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Prevalence and correlates of walkable short car trips: A cross-sectional multilevel analysis

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ABSTRACT

Many short trips are made by car, and replacing them with walking is a potential strategy to increase physical activity at the population level. The prevalence and correlates of walkable short car trips were examined among adults aged 18–84 years living in the state of Queensland, Australia. Participants (N=14,481) reported their travel behaviors using a 24-h travel diary in the 2009 South East Queensland Travel Survey (SEQTS). A threshold distance within which adults can walk was first identified using the SEQTS data. Consistent with previous studies, we used the 80th percentile distance in walking trips, determined for specific age groups (18–34, 35–49, 50–64, and 65–84 years) and gender, as the distance threshold. This ranged from 1.6 to 2.0 km for a single trip, and 3.4 to 4.7 km for a trip chain. Car trips that did not exceed the distance threshold were regarded as short trips. The study found that 7% of all car trips were short enough to be walked, and 11% of participants reported at least one short trip on the survey day either as a driver or passenger. Short car trips were more likely to be made by middle-to-older aged adults, women, those who were unemployed, those who had children in the household, those living in the middle-to-most disadvantaged areas, and those living in higher population density areas. The findings suggest a potential for some car trips to be converted into walking among some population groups in Australia. Initiatives to replace short car trips with walking may be particularly effective in higher density areas where local destinations are within a walking distance. Barriers that discourage walking will need to be addressed to facilitate walking trips among middle-to-older adults and in disadvantaged areas.

1. Introduction

Promotion of physical activity continues to be an international public health priority (Das et al., 2016; Lee et al., 2012). Evidence consistently highlights the role of integrating active living behaviors into daily routines as a key to increasing population levels of physical activity (Haskell et al., 2007; Rachele et al., 2015). The use of active modes of transport, in particular walking, is one way of incorporating physical activity into daily life. It has been shown that a large number of daily trips by car tend to be short: studies

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using household travel survey data in Sydney, Australia and in Phoenix, Arizona reported that about a quarter of car trips were five minutes or less in duration (Sugiyama et al., 2012a) or two miles or less in distance (Paul et al., 2013). Converting such short car trips into walking may be a potential strategy to increase physical activity at the population level (Maibach et al., 2009). It is thus important to estimate the prevalence of short car trips, and where and by whom such trips are made. Although some existing studies have examined short car trips, these are characterized by a number of limitations.

First, studies have applied one distance threshold for all participants to determine short car trips. For instance, a "walkable" distance has been defined as 1.6 km (Morency et al., 2014; Paul et al., 2013), 3 km (Vagane, 2007), or the distance covered by five minutes of driving (Olabarrio et al., 2012). However, the distance that can be walked is likely to vary between different age and gender groups (Harrison et al., 2013). Thus, the definition of short car trips may also vary between different sub-groups. Second, only a few studies have addressed the sequential nature of trips in identifying short car trips (Beckx et al., 2013; Morency et al., 2014; Vagane, 2007). Studies on short car trips often use household travel surveys, in which participants report their travel behaviors for each trip stage that has a single purpose and mode. A sequence of trips starting and ending at the same place (i.e., home or work) is considered as a trip chain. A trip chain can consist of two or more trips, depending on the number of destinations included in the trip chain. Thus, even if a single trip is short, it may not be walkable if the trip is part of a longer trip chain. In one study that considered the distance threshold for trip chains (Morency et al., 2014), a trip chain up to 6.4 km (four times the threshold for a single trip) was deemed to be walkable. However, it will take about 1 hour and 20 minutes to walk 6.4 km at a walking speed of 4.8 km/h (Bohannon, 1997), and the feasibility of converting such a distance into walking is not clear, particularly for some population groups such as older adults.

To address these limitations, we used an Australian household travel survey to examine the prevalence of short car trips that could be converted to walking trips, based on the age/gender-specific distance thresholds, and taking the distance of trip chains into account. We then determined individual-, household-, and area-level correlates of short car trips to identify sub-groups and areas where such short car trips are more common.

2. Materials and methods

2.1. Household travel survey: study setting and survey design

The data used were from the 2009 South East Queensland Travel Survey (SEQTS). The SEQTS is a travel behavior survey administered by the Queensland Government Department of Transport and Main Roads, primarily for modelling travel behavior and informing state-level infrastructure and service investments. The survey covers the Sunshine Coast, Brisbane, and Gold Coast Statistical Divisions, which had a population of 2.9 million. The region has a diversity of built environments from high-density urban areas to low-density suburban/regional areas. Further details of the SEQTS can be found at http://www.tmr.qld.gov.au/Community-and-environment/Research-and-education/South-East-Queensland-Travel-Survey.

The SEQTS used a multistage random sampling design in which Census Collection Districts (CCD, a geographical unit comprising about 250 households) were first selected, followed by recruitment of households from each CCD. The median area of selected CCDs was 0.36 km^2 (interquartile range: 0.61 km^2). Data were collected from 10,335 households, approximately 4.4% of all households in the study area. The response rate was approximately 60%. All residents and visitors in the selected households were asked to report their travel behaviors on the allocated survey day. The total number of participants in the 2009 SEQTS was 27,213. The sample for this study was delimited to 14,481 adults aged 18 to 84 years, who reported at least one car trip on the survey day.

The SEQTS asked information about the household and its members using hand- or mail- delivered self-administered questionnaires. In addition, all household members were asked to record their trips using a 24-hour travel diary. For each trip, they reported the time when the trip started, time when it ended, origin, destination, purpose, and mode of the trip. The survey was administered in accordance with ethical guidelines under government statutes and regulations. Informed consent was obtained from all participants.

2.2. Identifying short car trips

2.2.1. Definition of car trips

Car trips were defined as any trip that was made as a car driver, car passenger, or taxi passenger. We excluded car trips to pick up or deliver something, as they typically involve carrying loads. However, we did include car trips to pick up or drop off a passenger as such trips could be undertaken by walking.

2.2.2. Distance thresholds for a single trip

Trip distances were derived from the street network distances between geocoded coordinates of origins and destinations. Consistent with a previous study (Morency et al., 2014), the distance thresholds for a single trip were determined at the 80th percentile of walking trip distances. We divided the sample into eight age/gender-specific groups (18–34, 35–49, 50–64, and 65–84 years old for each gender). Table 1 shows the age/gender-specific distance thresholds, which ranged from 1.6 to 2.0 km. These are comparable to the thresholds used in previous studies (Burke and Brown, 2007; Morency et al., 2014; Paul et al., 2013). Car trips that did not exceed these threshold distances were considered as short car trips.