Preventive Medicine Reports 4 (2016) 532–539

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: http://ees.elsevier.com/pmedr

Check the score: Field validation of Street Smart Walk Score in Alberta, Canada

Candace I.J. Nykiforuk *, Jennifer Ann McGetrick, Katelynn Crick, Jeffrey A. Johnson

School of Public Health, University of Alberta, 3-300 Edmonton Clinic Health Academy, 11405 87 Avenue NW, Edmonton, Alberta T6G 1C9, Canada

ARTICLE INFO

Article history:
Received 2 May 2016
Received in revised form 6 August 2016
Accepted 25 September 2016
Available online 28 September 2016

Keywords:
Chronic disease
Geographic mapping
Health promotion
Validation studies
Walking

ABSTRACT

Walk Score® is a proprietary walkability metric that ranks locations by proximity to destinations, with emerging health promotion applications for increasing walking as physical activity. Currently, field validations of Walk Score® have only occurred in metropolitan regions of the United States; moreover, many studies employ an earlier Walk Score® version utilizing straight line distance. To address this gap, we conducted a field validation of the newest, network-based metric for three municipal types along a rural-urban continuum in Alberta, Canada. In 2015, using street-level systematic observations collected in Bonnyville, Medicine Hat, and North Central Edmonton in 2008 (part of the Community Health and the Built Environment (CHBE) project), we reverse engineered 2181 scores with the network Walk Score® algorithm. We computed means, 95% confidence intervals, and t-tests ($\alpha = 0.05$) for both sets of scores. Applying the Clifford-Richardson adjustment for spatial autocorrelation, we calculated Spearman's Rank Correlation Coefficients (rho, r_s) and adjusted p-values to measure the strength of association between the derived scores and original network scores provided by Walk Score®. Spearman's rho for scores were very high for Bonnyville ($r_s = 0.950$, adjusted $p < 0.001$), and high for Medicine Hat ($r_s = 0.790$, adjusted $p < 0.001$) and North Central Edmonton ($r_s = 0.763$, adjusted $p < 0.001$). High to very high correlations between derived scores and Walk Scores® field validated this metric across small, medium, and large population centres in Alberta, Canada. However, we suggest caution in interpreting Walk Score® for planning and evaluating health promotion interventions, since the strength of association between destinations and walking may vary across different municipal types.

1. Introduction

1.1. Walkability and walking for health

Population levels of overweight and obesity are accelerating across the United States and Canada (World Health Organization, 2009). Walking as physical activity is generally feasible for most people, and efforts to increase community walking can help combat this trend, potentially reducing the burden of chronic illnesses (cardiovascular, cerebrovascular, and respiratory diseases; diabetes; and many kinds of cancer) (Guh et al., 2009). Understanding the influence of built environments is key for efforts to increase walking, since most walking occurs routinely in neighborhoods. The term built environment refers to both aggregate and individual features of urban design, transportation infrastructure, and land uses (Rao et al., 2007). Walkability, a concept from the planning literature evaluating built environments as suitable for walking (Lo, 2009), is a rapidly evolving topic in health promotion research.

Walkability has been conceived in different ways, such as proximity to destinations (McCormack and Shiell, 2011; Owen et al., 2004; Pikora et al., 2003); street-connectivity (Grasser et al., 2013; McCormack and Shiell, 2011; Saelens and Handy, 2008); light traffic and appropriate pedestrian infrastructure (McCormack and Shiell, 2011; Owen et al., 2004; Pikora et al., 2003; Saelens and Handy, 2008); pleasant aesthetics (Humpel, 2002; Owen et al., 2004; Pikora et al., 2003; Saelens and Handy, 2008); higher residential density (Grasser et al., 2013; McCormack and Shiell, 2011; Saelens and Handy, 2008); mixed land uses (Grasser et al., 2013; McCormack and Shiell, 2011); and safety (Pikora et al., 2003), all of which have shown associations with walking for both transportation and recreation. However, the diversity of conceptual and operational definitions across studies and indices (Schaefer-McDaniel et al., 2010) has resulted in poor generalizability for walkability research (Feng et al., 2010), and limited our ability to directly compare or aggregate study findings (Schopflocher et al., 2014).

1.2. Walk Score® as a walkability metric

Walk Score® is a proprietary metric that operationalizes the walkability of locations with a score from 0 to 100, based on walking

Abbreviations: ABL, Average Block Length; BMI, Body Mass Index; CHBE, Community Health and the Built Environment; CI, Confidence Interval; CSRS, Canadian Spatial Reference System; GIS, Geographic Information System; ID, Intersection Density; IMI, Irvine-Minnesota Inventory; NAD, North American Datum; NC, North Central; NRN, National Road Network; SS, Street Smart; TM, Transverse Mercator.

* Corresponding author.
E-mail addresses: candace.nykiforuk@ualberta.ca (C.I.J. Nykiforuk), mcgetric@ualberta.ca (J.A. McGetrick), kccrick@ualberta.ca (K. Crick), jeffreyj@ualberta.ca (J.A. Johnson).

http://dx.doi.org/10.1016/j.pmedr.2016.09.010

destinations and some measures of pedestrian friendliness (Walk Score, 2015). Potential advantages of Walk Score® include rapid, inexpensive acquisition and greater comparability between locations (Carr et al., 2011; Chiu et al., 2015; Duncan et al., 2013). Potential disadvantages of Walk Score® include a lack of information about influential built environment variables like pedestrian infrastructure, aesthetics, cold weather climate-related impedance, and/or traffic information. The most common data sources for other walkability indices, namely, street-level systematic observations (neighborhood audits) (Schaefer-McDaniel et al., 2010) and Geographic Information Systems (GIS), however, are more time-consuming and expensive to collect, and provide only limited generalizability between studies (Feng et al., 2010).

Walk Score® is available for locations across the United States, Canada, Australia, and New Zealand, with more comprehensive commercial and research data obtainable from Walk Score® Professional (Walk Score, 2015). The producers of Walk Score® have continued to refine their metric; in 2011, Walk Score® launched the "Street Smart Walk Score" (hereafter referred to as Walk Score®) (Walk Score, 2015). The newest version of Walk Score® features a network-based algorithm (counting amenities along street routes versus straight line distances), provides additional consideration for depth of choice among amenities, and penalizes locations with lower pedestrian friendliness (Duncan et al., 2013; Frank and Ulmer, 2013; Walk Score, 2015).

1.3. Walk Score® research and field validation studies

A growing body of research has been conducted with Walk Score®, measuring its association with increases in different kinds of walking in communities (Hirsch et al., 2013, 2014; Manaugh and El-Geneidy, 2011), general physical activity levels (Cole et al., 2015; Thielman et al., 2015; Winters et al., 2015), and decreases in weight or body mass index (BMI) (Chiu et al., 2015). Notably, two large-scale Canadian studies based on surveys of over 100,000 participants, and controlling extensively for confounding variables, found higher Walk Scores® were associated with greater energy expenditure on walking for active transportation (Chiu et al., 2015; Thielman et al., 2015). Other recent Canadian studies have demonstrated higher Walk Scores® are associated with increases in utilitarian walking (Chudyk et al., 2015; Wasfi et al., 2015) and decreases in BMI (Wasfi et al., 2016), although one study found no association between Walk Scores® and daily steps measured by accelerometer (Hajna et al., 2015).

Field validations of Walk Score® can contribute necessary assurances of the metric's geographic validity, accuracy, and reliability. Indeed, walkability studies failing to reference an appropriate field validation are not considered geographically rigorous according to longstanding conventions in geospatial and cartographic research (Thornton et al., 2011). Two key field validation studies have examined how Walk Score® corresponds with objective measures of the built environment; one conducted with the previous version of Walk Score® in Rhode Island (Carr et al., 2010, 2011), and the other with the network-based Street Smart Walk Score across five highly urban regions of the United States (Duncan et al., 2011, 2013). With increasing refinement of the Walk Score® algorithm, such studies will need to contend with the geospatial complexity of the metric (Duncan et al., 2011, 2013). As use of Walk Score® expands outside of urban America, these studies should critically assess Walk Score® as a tool for community health promotion policies and interventions. The contribution of the current study to the research literature consists of a geospatially rigorous field validation of Walk Score® with systematic street-level observation data collected as part of the Community Health and the Built Environment (CHBE) project in three communities along a rural-urban continuum in the province of Alberta, Canada.

2. Methods

2.1. Systematic street-level observation: the Community Health and the Built Environment project

The Community Health and the Built Environment (CHBE) project (2007–2012) was a multi-community health promotion initiative in Alberta, Canada (Nykiforuk et al., 2013). From a socio-ecological perspective, CHBE examined how local environments contribute opportunities and barriers for community members' health and wellness (Nykiforuk et al., 2013). Four Alberta communities were partnered in the project, including Bonnyville, Medicine Hat and Redcliff,[1] North Central Edmonton, and St. Paul. In 2008, as part of the CHBE project, we conducted systematic street-level observations using a neighborhood audit tool which adapted the Irvine-Minnesota Inventory (IMI) (Boarnet et al., 2006; Day et al., 2006) with elements of the Systematic Pedestrian and Cycling Environmental Scan (Pikora et al., 2002) and Pedestrian Environmental Data Scan (Clifton et al., 2007) to incorporate additional data collection (such as bike lane information). Our CHBE-modified tool provided an opportunity for field observers to document both macro-scale and micro-scale features of the built environment, including urban design, traffic, pedestrian infrastructure, and the presence or absence of institutional, commercial, or recreational destinations (forming the basis for the Walk Score® field validation) (Nykiforuk et al., 2013). Three observers were trained with standardized manuals over a three-day workshop to administer the adapted tool (Schopflocher et al., 2014). Over 300 microscale observations were comprehensively documented and GIS mapped for both sides of every street segment in each community, using the National Road Network (NRN) data set in the North American Datum (NAD) 1983 Canadian Spatial Reference System (CSRS) Alberta 10 Transverse Mercator (TM) (Resource) projection (Government of Canada, 2014).

In 2015, relevant systematic street-level observation data were extracted from three CHBE communities to correspond with the 2181 data points available in Bonnyville, Medicine Hat, and North Central Edmonton provided as latitude longitude coordinates in a Walk Score® Professional data set for the province of Alberta, Canada. According to the metadata, over 95% of the Walk Scores® in the data set were derived in September 2010. The CHBE communities included for field validation corresponded to the most recent population centre designations from the Statistics Canada Census Dictionary 2011, and consisted of Bonnyville - small (between 1000 and 29,999 population), Medicine Hat - medium (between 30,000 and 99,999 population), and North Central Edmonton[2] - large (over 100,000 population) (Statistics Canada, 2011). In our research, the field validation study communities were further differentiated by spatial extent and road surface length, which were for Bonnyville 14.10 km^2 and 58.2 km, for Medicine Hat 112.01 km^2 and 353.9 km, and for North Central Edmonton 11.06 km and 165.1 km (City of Edmonton, 2015a; Statistics Canada, 2016).

2.2. Calculating Walk Score® with observational data

Walk Score® is scaled linearly, ranging from 0 to 24 "car-dependent" (car required for almost all errands), 25–49 "car-dependent" (car required for most errands), 50–69 "somewhat walkable" (car required for some errands), 70–89 "very walkable" (car not required for most errands), to 90–100 "walker's paradise" (car not required for errands) (Walk Score, 2012). Walk Scores® and component information

[1] Medicine Hat and its suburb Redcliff were partnered in the Community Health and the Built Environment (CHBE) project as a single community.

[2] North Central Edmonton as partnered in the Community Health and the Built Environment (CHBE) project consists of eleven inner city communities in Edmonton (one of the two largest cities in Alberta); namely, Alberta Avenue, Boyle Street, Central McDougall, Cromdale, Delton, Eastwood, Elmwood Park, McCauley, Parkdale, Spruce Avenue, and Westwood with a combined population of approximately 41,000 within the greater Edmonton population of 782,000 (City of Edmonton, 2015a).