

# CHAPTER 8

## CONCLUSION

### 8.1 Introduction

The purpose of this research was twofold: 1) to explore the impeding factors on decision making about a child's walking to and from school by modelling the relationship between multiple influential factors; and 2) to determine if these impediment factors vary across different socio-economic areas. Tehran, the capital city of Iran, was chosen as a case context to test models for predicting influences of the built environment as well as non-urban form factors on parental decision about their children's modes of travel to and from school.

Walking and cycling to school has gained a lot of attentions in recent ten years in US, Australia, New Zealand and European countries due to urban sprawl and increased obesity among children. However, in Tehran transport is a significant issue where the private cars and taxis account for 73.8 %, and it is the main source of air pollution in Tehran (Municipality of Tehran, 2007). It is widely recognized that an increase in walking for short journeys in urban areas could reduce traffic congestion, improve the quality of urban environment, promote improved personal health, and contribute to a reduction in carbon emissions. In response, national and regional transportation policies

in Tehran such as, “Making safe the environment around the school”, have increasingly corporate travel demand management tools, including workplace, community and school travel plans.

The programmes in Iran assume, lack of traffic safety make parents to use motorized modes of travel for their children to go to school. However, using motorized modes of travel by some of children makes immediate environment around schools unsafe for those who walk to and from school. Elements such as absence or poor condition of crosswalks, traffic speed more than 30 km/hr, and the absence of speed bumps in neighbourhood are correlating to traffic safety. The programme in Iran suggests that there is a direct association between carrying out engineering work (e.g. installing speed bumps, traffic signs, and painted cross-walks) around the school and increasing in number of children walking to school. However, this programme did not consider other factors that might influence on parental decision making about choosing modes of travel for their children. This emphasizes that although investment in the infrastructure around schools is essential to improve safety, it may not be enough to change travel behaviour.

In this study, children’s travel pattern to and from school is carefully examined, and how traffic safety factors play a role in this complex procedure is explored. All children were involved in this study live in walking distance from school (as discussed in chapter 4). Therefore, long travel distance, which is the main barrier for children to walk to and from school, is not included in analysis. It moves the discussion of the relationship between traffic safety and walking to and from school to identify other influential elements. Learning more about children’s travel patterns, and how it can be changed, can help urban planners in establishing effective and equitable transportation,

land use and infrastructure investments, not only for children but for pedestrians of all ages regardless of the purpose of their travel.

## **8.2 A summary of the research findings**

The research findings support the general hypothesis that traffic safety plays a role in decision-making about a child's mode of transportation to school. This result is consistent with the results of previous studies concerning children being driven by parents or using a school bus (Bringolf-Isler et al., 2008; Beck & Greenspan, 2008; Schofield et al., 2008). This study found that the relationship between perceived traffic safety (parental and children's perception about traffic safety in the neighbourhood) and children walking to school is significant. However, there are other factors influence on parental decision making about children's walking to and from school that increase the complexity of the association.

Factors that have not been widely studied in research on travel patterns of children to school, such as mother's occupation, father's travel mode to work, and children's fear of having car accident or being abducted impacted significantly on parental decisions about children's mode of travel to and from school. Those factors that have been more commonly studied in active commuter literature, such as socio-demographics and neighbourhood safety, have also influence on decision-making about children walking to and from school on their own. The results also show that children aged between 9 and 12 years were able to self-report their travel behaviour. Furthermore, findings of this study reveal that there is not any significant difference for children walking to and from school autonomously across gender, and it is consistent with other literature that showed in urban areas boys and girls have the same freedom in choosing walking and cycling to school.

Parents' self-reported measures of traffic safety such as street width, absence of traffic signs to stop traffic at intersections and lack of painted crosswalks has the greatest impact on how children travelled to school. Parents also indicated traffic with high speed on local streets and all aforementioned traffic safety factors impact on modes of children's transportation back home. Children's fear of motor cyclists who ride on pavements instead of streets affect on their modes of travel to and from school. In addition, parents who believed that walking to school is good for their children's health are more likely to choose an active travel mode for them, especially to go back home; however, they preferred to escort their children while walking back home. These results suggest that programmes focusing solely on traffic safety improvements to increase the number of children walking to and from school (especially on their own) will see little change in the travel pattern. As such, programmes must modify the urban form to improve traffic safety along with traffic safety education for children and educating parents concerning the benefits of walking to be more successful in changing the travel patterns.

Additionally, the analytical framework suggested that parental and children's perception of personal safety in the neighbourhood also affect on modes of children's travel to and from school. While previous literatures showed presence of local shops in the neighbourhood increase the potential of interaction between people and can build the sense of safety in the neighbourhood, the result of this study showed young shopkeepers have a bad reputation in having potential to abuse children (especially female). In general, parents' negative perception of safety in the neighbourhood is due to presence of undesirable people (e.g. addicted people, foreigner workers in construction sites and young shopkeepers).

The framework also suggested that neighbourhood safety and traffic safety factors are influenced by urban form and the relationship between traffic safety and personal safety with walking to and from school are modified by socio-economic and socio-demographic factors. It proposes a structure for how traffic safety and personal safety impact children's walking to and from school.

Only a few physical elements in built environment that represent traffic safety and neighbourhood safety were significantly related to children walking to and from school (street width, pavements' width, number of traffic lanes, presence of pavements, block length, lack of mixed land uses and density in neighbourhood). These findings indicate that it is not clear whether modifying urban form can improve parental concerns about neighbourhood safety and traffic safety or not. Additionally, result of this study confirms that improving infrastructure around schools will not have a great impact on increasing the number of children walking to and from school.

The results of this study also show traffic safety factors are more important in the process of choosing modes of travel to and from school for children rather than neighbourhood safety factors. Moreover, children's perception of personal safety is only effective on their travel mode to school. It may explain that, number of people on the streets at noon (at dismissing time of the primary schools) is more than number of pedestrian early in the morning. Therefore, children feel more secure to walk back home autonomously; also there is more chance for children to walk back home with their friends in a group.

There is little evidence from literature to support the hypothesis that traffic safety and other influential factors on choosing a child's travel pattern may vary across different areas. However, the conceptual framework in this study suggested that the strength of relationship between traffic safety, neighbourhood safety and children's

walking to school vary depending on the socio-economic and socio-demographics of the child, parents, household and the area. This hypothesis of moderating factors was supported in the analysis.

Particularly, children's age and gender, number of children under 5 in a household, and number of children in a household interacted with neighbourhood safety and traffic safety to affect children walking to and from school. Mother's occupation, father's travel mode to work, number of cars in a household, number of people in a household who are holding driving license and average household monthly income also interacted with neighbourhood safety and traffic safety to influence children's travel mode to and from school. These results confirm that the effective programme that aim at promoting children's walking to and from school, requires knowledge of children and parents' characteristics (e.g. socio-demographics). Moreover, these programmes and policies will be successful if their strategies vary for different groups of population and meet needs of more vulnerable groups e.g. younger children.

The findings further show more walk able neighbourhoods with many optional destinations and well-connected street networks are busy places with increased levels of traffic and noise. Second, Higher levels of traffic can be the attributes of lower socio-economic neighbourhoods. Finally, people with higher income have more choices to avoid living in noisy neighbourhoods and choose a desirable neighbourhood e.g. near to mountain with less air pollution.

The study also showed that the travel behaviour of children in all income groups was more sensitive to parents' perceptions of the environmental barriers. Children's perception of traffic safety and personal safety in the neighbourhood also impacts on their trip to school, but only across low-income areas. It may explain that parents and especially mothers of children from lower income groups have more flexible schedule;

as such, they can escort their children to walk to and from school. Moreover, more children walk to and from school in low-income areas to avoid travel cost that makes sense of safety in the neighbourhood.

Children from low income areas are concerns about motor cycles which are riding on pavements and absence of police officers in neighbourhoods. It is explained by considering most of low-income areas are located in Restricted Traffic Zone (as discussed in chapter 3 ) and private cars cannot enter this zone(6:00am-7:00pm); however, this rules does not impose on motorcycles. As such the number of motorcycles is more in low-income areas and most of them try to skip traffic by riding on pavements.

Parent's concerns about safety in all income groups were more commonly related to traffic safety compared to personal safety. However, the representative built environment factors for personal safety and traffic safety varied across different areas. Higher and middle income households were more concerned about their children if they needed to cross busy intersections, while in lower income areas poor access to painted crosswalks and pavements with insufficient width or absence of pavements prevented the children from walking to and from school on their own. Lower income households may have fewer options for getting their children to and from school, which resulted in the parents being less sensitive to environmental barriers. Another explanation for the differences is the average of street width in low-income areas are less than high-income and middle-income areas, so crossing the street is easier for children and traffic speed cannot be so high .

In overall, the results suggest that there is a moderate relationship between actual traffic safety and children's travel mode to school; however, as discussed earlier, perceived traffic safety is strong enough to have a significant impact on children's

walking to and from school. Only one physical element (presence of mixed land use) that is represented personal safety in the neighbourhood, impacts on children's travel to and from school. Therefore, it is safe to claim that traffic safety is more important than neighbourhood safety for walking to and from school.

### **8.3 Policy implications of the research findings**

The primary focus of this research was to identify how traffic safety and personal safety relates to children walking to and from school in different socio-economic areas. Because of limited resources, identifying what the problem is before finding the solution is most important in the success of programmes relating to the travel mode of children to and from school.

Safety programmes in Tehran focus on improving infrastructure in front of the main gate of schools as the solution for increasing the number of children walking to and from school along with educating children on traffic safety. Therefore, it has been assumed that installing traffic signs, painted crosswalks and speed bumps will change the travel patterns. However, the programmes in Tehran have focused on facilitating neighbourhoods for pedestrians by providing pavements in main streets, but not in local streets; installing traffic signs, but no guards on crossings; and adding speed bumps, but no speed limits around the primary schools.

Moreover, the results show that presence of speed bump is not relating to increase number of children who walk to school, because it does not guarantee to make drivers stop or slow down. Drivers should be educated on how to behave on the street and give priority to pedestrians and especially child pedestrians. They should be made aware that they are not the only street users. Some of the most influential variables in this analysis, such as perceived traffic speed, street width, absence of pavements and pavements with insufficient width, can be improved by changing the built environment. However,



educating learner drivers before they are given their driving licence, highlighting the negative impacts of driving on national health and setting some regulations for construction sites to stop those blocking pavements seems also necessary to improve the traffic safety and cannot be achieved through improving built environment. This suggests that a change in traffic safety only (through urban form) may not have much effect on children's travel patterns. Improving the infrastructure of the neighbourhood to improve traffic safety is necessary but is less effective than considering parents' feelings about their children walking to and from school.

Transportation projects already consider health issues such as the reduction of car accidents, the impact of environment changes on air quality and children's obesity. The results of this study also suggest that the design of the neighbourhood can significantly affect parents' and children's perceptions of car accident. However, most of parents think walking to and from school does not affect children's obesity because the travel distance is too short. It confirms educating parents on benefits of walking to and from school is vital and cannot be achieved through improving built environment.

Programmes that aim at promoting walking to school will be successful with multi approaches, such as using education, enforcement and engineering, to encourage children to walk to and from school. These projects will be successful at not only addressing traffic issues at existing school sites, but also at identifying potential problems for future schools. However, this requires increased communication between the school district municipality and the department of Traffic and Transportation in Tehran. This study also revealed the need for the involvement of parents and children in implementing any projects relating to improving the safety around schools.

This research helps policymakers to understand modes of children's transportation to and from school as well as the travel patterns of their families. Concepts like New

Urbanism and Smart Growth and programmes like Safe Routes to School suggest that neighbourhood design should promote multiple modes of transportation for different groups of people. The results of this study also emphasize changing in built environment must aim at facilitating it for all street users, drivers and pedestrians from all ages. Policy makers and urban planners who target at promoting walking through providing transportation alternatives also need to consider people needs and neighbourhood design across different income groups.

The results also show that the lack of perceived personal safety in the neighbourhood, such as presence of undesirable people in a neighbourhood, also impacts on the children's trip to school. The presence of police officers around the schools around the starting and dismissal time of schools could improve the perception of safety for both parents and children.

The findings of this study support the idea that urban planners and policymakers should be sensitive to how a place is used and the population is served across different areas, specifically the more vulnerable users of the space (i.e. children). For example, municipalities may use the information regarding the strong effect of parents' and children's perceptions of neighbourhood safety and traffic safety concerning children walking to school (especially on their own) to revitalize neighbourhoods to address these concerns. The findings of this study indicate that policymakers and urban planners need to be sensitive about individual factors across different income groups. Neighbourhood safety and traffic safety have an association at different levels across different areas. For example, street width in respect of children walking to school is significant in low-income groups while the relationships are modest within high-income groups. Overall, the results show that the influential factors for middle-income groups

and high-income groups are quite similar and different from those in low-income groups.

The research suggests that the average of household income, household car ownership and infrastructure of the neighbourhood significantly impact on this variation. This can be explained in that infrastructure investment was not distributed equally across different areas, and that, commonly, low-income areas have been ignored. This study can inform the policymakers to be aware of the impact of land use, urban design, socio-demographic and socio-economic factors on the developing process (e.g. presence of mixed land use in low income areas decreased the perception of personal safety).

Additionally, the findings are important for transportation projects concerning the influence of transportation on the environment, as research moves forward on studying the effects of children walking to and from school on air pollution. It provides support for further examination and programme development.

This study, adds to the literature by showing that living within walking distance from school (500 m) may not guarantee that children walk to and from school, especially on their own. Finally, this study suggests that the location of the school does not have any effect on parents' and children's perception of safety (both personal safety and traffic safety). Because all schools were involved in this study were neighbourhood, small size schools, however, parents did not feel comfortable to allow their children to walk to and from school on their own.

The socio-ecological framework that was presented earlier in chapter 4 is modified according to the results of this study and present below. Arrows with dots shows the indirect relationship while solid arrows show the direct relationships between

variables. Differences in width of arrows also show the magnitude of their impact on each other. The cross lines (x) shows those two groups of variables are interacting with each other (Figure 8.1).

The social ecological model shows that the travel mode of an individual can be influenced by a factor at several levels. This research confirms that traffic safety is definitely an influential factor on a child walking to and from school; therefore, it should be considered by any programmes that target changing travel patterns. However, improving the infrastructure in front of the main gate of the schools is not enough to improve the perception of traffic safety in the neighbourhood.

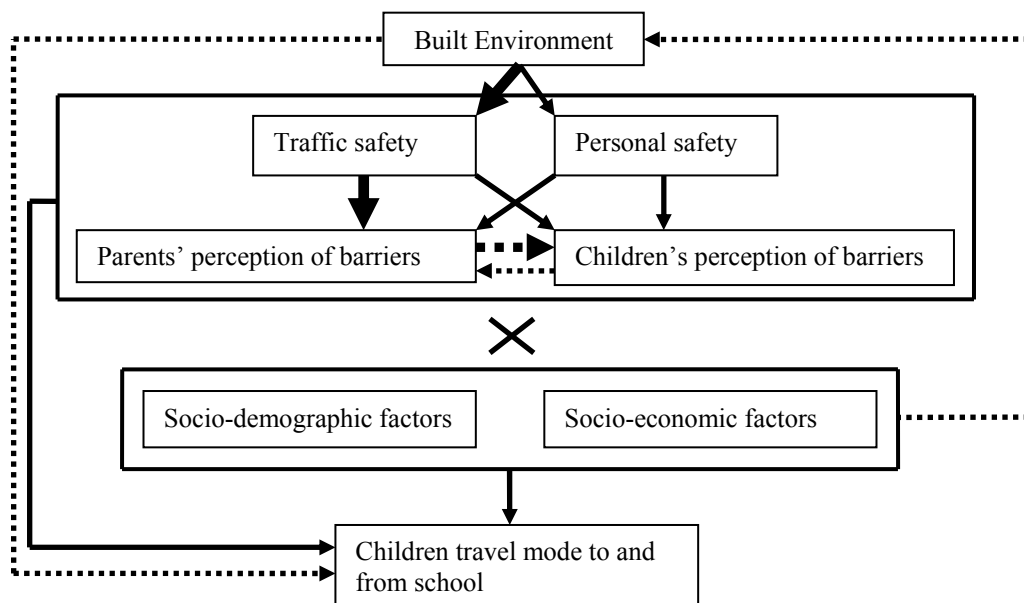


Figure 8.1: The modified conceptual framework based on results of study

The framework shows physical elements in built environment are more correlated to parental perception of traffic safety rather their perception of personal safety in the neighbourhood. Moreover, these elements vary across different socio-economic areas; it confirms socio-economic factors impact on built environment indirectly. It also shows children's perception of personal safety and traffic safety in the neighbourhood has small impact on parental decision making about their modes of travel to and from

school. Socio-economic and socio-demographic factors are moderating the relationship between built environment, personal safety and traffic safety and a child's travel mode to and from school.

#### **8.4 Future research**

The development of a framework that examines how traffic safety and personal safety affects children's travel mode to and from school; that can be tested using multinomial statistical analysis fills a gap in transportation research. The complexities of choosing the travel mode to school for a child highlights that several factors influence on choosing travel patterns, and time and cost of travel are not the only influential factors. The results of the study support the need to examine the nature of travel patterns deeper. This study identified the concerns of individuals in respect of the household's choice to make a trip to and from school. Findings of this study also addressed which of parental and children's concerns were influenced by urban form. However, future research concerning people from different income groups life style and household travel needs would help in clarifying the transportation needs and preferences of different segments of the population.

As was discussed in chapter 2, active commuting has been studied by several methods and different methodological approaches, with different results and limited success at recognizing what factors influence on children walking to and from school autonomously. Therefore, the interdisciplinary focus of this research took an important and profound initial step towards addressing travel patterns. The hypothesized relationship between traffic safety and children walking to and from school will be more comprehensive, by combining the influence of transportation, urban form, traffic safety, neighbourhood safety and health. Making trips by motorized modes can increase pedestrian and especially child pedestrian injuries and risk factors for chronic diseases.

However, this research did not look directly at the effect of traffic safety on health issues. Future studies must identify the environmental factors that contribute to children's health, especially because the rate of obesity is increasing among Iranian children, and the rates of children pedestrian injuries and death is also high.

The measure of walking in the present study only included one purpose: walking to and from school. The study highlights barriers that must be overcome to increase the number of children walking to and from school autonomously. It also provides an analytical framework to examine how traffic safety, neighbourhood safety, urban form and cultural norms may relate to children's travel behaviour. However, the barriers to children in their general physical activity and leisure walking may be different from the barriers that must be overcome while they are walking to and from school on their own. Future research should also examine the impact of traffic safety and personal safety on children's general physical activities, not just the trip to school. It will help to explore if the variation of activities are related to traffic safety and personal safety or to urban form.

Future research should also examine the efficiency of several moderator factors, such as creation of traffic calmed space or neighbourhood parks, at changing the travel pattern and influencing health, to use resources efficiently. As was discussed previously, looking at these factors carefully across different groups of population and different socio-economic status areas will also lead to a more fair distribution of resources. Finally, this study explored the barriers to children in their walking to and from school in urban areas of Tehran. Future research should consider exploring the barriers to children walking to and from school in rural areas, with considering a wider range of personal, family, and social factors.

## **8.5 Research highlights**

The results of this research confirm the findings of previous literature about transportation and physical activity – that children travel patterns is complex. However, this study is one of the first studies on examining the relationship between urban form, perceived traffic safety, neighbourhood safety, and other factors with walking to and from school autonomously. Moreover, in this study, some unexpected results were also found. These findings are very informative and help policymakers and urban planners to not look for an easy “one size fits all” answer to children’s travel modes to and from school. Transportation investments in Iran are often made for the middle-income group of people, however, it is necessary to look deeper at different segments of the population and create solutions that are practical for those who are meant to serve.

This study also provides evidence that parents are more likely to allow their children to walk to and from school when their children’s classmates also walk to and from school. The effects are strongest for girls and low-income households. The findings suggest that departments and communities relating to children’s travel to school must create informal connections among parents through education programmes. In this way, parents will get to know each other and their children’s classmates as well. As such, parents are more likely to allow their children to walk to and from school in group with their friends.

Previous studies discussed about the influential factors concerning children travel patterns; however, most of them were conducted in developed countries and little research exists to indicate individual intervention factors that may increase children walking to and from school in developing countries. Moreover, few studies exist to show if these factors vary across different income groups of population. In other words, the question of what determines the children’s active travel mode to school across

different areas has yet to be answered. In addition, limited studies exist to identify the influential factors on walking to and from school separately and emphasize on walking to and from school autonomously. While children walking to and from school with an adult is good for their health and can improve the public health as well, children's autonomous walking to and from school can make parents' schedule more flexible (especially mothers). Children walking to and from school on their own help children to build sense of safety in neighbourhoods and make them more independent.

Obviously, schools should be located within walking distance from home and children's safety as pedestrians needs to be improved. However, personal and cultural norms and habits were important factors associated with the frequency of using motorized modes. All the current policies and programmes regarding the trip to school in Iran assume a simple association between improving traffic safety and increased in number of children walking to and from school; however, evidently there is no such simple association. Both of these gaps in the knowledge put the programmes at high risk of failure, which, although they may provide some good solutions, many needs of people are still being overlooked. This study highlights the need for quantitative studies to validate and the extent to which these factors may affect the modes of transportation to and from school for children.

Although the study is confined to Tehran, the findings were compared with other studies (discussed in chapter 6 and 7) to show to what extent Tehran is different from or similar to other cases. Moreover, it is expected that many of the findings could be applied to other cities in developing countries. In United States, and Canada, the main reason to motivate policy makers and urban planner to encourage children to walk or cycle to school is childhood obesity. As such, programs target at walking to school, are looking for the relationship between walking to school and children overall physical



activities. Urban sprawl that leads to increase in travel distance is the main reason for decreasing in walking and cycling to school. Long travel distance between home and school is also the main barriers to children in choosing active commuters to school in Australia and New Zealand. Large cities are extended to suburban areas and schools are located in remote areas. Moreover, lack of traffic safety also prevents parents to allow their children t walk and cycle to school. In European countries have some successful policies to provide safe conditions for walking and cycling in their cities and need to build and maintain the habit of walking and cycling in their children.

In Iran, there are some policies to decrease distance between home and schools (government schools) and childhood obesity has not been epidemic yet, however, traffic congestion and air pollution is the main reason to encourage children to walk to and from school and build the habit of choosing active modes of travel at childhood age. The results of this study are useful for urban transport development in developing countries. Specifically, this study would assist the Tehran Municipality, Department of Traffic and Transportation in Tehran and other departments involved in implementing urban transport policies for a sustainable approach and satisfactory outcome.