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Examining relationships between perceptions and objective assessments of neighborhood environment and sedentary time: Data from the Washington, D.C. Cardiovascular Health and Needs Assessment

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ABSTRACT

Sedentary time (ST) and neighborhood environment (NE) are predictors of cardiovascular (CV) health. However, little is known about ST's relationship with NE. We examined associations of perceived and objective NE with ST in the predominantly African American faith-based population of the Washington, D.C. CV Health and Needs Assessment. After using community-based research principles, participants reported NE perceptions, including sidewalks, recreational areas, and crime presence. Factor analysis was conducted to explore pertinent constructs; factor sums were created and combined as Total Perception Score (TPS) (higher score = more favorable perception). Objective NE was assessed using Google Maps and the Active Neighborhood Checklist (ANC). ST was self-reported. Linear regression determined relationships between TPS and ST, and ANC scores and ST, for 1) overall population, 2) lower median-income D.C. areas, and 3) higher median-income DC and Maryland areas. For the sample (N = 98.9% African-American, 78% female), lower median-income areas had significantly lower mean TPS and ANC scores than higher median-income areas ($p < 0.001$). Three factors (neighborhood violence, physical/social environment, and social cohesion) were associated with overall NE perception. Among those in lower median-income areas, there was a negative association between TPS and ST that remained after covariate adjustment; this was not observed in higher median-income areas. There was no association between ANC scores and ST. Poorer NE perception is associated with greater ST for those in lower income areas, while objective environment is not related to ST. Multi-level interventions are needed to improve NE perceptions in lower-median income areas, reduce ST, and improve CV health.

1. Introduction

Sedentary behavior, defined by sitting or lying down for long periods of time (Department of Health, n.d.), is a known independent risk factor for cardiometabolic disease (Same et al., 2016), with mounting evidence of its association with all-cause mortality (Young et al., 2016). A Finnish population-based survey on risk factors of chronic, non-communicable diseases found that total daily sitting time was a predictor of CVD (cardiovascular disease), even after adjusting for potential confounders, such as age, gender, BMI, smoking status and physical

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activity (Borodulin et al., 2015). Further research has also shown that as little as a 30-minute decrease or increased breaks in sedentary time per day can have a positive impact on body mass index (BMI) comparable to moderate to vigorous physical activity (MVPA) (Saleh et al., 2015; Healy et al., 2008).

A significant contributing factor to CVD risk is the neighborhood built environment (Malambo et al., 2016). Individuals' physical neighborhood surroundings, their perceptions of the local environment, as well as their interaction with the community's resources are all neighborhood built environment factors that strongly predict CV health (Chum and O'Campo, 2015). However, despite the growing body of evidence on the detrimental effects of sedentary time, much of the research evaluating the relationship between neighborhood environment and CVD risk factors has centered solely on physical activity. For example, it is established that an individual's built environment can influence physical activity (Malambo et al., 2016). It is also known that one's perceptions about the neighborhood environment are related to physical activity levels (Florindo et al., 2013), and may have a stronger relationship to physical activity than the objective built environment (Hanibuchi et al., 2015; Nyunt et al., 2015; Prins et al., 2009). Furthermore, lower socioeconomic areas appear to be differentially impacted with lower rates of physical activity due to decreased accessibility to physical activity resources (Estabrooks et al., 2003). Unsurprisingly, communities with higher socioeconomic disadvantage are thus associated with higher BMI and obesity rates (Powell-Wiley et al., 2013; Robert and Reither, 2004).

Unlike studies evaluating physical activity, however, studies examining the potential neighborhood environmental predictors of sedentary time, especially the psychosocial and environmental factors, remain scant and contradictory (Koohsari et al., 2015). One cross-sectional survey suggested that physical and social neighborhood conditions were associated with higher television viewing behaviors (Strong et al., 2013), while another could not reach clear conclusions about the correlates to sedentary time (Van Dyck et al., 2012). Furthermore, both of these studies restricted their analyses to perceived neighborhood environment, which precluded comparisons between perception and objective measures that might aid in identifying targets for intervention. Research incorporating socioeconomic status for examining sedentary time is even more scarce (Young et al., 2016). Therefore, it is pertinent to further characterize the relationship between neighborhood physical and social environment and sedentary time. Understanding the association between individuals' surroundings and excessive sitting behavior may elucidate potential information through which environment impacts CVD risk.

Using data from a community-based participatory research (CBPR) study, we examined the relationships between perceptions of neighborhood environment and sedentary time, as well as between the objective built environment and sedentary time among predominantly faith-based African Americans at high risk for CVD. We hypothesized that there would be a difference in strength of the two relationships, that perceptions of one's neighborhood environment would be more strongly associated with sedentary time compared to objective measurements of neighborhood environment, and that this relationship may be stronger within lower income neighborhoods.

2. Methods

2.1. The Washington, D.C. Cardiovascular Health and Needs Assessment

The Washington, D.C. CV Health and Needs Assessment (DC-CHNA) was a CBPR-designed, observational study to evaluate CV health factors, neighborhood environment characteristics, and cultural norms in a predominantly African-American faith-based population in Washington, D.C. communities at risk for significant CV disease. As a generally understudied community, low-income African Americans represent a population with the potential for significant improvement in CV risk factors. The DC-CHNA serves as a preliminary step in the development of a community-based behavioral change intervention to improve CV health in this community (Yingling et al., 2016; Thomas et al., 2016).

The project was conducted in 2014–2015 in partnership with a community advisory board, the D.C. Cardiovascular Health and Obesity Collaborative (D.C. CHOC), and has been described previously (Yingling et al., 2016). Data analyses were performed in 2016–2017. The Washington, D.C. CV Health and Needs Assessment was approved by the National Heart, Lung, and Blood Institute (NHLBI) Institutional Review Board (ClinicalTrials.gov NCT01927783). Informed consent was obtained from all study participants. Details about the design, recruitment and participation have been previously reported (Yingling et al., 2016, 2017; Thomas et al., 2016). Briefly, the study was designed using CBPR methods in collaboration with the D.C. CHOC, a community advisory board comprised of research team members, community members, and faith-based community leaders. Participants were recruited from Christian churches of various denominations in Wards 5, 7, and 8 of Washington, DC to facilitate a culturally appropriate, multicomponent study with the possibility of fostering future behavior change through the churches' influence as prominent social institutions.

2.2. Study definitions and measurements

2.2.1. Perceptions of neighborhood environment

The questions used to assess individuals' perceptions of their neighborhood were derived from the Project on Human Development in Chicago Neighborhoods (https://www.icpsr.umich.edu/icpsrweb/PHDCN/about.jsp). Participants were asked to respond to 18 questions about perceptions of their neighborhood environment, ranging from access to sidewalks and recreational areas to the seriousness of violence. The responses were standardized on a scale of 1 to 5 such that a higher score on the scale represents a more favorable perception of that specific characteristic.

Principal components factor analysis with varimax (orthogonal) rotation was used to define constructs or factors based on the 18 questions, as has been previously described (Estabrooks et al., 2003). Factor sums were then calculated by totaling numeric values of the answers for questions within each factor. A Total Perception Score (TPS) was derived by adding the factor sums. A higher TPS represents a more favorable perception of the neighborhood environment and vice versa.

2.2.2. Neighborhood environment audits

The Active Neighborhood Checklist (ANC), a validated neighborhood audit measure (Hoehner et al., 2007), was paired with Google Maps Street View to obtain objective information about participants' neighborhood environment. The measure consists of five sections (89 items) that assessed land use, residential density, street characteristics, and environmental quality.

For conducting the virtual audits, home addresses of study participants were obtained as part of the DC-CHNA. Up to 16 street segments, approximately 4 blocks in length, immediately adjacent to the participants' home addresses were assessed for the five sections on the ANC (land use, public transit stops, street characteristics, quality of the environment for a pedestrian, and places to walk and bicycle). A neighborhood street-segment map was created for each address. Each item on the ANC was scored on a scale of 0–2 points (maximum of 87 points per segment) based on its hypothesized influence on physical activity engagement. Two points indicated a positive effect on PA, while zero points were assigned to feature(s) with little to no effect on PA. The scores from all the segments were added to yield a Total ANC Score. Further details about the assessment process have been previously reported (Adu-Brimpong et al., 2017).