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Regional differences in walking frequency and BMI: What role does the built environment play for Blacks and Whites?

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ABSTRACT

Studies have found that urban sprawl explains many regional differences in BMI and walking behavior. Yet, African Americans, who often live in dense, urban neighborhoods with exemplar street connectivity, suffer disproportionately from obesity. This study analyzed walking and BMI among 1124 Whites and 691 Blacks in Los Angeles County and southern Louisiana in relation to neighborhood safety, street connectivity, and walking destinations. While the built environment partly explains regional differences in walking and BMI among Whites, the magnitude of effect was modest. There were no regional differences in outcomes for African Americans; individual rather than neighborhood characteristics served as the best predictors.

1. Introduction

Because neighborhood design has been associated with physical activity, it may explain why obesity rates vary significantly by state and region over time (Mokdad et al., 1999, 2001, 2003; Galuska et al., 2006). One study found that states with the highest rates of urban sprawl also suffered the steepest increases in obesity (Vandegrift and Yoked, 2004). Many argue that urban sprawl is unhealthy because it discourages an active lifestyle which includes walking, bicycling, and other forms of exercise. Poor street connectivity and large blocks in sprawling neighborhoods increase trip distances; modern suburban development practices routinely segregate land uses, separating residents from walking destinations like stores and places to exercise like parks (Plantinga and Bernell, 2007). Studies of both metropolitan areas (Lopez, 2004; Ewing et al., 2003) and individuals (Frank et al., 2004) have identified a link between urban sprawl and obesity.

Paradoxically, African Americans, who have higher obesity rates than non-Hispanic whites, often live in urban neighborhoods that are, in terms of their density, high street connectivity, and many walking destinations, models of healthy design (Lopez and Hynes, 2006). Yet these same neighborhoods also tend to have worse access to parks (Gordon-Larsen et al., 2006; Godbey and Graefe, 1992; Wolch et al., 2005), higher concentrations of poverty (Sampson and Wilson, 1995; Wilson, 1987), and higher rates of violent crime (Shihadeh and Flynn, 1996), factors that may counteract the benefits of good design.

Even when African Americans live in affluent neighborhoods, numerous studies have shown that they benefit less than similarly placed Whites from the opportunities in those neighborhoods for maintaining healthy lifestyle behaviors such as walking (Acevedo-Garcia et al., 2008). The influence of neighborhood characteristics on individuals may be modified by race and ethnicity (Krieger, 2000; Williams, 2005).

This study looked at randomly sampled non-Hispanic whites and African Americans in Los Angeles and southern Louisiana to determine to what extent differences in neighborhood characteristics explain regional differences in walking and BMI by race.

2. Methods

Data for these analyses come from a study of neighborhoods, marketing and individual health behaviors conducted in Los Angeles County and pre-Katrina Southern Louisiana in 2004–2005. Our sampling approach was multi-staged from densely populated (>2000 residents per square mile) urban census tracts in Los Angeles county within 17 miles of Drew

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Medical Center (1328 tracts) and in Louisiana counties within a 2 h drive of New Orleans (381 tracts). Out of those census tracts, a random sample of 114 urban census tracts in Los Angeles county and 114 urban census tracts in Southeastern Louisiana were selected.

Telephone interviews were conducted with a systematic sample of adults from geographically referenced telephone-listed households. Participants were offered $15 to complete a 15–20 min interview. Procedures were approved by the RAND Institutional Review Board. Calling was halted early in New Orleans due to Hurricane Katrina, resulting in respondents from 106 tracts.

2.1. Walking and BMI measures

To measure utilitarian walking, we asked respondents on how many days a week they engaged in walking to work or to school, to a store or to do an errand, to the bus, or to a neighbor's house for a walk that took at least 10 min. Recreational walking was captured by asking the number of days per week that individuals walked outdoors for at least 10 min just for exercise or pleasure, including walking with a dog. Because we do not have information about the duration of each bout of walking, we will refer to these variables in terms of frequency (i.e. times a week). Body mass index was calculated from self-reported height and weight.

2.2. Other respondent measures

The phone survey gathered information on respondents' basic demographics. These variables included age, gender, and a re-code of race/ethnicity broken into four categories: (1) non-Hispanic whites, (2) non-Hispanic African Americans, (3) Hispanics, and (4) all other races/ethnicities. Because Hispanics and Others represented only 5% ($n = 52$) and 2% ($n = 30$) of our sample in Louisiana, we excluded them from our analyses and focused on the two ethnic groups that were substantially represented in both sites: non-Hispanic whites and African Americans. Participants also reported their annual household income and whether anyone in their household had access to a car.

2.3. Neighborhood safety

In order to gauge possible barriers to outdoor activity like walking, the telephone survey instrument gathered information on how safe respondents perceived their neighborhood to be. Original responses were categorized on a Likert 4-point scale ranging from very safe to very unsafe. For our analyses, we dichotomized this variable into safe or unsafe.

2.4. Neighborhood destinations

We defined a 1-mile radius around each respondent's home using ArcGIS 9.1 and then subsequently used this buffer to calculate the number of markets and parks. We chose 1 mile as it encompasses the national median walking trip distance [0.39 miles (s.d. 0.85)] (Hu and Reuscher, 2004). The park data came from ESRI's national park files which combine federal, state, and local park resources into one layer. Data on markets came from the InfoUSA's geocoded database listings for all retail groceries and markets.

2.5. Neighborhood design

We used the street segments available from the Census 2000 TIGER files to derive three different variables to characterize the physical structure of respondents' neighborhoods: the alpha index, median block length, and street density. Theoretically, walking is facilitated where the connectivity of the street network is well-connected—i.e. a grid rather than a network with many cul-de-sacs or dead end streets that limit walkers route-choices and/or destinations (Saelens et al., 2003). The alpha index is one measure used to characterize street connectivity. For any given system of street segments, it is the ratio of the number of intersections to the maximum possible number intersections, given by the formula:

$$(\#\text{ street segments} - \#\text{ intersections} + 1)/(2 * (\#\text{ of intersections}) - 5)$$

The values for the alpha index range from 0 to 1, with higher values representing a more connected network.

Other researchers have thought it important to describe the length of blocks in neighborhoods (Cervero and Kockelman, 1997). Shorter blocks mean more intersections and, therefore, shorter travel distances and a greater number of routes between locations. To diffuse the possible skewing effects of highways or freeways in tracts, we chose to use median block length.

Street density, or the number of street miles contained in a tract per square mile, characterizes the coverage of the network over space. For example, tract with short blocks in perfect grid formation that only covers 10% of the total area would provide a limited number of possible destinations.

2.6. Neighborhood socioeconomic status

We used the neighborhood socioeconomic status (NSES), created as part of RAND's Center for Population Health and Health Disparities. The index is comprised of six variables: (1) percent of adults older than 25 with less than a high school education; (2) percent male unemployment; (3) percent of households with income below the poverty line; (4) percent of households receiving public assistance; (5) percent of households with children that are headed only by a female; and (6) median household income. Each of the six measures' mean and standard deviation were calculated across all US tracts. For each census tract, a z-score was derived for each variable by subtracting from it the US mean and dividing that number by the US standard deviation. The unnormalized index was calculated by taking the z-score for variable (6) in Step 1 above (median household income), and subtracting from it the z-scores for each of the other five variables. Thus, for census tract j, the unnormalized index $\text{UNINDX}(j) = Z6–Z1–Z2–Z3–Z4–Z5$. Using the maximum and minimum value of UNINDX, the index measures were rescaled such that the values would fall between 0 and 100, where higher values correspond to higher NSES.

3. Analyses

In order to make the sample more representative of the sampling frame, we constructed post-stratification weights. The weights were calculated separately for Louisiana and Los Angeles and are based on the tract counts of people stratified by (1) gender, (2) age (<34, 35–44, 45–54, 55–65), (3) race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), and (4) median tract household income (<$27,000, $27–40,000, $40–55,000, >55,000). Because of the large variance in weights when we attempted to construct cross-classified weights, we