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Journal of Transportation Management

Volume 25 | Issue 2 Article 5

1-1-2015

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ABSTRACT

In light of the decline in social acceptance of walking and biking to school, there is a critical need to examine issues impacting school transportation decisions and to identify strategies to promote healthier behavior. In urban areas with high volume freight corridors, factors affecting school walking decisions can be complicated by increased truck and rail traffic. This paper presents findings from a study of urban neighborhoods in a major southeastern city, including those that are adjacent to freight corridors. Perceptions of neighborhood residents are compared in the context of existing infrastructure and network characteristics (urban vs. urban freight-centric). The results provide insight into factors influencing school transportation decisions in urban environments, and highlight discrepancies between perceptions and actual issues relevant to child pedestrian safety.

INTRODUCTION

Thirty years ago, nearly half of all school-aged children walked or rode bikes to school (FHWA, 2008), but in recent years, this practice has declined significantly, with currently less than 15% of children walking or riding bikes to school (Safe Routes to School National Partnership, 2010). Encouragement of active transportation is essential for promoting healthy lifestyles, and particularly for establishing healthy habits in children. However, because of the decline in social acceptance of walking and biking to school, there is a critical need to examine issues impacting school transportation decisions and to identify strategies to shift behavior in a healthier direction. With support from disciplines such as engineering, marketing, and public health, there is a growing synergy for initiatives that will help make walking and bike riding to school safer, healthier, and more popular. One avenue for multidisciplinary collaboration in support of active transportation to school is through the National Safe Routes to Schools (SRTS) program, originally funded from 2005-2012 under the federal *Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users Act (SAFETEA-LU).* The goal of the SRTS program is to provide support and funding for changes to communities through the 5 E's (Engineering, Enforcement, Encouragement, Education, and Evaluation) to make walking and bicycling to school a safe and more popular activity. The program was administered through state DOTs through a designated SRTS program coordinator. The new Moving Ahead for Progress in the 21st Century Act (MAP-21), for highway and broader transportation funding, includes SRTS program eligibility through the Transportation Alternatives Program funding mechanism. States have the option of continuing SRTS initiatives through MAP-21, but are not required to have a state SRTS coordinator.

In 2010, the National Center for Safe Routes to School reported key statistics on why parents do or do not allow their children to walk to school (National Center for Safe Routes to School, 2010). These findings were based on more than

130,000 parent surveys from elementary and middle schools from 47 states for the years 2007-2009. Results were segmented by students who do walk/bike to school versus those who do not. For both groups, distance was reported as the most significant barrier to walking/biking to school (52% walkers, 62% non-walkers). Parents whose children walked also indicated intersection and crossing safety (44%), weather (41%), and sidewalks (38%) as influential factors. For children who were not allowed to walk, traffic speeds (55%), traffic volumes (55%), intersection and crossing safety (47%) and weather (44%) were significant deterrents.

There are considerable gaps in the school walking related literature related to impact and implications for urban areas with significant minority populations. Urban areas arguably provide more suitable settings for active transportation to school given increased land use densities (which decrease walk distances) and the grid design more typical of urban street networks (which improves connectivity). In addition, promoting active transportation among minority populations (particularly African-American) is of particular importance due to the more significant health risks (obesity, hypertension, diabetes, and associated conditions) faced by these groups (Cole and Fox, 2008; NHLBI, 2012; ADA, 2014; OMH, 2014). However, urban corridors may also contain significant rail and truck traffic, which may influence parent and student attitudes toward active transport to school, and increase community safety concerns.

The primary objective of this research is to examine factors influencing school walking decisions in urban settings for schools adjacent to rail and truck corridors. This study was conducted in urban neighborhoods in a major southeast city in the United States. Findings from this study are used to identify differences in perspectives of residents of urban areas adjacent to rail and truck corridors versus those from comparable urban areas not adjacent to rail and truck corridors. It is expected that the results can be used to develop effective messages and strategies for improving the safety and health of urban students through active transportation to school efforts. Moreover, the study identifies community safety concerns related to traffic and walking patterns near rail/truck corridors. As such, this research has potential critical implications for future funding of research that would specifically address these safety and health issues. This paper first presents relevant literature, outlines the pilot study methodology, highlights preliminary findings, and finally describes future research.

LITERATURE REVIEW

The benefits of and barriers to active school transportation are numerous, particularly for child pedestrians. School-aged children rarely make the decision about travel to school on their own; thus parental attitudes and perceptions are important to understand and address for changes in behavior to occur. The following sections briefly outline relevant literature related to both benefits and barriers to walking and biking to school. This literature review, along with the experience of the research team, helped guide the construction of the survey instrument developed for this project.

Benefits of Active Transportation

About one-third (31.7%) of American children aged 2-19 (about 25 million) are now overweight or obese (Ogden, et al., 2010), substantially increasing their risk of developing diabetes, cardiovascular disease, hypertension, and other chronic illnesses. One of three children born in 2000 is expected to develop diabetes during his/her lifetime (CDC, 2012). Certain racial and ethnic groups (African American and Latino) are genetically predisposed for diabetes, and the high prevalence of obesity in these groups exacerbate this increased risk. In fact, rates of childhood obesity are highest among non-Hispanic black girls and Hispanic boys (Anderson and Whitaker, 2019).

Childhood obesity also has psychosocial consequences due to stigmatization. Obese children are reported to have low self-esteem and are more likely than non-obese children to feel sad, lonely, and nervous (Strauss, 2000). Obesity also has adverse economic consequences for our health system. Nearly $150 billion is spent annually to treat obesity-related medical conditions (Finkelstein, et al., 2009), while the direct medical costs of childhood obesity alone are estimated at $3 billion per year (Trasande and Chatterjee, 2009). Further, it is well established that obesity and overweight significantly threaten the health and well-being of children and families, and physical inactiv-ity is a primary cause. Currently, less than half of American children and adolescents get the recommended 60 minutes of daily physical activity (CDC, 2004; Haskell et al., 2007; Troiano, et al., 2008).

Public health officials recognize the potential of low-cost methods that increase children's physical activity, such as walking and biking to school, in reducing the epidemic of obesity. Research confirms the health benefits of walking or biking to school. A six-state study of more than 1500 middle school-age girls found that those who reported walking before and after school had 13.7 more minutes of total physically activity than those who did not (Saksvig, et al., 2007). Moreover, cardiovascular fitness is improved for children who walk or bicycle to school compared to children who do not actively commute to school (Davison, et al., 2008).

Beyond the physical health benefits, recent studies have also shown cognitive benefits to walking and biking to school. A 2011 study revealed significant links between active transportation and cognitive function in children (Martinez-Gomez, 2011). Physical activity has also been shown to be a positive factor in influencing concentration, memory and classroom behavior (Trudea and Shephard, 2008). Another study showed that children who commuted one or more days in the week were most likely to achieve the MVPA criterion (Moderate-to-Vigorous Physical Activity; 60+ mins/day × 5) (Daly-Smith, 2010). MVPA was found to be the type of activity that has the greatest positive effect on cognitive performance (Active Bodies, Active Minds, 2010).

Active transportation has other public health benefits, such as reducing carbon monoxide, nitrogen oxide, and greenhouse gas emissions (EPA, 2006). These harmful pollutants from cars and trucks exacerbate asthma and cause respiratory illnesses. Research has shown that schools which facilitate walking and biking have significantly better air quality, although cause and affect may be unclear. A 13% increase in walking/biking leads to at least a 15% reduction in dangerous vehicle emissions. (EPA, 2003). Additionally, if 100 children at a single school switch to walking or bicycling for a year, more than 35,000 pounds of harmful emissions will be eliminated and nearly 12,000 hours of physical activity will be generated by the group (National Center for Safe Routes to School, 2013).

Barriers to Walking/Bicycling to School

In 2009, just 13% of students rode a bike or walked to school, down from 44% in 1969 (*3*), and this decrease in active commuting corresponds to the growing increase in childhood obesity. Similarly, school bus ridership has also declined, as more students report coming to school by personal vehicle than other methods (National Center for Safe Routes to School, 2010). One study reported three key barriers that prevented parents from allowing their children to walk or bicycle to school: distance to school, traffic-related danger, and weather (Martin and Carlson, 2004). In the same survey, 12% of parents referred to safety issues, while 6% of parents also indicated school policies prohibiting walking and biking to school as the reason their children did not walk or bike to school.

Bike and pedestrian safety are already a critical concern. Statistics from the Centers for Disease Control and Prevention (CDC) show that for

children 15 years and younger, pedestrian injury is the third leading cause of death by unintentional injury (CDC, 2002). In addition, children account for a significant portion of all traffic deaths (25-30%), with nearly 3,900 children 15 years and younger killed while walking (Transportation for America, 2014).

For urban environments, additional considerations such as higher traffic volumes and greater presence of freight traffic may increase pedestrian risk, yet frequently such areas have reduced block lengths and better connectivity, which can be more conducive to active transportation. There is limited research focusing specifically on urban inner-city schools. In 2011, a study conducted on such schools found that children living in low socioeconomic neighborhoods were exposed to greater hazards on their walk to school, yet were more likely to walk (Rossen, et al., 2011). Another study indicated that for urban inner-city communities, more focus should be placed on increasing safety rather than impacting mode choice, as high numbers of walkers typically already exist for schools in these communities (von Hagen, et al., 2009). A 2012 study investigating factors affecting school walking decisions in urban environments found that crime and animals were the key barriers to active transportation, while family mobility (length of time living in a neighborhood) and previous walking behaviors were positively correlated with active transportation (Royne, et al., 2012).

A 2013 study conducted on safety and school travel in Toronto found that high volume traffic at intersections played a significant role in mode choice decisions (Larsen, et al., 2013). There is little research, however, related to the impact of high freight volumes on child pedestrian safety and mode choice. The same 2013 study did explore vehicle mix in assessing active transportation and included a 'vehicle fleet index' in a regression model for predicting mode choice for school trips (Larsen, et al., 2013). The study found that vehicle mix did not influence mode choice. The schools participating in the study were selected to include a range of built environments and income levels, but freight-centric areas were not specifically targeted. Thus, for urban areas where high volume freight corridors are in close proximity to schools, it is particularly important to determine the impact, both perceived and actual, on child pedestrian safety, as very little research is available to inform infrastructure improvement decisions and education initiatives.

The following sections detail a pilot study conducted for a central urban community within a major metropolitan area to help determine the influence that heavy freight traffic (both truck and rail) has on the decision to walk or bike to school and the impact on safety. The study utilizes a multidisciplinary perspective, representing collaboration among engineering, public health, and marketing professionals.

METHODOLOGY

This research was conducted in two phases to obtain feedback from urban residents on perceived differences in walkability and safety across freight-centric (FC) vs. nonfreight-centric neighborhoods. Phase 1 of this project involved the development and online administration of a survey instrument to gauge perceptions regarding children's walk/bike trips to school in urban environments. Phase 2 utilized a focus group to elicit more detailed responses regarding mode choice decisions in the journey to school.

Phase 1: Survey

Based on the national Safe Routes to School questionnaire, we developed a seventeen-item survey instrument consisting of questions related to neighborhood identity, family characteristics, frequency of walk/bike trips of children in the neighborhood, perceptions regarding safety for walk/bike activity, perceptions regarding benefits of walk/bike activity, and perceptions regarding barriers to walk/bike activity. Additional freight-oriented topics were also assessed. The survey was administered in an

online format through neighborhood associations.

Neighborhoods located within the central urban communities of the major metropolitan area were specifically targeted to participate, and association leaders were asked to distribute the survey to residents of their neighborhoods. Participants were asked to indicate the neighborhood in which they live so that survey responses could be coded based upon presence or absence of significant freight corridors. Presence of significant freight corridors was determined based upon multiple arterials with high freight volumes, rail lines, and warehouse/ trucking companies located within the neighborhood boundaries. The presence of such corridors/facilities within neighborhood boundaries defines a freight-centric neighborhood for this study.

A total of 104 individuals completed the survey, including the focus group members who completed surveys prior to the start of the focus group. However, it is important to note that not all response categories add up to 104 responses, because participants were not required to answer every question. Therefore, the total number of responses for each item is reported for each individual result.

Phase 2: Focus Group

To obtain greater insight into factors influencing school walk decisions, a focus group was conducted in conjunction with a local community organization after the initial online survey event. The community organization helped with recruiting urban participants for the focus group, and provided an established venue for community meetings. Twenty-two urban residents participated in the focus group. Participants were first asked to complete the project survey before any discussion began. The participants were then shown a brief informational video regarding the Safe Routes to School program, followed by a brief presentation by project team members regarding the focus of the project. The participants then engaged in a discussion of perceived benefits of active transportation to school along with barriers. All discussions were transcribed to ensure accuracy of data and for potential input into additional research on the topic.

RESULTS

Phase I: Survey

Neighborhood Identity

Survey participants were asked to identify the neighborhood in which they lived and how long they had lived in their current neighborhood, because previous research has suggested that this may be an influential factor in active transportation decisions (Royne, et al., 2012). Of the 104 respondents, 83 lived in urban neighborhoods that are not significantly impacted by freight, while 21 lived within freight-centric neighborhoods. For the freight-centric (FC) neighborhoods (n=21), 40% (8) of the respondents reported living in the neighborhood for more than 7 years, 30% (6) between 4 and 7 years, and 30% (6) between 1 and 3 years. For the nonfreight-centric neighborhoods, 51% (39) of responding residents (n=76 for this item) have lived in these communities for more than 7 years, 17% (13) between 4 and 7 years, 22% (17) between 1 and 3 years, and 9% (7) for less than one year.

Family Characteristics

Family characteristics (number of children, number of schools children have attended, and walk/bike behaviors) were requested on the survey. Of responding residents of NF neighborhoods (n=63), 53% (33) reported having at least one child, while 47% (30) indicated they do not have any children. For FC neighborhoods, 39% (5) of respondents (13) reported having at least one child, while 61% (8) indicated they do not have any children. In addition, 50% (2) of responding FC participants with children (n=4) indicated that their children have walked or biked to school, while NF respondents (n=29) reported 38% (11) had

allowed their children to walk or bike to school. Table 1 summarizes responses related to participants' perceptions of appropriate ages for children to walk or bike to school. While the reported average safe age for children to walk or bike to school is slightly higher for the FC group for all responses, there is no statistically significant difference ($p > .05$) between the values in any category.

Frequency of Walk/Bike Trips
In Neighborhood
In terms of walk/bike trips in the neighborhoods of the survey participants, 71% (58) of NF participants (n=81) reported seeing children walking to or from school, and 40% (32) reported seeing children biking to or from school in their neighborhoods. For FC participants (n=20), 80% (15) of respondents indicated they see children walking, and 35% (7) reported seeing children biking to or from school in their neighborhoods.

Neighborhood Safety Perceptions
The statement "Children's walk to school in my neighborhood would be safer if:" and a list of factors thought to be influential to child pedestrian safety (based on literature review and research team experience) was included in the survey to assess perceptions of participants regarding the safety of their neighborhood for active transportation to school. Participants were asked to rate how strongly they agreed (or disagreed) with the statement for these factors. The items were rated on a Likert scale, where 1 indicated strongly disagree, and 5 indicated strongly agree. Results are presented in Table 2. The results are presented by FC and NF groupings, with average response (ì), standard deviation (s), t-statistic (using a one-tailed test of hypothesis H_o: $ì_{FC} - ì_{NF} > 0$), and p-value for the t-test reported.

All of the mean responses from the FC group were equal to or greater than that of the NF group. Only three factors were significantly different at a statistical level. These factors included walking with parents or other adults, increasing the number of crossing guards, and additional parent or police volunteers along walk routes. The top five factors based on mean scores for the FC participants are highlighted in Table 2. Note that there are actually six factors shaded for the NF group, as there were multiple factors with the same mean response such that five distinct factors could not be identified. The ranked scores are very consistent between the two groups. The presence of trucks and rail crossings along the walk route was rated among the lowest concern for both the FC and NF groups.

Neighborhood Barriers to Walking/Biking
Survey participants were asked to indicate how concerned they are about a series of safety issues near schools in their neighborhood. The items were rated on a Likert scale (1 = no concern, and 5 = extreme concern). The average response,

TABLE 1
SCHOOL AND TRANSPORTATION CHARACTERISTICS OF FAMILIES IN FC AND NF NEIGHBORHOODS

Survey Item	FC	NF
	Average Response	Average Response
At what age do you think it is safe for a girl to walk to school? (years)	10.7 (n=18, s=2.5)	9.7 (n=68, s=2.4)
At what age do you think it is safe for a boy to walk to school? (years)	10.3 (n=18, s=2.4)	9.4 (n=68, s=1.9)
At what age do you think it is safe for a girl to bike to school? (years)	10.7 (n=18, s=2.3)	10.5 (n=69, s=2.1)
At what age do you think it is safe for a boy to bike to school? (years)	10.3 (n=18, s=2.2)	10.2 (n=69, s=1.7)

TABLE 2
FACTORS IMPORTANT FOR CHILD PEDESTRIAN SAFETY IN FC AND NF NEIGHBORHOODS

Survey Item	FC	NF	t-stat	p-value
	Average Response, μ_{FC} (std. dev.) n=19	Average Response, μ_{NF} (std. dev.) n=76		
She or he walked with other kids	4.3 (s=0.6)	4.1 (s=1.0)	0.78	0.21
She or he walked with a parent or other adult	4.7 (s=0.5)	4.1 (s=1.0)	4.17	0.00004*
Schools provided walking route maps to parents and kids	4.0 (s=0.9)	3.8 (s=1.1)	0.96	0.17
Schools provided more walking safety training for kids	4.3 (s=0.6)	4.1 (s=0.9)	1.01	0.16
More crossing guards were present	4.2 (s=0.7)	3.6 (s=1.1)	2.96	0.002*
There were continuous sidewalks from my neighborhood to school	4.0 (s=1.1)	4.0 (s=1.0)	0.05	0.48
There were fewer cars where kids walk to school	3.8 (s=0.8)	3.8 (s=1.0)	0.20	0.42
Vehicle speeds were lower along the routes to school	4.2 (s=0.8)	4.0 (s=1.1)	0.69	0.24
There was better street lighting along walk routes to school	3.6 (s=0.8)	3.3 (s=1.1)	1.02	0.16
Kids lived closer to the school	3.7 (s=0.7)	3.5 (s=1.0)	1.02	0.16
There were fewer trucks	3.5 (s=0.9)	3.4 (s=1.0)	0.49	0.31
There were fewer rail crossings required	3.3 (s=1.0)	3.1 (s=0.9)	0.82	0.21
There were more crosswalks	4.4 (s=0.8)	4.1 (s=0.9)	1.13	0.13
There were more parent volunteers or police officers along walk routes to school	4.4 (s=0.8)	4.0 (s=0.9)	1.76	0.04*

standard deviation, t-statistic (using a one-tailed test of hypothesis H_o: $ì_{FC} - ì_{NF} > 0$), and corresponding p-value for the t-test are presented in Table 3 for each item.

The responses from participants living in FC neighborhoods had a higher mean for all items than the corresponding responses from participants living in NF neighborhoods. The differences were significant for the following factors: stray dogs/animals, crime, fights/ bullying, railroad crossings/trains, illegal drugs, abandoned houses, gang activity, trash/junk/trees on the sidewalk, and lack of crossing guards. It is interesting to note that neither presence of railroad crossings/trains nor large trucks were ranked at a particularly high level of concern by either group. The top five rated factors are highlighted in Table 3 for each group. Fast cars, busy intersections, and missing/hard to see crosswalks were in the top 5 of both groups. FC participants also included missing/broken sidewalks and trash/junk/trees on the sidewalks, while NF participants rated heavy traffic and lack of bike lanes as higher priority concerns.

Benefits of Walking/Biking

Survey participants were also asked to indicate how strongly they agreed with a series of statements about the benefits of walking/biking to school. The results are reported in aggregate (Figure 1), as there is no relevance to the type of neighborhood in which the respondent lives (FC or NF). A total of 94 participants responded to this survey item. While most participants recognized the potential health benefits of active

TABLE 3
RELATIVE LEVEL OF CONCERN FOR SAFETY FACTORS IN URBAN NEIGHBORHOODS

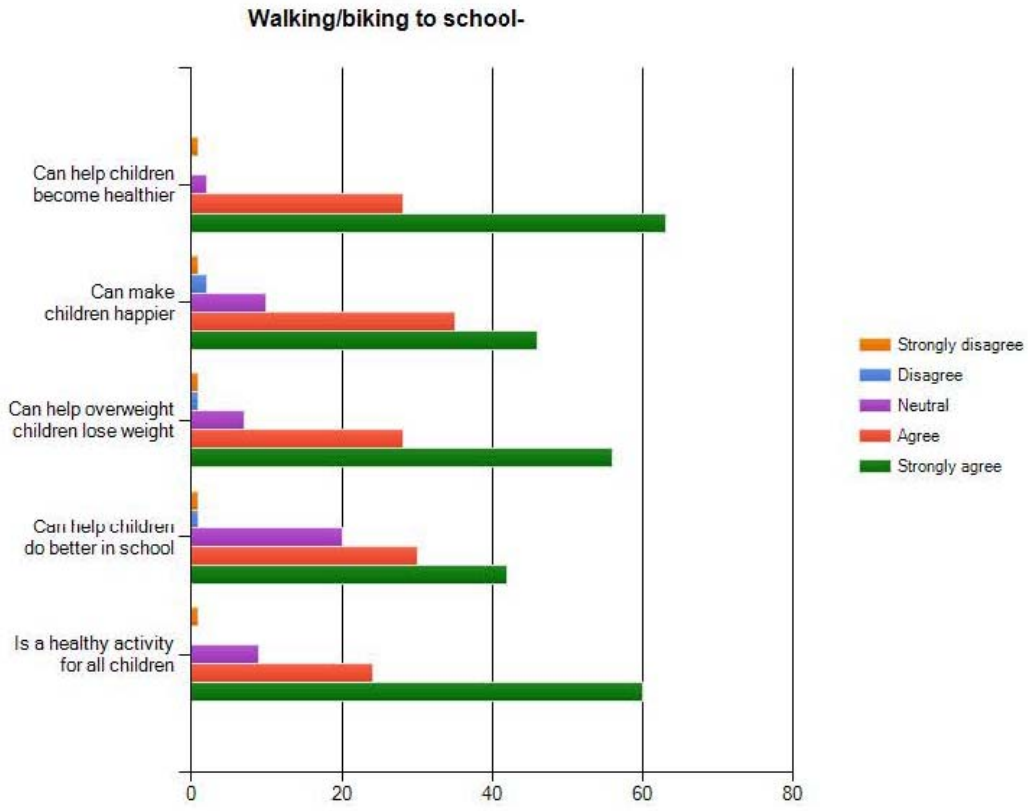
Survey Item	FC	NF	t-stat	p-value
	Average Response, μ_{FC} (std. dev.) n=19	Average Response, μ_{NF} (std. dev.) n=74		
Stray dogs/animals	3.5 (s=1.2)	2.8 (s=1.4)	2.3	0.01*
Crime	4.1 (s=1.1)	3.5 (s=1.3)	1.9	0.03*
Fights/bullying	3.7 (s=1.2)	3.3 (s=1.4)	1.3	0.10*
Fast cars	4.3 (s=0.7)	4.0 (s=1.0)	1.1	0.14
Large trucks	3.7 (s=0.9)	3.4 (s=1.3)	1.0	0.15
Railroad crossings/trains	3.2 (s=1.1)	2.4 (s=1.4)	2.6	0.006*
Child predators	3.5 (s=1.2)	3.2 (s=1.3)	1.0	0.15
Missing/broken sidewalks	4.3 (s=0.9)	3.6 (s=1.4)	2.5	0.008
Busy intersections	4.3 (s=0.7)	4.2 (s=1.0)	0.6	0.28
Missing/hard to see cross walks	4.1 (s=0.8)	3.8 (s=1.3)	1.1	0.13
Illegal drugs	3.6 (s=1.3)	2.9 (s=1.5)	2.1	0.02*
Abandoned house	3.9 (s=1.2)	3.0 (s=1.6)	2.7	0.005*
Gang activity	3.7 (s=1.2)	3.0 (s=1.6)	1.7	0.04*
Trash/junk/trees on the sidewalks	4.1 (s=0.9)	3.3 (s=1.4)	3.0	0.002*
Heavy traffic	4.0 (s=0.9)	3.8 (s=1.2)	0.9	0.20
No bike lanes	4.0 (s=0.9)	3.8 (s=1.4)	0.8	0.21
No crossing guards	4.1 (s=0.8)	3.2 (s=1.4)	3.6	0.0002*

transportation, 21% (20) were unsure whether active transportation could help children do better in school.

Phase 2: Focus Group

The focus group provided insight into additional barriers to walking and bicycling to schools. The research team highlighted examples of potential safety issues for child pedestrians in urban areas to elicit discussion. Some barriers that were discussed include distance, railroads, school traffic queuing, lack of crossing guards, the weight of children's backpacks, and concern with freight trucks on residential roadways. The presence of freight trucks on residential roadways was attributed to local truck drivers' bringing their trucks home despite ordinances prohibiting this, as well as zoning rules that allow industry adjacent to residential areas. Focus group participants repeatedly noted railroads that do not provide an at-grade crossing location for pedestrians except at the roadway and railroad intersection. There are no pedestrian facilities at these intersections, which forces the pedestrians into the roadway. Another important barrier identified is the weight of children's backpacks. This is also supported in the literature, as indicated by the U.S. Consumer Product and Safety Commission which estimates that, "…more than 7,000 emergency room visits in 2001 resulted from injuries related to backpacks and book bags; half of these injuries occurred in children 5 to 14 years old-the age of elementary and middle-school students" (U.S. Consumer Product Safety Commission, 2001). The focus group also discussed possible stakeholders to help identify and diminish safety concerns (including the barriers that were introduced during the focus group). These stakeholders include the School Board, Parent Teacher Associations (PTA's), the students, rail

FIGURE 1
PARTICIPANT RATINGS OF POTENTIAL BENEFITS OF WALKING/BIKING TO SCHOOL



and trucking companies, and local law enforcement.

DISCUSSION, CONCLUSIONS AND FUTURE RESEARCH

Results of this pilot study provide valuable insight into important areas for further exploration. For example, the number of respondents who reported seeing children walk or bike to school in their neighborhoods was similar for both groups, suggesting that the presence of significant freight activity is not necessarily a deterrent to active transportation. However, the fact that the freight centric group was more concerned with railroad crossings/ trains does indicate that this issue is present in those areas. Future research should explore this issue in more detail and with a larger sample.

With regard to perceived impact on safety, increasing the presence of adults (either parents, chaperones, or crossing guards) along walk routes as well as having other children to walk with were rated highly by both FC and NF respondents. While the ratings differ from what is frequently seen in the literature, this may be due to the fact that our survey participants were not necessarily parents of school-age children (and the low response rate to these survey items). More insight into differences for urban communities should be examined in future research with a sample of school children and their parents.

Perhaps the most important finding of this pilot study is that neither the FC nor NF groups rated the presence of truck traffic or rail corridors highly in terms of being a barrier to walking or negatively impacting child pedestrian safety. In

fact, freight activity (both rail and truck) was of least concern to survey respondents in both FC and NFC communities. Even within the focus group, the research team had to specifically raise the issue and point to examples of safety concerns to elicit discussion regarding freight traffic. This is a significant issue because site visits to urban schools within the metropolitan area studied found numerous examples of safety issues and "close-call" situations with child pedestrians and freight activity. Overall, however, because of the relatively small sample size, conclusions should be carefully considered. But this research provides insights and can guide future studies. This points to the importance of additional research so that this apparent discrepancy can be further investigated and appropriate recommendations for safety improvements/practices and education can be made given the high number of child pedestrians in the FC communities.

Urban schools, particularly within inner-city areas, are likely to have children walking or biking to or from school due to socio-economic factors limiting the availability of personal vehicles. In addition, street networks in these environments are often well connected with shorter block lengths, and may be more conducive to promoting active transportation than in suburban or rural communities. The potential for a significant positive impact on health, academic performance, air quality, and congestion by increasing the number of children using active transportation points to the importance of research to understand existing barriers (both perceived and actual). For urban environments, the presence of significant freight activity can further complicate the approach to safe walk and bike routes, and its significance may not be fully understood by children and parents.

Hence, future research must investigate both stakeholder perceptions and current traffic data for a selected group of study and control urban elementary schools. Infrastructure and traffic data (including vehicle mix) should be collected at all schools included in this research, in addition to survey data from students, parents, teachers/administrators, and freight industry professionals. Such data can then be analyzed to determine if gaps in alignment exist between stakeholder groups as well as between stakeholder perceptions and existing conditions. The ultimate goal of this line of research is to identify perceived versus actual safety issues and to outline strategies for increasing safety and prominence of active transport to school in urban settings.

Accomplishments
This study was funded in part by the University of Memphis Intermodal Freight Transportation Institute (IFTI). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of IFTI.

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