible for school bus transportation. However, many eligible children do not regularly ride the bus. A sample count by school staff member Courtney Bruno during the week of May 20th indicates that only about 44% of eligible students ride the bus on a given day. Among survey respondents who were eligible for bus transportation, 51% of parents stated that their children regularly ride the bus. This low usage rate is an indication of some dissatisfaction with the school bus option.
For example, respondents complained about delays and unpredictable arrival times for school buses. One respondent stated that the "bus home varies from 15-60 minutes depending on bus delays/difficulties." Another parent agreed noting that the bus takes "15-45 minutes depending on the bus driver du jour." A third respondent complained about the lack of communication about bus delays, saying, "Transportation Department reps need access to drivers in cases of severely late busses. Having to call the yard and wait for a response is a time delay that some parents cannot handle when bus is 1 hour+ late"

Respondents complained about the lack of consistent drivers and drivers who do not know the route. As one respondent put it, "bus drivers . . . are not given a mapped route. They are just given a set of stops. That doesn't work well,
and any information is lost when there's a covering bus or driver change."

Another complaint was about the lack of supervision on the school bus. One parent explained, “some bullying does occur on buses.”

**Figure 13: School Buses Picking up Students**

![School Buses Picking up Students](image)

Source: Author photograph, Fall 2012

The rate of school bus usage among eligible families depends on the other available transportation options. Many families who own one or more cars find that driving their children to school is preferable to using the school bus. Ninety-two percent of bus-eligible families that do not own a car regularly use the school bus. However, the rate of bus usage drops dramatically with each additional car that the family owns. Among families with one car, 56% use the bus regularly while 35% drive their child to school. Among families with two or more cars, only 24% use the bus regularly while 75% drive to school. Figure 14 depicts the different travel mode choices based on car ownership.
A chi-square test shows that the greater number of cars a family owns the less likely they are to use the school bus ($p < 0.01$).

**Biking**

Only about 4% of students regularly bike to school. However, 78% of students in the responding families know how to ride a bike, and 77% own a bike. Biking can be a great option, especially for families that live within a mile or two of the school. Biking can save time over walking. As one survey respondent put it, walking “takes too long with 3 kids & bike is better.” Mission Hill School is fortunate to be located just a few blocks from the Southwest Corridor bike path.

**Public Transportation**

Mission Hill School is well served by public transportation. The school is a short walk from the Green Street and Forest Hills T stops on the Orange Line. It
is also close to public bus stops on South Street. However, only about 4% of MHS students regularly take public transportation to school. On average, responding parents believe that children should be 12 or 13 before they take public transportation without an adult. However, BPS often gives students in 6-8th grade T passes instead of school bus transportation. One parent explained, "in 6th grade we were not assigned a bus, but given T pass only." Some parents may not feel comfortable with their middle school children taking public transportation independently.

RECOMMENDATIONS OF SURVEY RESPONDENTS

The survey asked parents to provide feedback on different ideas of how Mission Hill School could make students’ transportation safer and more convenient and healthy. Respondents were also encouraged to share their own suggestions. The following section summarizes the general concerns and feedback expressed by parents that completed the survey.

A complete school directory

A comprehensive school directory distributed early in the school year would enable parents to identify other families who live nearby. Forty-five percent of respondents said they would like a more complete and timely directory. As one parent put it, "Better directory! Current directory is far from comprehensive.”

Walking buddies or walking “school bus.”

Fifty percent of responding parents are interested in this idea. On average, respondents do not want children to walk without an escort until age 10 or 11, so walking in a group may allow a greater number of children to walk. One parent’s
enthusiastic response was “Yes! I had the buddies idea myself.” With a good school directory and some encouragement, parents may be able to set up walking groups informally. Alternatively, the school could set up a more formal group walk on a regular or occasional basis.

*Pedestrian Safety Training*

Thirty-six percent of respondents would like the school to teach pedestrian safety. This could happen, if it does not already, as a natural part of walking field trips.

*Crossing guards*

Thirty-five percent of responding parents would like to see crossing guards at important intersections. Figure 15 shows the requested locations for crossing guards. The most requested locations are near the school on South Street, a nearby commercial street. However, other requested locations are to the north of the school and reflect the fact that many students are coming from that area.
Traffic Concerns near the School

Parents are asking for “signs for drivers to be aware of children” and asking the school to “continue making/posting signs for non-school drivers to be aware that young children may be around.” Another parent brought up the
detrimental effect of the school buses on the safety of students walking on the Carolina Street sidewalk. See Figure 16. "As a walker, the buses that pull up on the sidewalk are a danger as they are so big, the kids are so small (the wheel wells are huge!) and I wish they would not come onto the sidewalk."

Figure 16: School Bus Blocking Sidewalk

Source: Author photograph, Fall 2012

Encourage Walking

The school could encourage students through “bike to school/walk to school weeks or other celebrations.” Students who live too far away to walk the whole way could be encouraged to walk to the school bus stop, or to walk the last few blocks if they are driven to school.

More and Better Bike Racks

The current bike rack will not hold many bikes. If more children are going to bike to school, the school will need "more bike racks." One parent
recommended an “additional bike rack, covered by roof (under the overhang).”

The existing bike rack (Figure 17) also has some design flaws: “Move current bike rack/enlarge space it's in so bikes' wheels fit into rack w/o hitting wall behind."

**Figure 17: Small Bike Rack at MHS**

Source:  Author photograph, Fall 2012

*Better Bicycle Infrastructure*

One parent asked for "better bike facilities to encourage riding. We ride on the sidewalk, but protected bike lanes would be safer. I know this is not under MHS's control, but the schools could advocate for safer ped/bike routes to school."
Encouragement of Carpooling

One respondent recommended carpooling as an alternative, saying “it's safe and you get the benefits of socialization to and from school.” A timely and complete school directory would enable parents to set up carpools.

Consistent Bus Drivers

If the same bus driver drives the same bus for the whole school year, he/she will get to know the route and the kids, reducing both delays and disciplinary issues. One parent made this point, calling for, "1.) consistent drivers - provide same driver on bus route. 2.) give bus drivers maps for route - not just list of stops."

Supervision/Accountability for School Bus Behavior

Fifty-two percent of respondents would like bus monitors riding the buses. One parent of a three-year-old boy said, "my most important one was bus monitors. Sometimes my son comes home half out of his seatbelt.” Even in the absence of bus monitors, the school needs to hold children accountable for their behavior on the bus. A parent asked the school to "take disciplinary actions against unruly children including bullies.”

Listings of Bus Routes and Bus Rosters

Forty-six percent of responding parents would like a listing of bus stops and bus rosters for their child’s bus so they know who is on the bus and where the bus is going. One enthusiastic parent said, "Yes++++ to bus roster." This intervention would take some of the uncertainty out of the bus trip, and help parents to help each other, especially in the case of delayed buses.
School buses are an important transportation option for children who live too far to walk to school. They relieve parents of the burden of having to drive and they are provided free of charge by the school district. However, parents have legitimate concerns about the buses that limit their usefulness. Mission Hill School could work with the BPS Transportation Department to address these concerns.
DISCUSSION

COMPARISON OF RESULTS WITH THE LITERATURE

Travel Mode

Figure 18 shows the proportion of each travel mode for MHS students compared to nationwide averages reported in McDonald 2007. There is relatively more utilization of school buses, walking, biking, and public transportation and less driving than the national averages. This is not surprising given the urban environment and the free provision of school bus transportation to most students.

Figure 18: MHS Travel Modes compared to National Averages

About 15% of Mission Hill School students regularly walk to school, which is not surprising since only 16% of the students live within one mile of the school along the street network. MHS students who walk to school have an average commute of 12 minutes, which is consistent with long-term data that
indicate for students who do walk to school, average walk times of 10-12 minutes have remained relatively constant in surveys since 1969 (McDonald 2007). A 12-minute walking commute suggests an average walk of about 0.5 miles. The survey data and the literature agree that families may only be willing to walk up to one mile along the street network, with an average walk of 0.5 miles.

*Independent Mobility of Children*

This survey found that parents were willing to allow children to walk about their neighborhood beginning at the age of 10 or 11. This is consistent with the work of Matthews (1992) that found that in the United States children begin to travel independently around the age of 10. However, this finding is in contrast to studies from Germany in 1990 and from England in 1971, which found that the majority of children gained walking independence at the age of 7 or 8 (Hillman et al. 1990). Figure 19 shows the percentage of children who are independent walkers at each age, comparing the Hillman et al. (1990) data with the MHS data. The “predicted” line gives the age at which MHS parents predicted their children would be given the freedom to walk independently.
Figure 19: Percentage of Children who are Independent Walkers - an International Comparison:

Data source: MHS Transportation Survey, April 2013 and Hillman et al. (1990)

Figure 19 shows a dramatic drop in the percentage of children aged 7-11 who are independent walkers in England between 1971 and 1990. The data from MHS is more similar to the later English data than the German data or the earlier English data. These data are just snapshots, and may not be directly comparable. However, further research would be beneficial to determine how to make our neighborhoods and streets safe enough that parents would feel comfortable allowing their young children to walk independently.

Unfortunately, the MHS survey did not yield useful data about specific parental concerns, since most parents simply stated that their children were “too young” to walk independently. However, Figure 19 indicates that the concept of an appropriate age for independence is a relative concept, likely influenced by cultural factors and the perceived or actual safety of the environment. A future study could include more detailed questions about parental perception of traffic
and social danger as in Alparone et al. (2003). This information could be used to improve the safety of the city for children.

**IMPLICATIONS OF CHANGES TO SCHOOL ASSIGNMENT PLAN**

Beginning with the 2014-2015 school year, the Boston Public Schools is proposing a new school assignment plan for the whole city. If implemented as planned, the new assignment plan will gradually change Mission Hill School from one that serves students from all over the city to one that serves only students from the neighborhoods of Mission Hill and Jamaica Plain. This change will mean that many more of the students at Mission Hill School will live within potential walking and biking distance of the school. The transition provides a unique opportunity to improve transportation options for students and encourage active commuting.

The current school assignment plan divides the city into North, West, and East zones. Elementary school students enter a lottery for one of the 20+ schools in their zone. Because of its recent move from the North to the West zone, Mission Hill School is currently available to students in both the North and West zones. Under the complex new school assignment plan, each student is eligible to enter the lottery for an individualized list of approximately 6-13 nearby elementary schools. If the nearest schools are of lower quality, the students are given additional options until they have at least two “top-tier” schools on their list.

Due to the complexity of the proposed school assignment algorithm, it is difficult to determine exactly which households will be eligible to apply to attend.
Mission Hill School beginning in 2014-2015. Furthermore, students from the Mission Hill neighborhood have been promised continued access to Mission Hill School subsequent to the school move from Mission Hill to Jamaica Plain in 2012. By entering a sampling of addresses into the BPS school list calculator (BPS 2013a), I estimate that under the new school assignment plan, the Mission Hill School will only be open to students living in zip codes 02130 (Jamaica Plain), 02120 (Mission Hill) and parts of other zip codes that fall within the walk zone of the school. I refer to the area from which students will be eligible to apply to attend MHS as the new recruitment area for the school.

Figure 20 shows the probable new recruitment area for Mission Hill School. Also shown are street network buffers around the school at the 0.5, 1, 1.5, and 2-mile distances. While only 38% of the recruitment area lies within 1 mile of MHS, 87% of the area lies within 2 miles of the school. If the plan is implemented as proposed, eventually all children at Mission Hill School will come from this recruitment area. Many more children will live within walking distance of the school than currently do. More children will be able to walk or bike to school, and those who cannot will have shorter bus or car rides than MHS students do now.
Figure 20: Probable New Recruitment Area for MHS

Data Sources: Bostonschoolchoice.org

The changes brought about by the new school assignment plan will occur gradually. The plan calls for all current students, and their younger siblings, to be grandfathered into MHS, so no one will have to leave the school. This
grandfathering will provide stability for current families. However, all new families to the school will come from the new recruitment area beginning in 2014. Therefore, as the plan is put into effect, students living outside the recruitment area will increasingly be the only ones in their neighborhoods who attend MHS. This will further complicate efforts to provide transportation for these children. The school will have to be vigilant to make sure these students are not increasingly isolated and facing long rides alone on the bus.

**Major School Transportation Concerns**

*Car-dependence*

About 50% of MHS parents regularly drive their children to school. Most children live too far from school to walk, and parents have expressed deep dissatisfaction with the school buses. Families who have access to a car generally drive to school rather than walk or use the school bus. Driving is the most convenient option for many families, but it may be a time- and resource-intensive option that also burdens the neighborhood with increased traffic and pollution. Driving is also not an option for the 13% of families without a car, or for the many families whose one car is not available for the school run. Therefore, it is important to work to promote viable and attractive transportation alternatives.

*Lengthy commutes*

Another issue of concern is the lengthy commutes of some Mission Hill School students. Students live a mean distance of 2.9 miles from the school. The student with the longest commute lives 7.3 miles from MHS. Through city traffic
on an even longer school bus route, this can mean a commute of up to 1½ hours each way.

*School bus issues*

The long commutes exacerbate problems that the school buses face. School buses are often delayed due to traffic or other issues, making it challenging for parents trying to meet the bus. Students get restless on the long ride and begin acting up, causing safety concerns. The high turnover of bus drivers means that drivers often do not know the route or the children, leading to more delays and behavioral issues.

*Pedestrian safety*

Although most of the roads surrounding the school are quiet residential streets, there are busy streets that some students must cross in order to walk to school. The school buses and the private cars dropping off students at school also create hazardous conditions for students on foot.
POLICY RECOMMENDATIONS

OVERALL RECOMMENDATION

School directory

The easiest policy recommendation to implement is to provide a comprehensive school directory at the beginning of the school year. This idea was endorsed by 45% of survey respondents. Currently the school directory is only put together if and when a parent volunteer is willing to take on the task. Often the directory is not completed until almost halfway through the school year. The 2012-2013 directory was incomplete when it did come out.

A comprehensive directory would help parents to set up carpooling or walking buddies. It would also help parents with non-transportation related issues such as play dates or birthday party invitations. A directory is a vital first step to building a community that bridges the gap between school and home.

I recommend that school staff take on the responsibility for putting together a directory each year with a goal of distributing it by the end of September. This recommendation should be implemented in any school that is not already putting out a timely and comprehensive school directory.

RECOMMENDATIONS FOR CHILDREN WHO LIVE FAR FROM SCHOOL

Although changes in the school assignment plan may eventually lead to more children living near their schools, at present many children at Mission Hill
School live a considerable distance from the school. This is particularly true of Mission Hill School because it used to be a citywide school, and it is also true of charter schools such as Conservatory Lab Charter School that draw children from a large area. However, many other schools in Boston and around the US also serve children from a large geographic area. These children may not be able to walk or bike to school, but the schools can work to improve their transportation to school to ensure that it is safe, efficient, and minimally burdensome on families.

*Bus rosters and parent communication about bus delays*

The school provides school buses for children who live far from school, but many families do not use them because of frustration about delays and lack of communication. The school could improve this situation by providing each family who has a school bus assignment with a listing of the bus stops and a roster of the children assigned to the bus. Forty-six percent of survey respondents recommended this idea.

The Conservatory Lab Charter School in Brighton, Massachusetts has implemented a state-of-the-art system for keeping track of children and their buses. Graphic designer Adaleta Maslo-Krkovic and programmer Ivan Posinjak have designed an iPad app that allows school staff to check off children as they get on the bus in the afternoon. Once the bus is loaded, the “dismissal manager” can activate a text or email to parents notifying them that their children are on the bus and the bus has left the school. The Parent Advisory Council states, “we hope that the system will prevent families from wasting precious time waiting for delayed buses and reduce the amount of stress that this unfortunate situation can
The developers are happy to make the iPad app available to other schools.

The Conservatory Lab Charter School has also developed a database called Bus Buddies in the restricted section of the website where parents can share their contact information with parents of other children on the same bus. If parents have the contact information for other families on the bus, they will be able to help each other, for example, if one parent is delayed and cannot meet their child at the bus stop. Parents can warn each other about delays or other problems along the bus route. The bus rosters will also help families who live nearby to get to know each other. Mission Hill School may want to copy some of the work done at Conservatory Lab Charter School.

**Consistent and well-trained bus drivers**

Another way to improve the trip to school for children who ride the bus is to provide consistent and well-trained bus drivers. This is the responsibility of the BPS Transportation Department and needs to be addressed on a district, rather than school, level. BPS should make every effort to keep the same bus driver on the same route for the entire school year so that the driver will know the route and the children well. This will help avoid delays, as well safety and behavioral issues that have plagued the school buses.

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**Recommendations for children who live near school**

1 [www.conservatorylabparents.com](http://www.conservatorylabparents.com)
Encourage Walking and Biking

It is currently difficult for most MHS students to walk to school since only 16% of students live within one mile of the school along the street network. However, the new school assignment plan will likely change this situation. Once the new plan is fully implemented, I predict that close to 50% of the student body will live within one mile of the school along the streets. There will then be the critical mass of walkers that will make walking both safer and more fun.

However, even a one-mile walk may be considered too far, especially for children who must be escorted by an adult. Survey data indicate that parents on average do not want their children to be walking without an adult until the age of 10 or 11. Walking with their child to school and then walking back home or to work may be too much for some parents. A system of walking buddies or a walking “school bus” might allow more children to walk in groups without every parent having to escort their own child. The survey respondents were enthusiastic about this idea, with a full 50% of respondents specifically endorsing it. The Conservatory Lab Charter School “Bus Buddies” database also has a section for walkers so that families whose children walk to school can support each other. Mission Hill School could do something similar.

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2 38% of the land area in the new recruitment area is within the one-mile street network buffer of the school, but since parents from close by are more likely to choose MHS, the percentage of enrolled students within one mile will likely be higher.
Under the new school assignment plan, almost every student at MHS will live within potential biking distance of school. The school can encourage more biking by installing more bike racks and continuing to teach bike safety skills.

Crossing Guards

Parents also expressed a desire for crossing guards at major intersections both near the school and along the way many students would travel to school. While it is expensive to hire crossing guards, they would make it considerably safer for both children and adults to cross the busy streets. More families would feel comfortable allowing their children to walk to school if there were crossing guards.

Better bicycle and pedestrian infrastructure

The City of Boston should continue the work that it has been doing in recent years to improve the bicycle and pedestrian facilities in the city. These improvements will help not only students, but all residents, to safely move about the city without a car.
CONCLUSION

This study seeks to understand the factors that inform parents’ decisions about their children’s independent and escorted transportation through a survey of parents at Mission Hill School in Boston. Survey distribution and collection ran from March 1\textsuperscript{st} to April 12\textsuperscript{th} 2013. There were 112 completed surveys, representing 50\% of all students. Survey respondents indicated their children’s usual means of getting to and from school. Approximately half of families drive to school regularly, regardless of whether they live within a one-mile radius of the school or not.

About 40\% of the students take the school bus, about half of the bus eligible students, indicating substantial parental dissatisfaction with the school bus service. The school district should address parental concerns about the school buses so that fewer families feel the need to drive their children to school while the buses run half empty.

About 15\% of students regularly walk to school. Students who live closer to the school are more likely to walk; however, only 16\% of the student body lives within one mile of the school along the street network. Under the new BPS school assignment plan, more MHS students will come from the neighborhoods within feasible walking distance of the school. The school has the opportunity to encourage and help these students walk to school. On average, survey respondents felt comfortable allowing children to walk without an adult by the age of 10 or 11. Walking buddies or a walking “schoolbus” or “carpool” may
allow younger children to walk without every parent needing to escort his/her own children. The school can facilitate these connections indirectly by providing parents with a timely and comprehensive school directory.

The scope of this survey was limited to one school within the Boston Public School system. However, the results were consistent with many previous findings in the literature, and added some additional insight, especially in regards to children’s independent travel. This research is particularly timely because new school assignment plan in Boston will create more opportunities for students to walk and bike to school. The survey also comes at a time when new technologies are available to improve student transportation, as at Conservatory Lab Charter School. The data from this survey will help identify parental concerns and ways to improve children’s journeys to school.
APPENDIX A: SURVEY

Mission Hill School Transportation Survey

Hi, my name is Christina Kim and I have a daughter, Rachel, in 4th grade at Mission Hill School. I am also in school myself, getting a master's degree in Urban Planning from Tufts University. For my thesis research, I am studying how children get around the city and how cities could be designed so children can get around more safely and more independently. This survey seeks to understand how children get to school and other places they would like to go.

Please answer the following questions for your child at Mission Hill School. If you have more than one child at the school, please answer for only one child per survey form. Answers to this survey will be kept anonymous and confidential. As a token of my appreciation, I will donate $1 to Mission Hill School for each survey completed. Please return the survey to your child's teacher in the envelope provided. Thank you!

Your child’s age at last birthday: _______
Your child's grade: _______
Your child's gender:  M  F

Your zip code: _______________

Transportation to/from Mission Hill School:

Do you live within the Boston Public School “walk zone” (one mile) of Mission Hill School?
   ______ yes       ______ no       ______ don't know

Is your child eligible for school bus transportation to/from Mission Hill?
   ______ yes       ______ no       ______ don't know

How does your child usually get to school in the morning?
   ______ private car
   ______ carpool
   ______ school bus
   ______ public bus or subway
   ______ bicycle
   ______ walk

How long (in minutes) does it take your child to get to school in the morning?
   ______

Does an adult accompany your child on the trip to school in the morning?
How does your child usually get home from school in the afternoon?

- _______ private car
- _______ carpool
- _______ school bus
- _______ public bus or subway
- _______ bicycle
- _______ walk

How long (in minutes) does it take you child to get home from school in the afternoon?  ____________

Does an adult accompany your child on the trip home from school in the afternoon?

- _______ yes
- _______ no

Does your child ever walk to or from Mission Hill School? __________

if yes, what are the main reasons your child walks?

- _______ healthy physical activity
- _______ most convenient option
- _______ child can walk independently (if applicable)
- _______ most environmentally friendly option
- _______ other: __________________________

if no, what are the main reasons your child does not walk?

- _______ distance is too far to walk
- _______ parent does not have time to escort child
- _______ traffic is dangerous
- _______ fear of crime
- _______ child does not want to walk
- _______ other: __________________________

When your child goes somewhere other than school (friend’s house, playground, library, corner store) that is within walking distance, is he/she allowed to walk without an adult?

- _______ yes
- _______ no

if yes,

At what age did you start allowing your child to walk places within your neighborhood without an adult? ________

if no,

what are the main reasons for not allowing your child to go without an adult?

- _______ traffic danger
- _______ child unreliable or too young
___ fear of assault or molestation by an adult
___ fear of bullying by other children
___ other ____________________________

At what age do you think you will allow your child to walk places within your neighborhood without an adult? _____

Is your child allowed to travel on the public bus or subway without an adult? 
if yes, at what age was your child first allowed to take the bus or subway without an adult? _____
If no, what are the main reasons your child is not allowed to ride the bus or subway without an adult?
___ traffic danger
___ child unreliable or too young
___ fear of assault or molestation by an adult
___ fear of bullying by other children
___ other ____________________________

At what age do you think you will allow your child to take the bus or subway without an adult? _____

Transportation options:

How many cars does your household own? 0 1 2 3
Does your child know how to ride a bike? _____ yes _____ no
Does your child own a bike? _____ yes _____ no

Action Steps:

What could Mission Hill School do to make students’ transportation safer and more convenient and healthy? Please check all ideas that you like and/or add your own.

______ school directory of students so parents can contact each other
______ listing of bus stops and bus rosters for each bus so parents know who is on the bus and where the bus is going
______ bus monitors riding school buses
______ crossing guard
priority location _______________________
______ bike riding training
______ pedestrian safety training
______ walking buddies or walking “school bus”
______ other ideas: please elaborate below
REFERENCES


connectivity and traffic exposure in school neighborhoods. Health and Place 17(2).


