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Impacts of the built environment on activity-travel behavior: Are there differences between public and private housing residents in Hong Kong?

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ABSTRACT

The built environment impacts individuals' participation in daily activities and associated travel (or activity-travel behavior). However, it is not well understood how these impacts differ between different socioeconomic groups (e.g. economically advantaged and disadvantaged people) and how neighborhood planning affects the difference. Using data of public housing and private housing residents in Hong Kong in 2010, this study applies the propensity score matching approach to identify differences in activity-travel behavior under different built environment settings for private and public housing residents respectively. We find that density, accessibility and self-containment collectively affect private housing residents' auto ownership, travel time, trip frequency, and entertainment time spent at home, but have few influences on public housing dwellers. The different built environment effects are partly because the planning standards and guidelines in Hong Kong stipulate the provision of daily facilities and services such as grocery shops/supermarket, primary school and transit in proximity to public housing development. Thus, although economically disadvantaged people have limited transportation resources, neighborhood planning can adequately meet their daily needs even if they are placed in suburban areas.

1. Introduction

Many studies have examined the impacts of the built environment on individuals' engagement in daily activities and associated travel (or activity-travel behavior). Land use pattern, urban design, and transportation systems at various geographical scales are associated with trip length, vehicle miles traveled, transport modal split, engagement in daily activities and time use, and so on (Newman and Kenworthy, 1989; Ewing and Cervero, 2001; Ewing and Cervero, 2010; Ettema et al., 2007; Wang et al., 2011).

With the deepening of the knowledge on the associations, one open question emerges: How does the built environment facilitate/constrain activity-travel behavior of people of different socio-economic classes? For example, will the built environment have a stronger influence on the behavior of poor people than that of affluent people? How can neighborhood planning measures be used to address mobility constraints of poor people? High-income and low-income groups face different

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transportation and spatial opportunities and constraints (Ureta, 2008), which presumably lead to different activity-travel patterns. Low-income people tend to have limited options for residential location choice and be less able to realize their preferences and needs than their high-income counterparts (Cao, 2008; Schwanen and Mokhtarian, 2004). That is, they are more likely to experience mismatches between built environment characteristics they prefer and those they choose (or less likely to self-select where to live than affluent people). Because matched and mismatched people have different travel behaviors (Frank et al., 2007; Schwanen and Mokhtarian, 2005; Cao, 2015), the impact of the built environment on activity-travel behavior is presumably different between poor and affluent people. On the other hand, if policy measures are taken to address daily needs of low-income people, built environment constraints resulting from their limited residential choice may be attenuated. In other words, planning measures could moderate the effects of the built environment on activity-travel behavior for different groups of people.

This study attempts to test the hypothesis by illustrating different impacts of the built environment on activity-travel behavior of public housing and private housing residents, representing economically disadvantaged and advantaged groups, respectively. Using a household survey administered in Hong Kong in 2010, we examine individuals' activity-travel behavior in different built environment settings for public housing and private housing dwellers respectively. The propensity score matching method is employed to account for the effects of socio-economic and demographic characteristics. We contend that although the decentralization of public housing may impose additional constraints to its residents, progressive planning around public housing sites in Hong Kong help public housing residents to close activity-travel gaps in different built environment settings.

The paper is structured as follows. The next section reviews the relationships among the built environment, activity-travel behavior, and income. Section 3 describes the data and variables and briefly introduces the modeling approach. Results are presented in Section 4. The last section recapitulates key research findings and discusses policy implications.

2. Literature review

The past two decades have witnessed a proliferation of research on what activities individuals conduct in their daily life and how they travel for the activities. An intriguing finding is that different socio-economic and demographic groups tend to show heterogeneous behaviors. For example, Giuliano and Narayan (2003) found that elderly people (65 or older) travel fewer miles and make fewer trips than young people (between 18 and 64 years old) in the US and the UK. Polk (2003, 2004) and Best and Lanzendorf (2005) reported that women are more likely to use car for maintenance trips than men whereas the latter tend to use car for subsistence trips more frequently than the former. Lu and Pas (1999) and Wang et al. (2011) showed that compared to the unemployed, employed individuals spend more time on subsistence activities but less time on maintenance and recreation activities. Further, employed individuals make fewer trips but travel longer time than the unemployed.

Income is a key socio-economic variable that stratifies individuals in terms of activity-travel behavior. Compared to higher-income people, lower-income ones have been reported to have lower mobility, make fewer trips, travel shorter distance, be more likely use non-motorized modes, and/or have a larger share of trips for subsistence activities in Santiago, Chile (Ureta, 2008); Nairobi, Kenya (Salon and Gulyani, 2010); and Huzhou, China (Cheng et al., 2013). Chen and Mokhtarian (2006) and Wang and Law (2007) found that affluent people tend to spend more time on maintenance activities than poor people. Stokes and Lucas (2011) further concluded that the income effect is persistent across different segments by gender, age, employment status, race, or size of cities.

The significant differences in activity-travel behavior between poor and affluent people are partly attributable to different levels of transportation resources, which are associated with their financial affordability. The poor are more likely to depend upon alternative transport modes such as scooters or non-motorized transport. This imposes constraints on the choices of activity, destination, and travel. For example, Ureta (2008) investigated how and where low-income people travel in Santiago, Chile, and found that poor people's opportunities to participate in urban life are limited by their access to transport modes. Kenyon et al. (2002) noted that contemporary societies and cities, built upon the high mobility enacted by expressways, transit, mobile phone, Wi-Fi hotspots, and other networks (Ureta, 2008), are not accessible by those with inadequate mobility. Thus, poor accessibility, an outcome of limited transportation resources and poor mobility, impedes low-income people from reaching jobs and services (Clifton, 2003).

Poor accessibility of low-income people also results from their residential environment. Different socio-economic groups tend to live in different built environments, owing to factors such as residential segregation (Massey and Denton, 1987; Logan et al., 2004). The built environment determines access to urban amenities including goods, infrastructures and services. There are links between spatial patterns of population subgroups and spatial distribution of urban amenities including parks (Talen, 1997); secondary schools (Pacione, 1989); day-care facilities (Truelove, 1993); primary health care centers (Martin and Williams, 1992), etc. Parady (2014) reported that in Japanese cities residential location is the outcome of not only a self-selection guided by life stage, lifestyle and preference, but a decision constrained by supply and demand; the housing costs at city center may be prohibitively expensive for the low-income group who may have to live in the suburbs (Parady, 2014). Zegras and Srinivasan (2007) revealed that in Chengdu, China, the concentration of low-income households is mostly found in locations with poor local accessibility (access to parks, shopping mall, food market, etc.) and land use mixed with industrial uses; similarly, in Santiago, Chile, few low-income households live in areas with high accessibility to recre-