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Subjective neighborhood assessment and physical inactivity: An examination of neighborhood-level variance

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ABSTRACT

Research suggests a linkage between perceptions of neighborhood quality and the likelihood of engaging in leisure-time physical activity. Often in these studies, intra-neighborhood variance is viewed as something to be controlled for statistically. However, we hypothesized that intra-neighborhood variance in perceptions of neighborhood quality may be contextually relevant. We examined the relationship between intra-neighborhood variance of subjective neighborhood quality and neighborhood-level reported physical inactivity across 48 neighborhoods within a medium-sized city, Texas City, Texas using survey data from 2706 residents collected between 2004 and 2006.

Neighborhoods where the aggregated perception of neighborhood quality was poor also had a larger proportion of residents reporting being physically inactive. However, higher degrees of disagreement among residents within neighborhoods about their neighborhood quality was significantly associated with a lower proportion of residents reporting being physically inactive ($p = 0.001$). Our results suggest that intra-neighborhood variability may be contextually relevant in studies seeking to better understand the relationship between neighborhood quality and behaviors sensitive to neighborhood environments, like physical activity.

1. Introduction

Physical inactivity is a significant modifiable risk factor for developing numerous chronic illnesses, decreased quality of life, and premature mortality (Blair and Brodney, 1999; Lee et al., 2012; Physical Activity Guidelines Advisory Committee, 2008). Beyond individual behaviors, attitudes, and attributes related to physical activity, urban environmental factors are widely understood to be key determinants of physical inactivity, particularly at the neighborhood level (Molnar et al., 2004; Moudon et al., 2007). Neighborhood ecology can be measured using two different approaches: the subjective experiences of the neighborhood's residents or the objective observations of a researcher external to the neighborhood environment (Giles-Corti and Donovan, 2002; Hoehner et al., 2005; Kamphuis et al., 2010; Martinez et al., 2002; Millstein et al., 2013; Sallis et al., 2015; Weden et al., 2008; Wilhelm et al., 2009). Subjective neighborhood environmental assessments, often, are reported perceptions of neighborhood environment using one of a number of validated instruments, including the

Neighborhood Environment Walkability Scale (NEWS) and the Perceived Neighborhood Scale (PNS) (Martinez et al., 2002; Saelens et al., 2003). These measures can be contrasted with more objectively measured assessments of neighborhood environment (such as researcher, rather than resident, observations collected by using validated instruments, windshield surveys, etc.), examples of which include the Physical Activity Resource Assessment and the increasingly referenced WalkScore® (Carr et al., 2011; Lee et al., 2005).

Neighborhood-level environmental assessments, whether objective or subjective, often treat neighborhoods as defined geographic space composed of relatively homogenous groups of individuals and represented by a measure of central tendency (e.g., the mean or median of responses) (Mujahid et al., 2007; Weden et al., 2008). It is common practice to utilize aggregated (e.g., mean or median) measures of perceived neighborhood quality as an indicator of neighborhood context in neighborhood health studies (Kim et al., 2010). This approach assumes that individuals within neighborhoods are more similar to each other as compared to individuals living in other neighborhoods. Thus,

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researchers have increasingly employed multilevel or hierarchical modeling techniques to control for intra-neighborhood heterogeneity (Diez-Roux, 2000; Raudenbush and Bryk, 2002).

However, testing the accuracy of these aggregated measures is not commonplace (O'Brien, 1990). Further, the aggregated measures of centrality (e.g., mean or median) account for one dimension of aggregated perceptions of neighborhood quality, that of central tendency. This method of measuring neighborhood context assumes that two neighborhoods with the same aggregated measure are the same. In reality, this may not be the case, as it ignores the variability around the central tendency. Previous work has posited that a measure of variability rather than central tendency may be a better way to describe neighborhoods along some dimensions (Coulton et al., 1996). Such a measure would be a quantifiable method of measuring consensus within a neighborhood. The authors noted that neighborhoods may differ in the degree to which residents agree, and that this difference (i.e., the degree of within-neighborhood consensus) may be a better indicator of neighborhood context than the aggregate measure.

Consider, for example, a neighborhood where the population has been generally stable and consists of very similar individuals (e.g., a relatively homogeneous neighborhood). Consider a second neighborhood with the same aggregated measure of perceived neighborhood quality as the first neighborhood, but where the residents are more disparate in terms of income, race/ethnicity, age, and other important variables. A neighborhood actively undergoing gentrification have such a property. Accounting for the degree of variability within neighborhoods in the perceived quality, in addition to the aggregated measure of central tendency (e.g., mean) of the perceived quality would add additional context that may be important in determining health behaviors, including physical inactivity. A review of the literature demonstrated that the utility of measuring variability as well as centrality of aggregated perceived neighborhood quality, and its relationship with neighborhood levels of physical inactivity, has not been adequately explored.

We sought to explore the hypothesis that neighborhoods vary in terms of physical inactivity (a behavior that is determined in part by perceptions of neighborhood quality) both on differences in aggregated perception of neighborhood quality, as well as on the variability of these perceptions within neighborhoods. Do neighborhoods where the agreement among residents' perceptions about the quality of their environment is higher promote physical activity more than in neighborhoods where there is greater disagreement in perceived neighborhood quality? We propose that, in a given community, the degree of intra-neighborhood homogeneity is not consistent across each neighborhood, and that this difference may be worth examination. In other words, the extent to which neighbors within a given neighborhood disagree about the quality of their neighborhood may be an important correlate in relationship to physical inactivity.

We explore this phenomenon by examining the relationship between aggregated neighborhood-level agreement in self-reported subjective environmental assessments and the proportion of residents in a neighborhood who report engaging in no leisure-time physical activity at the neighborhood level. In this study, we sought to examine this dimension of neighborhood agreement on perceived neighborhood quality and its relationship to health behaviors (specifically reporting no leisure-time physical activity over the past week). Previous research demonstrates that neighborhoods where residents reported more negative subjective assessments of neighborhood quality were less likely to have residents reporting engaging in physical activity (Humpel et al., 2002; Saelens et al., 2003). We hypothesize that neighborhoods where there is more agreement in terms of perceived neighborhood quality will have less extreme proportions of residents reporting physical inactivity than in neighborhoods with less agreement (see Fig. 1), as neighborhoods with more variability include a more diverse, and likely less extreme, mix of perceptions of neighborhood quality. If confirmed, such a result could begin to explain, at least partially, findings in the

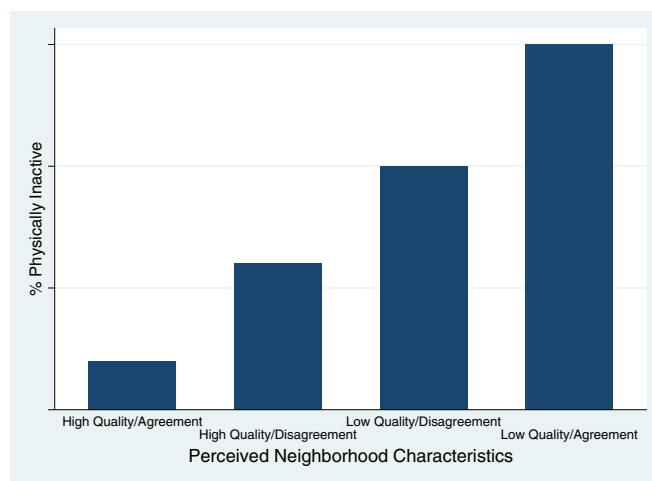


Fig. 1. Hypothesized relationship between perception of neighborhood quality, agreement, and reported physical inactivity, Texas City, Texas, 2004–2006.

literature that show a relatively weak association between perceived neighborhood quality and physical inactivity (Ding et al., 2011).

2. Methods

This study was conducted to examine this hypothesis in a medium-sized urban community with a racially and socioeconomically diverse population. Data for this study are from the Texas City Stress and Health Study (TCSHS) (Cutchin, 2007; Peek et al., 2009, 2010). This urban population-based study aimed to evaluate the sources of sociobiological stress associated with living near environmental hazards (petrochemical refineries in particular). The TCSHS collected survey data and biological samples from a random sample of adults (ages 18 and older) living in Texas City, Texas, between 2004 and 2006. Texas City is a city southeast of Houston with a population of approximately 35,000 at time of study. This data set is particularly valuable in that study participants represent diverse age groups, income and education levels, and racial and ethnic groups (including both native born and non-native born Hispanic populations). For this study, we utilized survey responses from 2706 residents of Texas City. Additional details about the TCSHS are presented elsewhere (Peek et al., 2009, 2010).

2.1. Neighborhood boundary definition

Many neighborhood-level studies utilize census-defined boundaries (e.g., census tracts, zip code tabulation areas, etc.) as proxies to delineate neighborhood boundaries. However, some researchers have demonstrated the limitations of using such boundaries (Cummins et al., 2007; Cutchin et al., 2011; Diez-Roux and Mair, 2010). Recognizing these limitations, Cutchin and colleagues defined a set of neighborhoods in Texas City using an innovative estimation method, which incorporated both social and spatial processes into determining neighborhood boundaries (Cutchin et al., 2011). This divided Texas City into the 48 neighborhoods used in this study (Fig. 2).

2.2. Dependent variable

Our dependent variable is the percentage of respondents in a given neighborhood who reported engaging in no physical activity in the last week. This variable was created using two physical activity questions from the TCSHS survey, which were adapted from physical activity questions used by the Centers for Disease Control and Prevention's (2005) Behavioral Risk Factor Surveillance Survey (BRFSS). This variable has demonstrated good validity (ICC = 0.69) and reliability (kappa = 0.40) in discriminating respondents into physical activity

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