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Neighborhood features and physiological risk: An examination of allostatic load

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ABSTRACT

Poor neighborhoods may represent a situation of chronic stress, and may therefore be associated with health-related correlates of stress. We examined whether lower neighborhood income would relate to higher allostatic load, or physiological well-being, through psychological, affective, and behavioral pathways. Using data from the Biomarker Project of the Midlife in the United States (MIDUS) study and the 2000 Census, we demonstrated that people living in lower income neighborhoods have higher allostatic load net of individual income. Moreover, findings indicate that this relation is partially accounted for by anxious arousal symptoms, fast food consumption, smoking, and exercise habits.

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1. Introduction

Low socioeconomic (SES) neighborhoods are associated with higher rates of mental and physical health problems (for a review see [Diez Roux and Mair \(2010\)](#)), with recent evidence suggesting greater cumulative damage to the body's physiological regulatory systems (e.g., [Bird et al., 2010](#); [Merkin et al., 2009](#); [Schulz et al., 2013](#)). This cumulative physiological damage may result from psychological, affective, or behavioral mechanisms. For example, residents' perceptions of neighborhood safety ([Meyer et al., 2014](#)) and cohesion (neighbors are less trusting of and helpful to one another; for a review see [Murayama et al. \(2012\)](#)) are associated with poor health outcomes for their inhabitants. Moreover, low income neighborhoods are sometimes perceived as less cohesive ([Cagney et al., 2005](#)), and less cohesive neighborhoods are often perceived as less safe (e.g., [Greene et al., 2002](#)). Additionally, life in low SES neighborhoods may be chronically stressful, and chronic stress is often associated with negative mood states ([Hammen et al., 2009](#)) and greater engagement in health-compromising behaviors ([Ng and Jeffery, 2003](#)).

In the current study, we examined whether these factors may serve as psychological, affective, or behavioral pathways linking the SES of the neighborhood where an individual lives to his or her level of allostatic load. Allostatic load is a composite measure

posited to capture a person's functioning across multiple physiological systems, with greater allostatic load representing physiological damage and risk for the development of later health problems ([McEwen, 1998](#)). Based on prior research, we predicted that allostatic load would be higher in lower SES neighborhoods, even after adjusting for individual SES and other sociodemographic factors. We further hypothesized that individual perceptions of neighborhood safety and cohesion, as well as self-reported levels of perceived stress and anxious arousal, and health behaviors (exercise, fast food consumption, and smoking) would partially account for this relation.

1.1. Neighborhood SES and Health

People who reside in low SES neighborhoods report worse health than those living in more affluent neighborhoods (e.g., [Browning and Cagney, 2003](#); [Carpiano, 2008](#); [Do, 2009](#); [Giatti et al., 2010](#); [Hou and Myles, 2005](#)). Associations between neighborhood SES and self-rated health have been observed when using various neighborhood socioeconomic indicators, including income, affluence or other wealth measures, and the percentage of residents living in poverty ([Subramanian et al., 2006](#)). A number of chronic health conditions are reported more often among people living in poor, compared to wealthy, neighborhoods. Low neighborhood SES is related to higher rates of obesity ([Dragano et al., 2007](#); [Grafova et al., 2008](#); [Stimpson et al., 2007](#); [Mondon et al., 2006](#)), hypertension ([Dragano et al., 2007](#); [Johnson et al., 2011](#); [Matthews and Yang, 2010](#)), and coronary heart disease (e.g., [Diez](#)

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Roux et al., 2001). Other studies have found associations between low neighborhood SES and chronic conditions such as arthritis, cardiovascular disease, diabetes, stroke, respiratory infections, cancer, and the metabolic syndrome (Clark et al., 2013; Johnson et al., 2011; Mustard et al., 1999), as well as asthma, heart problems, arthritis, and diabetes (Matthews and Yang, 2010).

Several studies have identified physiological characteristics linked to low neighborhood SES, such as elevated cholesterol (Johnson et al., 2011; Matthews and Yang, 2010), blunted diurnal cortisol patterns (Hajat et al., 2015; Karb et al., 2012), greater inflammation (Nazmi et al., 2010), and higher triglyceride levels (Stimpson et al., 2007). These physiological states may underlie the associations between health conditions and neighborhood SES. An intervention found that people who moved from high to low poverty areas had lower glycated hemoglobin than those who remained in high poverty areas, suggesting a causal role that neighborhoods play in pathophysiological processes related to the development of diabetes (Ludwig et al., 2011).

Some researchers posit that macro-level factors such as a neighborhood's SES relate to health through the built environment and social context (Schulz and Northridge, 2004). By differentially investing or disinvesting in certain communities, there is an unequal distribution of public physical and social resources across neighborhoods varying in SES. Poorer physical and social environments are related to a greater number of stressors, fewer opportunities for social cohesion and engagement, and poorer health behaviors among those inhabitants. These factors increase the risk for poorer mental and physical health. Others (Daniel et al., 2008) have argued the importance of biological mechanisms, stating that inferences of causation require attention to physiological stress processes that explain links between neighborhoods and health. Building on these models, we examined whether neighborhood income relates to a physiological pathway to health, captured by allostatic load, as well as some of the psychological, affective, or behavioral factors that may account for this relation.

Neighborhood SES is typically derived from the SES of its residents. Therefore, researchers have questioned whether associations between neighborhood SES and health simply reflect the risk conferred by low individual SES, such as poor access to healthcare, low health literacy, greater frequency of engagement in health damaging behaviors, or other risk factors associated with lower individual SES. However, some studies have found that greater neighborhood socioeconomic deprivation is associated with poorer health even after statistically adjusting for individual education level (e.g., Lang et al., 2009). Identifying unique effects of neighborhood SES on factors that influence individual health thus requires adjusting for individual SES (e.g., income, education, or occupation; Oaks, 2004), a strategy that will be used in the present analyses.

1.2. Neighborhood SES and allostatic load

Allostatic load represents a summary score of individuals' physiological assessments that together produce an indicator of future risk for poor health and mortality (McEwen, 1998). Scores typically incorporate information on the structure and functioning of the body's key regulatory systems that are often disrupted by psychosocial stress, including the cardiovascular, sympathetic and parasympathetic nervous, neuroendocrine, immune and glucose and lipid metabolic systems (e.g., Gruenewald et al., 2012; Seeman et al., 1997). Data on an array of biomarker indicators of these systems are aggregated into a composite risk score reflecting evidence of wear and tear (e.g., low or high resting state levels or hypo- or hyper-reactivity of biomarker indicators) across these multiple systems.

Researchers hypothesize that allostatic load reflects the

cumulative wear and tear on the body's physiological regulatory systems that results from the body's chronic attempts to regulate optimal functioning under conditions of challenge or demand (McEwen, 1998; Seeman et al., 1997). In the short term, physiological arousal is adaptive as it facilitates a biological response to a stressor. Repeated or prolonged arousal, on the other hand, can be damaging to the body and place people at risk for higher rates of morbidity and mortality (McEwen, 1998).

Low SES neighborhoods have been characterized as a source of many psychosocial (crime, violence) and physical (poor quality housing, poor street connectivity) hazards (Diez Roux and Mair, 2010). Exposure to these environments may elicit allostatic processes, and with repeated or prolonged exposure, allostatic load. For instance, individuals living in neighborhoods with a higher degree of psychosocial hazards such as crime had greater odds of a history of cardiovascular events (e.g. myocardial infarction; Augustin et al., 2008). Examining allostatic load in the context of neighborhood SES has the potential for identifying individuals at the greatest risk for later health problems, and therefore early detection and intervention. Indeed, a few studies have linked higher neighborhood SES with lower allostatic load (Bird et al., 2010; Brody et al., 2014; Merkin et al., 2009; Theall et al., 2012) and similar measures of cumulative physiological risk (Schulz et al., 2013), even after adjusting for individual SES.

Neighborhood SES may relate to allostatic load through multiple pathways. Researchers have posited that low SES neighborhoods are related to health through physical and social contextual features. These features are, in turn, related to residents' exposure to stressors, ability to form social supports, and engage in various health behaviors. Allostatic load is not only posited to increase in response to repeated stressors (McEwen, 1998), but also has documented associations with health behaviors (Gruenewald et al., 2012). In general, engaging in fewer health-compromising behaviors (smoking, consuming fast food and alcohol) is associated with lower allostatic load, indicating less physiological risk for the development of chronic health conditions. Similarly, having greater contact with friends and family is related to lower allostatic load. Taken together, we aimed to examine multiple pathways linking neighborhood income to allostatic load in the present study. We hypothesized that both neighborhood- (safety appraisals and perceptions of social cohesion) and individual-level (perceived stress and health behaviors) factors would partially account for this relationship.

1.3. Psychological, affective and behavioral pathways

Low neighborhood SES may put residents at greater risk for physiological damage through psychological, social, and physical means (Cutrona et al., 2006). Some researchers suggest that psychological factors such as residents' perceptions of their neighborhoods partially explain the neighborhood SES and health relationship. For example, low SES neighborhoods are sometimes less cohesive (Cagney et al., 2005; but see Qadeer and Kumar (2006)) and sometimes less safe (Greene et al., 2002) than higher SES neighborhoods. Furthermore, perceptions of both neighborhood safety and cohesion are related to various health outcomes (e.g., Meyer et al., 2014; Murayama et al., 2012). Perceptions of neighborhood characteristics (e.g., observed and perceived crime and disorder) and personal safety, and to a lesser degree social cohesion, are also associated with physiological functioning and risk (Mair et al., 2011; Mujahid et al., 2008; Schulz et al., 2013).

Perceptions of neighborhood safety may be associated with physiological functioning in that people living in such neighborhoods maintain a heightened sense of vigilance and mistrust of their surroundings. Conversely, perceiving one's neighborhood as cohesive may have similar stress-buffering effects as those

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