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Neighborhood socioeconomic context and change in allostatic load among older Puerto Ricans: The Boston Puerto Rican health study

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ABSTRACT

Neighborhood context may influence health and health disparities. However, most studies have been constrained by cross-sectional designs that limit causal inference due to failing to establish temporal order of exposure and disease. We tested the impact of baseline neighborhood context (neighborhood socioeconomic status factor at the block-group level, and relative income of individuals compared to their neighbors) on allostatic load two years later. We leveraged data from the Boston Puerto Rican Health Study, a prospective cohort of aging Puerto Rican adults (aged 45–75 at baseline), with change in AL modeled between baseline and the 2nd wave of follow-up using two-level hierarchical linear regression models. Puerto Rican adults with higher income, relative to their neighbors, exhibited lower AL after two years, after adjusting for NSES, age, gender, individual-level SES, length of residence, and city. After additional control for baseline AL, this association was attenuated to marginal significance. We found no significant association of NSES with AL. Longitudinal designs are an important tool to understand how neighborhood contexts influence health and health disparities.

1. Introduction

An emerging body of literature documents an association between low neighborhood socioeconomic status (NSES) and worse health across a broad array of outcomes beyond individual socioeconomic characteristics (Alegria et al., 2014; Chaix, 2009; Kim, 2008; Mair et al., 2008; Pickett and Pearl, 2001). In the past few years, this literature has begun to document neighborhood associations with allostatic load (AL), an indicator of cumulative biological risk (Bird et al., 2010; King et al., 2011; Merkin et al., 2009; Schulz et al., 2012; Stimpson et al., 2007; Theall et al., 2012; Wallace et al., 2013). AL has been linked to higher cardiovascular disease, type 2 diabetes, arthritis (Mattei et al., 2010), higher risk of 10-year all-cause mortality (Hwang et al., 2014) and depression (Kobrosly et al., 2014). A larger body of literature has documented gradients in AL by individual-level SES, where higher SES individuals generally (although not universally) exhibit lower AL (Dowd et al., 2009). This evidence suggests that neighborhood socioeconomic conditions may "get under the skin", affecting health through wear and tear on the body associated with cumulative exposure to stressful life conditions (Bird et al., 2010).

Although neighborhood SES is the most common measure of neighborhood context tested for its health effects (Chaix et al., 2010; Leventhal and Brooks-Gunn, 2000), other dimensions are also likely to matter. For example, recent research has examined the hypothesis that the shape of the income distribution within a community is important for individual health. This relative deprivation hypothesis suggests that what really matters to health is not the absolute value of one's socioeconomic position, but one's socioeconomic standing in relation to others (Wen et al., 2003; Schneider and Schupp, 2014; Zhang et al., 2013; Allender et al., 2012).

According to Wilkinson (1999), poorer people in developed societies compare themselves unfavorably with the rest of society, and this comparison is harmful to health (Wilkinson, 1999), self-esteem and life-satisfaction (Schneider and Schupp, 2014). Moreover, Cox et al. (2007) adds that social comparison with neighbors may have similar detectable effects on health. Individuals who perceive themselves as poor may experience chronic stress as a result of the psychosocial impact of their perceived lower relative social position (Cox et al., 2007). Chronic stress may result in dysregulation in multiple biological systems (i.e. AL) (Bird et al., 2010).

Racial residential segregation is a central feature of American inequality, and it is hypothesized to influence health of minorities through multiple pathways, for example by exposing minorities to unfavorable neighborhoods with chronic stressors (e.g. neighborhoods

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with higher risk of violent victimization), by restricting socioeconomic mobility (e.g. exposure to lower quality schools), and by reduced access to environments conducive for healthy behaviors (e.g. exposure to unhealthy foods (Larson et al., 2009)). Higher exposure to these types of external contextual stressors is, in turn, linked with higher AL (Bird et al., 2010; King et al., 2011; Merkin et al., 2009; Schulz et al., 2012; Stimpson et al., 2007; Theall et al., 2012; Wallace et al., 2013). Research has documented that the impact of racial residential segregation on the Hispanic population is likely to be smaller than that for African Americans, with the exception of Puerto Ricans (Williams and Collins, 2001). Puerto Ricans in the continental United States have a more jeopardized health status than Mexican Americans and a disease burden that parallels that of African Americans (Hummer, 2000; Vega and Amaro, 1994). To our knowledge, no prior studies have tested the health effects of neighborhood context within the Puerto Rican population, which is of increasing demographic importance given the projected increase in Latino populations over the next half-century.

Despite the increasing body of literature linking neighborhood context to AL, existing studies are limited in several ways. First, most are cross sectional, which does not establish the temporal order between neighborhood exposure and the health outcome. Using multi-level methods and longitudinal data, we assess the temporal relationship of the association between neighborhood processes at baseline and AL after 2 years, controlling for possible confounders, which allows for stronger causal inferences. Second, most studies have used census tracts as a neighborhood unit, which may not align as well with individuals' perceptions of their own neighborhoods compared to smaller neighborhood units, such as block-groups (Huie et al., 2002). This latter aspect of measuring neighborhood might be more important for minority populations, in particular the Puerto Rican population, who tend to live in minority neighborhoods (Logan et al., 2013). Finally, while previous research accounts for race/ethnicity as a covariate, few studies specifically focus on neighborhood impact among minority populations in the United States. Evidence suggests that racial/ethnic minorities may experience their neighborhood differently than non-Hispanic whites, even when the surroundings are similar. For example, Mexican-born women perceive their neighborhoods as more dangerous than US-born women (Roosa et al., 2009). Thus, analyses focusing on minority populations are essential to understand the distinct impact of neighborhood on health.

Despite evidence that neighborhoods are key determinants of individual health outcomes, little evidence exists to explain specific mechanisms linking the neighborhood environment to health (Carpiano, 2006). One psychosocial explanation for the poor health of people living in disadvantaged neighborhoods states that socioeconomic inequality increases an individual's sense of being deprived of status, leading to higher levels of stress and adverse health consequences (Zhang et al., 2013; Marmot and Wilkinson, 2001; Wilkinson and Pickett, 2006). This notion leads to the prediction that surrounding wealth (relative to one's own) would be detrimental to health (Zhang et al., 2013). On the other hand, Sampson (2002) argues that neighborhood social capital, conceptualized in terms of the differential ways in which communities are socially organized, is the relevant concept underlying neighborhood effects (Sampson et al., 2002). Yet income inequality may undermine social capital via stressful social comparisons, which damages health through individual psychosocial processes and detrimental physiological mechanisms (Wen et al., 2003).

We aimed to test this psychosocial explanation of deprivation and health inequalities. Our analysis focused specifically on Puerto Ricans, one of the most deprived and segregated Hispanic populations. We hypothesized that neighborhood impact on AL is due to a combination of neighborhood level socio-economic status (NSES) and stressful social comparisons with neighbors (relative income). Our research questions include: Is there an association between relative income and AL beyond NSES? If so, does this association provide support for the psychosocial theory of deprivation and health inequalities? The present study addresses gaps in the literature by testing whether neighborhood socioeconomic status and relative income (e.g. household income compared to one's neighbors), are associated with AL in the Puerto Rican population, using a longitudinal design.

2. Data and methods

We use data from the Boston Puerto Rican Health Study (BPRHS), a prospective cohort study of Puerto Rican adults living in the greater Boston area. The focus on Puerto Ricans builds on findings from an earlier NIH funded study that included other Hispanic groups and non-Hispanic whites in the greater Boston Area, and which showed a very distinctive pattern of health based disadvantage for Puerto Ricans relative to the other groups. The BPRHS is the only longitudinal data collection that includes the Puerto Rican population in large numbers to conduct this type of analysis. The design of the BPRHS has been described elsewhere (Tucker et al., 2010). Briefly, participants were sampled from high-density Hispanic areas, defined as year 2000 census tracts with populations of at least 25 Puerto Rican adults, ages 45–75 years. Participants were recruited using door-to-door enumeration within randomly selected block-groups with 10 or more Hispanics, by random approach during community events, and through calls to the study office from flyers distributed at community locations. Inclusion criteria/eligibility included self-identified Puerto Rican ethnicity, aged 45–75 years, and being able to answer questions in English or Spanish. Individuals who were unable to answer questions due to serious health conditions or who had a low Mini Mental State Examination (MMSE) score (≤ 10) were excluded (Tucker et al., 2010). Participants completed a comprehensive set of survey questionnaires and a neuropsychological test, via in person interviewing. In addition, participants were given instructions on fasting for a blood draw. In the day following the interview, or as soon as possible thereafter, a certified phlebotomist returned to the participant's home to collect urinary and saliva samples, and to draw blood. All interviewers were thoroughly trained by experienced staff to administer the questionnaires and perform measurements following standardized procedures. The Institutional Review Boards for Human Research at Tufts Medical Center and Northeastern University approved the protocol of the study.

Baseline data were collected between 2004 and 2009 ($n=1504$), and a second wave of data was collected from 2006 to 2011 ($n=1258$). Thus, our analytical sample includes a maximum of 1258 participants; although, due to missing values in the variables under study, the sample sizes differ between the first five models and the last model. An average of 2.18 years passed between baseline and wave 2. At baseline, participants reported having been living in their house for 6.8 years, on average. This length of residence suggests that the exposure to neighborhood deprivation had been for a sufficient amount of time for expected effects (O'Campo, 2003). We geocoded the individual's baseline address to census 2000 geography using ArcGIS version 10.1. Participants' homes were located in 318 block-groups (176 census tracts) in the Boston metropolitan area. The largest cities in the greater Boston area in which the participants resided included: Boston, Lawrence, Chelsea, and Cambridge. Thus, our sample represents a mix of mainly urban, but also suburban areas.

2.1. Outcome

Allostatic load is a well-established concept and has been shown to be a relevant measure for this population (Mattei et al., 2010). The AL score was created by summing across indices of cardiovascular and metabolic dimensions of biological risk, based on work by the MacArthur Studies of Successful Aging (Seeman et al., 1997). These include 10 parameters that reflect physiologic activity across a range of