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Walking and Proximity to the Urban Growth Boundary and Central Business District

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Abstract

Background—Planners have relied on the Urban Development Boundary (UDB)/Urban Growth Boundary (UGB) and Central Business District (CBD) to encourage contiguous urban development and conserve infrastructure. However, no studies have specifically examined the relationship between **proximity** to the UDB/UGB and CBD and walking behavior.

Purpose—To examine the relationship between UDB- and CBD-distance and walking in a sample of recent Cuban immigrants, who report little choice in where they live after arrival to the U.S.

Methods—Data were collected in 2008–2010 from 391 healthy, recent Cuban immigrants recruited and assessed within 90 days of arrival to the U.S. who resided throughout Miami-Dade County FL. Analyses in 2012–2013 examined the relationship between each UDB- and CBD-distance for each participant's residential address and purposive walking, controlling for key sociodemographics. Follow-up analyses examined whether Walk Score®, a built-environment walkability metric based on distance to amenities such as stores and parks, mediated the relationship between purposive walking and each of UDB- and CBD-distance.

Results—Each one-mile increase in distance from the UDB corresponded to an 11% increase in the number of minutes of purposive walking, whereas each one-mile increase from the CBD corresponded to a 5% decrease in the amount of purposive walking. Moreover, Walk Score® mediated the relationship between walking and each of UDB- and CBD-distance.

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Conclusions—Given the lack of walking and walkable destinations observed in proximity to the UDB/UGB boundary, a sprawl repair approach could be implemented, which strategically introduces mixed-use zoning to encourage walking throughout the boundary's zone.

Introduction

Planners have relied on the Urban Development Boundary, or Urban Growth Boundary, (UDB/UGB) to encourage contiguous urban development and conserve infrastructure.¹⁻⁶ Proximity to the UGB/UDB boundary typically indicates development that is single use, sprawling, and isolated,^{1, 6-8} the opposite of the Central Business District (CBD), which is characterized by mixed-use neighborhoods with high connectivity.⁹⁻¹¹ If it could be shown that the proximate environment of the UGB/UDB boundary demonstrates deleterious health impacts, then policy planners using the tool of the UGB/UDB to contain growth may reconsider zoning, density, and financial incentives that encourage any development that occurs at the boundary to manifest neighborhood characteristics associated with beneficial health impacts.¹²⁻¹⁴ However, no peer-reviewed studies have specifically examined the relationship between either proximity to a UDB or a CBD and residents' walking behavior.

Recent Cuban immigrants are a population who overwhelmingly reported little choice in their selection of built-environments,¹⁵ thus addressing selection bias, which occurs in many built-environment studies.¹⁵⁻¹⁸ When these immigrants arrive in the U.S., a population generally accustomed to physical activity^{19, 20} is exposed to a variety of neighborhood walkability conditions. This study investigates the relationship between UDB- and CBD-distance and recent Cuban immigrants' purposive or utilitarian walking.²¹⁻²⁶ Walk Score®, a built-environment walkability metric assessing proximity to amenities such as parks and stores,²⁷ was shown to be related to purposive walking in the current sample.¹⁵ The present study assesses whether Walk Score® mediates the relationship between UDB- or CBD-distance and purposive walking.

Methods

Study Population

Data were collected as part of the Cuban Health Study, a population-based, prospective cohort study.¹⁵ Analyses (2012-2013) utilized data from the baseline assessment (2008-2010).

Study Setting

Participants resided throughout Miami-Dade County FL, which encompasses diverse built-environments, with Walk Scores® ranging from 2-98 on a scale of 0-100.¹⁵ The UDB is a zoning mechanism delimiting the extent of urban and agricultural expansion within Miami-Dade County to protect Everglades National Park (Figure 1).¹ Growth originated along the east coast; sprawl extends to the UDB. The CBD is the cultural, financial, and commercial center of the county, which includes residences near retail and civic uses in downtown Miami (Figure 2).^{28, 29}

Measures

Distance to the UDB¹ and CBD²⁸ was calculated for participants' residential addresses using ArcGIS, version 9.3 (Esri, Redlands CA) and used as predictor variables. UDB-distances for participants who lived inside the UDB ($n=388$) were coded as positive numbers, whereas distances beyond the UDB ($n=3$) were coded as negative numbers because they are hypothesized to be detrimental.

Walk Score® is a measure of walkability, based on distance to amenities or walkable destinations.^{27, 30-32} Walk Score® awards points based on distance to the nearest destination of each type (e.g., retail, recreational) using multiple data sources (e.g., Google, OpenStreetMap). Points are summed and normalized to produce a score of 0-100.^{15, 27, 30-32} Reliability and validity are acceptable.^{15, 30, 31, 33-36} Participants' addresses were coded using walkscore.com.^{15, 27}

Purposive walking, used as the outcome variable, was assessed for the week prior to baseline using the International Physical Activity Questionnaire (IPAQ) "walking for transport" subscale, which assesses minutes of walking to get from place to place.³⁷

Covariates were age, gender, education, BMI, days in the U.S., and habitual physical activity level (walking and cycling frequency for the last year in Cuba).^{38, 39}

Statistical Analyses

Regression analyses examined separately the relationship between UDB- and CBD-distance and the amount of purposive walking ($\log_{10}$ -minutes, because of skewing), adjusting for covariates. Follow-up analyses assessed whether Walk Score® mediated the relationship between the outcome of purposive walking and each of UDB- and CBD-distance. Mediation was tested using the asymmetrical distribution of products test,⁴⁰ which multiplies the unstandardized coefficients of the two paths that determine the mediating pathway and estimates a corresponding SE. If the 95% CI for this product does not include zero, then mediation is assumed. Analyses were conducted using SPSS/PASW Statistics, version 18 (IBM, Endicott NY) and Mplus, version 7.0 (Muthén & Muthén, Los Angeles CA).

Results

Table 1 presents summary statistics for the study sample. Table 2 presents the results of the regression analyses. For each one-mile increase in distance from the UDB, there was a significant 11% increase in the number of minutes of purposive walking (0.045 $\log_{10}$ -minutes), and for each one-mile increase in distance from the CBD, there was a significant 5% decrease in the number of minutes of purposive walking (-0.023 $\log_{10}$ -minutes).

Planned post-hoc analyses included a path model which simultaneously examined the relationships among UDB-distance, Walk Score®, and purposive walking, with paths drawn from each covariate to the outcome: purposive walking (Figure 3a). Standard fit indices for structural equation modeling revealed an excellent fit of the model to the data: $X^2/df < 3$, Comparative Fit Index (CFI) > 0.90, and Root Mean Square Error of Approximation (RMSEA) < 0.08 suggested adequate model fit.^{41, 42} The direct pathway between UDB-

distance and purposive walking was no longer statistically significant when all variables were entered simultaneously into the model. The CI for the mediation test⁴⁰ did not include zero (product of unstandardized paths=0.017, 95% CI= 0.003, 0.032), suggesting that Walk Score® mediates the UDB-distance to walking relationship.

Similarly, the direct pathway between CBD-distance and purposive walking was no longer statistically significant when Walk Score® and all covariates were included simultaneously in the model. Model fit was excellent (Figure 3b). The CI for the mediation test⁴⁰ did not include zero (product of unstandardized paths= -0.017, 95% CI= -0.030, -0.005), suggesting that Walk Score® mediates the CBD-distance to walking relationship.

Discussion

For a sample of recent Cuban immigrants, living a greater distance from the Miami-Dade County UDB¹ and in closer proximity to the CBD²⁸ were associated with greater amounts of purposive walking. Given that Walk Score®²⁷ mediated the relationship of walking to both UDB- and CBD-distance, living closer to the CBD and further from the UDB may be associated with less urban sprawl and more destinations for walking.

This is the first study to find relationships between both UDB- and CBD-distance and walking behavior. It does so in a population who reported that they did not select where they lived based on built-environment characteristics,¹⁵ thus reducing the potential for selection bias.¹⁶⁻¹⁸

There are limitations: this analysis omits constructs such as pedestrian infrastructure, crime, and destination quality. However, levels of land-use mix (i.e., Walk Score®) may account in part for the relationships observed between UDB-, CBD-distance, and walking. Future studies should assess these findings' generalizability in similar and different populations. Finally, walking was assessed by a single measure (IPAQ)³⁷ and motorized vehicle access or travel were not assessed.

Conclusions

This is the first study to find that UDB- and CBD-distance are related to purposive walking and destinations for walking, measured by Walk Score®,²⁷ albeit in opposite directions. Increased distance from the UDB/UGB and reduced distance from the CBD may potentially offer health benefits associated with greater numbers of destinations to promote walking. UDB/UGB policies may therefore merit reconsideration. Given the health implications of such an environment, the UDB/UGB might benefit from a sprawl repair approach¹³ in which mixed-use zoning, connection of roadways, and development of amenities that better serve the citizenry living in the boundary's zone are strategically introduced.¹²⁻¹⁴

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Professor Joanna Lombard is a licensed architect and public speaker on New Urbanism, and the results of this study may lead to financial benefit because she has expertise in New Urbanism, which encourages walkable community designs. Professor Elizabeth Plater-Zyberk is a founding member of the Congress for the New Urbanism and one of the principals of the Duany Plater-Zyberk (DPZ) architectural firm; therefore, the results of this study may lead to financial benefit because she has expertise in New Urbanism. None of the authors have any financial interest in walkscore.com.

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Figure 1.
Distance (in miles) from the Urban Development Boundary in Miami-Dade County, Florida.

Figure 2.
Distance (in miles) from the greater Miami Central Business District in Miami-Dade County, Florida.

Figure 3.

Final path models of the interrelationships among: A) UDB-Distance, Walk Score®, and purposive walking; and B) CBD-distance, Walk Score®, and purposive walking. CBD, Central Business District; CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation; UDB, Urban Development Boundary

Table 1

Descriptive statistics for the sample

Variable	Overall sample		
	M	(SD)	Range
Demographics			
Age	37.11 52.2	(4.52)	30.00–45.00
Gender, % male	%		
Education, years	13.13	(2.52)	6.00–17.00
BMI	24.95	(2.44)	18.73–30.36
Days in U.S. at baseline assessment	40.99	(24.71)	6.00–123.00
Habitual physical activity in Cuba	3.13	(0.69)	1.00–5.00
Predictor variables			
UDB-distance, miles ^a	5.35	(3.41)	–2.35–15.73
CBD-distance, miles	9.48	(4.98)	0.12–26.51
Mediator variable			
Walk Score®	59.26	(16.43)	2.00–98.00
Outcome variables			
Amount of purposive walking in last week, minutes (in U.S.)	121.5 6	(251.2 8)	0.00– 1260.00

Negative values for UDB-distances correspond to participants whose addresses were outside the UDB boundary (i.e., beyond the extent of allowable urban expansion).¹

CBD, Central Business District; UDB, Urban Development Boundary.

^aPositive values for UDB-distances correspond to participants whose residential addresses were inside the UDB.

Table 2

Adjusted regression analyses of the relationship between (a) UDB-distance and (b) CBD-distance with the amount of purposive walking

Outcome variable: Amount of purposive walking (log ₁₀ -min), last week (in U.S.)									
(a) UDB distance and covariates in relation to purposive walking					(b) CBD distance and covariates in relation to purposive walking				
Independent variables	Unstandardized Coefficient (b)	SE	P-value	β	Independent variables	Unstandardized Coefficient (b)	SE	P-value	β
UDB distance (miles)^a	0.045	0.016	0.004 **	0.143	CBD distance (miles)	- 0.023	0.011	0.034 *	- 0.107
Age	0.015	0.012	0.206	0.064	Age	0.015	0.012	0.222	0.062
Gender ^b	-0.040	0.111	0.721	- 0.019	Gender ^b	-0.045	0.112	0.687	- 0.021
Education, years	0.037	0.022	0.085	0.088	Education (years)	0.036	0.022	0.099	0.084
BMI	-0.023	0.023	0.315	- 0.052	BMI	-0.023	0.023	0.312	- 0.053
Number of days in U.S.	0.002	0.002	0.362	0.046	Number of days in U.S.	0.002	0.002	0.355	0.047
Habitual PA in Cuba	0.220	0.078	0.005 **	0.143	Habitual PA in Cuba	0.219	0.080	0.006 **	0.139

Note: Boldface indicates statistical significance.

β, standardized path coefficient; CBD, Central Business District; b, unstandardized path coefficient; PA, physical activity; UDB, Urban Development Boundary

*
p<0.05

**
p<0.01.

^aPositive values for UDB distances correspond to participants whose residential addresses were inside the UDB. Negative values for UDB distances correspond to participants whose addresses were outside the UDB boundary (i.e., beyond the extent of allowable urban expansion).¹

^bGender coded as a dichotomous variable (1=male, 0=female).