



Association between route walkability measures and children's walking to school

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ABSTRACT: Increasing active school trips is a strategy for children's health. Although route features may associate with higher amounts of walking school trips, the majority of previous studies have focused on buffer-level characteristics of the built environment. Moreover, the role of children's interests has not been widely examined in previous studies. The present study investigates the associations between the route-level features of the built environment, socio-economic, and cognitive characteristics on children's walk to school. A total of 340 questionnaires were distributed among 7-12 year-old pupils across three primary schools in a neighbourhood in Tehran. For each route to school the environmental features were collected per Pedestrians First (PF) instrument, a tool for measuring walkability. Results reveal that number of motorcycles, and distance from home to school are negatively, and non-residential land use and proportion of favourable sidewalks are positively related to children's walk to school. Parental worry about children's walking to school is negatively associated with children's walk to school. It is also found that children's interest in walking is not significant. Results have important ramifications for planning the walk to school programs in the neighbourhood level. Furthermore, findings underscored the provision of multi-facet long-term policies such as land use changes and school location patterns across the neighbourhood, when preparing master and land use plans, to enhance walking school travels for health reasons.

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1. INTRODUCTION

Walking is the most important way of getting about and the most feasible way of discovering environmental attractions [1]. Research shows that physical activity lowers the risk of several common cancers and type-two diabetes and also improves fitness and quality of life [2].

Previous studies have used various tools such as "Pedestrians First" (PF) to measure the built environmental features related to the walkability of the neighborhood [3]. PF was developed by the Institute for Transportation and Development Policy (ITDP) in 2018 to expand the concept of walkability into more places than the local neighborhoods from the high-income cities around the world where the concept has been adopted. It is also claimed that the PF incorporates to make the concept of walkability more understandable at multiple levels from the city-level to the neighborhood-level and the street-level [3].

Very few studies thus far have attempted to understand the relationship between the walkability measures and children's walking to school. As children tend to walk fixed routes on their school journeys, walking behavior on school trips is mainly affected by route-level environmental features [4] than the features measured on buffer-level (across the area where they live or study). The majority of previous studies,

however, have focused on a buffer around the children's house (e.g., see [3]).

This study aims to investigate the relationship between the route-level walkability measures above and beyond the demographic and socio-economic variables and parental and children's cognitive characteristics on children's walking to school.

2. METHODS AND MATERIALS

The present study uses data from two different sources. The demographic and socio-economic variables and parental and children's cognitive characteristics were collected by distributing a questionnaire among 7-12 year-old pupils across three primary schools in Tehran. Walkability in the route-level was also measured using the PF tools by measuring the environmental features during the site surveys. The hierarchical binary logistic regression model was carried out to examine the association between the explanatory variables and the children's walking to school.

2.1. Questionnaire

A total of 340 questionnaires were distributed among 2nd, 3rd, 5th and 6th-grade pupils across three schools in a neighborhood in district 15 of Tehran (82% return rate). The questionnaire included two parts. The first part was completed by the parents and the second part was filled out by the pupils.

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The first part has consisted of questions about the frequent mode of travel that the child used on school travels. This part also had questions related to the demographic and socio-economic status of the family, parental worry that the child got involved in a road crash when he/she uses each mode of traveling to school, and the parental license for the children's independent activities in both real and virtual world. The parents were also asked to mark the nearest intersection to their home on the map that was attached to the questionnaire. The second part of the questionnaire has consisted of questions about the child's interest in any of the travel modes for school travels, and also the actualized affordances in the real/virtual world where the child lived.

2.2. Built environment measurement

Route-level walkability measures were collected objectively using the PF tools. For each school journey, the shortest path from home to school was provided from Google maps and digitalized in ArcGIS. Each route was further divided into several segments for which the built environment was more homogeneous. According to the PF instructions, 12 route-level walkability measures (such as Distance to school, Walkways, Crosswalks, Land uses, Small blocks, Shade & shelter, etc.) were measured by direct surveys that were conducted while walking along the individual routes. Altogether a total distance of approximate 180 kilometres was walked to complete the site surveys in around one month.

2.3. Statistical analysis

A hierarchical binary logistic regression was carried out to examine the association between the explanatory variables and the children's walking to school. Child's grade, number of motorcycles owned by the family, parental exercise in a week, child's Body Mass Index (BMI), distance to school, non-residential land uses, walkways, shade & shelter, intersections, cellularity in real/virtual world, parents' worry about children's walking to school and children's interest in walking to school were considered as independent variables. Children walking to school (=1) versus not walking to school (=0) was used as the dependent variable. Different fit indices were used to examine the appropriateness of the hypothesized models. The model with the best fit to the data which were consisted of predictors that improved the predictive power of the model, was selected. To calculate the cellularity, both actualized affordances (scored from 0 to 20) and independent mobility license (scored from 0 to 20) were combined [5].

3. RESULTS AND DISCUSSION

It was revealed that the model significantly predicted the outcome variable (Model $\chi^2/\chi^2 = 80.979$, p -value < .001). The number of motorcycles (OR = .181), distance to school (OR = .802) and parents' worry about walking to school (OR = .469) were negatively associated with children's walking to school. Non-residential land uses (OR = 3.467) and walkways (OR = 5.409) were positively related to children's walking to school.

Results are justifiable with respect to the previous studies in the field. For instance, Hatamzadeh et al. showed that the distance between 0.25-0.5 miles decreases the probability of walking to school by 10.5% and 14.5% for boys and girls,

respectively, compared to the distance of less than 0.25 miles [6]. Since an increase in non-residential land uses may result in more accessible destinations and less trip distances, the probability of walking will increase as a result of more diverse land use. This finding is in accordance with the previous findings (e.g., see [6] and [7]). In line with previous studies, our study showed a positive relationship between walkways and children's walking to school. For instance, walkway coverage has been shown to increase walking rate [9].

4. CONCLUSIONS

Even though the walking distance to school is short, it plays a key role in children's physical and mental health [10]. In spite of numerous benefits of children's physical activity, this issue has been neglected in studies in developing countries such as Iran [11]. Empirical knowledge of the current study provided required evidence for the relevant authorities and policy makers directed towards promoting physical activity in areas that are similar to the study area.

The findings of the study put a focus on the households living far from the schools and owning motorcycles as important target groups in the programs aiming at more walking to school. The health and environmental benefits of walking should be well explained for those target groups during the walking campaigns and programs. Since parents' worry about travel modes to school was shown to have an important effect on children's walking to school, the provision of safe and secure walking facilities across the school areas should be considered by the traffic authorities if the walking rate is planned to increase.

Improving the built environmental features is necessary to increase walkability. So, the policy makers should be equipped with walkability measurement tools to use them for evaluating the quality of walkability features. As it is evident in the current study, it is easy to use the PF walkability measures. Besides that, results showed a significant association between some of the measures and the children's walking to school. Such findings underlined the provision of multi-facet long-term policies such as land use changes and school allocation patterns across the neighborhood when preparing master and land use plans to enhance walking school travels for health reasons

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