



The determinants of commuting mode choice among school children in Beijing



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ABSTRACT

This study explores the determinants of travel mode choice for journeys to school by students aged 13–15 in Beijing. The descriptive and regression outcomes show that there is a spatial diversity in travel patterns across the city. Students who live in the suburban areas travel longer distances than those who live in the core centre of the city, where most of the good-quality schools are located. In the core area, for students whose school is within 3 km of home, cycling is more popular than other modes. For students who must travel further than 3 km, there is a significant modal split between households with different socioeconomic status and car ownership. Among the most influential factors, policy factors such as the population policy of China and the impact of education policy on different social groups tend to make the determinants of school children's commuting mode choice more complicated.

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1. Introduction

Travel mode choice among school children has been widely discussed in recent years. These discussions have mainly occurred in the western context, due to the increasing use of cars to transport children to and from school and a decline in walking and cycling in these countries. The increasing use of cars to get children to school has negative economic, health, social and environmental effects. For example, it is reported that car dependence is a major contribution to a higher rate of childhood obesity in the US (e.g. McDonald, 2008a). In addition, it is argued that traffic congestion in peak hours will worsen should more children be chauffeured by parents (Mackett, 2002; Wen et al., 2008; Black et al., 2001). Travel mode choice is also related to social exclusion (McDonald, 2008c). Generally speaking, while modal choice among children is a transport issue, it is also a health and social issue (McMillan, 2005).

According to previous studies, many factors may affect modal choice among children (see Section 2). These include home–school distance, the personal characteristics of children and their household, the built environment and the specific transport culture of a given space.

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In relation to the situation in China, special contextual factors may lead to even more variation in modal choice among children. Firstly, the rapid spatial expansion of cities and the lag in the construction of more educational institutions have led to longer travel distances among children. Secondly, transport resources are unevenly distributed among different socioeconomic groups. As household income, hukou status, car ownership and living location all interact with transport resources, this suggests those less well off may be forced to live in less accessible areas, with fewer schooling choices. Hukou institution is a special population policy in China. It was introduced in the 1950s in order to control the movement of the rural population to the big cities. It was used to distribute the state's welfare, and residents with an urban hukou received a higher level of the state's welfare than a resident with rural hukou. This institution continues till now. Residents with and without local urban hukou are treated differently. Residents without local urban hukou, such as the migrant low-income workers usually are not qualified to access to local basic services at a normal round, such as education, medical care and other welfares. Finally, various educational policies (e.g. *techangsheng*, *zhankengsheng*), favouring children in higher socioeconomic groups, gives them the opportunity to travel further for a better education, and relatively more modal choices enable them to do so.

The determinants of children's travel behaviour could be explained with the socio-ecological model (e.g. Green et al., 1996; Stokols et al., 1996). According to the model, firstly, a child's travel features would be affected not only by their socioeconomic

features but also by a set of environmental factors including household characteristics, socio-spatial environment and the policy environment. However, previous studies are short of a thorough discussion on socio-spatial environment and the policy environment. Secondly, social structure is one of important aspects of social process. Social exclusion is one of key indicators of social structure. Transport-related social exclusion is often addressed in the field of transport study (e.g. Lucas and Jones, 2012; Lucas, 2003). Many researchers believe that a child's travel mode could reveal the degree at which the child is socially included (e.g. Talen, 2001; Loo and Lam, 2013).

This paper will explore the determinants of travel mode choice among school children in China, looking at the case of Beijing. This paper will contribute to the present literature in two respects. Firstly, a consideration of the specific institutional factors, such as housing reform, the *hukou* system and the heterogeneous urban education policies will broaden the research framework for studies of travel mode decisions among children. Secondly, providing new evidence from Beijing will compensate for the limited research in this field in developing countries.

2. Linking social exclusion and modal choice among children

Social exclusion refers to a situation where certain members of society are separated from the normal 'sphere' of living and working in society (Johnston et al., 2000). Some social groups are more adversely affected than others, especially children. These unequal outcomes reduce people's ability to fully participate in society and can lead to more significant social exclusion (Lucas and Jones, 2012). Poor educational achievement in particular, is regarded as an essential aspect of social exclusion (Lucas, 2003).

Transportation plays an important role in social exclusion. Poor transport, including lack of transportation infrastructure and personal transportation resources, can deprive people, especially the disadvantaged in society, of equal opportunities to participate in daily activities (Hanson et al., 2004). Social exclusion can, in turn, be exacerbated by poor access to public services and facilities (Pickup and Giuliano, 2005). This relationship echoes Lucas' (2003) views on the interaction between transport and social exclusion. The notion of socially sustainable urban transportation has been proposed as a theoretical attempt to understand the role of transportation in social inclusion (Boschmann and Kwan, 2008) and achieve a more equal and inclusive society. Children are considered to be a special group of transportation research for their role as both benefits and victims of the high-mobility society (Uth Thomsen, 2004). Among children, the transportation resources are unequally distributed, and the equality also contribute to diverse choices when it comes to schooling, attenuating the role of education in decreasing intergenerational poverty.

There are some studies that have paid attention to the relationship between transport and social inclusion among children, most of which aim to determine the relationship between school accessibility and school achievement. It is worth mentioning that Talen's (2001) study was conducted against the background of longer travel distances faced by children as a result of primary school consolidation in Virginia. The effect of a decrease in accessibility on school achievement was evaluated in this study, with the findings revealing 'unpatterned inequity' among children and a reverse relationship between travel distance and school achievement for students in Grade Three. Recently, an empirical study in a rural area of Taiwan found a similar connection between travel distances and school achievement among junior secondary school students (Lin et al., 2013).

Travel mode choice is significantly related to social exclusion. To begin with, children from low-income families are forced to

attend schools close to home because of the limited transportation options available, and the quality of schools near low-income neighbourhoods remains low. In contrast, their wealthier counterparts can obtain a better education because they have access to a car, which enlarges their scope for activity. Moreover, parents in higher socioeconomic groups can choose to live near schools of high quality, which may enable children to walk to school, or at least shorten the travel distance and time. In this respect, housing prices might increase, pushing families of lower socioeconomic status out of certain neighbourhoods, making social exclusion even worse. It needs to be recognized that mode choice is one indicator showing social exclusion. For example, for the students who have the same travel mode, they may actually be faced to different level of social exclusion due to their family situation or other factors.

From the ecological perspective, the continuing interactions between people and the environment could shape the social structure through complex processes such as concentration and segregation (e.g. Alihan, 1938, pp. 136–166). Different levels of environmental influences, especially the socio-economic and the policy factors are essential determinants of the school choice of children and their travel mode choice. In this sense, individual children's mode choice could be an indicator of the distribution of educational opportunities and the resources. The features of a child's mode choice could be used to investigate social exclusion caused by the distribution of education sources.

3. Literature review: Key factors in modal choice among children

Researchers have found that there are various factors influencing modal choices among children, especially the choice of active modes such as cycling and walking. The socio-ecological model is often applied to explain the determinants of physical activity (e.g. Green et al., 1996; Stokols et al., 1996). From the ecological perspective, physical activity links to the social and physical environment. Different levels of factors exert disproportional amount of influences on physical activity (Grzywacz and Fuqua, 2000). The influencing factors could be categorized into individual-level influences, household-level influences, surrounding environment influences and policy influences (see Fig. 1). The existing researches believe that the outcome of modal choice among children reflects the complex interactions between children and their surrounding environment. The following texts will review the existing literature on the multi-level determinants of modal choice among children from a socio-ecological perspective.

In this paper, individual characteristics and household features are internal factors. Surrounding environment and policy environment are seen as external factors. The surrounding environment refers to the broad living and studying environment the child is exposed to. It includes the built environment, the perceptive environment to children and their parents' mind. Community environment (e.g. the number of peers living with the child and crime rate of the community) and the school quality can be influential to form the perceptive environment. The local customs and the travel culture can be conducive to the modal choice and these variables also belong to surrounding environment. Following the surrounding environment, policies are another type of factor influencing children's travel mode. The policies usually include education, population, transportation and planning policies and legislation. These policies may constrain or promote school accessibility, affecting the modal choices of children.

3.1. Individual level

Demographic factors, referring to children's characteristics, are of relevance here, the most widely discussed of which are gender

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