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Walk Score™ As a Global Estimate of Neighborhood Walkability

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Abstract

Background—Walk Score™ has recently been demonstrated as a valid and reliable tool for estimating access to nearby facilities, a critical component of the physical activity environment. It has not yet been determined whether Walk Score relates to other critical components of the physical activity environment including street connectivity, access to public transit, residential density and/or crime.

Purpose—The aim of this study is to explore the relationship between Walk Score and objective/subjective measures of the physical activity environment.

Methods—Walk Scores were calculated for residential addresses of 296 participants of two RCTs (2006–2009). Street connectivity, residential density, access to public transit provisions and crime were objectively measured (GIS) and cross-referenced with Walk Scores and participant's perceptions of the environment (e.g., perceived crime, access to physical activity facilities, perceived neighborhood walkability). Pairwise Pearson correlations were calculated in March 2010 to compare Walk Score to subjective/objective measures of neighborhood walkability.

Results—Significant positive correlations were identified between Walk Score and several objective (e.g., street connectivity, residential density and access to public transit provisions) and subjective (e.g., summed score of the physical activity environment) measures of the physical activity environment. However, positive correlations were also observed between Walk Score and crime.

Conclusions—Collectively, these findings support Walk Score as a free, easy to use and quick proxy of neighborhood density and access to nearby amenities. However, positive associations between Walk Score and reported crime highlight a limitation of Walk Score and warrant caution of its use.

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Introduction

Increasing physical activity (PA) is one of the largest public health concerns of the 21st century.1 Growing research suggests that PA may be influenced by the built (e.g., access to amenities2, residential density,3, 4 land-use diversity,4,5 street connectivity5, access to public transit) and social (e.g., safety6) environment. Further, evidence suggests PA levels are higher among residents of supportive physical activity–friendly environments.3,5

In order to further explore the impact of the environment on PA, it is necessary to equip researchers with adequate measurement tools. Current measures rely primarily on costly and time-intensive observational measures 7, self report measures suffering from limited construct validity 8 and/or objective measures including GIS analyses which require specific expertise and can be difficult to access.

Recently, Walk Score™ (Front Seat Management, LLC, Seattle, WA)9 a publicly available website was found to be valid and reliable for estimating access to nearby walkable amenities10. Walk Score uses data provided by the Google™ AJAX Search application program interface (API),11 along with a geography-based algorithm to identify nearby and calculate a score of 'walkability'.9 The Walk Score algorithm calculates a score of walkability based on distance to 13 categories of amenities (e.g., grocery stores, coffee shops, restaurants, bars, movie theaters, schools, parks, libraries, book stores, fitness centers, drug stores, hardware stores, clothing/music stores). Each category is weighted equally and points are summed and normalized to yield a score of 0–100.

While valid and reliable for measuring access to amenities, it is unknown whether Walk Score relates to other critical components of the PA environment. Likewise, it is unknown how Walk Score relates to individual perceptions of the PA environment. Therefore, the aims of this study are to examine the relationship between Walk Score and multiple objective and subjective measures of the PA environment among a sample of 296 sedentary adults.

Methods

A convenience sample of 296 participants of one of two RCTs conducted in Rhode Island between September 2006 and July 2009 were included.12 Participant's authorized the use of their residential addresses for spatial analyses and research protocols were approved by each study's IRB (e.g., Brown University and The Miriam Hospital).

GIS data were analyzed using ESRI's ArcGIS suite version 9.3. Prior to analysis, addresses were geocoded and an address locator was created based on the 2005 Rhode Island Census TIGER/Line® (Topographically Integrated Geographic Encoding and Referencing System) data set made available on the Rhode Island GIS (RIGIS) database. All 296 addresses matched to the RIGIS TIGER/Line shapefile. Consistent with the Walk Score algorithm which awards points based on the number of amenities located within 1 straight mile9, a 1-mile buffer zone was created around each participant's address.

Street network data came from the 2005 U.S. Census Bureau TIGER/Line street file. Consistent with the Minnesota GIS Protocol,13 measures of street connectivity such as intersection density (e.g., sum of street intersections within 1 mile) street density (e.g., linear miles of street within 1 mile) and average block length (e.g., sum of street miles within 1 mile/number intersections within 1 mile) were calculated using the ArcGIS network analyst and summary functions. Residential density was calculated based on the 2000 U.S. Census Summary File 1 block data assuming homogenous population distribution per block group. The total number of residents residing within 1 mile was summed for each residential address. Public transit data were collected from the 2009 Rhode Island Public Transit Authority file. The total number of bus stops within 1 mile was calculated for each residential address. Crime data were obtained from municipal police department reports provided by the Rhode Island State Police Department14. Crime data for participants residing in Providence (*n*=69) were divided into nine previously established crime districts. Crime data from 2006 and 2007 were used for analyses to remain consistent with the timelines of the two RCTs. As areas of higher population density are likely to have a greater prevalence of crime, crimes reported per year was normalized by population and is reported as crimes per 100,000 people. Finally, Walk Scores were retrieved by entering each participant's address into Walk Score between June 2009 and March 2010.9

Data on the perceived PA environment were collected from participants at the time of their study enrollment using two previously demonstrated questionnaires 8, 15 designed to assess individual's perceived access to convenient PA facilities within a 5-minute drive (e.g., recreation centers, parks) and the individual's perceived neighborhood PA environment. The perceived neighborhood environment scale assesses presence of eight variables including positive (e.g., sidewalks, street lights, others exercising, enjoyable scenery) and negative variables (e.g., traffic, high crime, unattended dogs, hills).

Statistical Analyses

To address concerns of generalizability, participant demographics (M+SD) are presented (Table 1). Pearson correlations were calculated between Walk Scores and summed scores of objective and perceived measures of the PA environment (Table 2). Means, SDs, r-values and significance values are reported.

Results

The M±SD Walk Score of the 296 addresses was 50.9±24.9 and scores were widespread ranging from 0–94. Strong and significant correlations were observed between Walk Score and all objective measures of the PA environment assessed including intersection density (0.81; p<0.001), street density (0.74; p<0.001), average block length (−0.32; p<0.001), residential density (0.76; p<0.001) and access to public transit (0.52; p<0.001). However, positive correlations were also observed between Walk Score and the crimes reported per 100,000 people in both 2006 (0.52; p<0.001) and 2007 (0.52; p<0.001).

Correlations were not observed between Walk Score and the summed score of participant's perceived access to nearby facilities (p=0.21). However, Walk Score positively correlated with the summed score of participant's perceived PA environment (0.18; p=0.002).

Discussion

These findings indicate Walk Score significantly correlates with multiple objective measures of the PA environment including measures of street connectivity, residential density, and access to public transit. These findings support Walk Score as a quick, free, and easy to use proxy of neighborhood density and access to nearby destinations. Walk Score quickly calculates walkability scores addressing the time-sensitive limitations of previous measures of the PA environment and allowing for measurement of access to facilities on a large scale. Walk Score also allows for measurement of discrete individual addresses. While scores of next door neighbors may not differ, scores of locations on the same street often differ and reflect variations in proximity and density of nearby amenities. Finally, because Walk Score uses the Google API,[11] the geographic data are regularly updated; a feature that addresses temporal issues that plague GIS data sets.

Conversely, while Walk Score may serve as an estimate of access to facilities, it also positively correlated with reported crimes in 2 successive years illustrating its inability to serve as an absolute measure of walkability. It is therefore recommended that Walk Score be used simply as a proxy for estimating neighborhood density and access to amenities rather than a global measure of neighborhood walkability. Researchers using Walk Score in future studies are encouraged to utilize supplementary measures of the PA environment that are not addressed by Walk Score including crime, aesthetics, topography and weather.

Walk Score did not correlate with participant's perceived access to nearby PA facilities. While this finding may partly be due to the specificity of questions focused on PA facilities rather than all nearby amenities, it is also possible that a disconnect between the actual and perceived PA environment exists in this sedentary population. This is consistent with previous studies[16, 17] and provides support for environmentally tailored PA promotion programs that educate participants about personal access to available facilities. It is also conceivable that Walk Score could be used as an interventional tool due to its ability to clearly illustrate presence of and distance to available PA facilities and amenities.

Interestingly, Walk Score positively correlated with participant's perception of the PA environment. The authors remain cautious of this finding as this may be due to the high prevalence of street lights, sidewalks, and others exercising in areas of high density rather than an actual connection between Walk Score and areas perceived as more walkable.

While every effort was made to compare objective and subjective data sets of the same time frame, it is possible that changes may have occurred to the environment between the times participants completed the questionnaires (2006–2009) and when Walk Scores were calculated (June 2009–March 2010). Also, participants included for analyses were mostly women thus it is possible that gender may have influenced these findings.

To our knowledge, Walk Score has not yet been shown to predict PA behavior warranting future studies. Moreover, researchers developing environmentally tailored PA interventions should consider using Walk Score as a means to educate sedentary participants about amenities available to them and within walking distance as a means to increase transportation and leisure time PA. Further, Walk Score might also serve as a recruitment tool for identifying individuals residing in areas of high/low density and access to facilities. Researchers are encouraged to calculate Walk Scores at the time of enrollment to ensure temporal consistency. Finally, future efforts should consider using Walk Score as a surveillance tool for regularly assessing access to facilities on state and national levels to inform future health policies and urban planning designs.

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Table 1

Demographic characteristics of participants (N=296).

	M±SD
Age	45.5+10.3
BMI	28.4+4.5
Minutes of MVPA	15.5+26.3
% female	91.0
Race(%)	
White	70.0
Black	8.0
Indian	1.0
Asian	0.0
Hawaiian	1.0
Hispanic	29.0
Education	
Less than high school	11.1
Graduated high school	11.5
Some college	25.7
Graduated college	26.4
Postgraduate studies	25.3

Table 2

Correlations between Walk Score™ and objective (GIS) measures of neighborhood walkability (N=296).

Measures of walkability	M±SD	r	P
Street connectivity			
Intersection density (number)	651±369	0.81	<0.001
Street density (miles)	50.4±32.7	0.74	<0.001
Average block length (miles)	0.09±0.05	−0.32	<0.001
Population density			
Total population in 1 mile	18,681±13,569	0.76	<0.001
Access to public transit provisions			
Total number bus stops in 1 mile	93.7±121.7	0.52	<0.001
Sum reported crimes per 100,000 people			
Total number crimes in 2006	6,032±2641	0.52	<0.001
Total number crimes in 2007	5971±2513	0.52	<0.001
Perceived environment			
Sum score of physical activity facilities	8.9±4.6	0.18	0.002
Sum score of physical activity environment	3.6±1.4	0.07	0.21