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Walk Score and Australian adults' home-based walking for transport

Rachel Cole [a,*], Peter Dunn [a], Ian Hunter [b], Neville Owen [c,d,e,f], Takemi Sugiyama [g,h]

[a] Cluster for Health Improvement, University of the Sunshine Coast, Sippy Downs, Queensland, Australia
[b] Gold Coast Local Health and Hospital Network, Queensland Department of Health, Robina, Queensland, Australia
[c] Behavioral Epidemiology Laboratory, Baker IDI Heart and Diabetes Institute, Melbourne, Victoria, Australia
[d] School of Public Health, The University of Queensland, Brisbane, Queensland, Australia
[e] School of Population and Global Health, Melbourne University, Melbourne, Victoria, Australia
[f] Department of Medicine, Monash University, Melbourne, Victoria, Australia
[g] Faculty of Health, Arts & Design and Centre for Design Innovation, Swinburne University of Technology, Hawthorn, Victoria, Australia
[h] Sansom Institute for Health Research and School of Population Health, University of South Australia, Adelaide, South Australia, Australia

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ABSTRACT

The relationships of Walk Score, a publicly-accessible walkability assessment tool, with walking for transport to and from home were examined among a large representative sample of Australian adults aged 18–64 years ($N=16{,}944$). Residents in highly and somewhat walkable areas were twice and 1.4 times more likely to accumulate 30 min of walking per day compared to those in very car-dependent neighborhoods, respectively. Mean duration of walking was also longer for participants living in highly and somewhat walkable areas compared to those in very car-dependent areas. Walk Score has potential as a widely-applicable tool for identifying the walkability of local neighborhoods.

1. Introduction

Promotion of physical activity is a public health priority in combating non-communicable diseases in Australia (National Preventative Health Taskforce, 2009) and internationally (World Health Organisation, 2004). Walking is a commonly-reported type of physical activity with known health benefits (Australian Bureau of Statistics, 2013a). Walking for transport, in particular, has become a focus for public health interventions because of its acceptability and accessibility, particularly among populations with a low prevalence of physical activity (Haskell et al., 2007; Ogilvie et al., 2004).

There is growing evidence in the public health, transport and planning literature of the role of the built environment on walking for transport (Saelens and Handy, 2008; Sugiyama et al., 2012). However, tools for measuring aspects of the built environment that are related to walking are often resource-intensive and methodologically complex. For instance, to calculate a walkability index, data on dwellings, road center line, land use, and shopping areas (parcel and floor areas) need to be gathered and analyzed in geographical information systems (GIS), a computer application that requires specialized training (Leslie et al., 2007). Thus, existing research tools can be limited in their practical utility for local community planning.

Walk Score is a free, publicly-accessible tool that "scores" the extent to which the built environment in a particular location is supportive of residents' walking. Walk Score uses a distance-decay algorithm to assess how a location's surroundings facilitate walking by awarding points based on the distance to the nearest destination in 13 categories, such as education, retail, food, recreation, and entertainment (Front Seat Management, 2011). The maximum points are assigned for a destination category if the straight distance to the closest establishment (as the crow flies) is less than 0.4 km. Fewer points are assigned as the distance approaches 1.6 km. Each type of destination is given equal weight and the points for each category are totaled and normalized to produce a score between 0 and 100. An empirical underpinning for this index is that proximity to destinations from places of residence has been found consistently associated with walking for transport (Forsyth et al., 2008; Millward et al., 2013; Sugiyama et al., 2012).

Several studies have shown associations of Walk Score with objectively-measured walkability components such as street connectivity, residential and retail density, and intersection density (Carr et al., 2010; Duncan et al., 2011), as well as perceived measures of walkability (Carr et al., 2010). Direct associations between

* Correspondence to: School of Health and Sports Sciences, University of the Sunshine Coast, Locked Bag 4, Maroochydore, Queensland 4556, Australia. Fax: +61 7 5456 4880.
E-mail address: rcole@usc.edu.au (R. Cole).

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Walk Score and walking for transport have also been found in studies conducted in North America (Brown et al., 2013; Hirsch et al., 2013), but these studies used non-context specific walking measures, which included walking that occurred outside one's local area. Given that Walk Score is based on destinations that exist in participants' neighborhood, walking within this area needs to be examined to more accurately estimate how Walk Score is associated with walking. A study in Canada examined associations of Walk Score with local walking, and found that higher Walk Scores were associated with a higher likelihood of walking for shopping (Manaugh and El-Geneidy, 2011). However, it is unknown how Walk Score is related to the duration of walking in a local area. This is relevant from a health perspective in which walking duration is used as a recommendation (30 min/day or more) to obtain health benefits (Australian Government Department of Health And Ageing, 2005). It is possible that residents living in areas with very high Walk Scores walk for a short duration because many relevant destinations are in close vicinity. In addition, the relationship between Walk Score and walking for transport in a context outside North America has not been examined.

This study examined the extent to which Walk Score is related to the occurrence and duration of adults' context-specific walking for transport to/from home, using data from a large population travel survey of residents in South-East Queensland, Australia.

2. Methods

2.1. Study area and survey design

The data used were from the *2009 South-East Queensland Household Travel Survey* (SEQHTS) database, a large biennially-administered travel behavior survey by the Queensland Government Department of Transport and Main Roads. Its primary purpose was to inform the development of transport modeling and analysis tools used for infrastructure and services decision-making. The geographic area covered by the survey included the Sunshine Coast, Brisbane, and Gold Coast Statistical Divisions (Australian Bureau of Statistics, 2006), a geographic area of 10,946 km^2 and estimated population of 2.9 million people (Fig. 1) (Australian Bureau of Statistics, 2013b). The region encompasses diverse built environments including high-density mixed-use urban centers with many walking destinations, low-density single-use suburban areas with fewer walking destinations, and regional agricultural areas.

The SEQHTS used a cross-sectional, multistage random sampling design in which CCDs were first selected (stage 1), followed by recruitment of households from each CCD (stage 2). CCD is the smallest geographic sub-units for the collection of Census data at the time of data collection, averaging approximately 225 dwellings in urban areas (Australian Bureau of Statistics, 2006). The median size of CCDs in the study area was 0.36 km^2 (interquartile range: 0.61 km^2). Data were collected from 10,335 households, approximately 4.4% of households from selected CCDs (response rate of approximately 60%). All residents and visitors in the selected households on the night before the specified "travel day" were asked to report their travel behaviors for that day. The specified travel day for each household was allocated by spreading the sample of households over the survey period, and then randomly allocating each household to a day of the week. The SEQHTS used self-administered questionnaires and a travel diary, which were hand- or mail-delivered to, and collected from participating households in person. Telephone and postal reminders, and telephone clarification calls were used to increase response rates. The survey was administered in accordance with ethical guidelines under government statutes and regulations. Informed consent was obtained from participants.

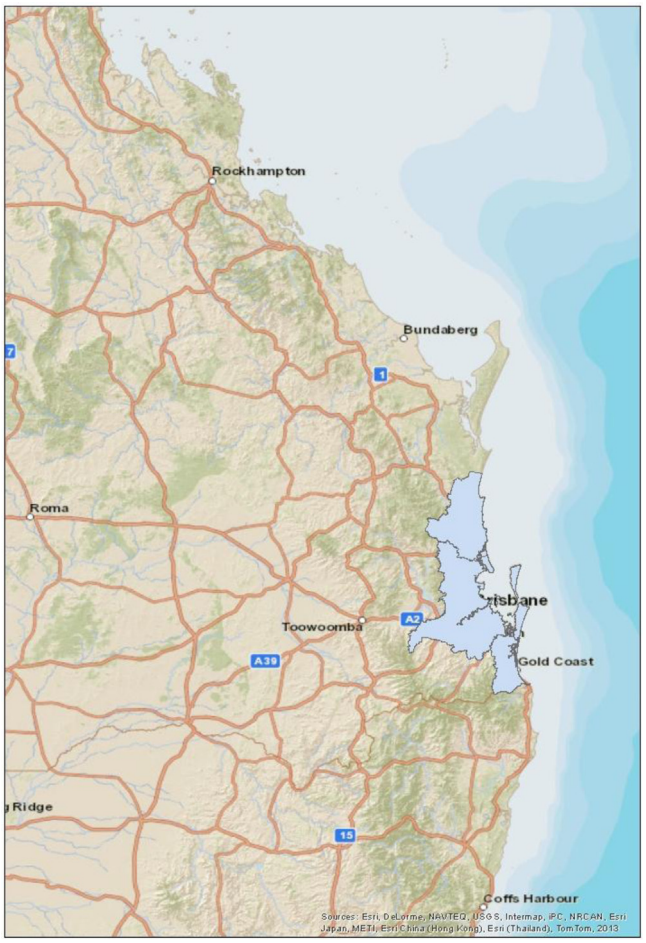

Fig. 1. Study location: South-East Queensland, Australia (including the Statistical Divisions of the Sunshine Coast, Brisbane, and Sunshine Coast).

The SEQHTS questionnaires included information about the household (the number of people usually residing in the household and dwelling type); vehicles (household vehicle number and type(s)); and, individuals (age, gender, country of birth, license-holding status, employment status, and occupation). All household members were asked to record their travel activity for 24 h using the travel diary. Travel was recorded for each "trip stage", a piece of travel with a single purpose and mode. For example, going to work using a bus could involve three trip stages: walking from home to a bus stop; traveling by bus; and walking from a bus stop to work. For each trip stage, participants reported the time when the trip segment started, time when it ended, origin, destination (place the person went to for the particular trip segment), purpose of the trip, and mode of the trip.

2.2 Measures

2.2.1. Exposure measures

Walk Score for each Statistical Area 1 (SA1) was derived by determining the centroid of each SA1, the smallest geographic unit for Census data in Australia from 2011 (Australian Bureau of Statistics, 2011a). The coordinates of the centroids were obtained using the "Calculate Geometry" function in ArcGIS (ESRI, 2011). This determines the center of gravity of a polygon. The *x*- and *y*-coordinates obtained for each SA1 were then manually entered into the Walk Score website (walkscore.com) to obtain its Walk