Health & Place 45 (2017) 1–9

Contents lists available at ScienceDirect

Health & Place

journal homepage: www.elsevier.com/locate/healthplace

Geographic regions for assessing built environmental correlates with walking trips: A comparison using different metrics and model designs

Calvin P. Tribby[a,b,*], Harvey J. Miller[a,b], Barbara B. Brown[c], Ken R. Smith[c,d], Carol M. Werner[e]

[a] Department of Geography, The Ohio State University, 1036 Derby Hall/154 North Oval Mall, Columbus, OH 43210, USA
[b] Center for Urban and Regional Analysis, The Ohio State University, United States
[c] Department of Family and Consumer Studies, University of Utah, United States
[d] Huntsman Cancer Institute, University of Utah, United States
[e] Department of Psychology, University of Utah, United States

ARTICLE INFO

Keywords:
Walking
Built environment
Neighborhood
GPS
Activity spaces

ABSTRACT

There is growing international evidence that supportive built environments encourage active travel such as walking. An unsettled question is the role of geographic regions for analyzing the relationship between the built environment and active travel. This paper examines the geographic region question by assessing walking trip models that use two different regions: walking activity spaces and self-defined neighborhoods. We also use two types of built environment metrics, perceived and audit data, and two types of study design, cross-sectional and longitudinal, to assess these regions. We find that the built environment associations with walking are dependent on the type of metric and the type of model. Audit measures summarized within walking activity spaces better explain walking trips compared to audit measures within self-defined neighborhoods. Perceived measures summarized within self-defined neighborhoods have mixed results. Finally, results differ based on study design. This suggests that results may not be comparable among different regions, metrics and designs; researchers need to consider carefully these choices when assessing active travel correlates.

1. Background

Research suggests that the quality of the built and natural environment is associated with active travel, walking, cycling, and transit use, and physical activity (Brownson et al., 2009; Ding and Gebel, 2012; Handy et al., 2002; Harris et al., 2013; Sallis et al., 2015). Some measures of the built environment are positively associated with active travel, such as land use mix (Frank et al., 2006), residential density (Ewing et al., 2008), and street network configuration (Berrigan et al., 2010; Ellis et al., 2016). One definition of walkability is an environment that provides support for walking or encourages physical activity (Brown et al., 2013; Forsyth, 2015). Two methods to assess the environmental supports for walking are sampling residents' perceptions and collecting audits of environmental features (Brownson et al., 2009). Research has also shown that both perceptual and audit metrics of a neighborhood are associated with physical activity (Ball et al., 2008; Gebel et al., 2011; Lin and Moudon, 2010; McGinn et al., 2007; Troped et al., 2011). However, many researchers have outlined steps to address inconsistencies in results and behavioral assumptions (Brownson et al., 2009). Suggested prescriptive steps include using environmental metrics that are comparable across studies, identifying and modeling the causally relevant built environment context, and using stronger research designs (Berrigan et al., 2015).

The assessment of built environment measures relies on the delineation of a geographic region that influences active travel (Berrigan et al., 2015; Lovasi et al., 2012; Moudon et al., 2006; Spielman and Yoo, 2009). Two common methods for delimiting this region for home-based travel are *neighborhoods* and *activity spaces*, with neighborhood referring to the community near an individual's home and activity spaces referring to the environment that an individual routinely experiences (Sharp et al., 2015). Neighborhoods can be defined by researchers or self-defined by participants (Coulton et al., 2001). Researcher-defined neighborhoods commonly use spatial buffers around participants' homes (Saelens et al., 2012) or census geography (Witten et al., 2012). Self-defined neighborhoods are captured by participant self-report (Bailey et al., 2014; Campbell et al., 2009; Gebel et al., 2011; Ivory et al., 2015) or by participant-drawn maps (Colabianchi et al., 2014; Siordia and Coulton, 2015; Suminski et al., 2015). Activity spaces are based on origin and destination travel diaries (Schönfelder and Axhausen, 2003) or

* Corresponding author at: Department of Geography, The Ohio State University, 1036 Derby Hall/154 North Oval Mall, Columbus, OH 43210, USA.
E-mail addresses: tribby.1@osu.edu (C.P. Tribby), miller.81@osu.edu (H.J. Miller), barbara.brown@fcs.utah.edu (B.B. Brown), ken.smith@fcs.utah.edu (K.R. Smith), carol.werner@psych.utah.edu (C.M. Werner).

http://dx.doi.org/10.1016/j.healthplace.2017.02.004
Received 23 June 2016; Received in revised form 9 February 2017; Accepted 10 February 2017
1353-8292/ © 2017 Elsevier Ltd. All rights reserved.

Global Positioning System (GPS) data loggers (Chaix et al., 2013; Hirsch et al., 2014; Tribby et al., 2016; Zenk et al., 2011) to delineate the portion of an environment experienced by participants over a given time period.

Previous research into self-defined neighborhoods and activity spaces provides two perspectives with regards to explaining walking. For example, research on self-defined neighborhoods compares these regions to census tracts (Coulton et al., 2013, 2001; Spilsbury et al., 2012), assesses the accessibility of recreational or exercise facilities (Hoehner et al., 2005; Ivory et al., 2015), or uses self-defined neighborhoods to estimate an optimum home buffer size (Siordia and Coulton, 2015). Prior research with activity spaces explores how different Geographic Information Systems (GIS)-based analyses and representations produce different built environment summaries compared to researcher-defined neighborhoods (Boruff et al., 2012; James et al., 2014; Rundle et al., 2016; Tribby et al., 2016). But research directly comparing self-defined neighborhoods and activity spaces is not common (Perchoux et al., 2016; Yin et al., 2013). There are preliminary findings that the built environment composition of these areas are different, but still unresolved is how these differences are associated with travel activities (Perchoux et al., 2016). Finally, there is insufficient research on how variation in the spatial measurement of neighborhoods explains walking, depending on the type of built environment metric. Specifically, how do different measures in these regions vary in their explanation of walking trips?

The type of study design may have an effect on the association between built environment measures and walking (Berrigan et al., 2015). Most of the current research on this relationship is cross-sectional (Cummins et al., 2007; Fitzhugh et al., 2010; Lovasi et al., 2012; Saelens and Handy, 2008; Sallis et al., 2011). Internationally, stronger support for causal relationships between built environment qualities and active travel comes from longitudinal studies that measure the changes in individuals' active travel with changes in the built environment (Coevering et al., 2015), often using natural experiments or quasi-experimental designs (Brown et al., 2015; Goodman et al., 2013; Ogilvie et al., 2010; Saelens and Handy, 2008). However, there are few longitudinal studies that examine different geographic regions to assess changes in walking behavior with respect to changes in the built environment (Berrigan et al., 2015).

The aim of this paper is to examine the geographic regions of walking activity spaces and self-defined neighborhoods for analyzing built environment associations with walking trips. We capture self-defined neighborhoods by having study participants explicitly delineate the spatial boundary of their neighborhood on a map. We construct walking activity spaces from home-based walking trips recorded with GPS. The first part of this study measures the geometric similarity of walking activity spaces and self-defined neighborhoods. This research question addresses a current shortcoming in existing research: what is the spatial similarity between the regions and do the regions vary for individuals between years? The second part of this study assesses the strength of walking trip models for the different geographic regions, using two different types of built environment measures: perceived and audit data. The final part of this study compares the difference in results due to using cross-sectional versus longitudinal research designs. This part also aims to assess the change in walking behavior due to a built environment intervention: a Complete Streets reconstruction. Complete Streets is a US transportation policy that promotes street design to accommodate all modes of transportation, with the goals of increasing safety for all road users and promoting active transport such as walking, cycling, and transit use (Laplante and McCann, 2008). This relates to international efforts to increase street safety and active travel, such as the Vision Zero policy to eliminate traffic deaths, or policies to improving cycling infrastructure (Johansson, 2009; Pucher et al., 2010).

2. Methods

To address the research question of geographic regions, we analyzed longitudinal data that includes built environment metrics from field audits, GPS and accelerometer data, participant-drawn maps, and neighborhood perception surveys. To allow comparison to other studies, we use an established built environment audit instrument and perceptual survey. This neighborhood experienced a built environmental intervention, namely, a Complete Streets intervention that includes the construction of a new light rail line, bicycle lanes, enhanced landscaping, and widened sidewalks (Brown et al., 2014). We compare data from before and after the intervention to investigate whether a substantial change in the neighborhood environment influences residents' walking trips by assessing the change in self-defined neighborhoods and walking activity spaces. We use a longitudinal, natural experiment design, with distance from home to the intervention as a proxy for exposure (Coevering et al., 2015).

The goal of this paper is to examine the geographic region for modeling built environment associations with walking trips. The first part of this study is how geometrically similar are walking activity spaces and self-defined neighborhoods? We compare the two regions using measures of area, shape, and overlap. These three measures give an indication of the spatial similarity and stability of the regions between years. The second part of this research is to measure the strength of the walking trip models for the two geographic regions by using different types of built environment measures. We assess the perceived data for the self-defined neighborhood and the audit data for the self-defined neighborhood and the walking activity space using cross-sectional models. The goal of these analyses is to assess the geographic region. The final part of this research examines the use of a longitudinal research design. We compare the effectiveness of longitudinal models to the cross-sectional models. The goal is to see which framework is better suited to modeling walking associations with the built environment.

2.1. Sample

The data for this project are from the Moving Across Places Study (MAPS) in Salt Lake City, Utah, USA. This project assesses built environment walkability, walking behavior, transit use, and physical activity before (2012) and after (2013) a Complete Streets intervention that includes the construction of a new light rail line, complete bicycle lanes, enhanced landscaping, and widened sidewalks (Brown et al., 2015). The data for this study are a subset (n=232) drawn from 536 participants whom we have GPS, accelerometer, and neighborhood perception data for both years. Participants' data for both years were included if they wore accelerometers (Actigraph GT3X+) at least three days for 10 h per day in 2012. Non-wear hours were defined as hours with zero accelerometer counts per minute, allowing for up to 2 min of 100 counts per minute, following procedures used in a national study (Troiano et al., 2008). Three days of wear has been a standard used in previous research (Hart et al., 2011; Zenk et al., 2011). Participants also wore GPS data loggers (GlobalSat DG-100) to record travel activities. The GPS and accelerometer data were collected on a rolling basis for several months, in part to balance the positive or negative weather effects on activity.

The study recruited n=939 participants living within 2 km from the Complete Street intervention for the 2012 data collection wave; of these participants, n=614 completed the 2013 data collection wave. Most of the attrition between 2012 and 2013 was because of participants moving residences (n=283, verified as movers or did not respond to 8 or more phone and in-person contact attempts), rather than refusals (n=34), or ineligibility (n=8). Of the n=614 who completed both data collection waves, n=536 had complete GPS data for both periods. The reasons for participants not having complete GPS data include failures to wear, recharge, or turn on the equipment properly,

Download English Version:

https://daneshyari.com/en/article/5114788

Download Persian Version:

https://daneshyari.com/article/5114788

Daneshyari.com