Walkscore.com: A New Methodology to Explore Associations Between Neighborhood Resources, Race, and Health

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Introduction

Proximity to resources and amenities is one aspect of the built environment linking place to health. The closer people are to amenities, the higher their levels of physical exercise.[1,2] For researchers and policy-makers, there is considerable interest in developing valid and easily usable measures of built environment factors.

We use a new measure, Walk Score, to test three hypotheses linking characteristics of place to health:

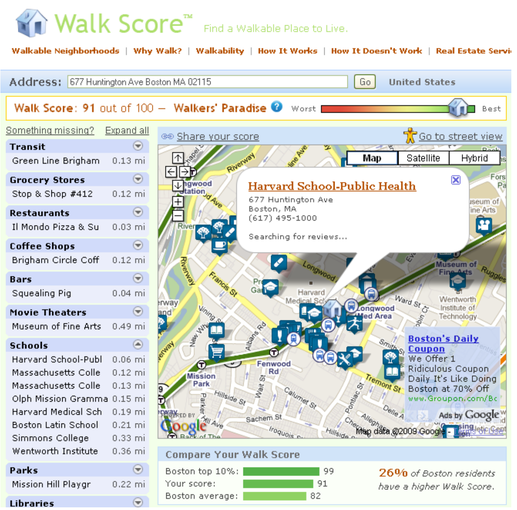
1. Areas with higher Walk Score have lower prevalence of obesity,[3] hypertension,[4] and diabetes.[5]

2. Exercise attenuates the association between Walk Score and obesity, hypertension, and diabetes, if exercise is a mediator.

3. Percentage Black and African-American residents attenuates the relationship between exercise levels and health outcomes, if Black people tend to live in low Walk Score areas, where persons exercise less, and where exercise-related disease rates are higher.

What is the Walk Score?

Walk Score measures resource proximity and density. Walkscore.com™ uses a Google search algorithm to find resources within a 1-mile radius of a user-entered address. Scores are the summed total of these resources, weighted by their distances from that address, and range 0 to 100. Resources include grocery stores, bars, movie theaters, libraries, schools, and more. Scores do not distinguish "health-friendly" resources from other types, and do not incorporate aspects like area crime or sidewalk quality.

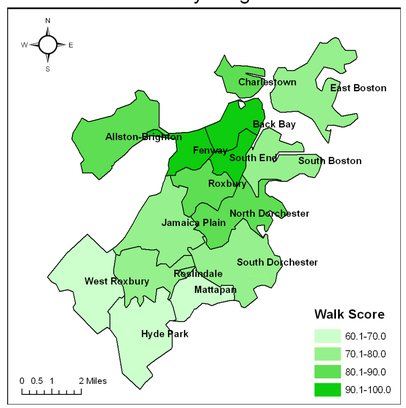


Methods

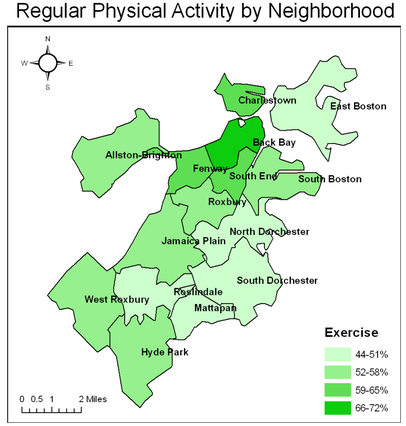
Aggregate data for neighborhood health outcomes and behavior prevalence are from the 2005 and 2006 Boston Behavioral Risk Factor Surveillance System (BBRFSS), and were retrieved from the 2009 Health of Boston Report published by the Boston Public Health Commission (BPHC). Aggregate demographic variables were retrieved from the 2000 Census. Walk Scores were retrieved from Walkscore.com in 2009.

Boundaries for 15 Boston neighborhoods were defined by BPHC using zip codes. To estimate Walk Score means, random samples of 30 street addresses were drawn from each Boston neighborhood using ArcMap. Samples were imported into Stata 10.1, merged with BBRFSS and Census data, and collapsed to the means. Linear regression with bootstrapped standard errors was used to estimate model parameters. Statistical significance of coefficients was evaluated using t-tests. All maps were made using ESRI® ArcMap 9.3.1.

Walk Score by Neighborhood



Regular Physical Activity by Neighborhood



Models

Hypothesis 1:

Health outcome = β_0 + β_1 Walk Score + ε

Hypothesis 2:

Health outcome = β_0 + β_1 Walk Score + β_2 Exercise + ε

Hypothesis 3:

Health outcome = β_0 + β_1 Walk Score + β_2 Exercise + β_3 %Black + ε

Results

Higher levels of Walk Score predict lower levels of disease. A one point increase in mean Walk Score is associated with a 0.17 percentage point decrease in obesity, a 0.15 percentage point decrease in hypertension, and a 0.06 percentage point decrease in diabetes.

After adjusting for percent residents with regular physical activity, there is no association between Walk Score and obesity or diabetes, and the association with hypertension is attenuated by 33%.

After adjusting for percent Black, there is no association between exercise and hypertension or diabetes. The association between exercise and obesity is attenuated, as well as that between Walk Score and hypertension.

Table 1. Distribution of Walk Score across outcome and predictor variables

Walk Score Category	Lowest n=3		Low n=5		High n=4		Highest n=3	
	Mean	(s.e.)	Mean	(s.e.)	Mean	(s.e.)	Mean	(s.e.)
Walk Score	64.2	(2.4)	73.6	(3.4)	81.9	(1.6)	94.2	(1.2)
Obesity	20.7	(7.5)	19.8	(5.5)	19.5	(6.9)	10.7	(6.4)
Hypertension	26.3	(3.2)	20.6	(2.9)	20.3	(5.1)	15.7	(1.5)
Diabetes	8.0	(2.6)	6.2	(2.3)	6.0	(1.8)	4.3	(1.5)
Exercise Daily	52.7	(2.5)	50.2	(5.5)	54.0	(6.4)	65.7	(6.0)
Fruits & Vegetables	27.0	(3.5)	24.0	(4.7)	25.0	(1.4)	29.3	(2.5)
Health Care Coverage	91.7	(6.7)	89.6	(6.1)	93.0	(2.6)	97.3	(0.6)
Area Poverty	10.7	(5.8)	17.1	(2.7)	23.4	(4.6)	23.9	(11.4)
Percent Black	40.1	(41.4)	18.0	(18.8)	28.7	(27.5)	11.5	(9.1)
Population Density	8.3	(4.6)	10.6	(3.0)	14.0	(2.1)	25.2	(5.0)

Table 2. Models adjusting association between Walk Score and health outcomes

	Obesity		Hypertension		Diabetes	
	Coef.	(s.e.)	Coef.	(s.e.)	Coef.	(s.e.)
Model 1						
Walk Score	-0.17**	(0.08)	-0.15***	(0.04)	-0.06**	(0.02)
Constant	31.15***	(6.19)	32.39***	(3.50)	10.76***	(2.09)
R-squared	0.14		0.24		0.17	
Model 2						
Walk Score	-0.03	(0.06)	-0.10**	(0.05)	-0.02	(0.02)
Exercise Daily	-0.58***	(0.11)	-0.19**	(0.09)	-0.15***	(0.05)
Constant	52.00***	(7.11)	39.27***	(5.35)	16.07***	(3.32)
R-squared	0.45		0.31		0.36	
Model 3						
Walk Score	0	(0.03)	-0.09**	(0.04)	-0.01	(0.01)
Exercise Daily	-0.38**	(0.15)	-0.07	(0.11)	-0.07*	(0.04)
Percent Black	0.17***	(0.05)	0.10**	(0.04)	0.07***	(0.01)
Constant	34.95***	(9.14)	28.85***	(7.49)	9.28***	(2.24)
R-squared	0.76		0.56		0.82	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusions

Higher neighborhood Walk Scores predict higher levels of exercise, and predict lower lower neighborhood levels of obesity, hypertension, and diabetes.

Through its influence on exercise, area resource density may contribute to the higher levels of obesity, hypertension and diabetes in places with greater percentages of Black and African American residents.

Researchers and policymakers may benefit the public by using Walkscore.com. Researchers can retrieve point estimates of subjects' built environments, while policy makers and health practitioners can locate and intervene in areas disadvantaged by low resource-density.

Limitations

Causal inference should not be made from this analysis alone since it is cross-sectional using aggregate data.

If places with healthier people are more prone to be indexed along with their addresses on the internet, Walk Scores will be biased, and estimates will be exaggerated.

Currently, Walkscore.com does not archive Walk Scores over time, making retrospective studies impossible. Archiving Walk Scores would be a major improvement.

The Walk Score calculation is not precise, e.g., it does not distinguish between health food stores and liquor stores, limiting the specificity of information provided by the site and the questions it can be used to answer.

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