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Neighborhoods and Health

DISSERTATION

Submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

In Social Ecology

by

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Charles, S.T. & **Robinette, J.W.** (2014). Emotion and emotion regulation. In P.A. Lichtenberg & B. T. Mast (Eds.), *APA handbook of clinical geropsychology*. American Psychological Association.

Robinette, J.W., Charles, S.T., Mogle, J.A., & Almeida, D. (2013). Neighborhood cohesion and daily well-being: Results from a diary study. *Social Science and Medicine*, 174-182. doi 10.1016/j.socscimed.2013.07.027

Robinette, J.W. & Charles, S.T. (2012). Negative affect and daily stressors in older adults. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 4305-4308). Dordrecht, Netherlands: Springer.

Trauner, D.A., **Williams, J.K.**, Ballantyne, A.O., Spilkin, A.M., Crowhurst, J.L., & Hesselink, J. (2010). Neurological impairment in nephropathic cystinosis: Motor coordination deficits. *Pediatric Nephrology,* 25, 2061-2066.

Ryan, H.S., **Williams, J.K.**, & Thomas, J.D. (2008). Choline supplementation attenuates learning deficits associated with neonatal alcohol exposure in the rat: Effects of varying the timing of choline administration. *Brain Research,* 1237, 91-100.

Dominguez, H.D., Schneider, R.D., Abou, E.J., **Williams, J.K.**, & Thomas, J.D. (2007). Choline supplementation during prenatal alcohol exposure attenuates ethanol's teratogenic effects in rats. *Alcoholism: Clinical & Experimental Research,* 31(6), Suppl., 104A.

Williams, J.K. & Guerra, N.G. (2007). *Epidemiology, victimization patterns by age, gender, ethnicity, socioeconomic status.* Encyclopedia of Interpersonal Violence. Thousand Oaks, CA: Sage.

Guerra, N.G. & **Williams, J.K.** (2007). *Social cognitive programs for violence*. Encyclopedia of Interpersonal Violence. Thousand Oaks, CA: Sage.

Trauner, D.A., Spilkin, A.M., **Williams, J.K.**, & Babchuck L. (2007). Specific cognitive deficits in young children with cystinosis: Evidence for an early effect of the cystinosin gene on neural function. *Journal of Pediatrics*, 151, 192-196.

ABSTRACT OF THE DISSERTATION

Neighborhoods and Health

by

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Doctor of Philosophy in Social Ecology

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Professor Susan T. Charles, Chair

Sociologists have documented associations between objective, socioeconomic characteristics of neighborhoods and residents' health. Recently, psychologists have been interested in how environmental perceptions are similarly related to health. In this dissertation, objective socioeconomic status (SES) and subjective perceptions of neighborhood safety and perceptions of cohesion among neighbors were assessed for both their relations with daily aspects of well-being, and with indicators of cumulative physiological risk for later morbidity and mortality. In Study 1, relations between these neighborhood features and daily aspects of affective and physical well-being, as well as affective and physical reactivity to daily stressors, were examined. In Study 2, allostatic load, a composite measure of an individual's physiological functioning, was assessed in relation to these neighborhood features. Lastly in Study 3, trait levels of emotionality – traits describing people's general responses to social tensions – were examined as a possible source of variability, or risk and resiliency factors, in the context of these neighborhood features. Results indicated that poor neighborhood social climates (low SES, perceptions of low safety and perceptions of low cohesion) were related to poorer affective and physiological outcomes. Moreover, higher levels of positive emotionality buffered, and higher

levels of negative emotionality exacerbated poor neighborhood social climates for physiological functioning. Although researchers have documented associations between neighborhood features and chronic health conditions, these results suggest that examining daily and physiological profiles of health in relation to neighborhood contexts may assist in identifying individuals 'at risk' for later health problems.

Introduction

One of the most extensively studied social determinants of health is socioeconomic status (SES), both at the individual (Gallo, 2009) and environmental (e.g., neighborhood; Diez Roux & Mair, 2010) levels. People living in low SES neighborhoods generally have worse health than their counterparts living in higher SES neighborhoods. A smaller but growing literature suggests that residents' appraisals, or perceptions of the quality of their neighborhoods are also related to their health (Bures, 2003). Yet, the vast majority of research examining health in the context of neighborhoods focuses on one neighborhood feature in isolation (primarily SES). This limitation precludes clarity regarding which neighborhood features contribute most, or potentially relate differentially, to various affective and physiological outcomes.

Neighborhood features are related to a wide range of well-being measures, including both affective (e.g., psychological distress; Booth, Ayers, & Marsiglia, 2012) and physiological (e.g., hypertension; Mujahid et al., 2008) outcomes. Affective and physical well-being fluctuate daily (Almeida, 2005), however, and these changes may lead to more pronounced mental and physical health problems later. Daily affective and physiological disturbances cumulate, often resulting in longer-term damage and diagnosable affective and physiological conditions (Charles, Piazza, Mogel, Sliwinski, & Almeida, 2013; Piazza, Charles, Sliwinski, Mogel, & Almeida, 2012). Very little is known regarding relations between neighborhood features and daily aspects of well-being, and neighborhood features with indicators of cumulative physiological risk for later morbidity and mortality.

Chronic exposure to undesirable circumstances, such as living in a neighborhood either perceived to be unsafe or lacking cohesion may be associated with health at many levels, from daily symptoms to more enduring measures of physical and mental health. In a series of three

studies, this dissertation examined these possible pathways and assessed whether exposure to neighborhoods with low income or those perceived either as unsafe or lacking cohesion is related to health-related outcomes.

Neighborhoods and Daily Health

A large literature corroborates relations between peoples' neighborhood environment and their chronic health conditions (Diez Roux & Mair, 2010) and mortality (Signorello, Cohen, Williams, Munro, Hargreaves, & Blot, 2014). However, neighborhood features may be associated with daily health-related outcomes as well. Daily stressful events are common (e.g., an argument with a spouse, a difficult commute to work; Almeida, 2005). These events generally elicit affective and physical reactions. After exposure to such a stressful event, positive affect decreases and negative affect increases (affective reactivity). Furthermore, stressful events often result in increased physical symptoms (Almeida, 2005) and hemodynamic arousal (physical reactions; Zanstra, Johnston, & Rasbash, 2010).

The degree of exposure to stressful events may be determined in part by neighborhood features. For example, low income neighborhoods are often described as the source of multiple stressors. Crime, vandalism, trash, and noise are more common in poorer neighborhoods than wealthier neighborhoods (Diez Rouz & Mair, 2010). In addition, trusting and helpful neighbors are less common – and resident turnover more common – in these neighborhoods, making it difficult to build lasting social resources. In this sense, neighborhood features can be associated with overall exposure to stressors.

Some evidence suggests that neighborhood social features are also associated with the magnitude of peoples' reactivity to stressors. One study found that cortisol, a physiological index representing the hypothalamus pituitary adrenal axis (HPA), increased more in response to an

acute stressor among residents of low SES neighborhoods than those residing in higher SES neighborhoods (Hackman, Betancourt, Brodsky, Hurt, & Farah, 2012). Another study found that adults in Boston who perceived their neighborhoods to be less cohesive were more reactive to daily stressors than adults living in more cohesive neighborhoods (Caspi, Bolger, & Echenrode, 1987).

These studies indicated that specific neighborhood features were associated with the degree to which some people react to stressful events. However, very few researchers have investigated relations between affective and physical reactivity with multiple objective and subjective neighborhood features. Thus, it is difficult to discern which aspects of neighborhoods have the strongest relation with health and health-related outcomes, and therefore where intervention efforts might be directed. Additionally, more research is needed to determine whether results of the aforementioned studies extend to more representative samples of adults residing in a wider range of neighborhoods.

Neighborhoods and Cumulative Physiological Functioning

Perceiving one's neighborhood as unsafe or lacking cohesion is precarious to health (Bures, 2003), and chronic exposure to these neighborhoods may wear down the body's physiological regulatory systems. As previously described, perceptions of neighborhood cohesion may reflect perceptions of neighborhood-level social support, and this support may have salutary associations with residents' physiological functioning. Conversely, perceiving one's neighborhood as unsafe may be related to chronic states of fear, or vigilance among residents. These neighborhood perceptions may therefore have important correlations with indices of cumulative physiological functioning.

Structural and functional abnormalities in stress-sensitive regions of the body occur as a result of chronic psychosocial stress (McEwen & Stellar, 1993). A measure of the extent of these abnormalities is referred to as allostatic load, a composite measure comprised of various biological indicators representing multiple physiological systems (e.g., cardiovascular, inflammatory, HPA, sympathetic and parasympathetic nervous systems, and glucose and lipid metabolism; Gruenewald et al., 2012). A few studies have demonstrated that allostatic load is elevated in objectively low compared to high SES neighborhoods even after statistically adjusting for individual SES (Bird et al., 2010; Merkin et al., 2009). It is currently unknown, however, whether perceptions of the quality of one's neighborhood is similarly associated with long-term physiological damage.

Two studies have demonstrated that relations between neighborhood SES and allostatic load were partially explained by objective rates of crime and vandalism (Theall et al., 2012; Schulz, Mentz, Lachance, Johnson, Gaines, & Israel, 2012). To my knowledge, however, no studies have assessed whether perceptions of neighborhood cohesion or perceptions of neighborhood safety – both of which may be linked to, but nevertheless distinct from objective crime rates and other forms of social disorganization – explain relations between neighborhood SES and allostatic load.

Positive and Negative Emotionality: Risk and Resiliency in Neighborhoods

Researchers have posited that the presence of individual resources, including psychosocial resources, can buffer the ill effects of environmental adversity (Gallo, 2009). A long history of research indicates that personality characteristics can serve as risk and resiliency factors for health (e.g. Bolger & Schilling, 1991; Scheier & Carver, 1985). For example, people with higher levels of neuroticism, a trait associated with negative affectivity and reactivity,

generally experience more health problems (Bolger & Schilling, 1991). Individuals with high levels of optimism who maintain positive expectancies for future events often report better health (Scheier & Carver, 1985).

Positive and negative emotionality are psychosocial traits that characterize individuals based on their affective, cognitive, and behavioral responses to social tensions (Patrick, Curtin, Tellegen, 2002). Perceiving one's neighborhood as unsafe or lacking cohesion may indicate the presence of neighborhood-level social tensions. In this final study, I tested the hypothesis that these traits would either buffer (positive emotionality) or exacerbate (negative emotionality) the presence of social tensions (lack of safety, lack of cohesion) in the neighborhood for allostatic load.

The Present Studies

The present studies examined relations between three neighborhood features (income, perceptions of neighborhood cohesion, and perceptions of neighborhood safety) and several aspects of well-being. The overarching purpose of these studies was to test three questions. First, are these neighborhood features significantly associated with daily aspects of health and well-being? And second, are these neighborhood features associated with cumulative physiological functioning? Most neighborhoods and health research has focused on chronic health conditions and mortality. However, daily assessments of health cumulate and have the potential to lead to longer-term health problems. Early identification of 'at risk' individuals may assist in reducing the burden of disease in poor neighborhood social climates. Third, are there personality traits that either attenuate or exacerbate the association between health and poor neighborhood social climates?

The first study in this dissertation assessed whether residents of low income neighborhoods or neighborhoods perceived as lacking cohesion would exhibit heightened reactivity to daily stressors. The second study examined whether objective (income) and subjective (perceptions of safety and perceptions of cohesion) features of neighborhoods were associated with long-term physiological functioning. As an extension to these investigations, the third study in this dissertation examined whether certain residents are more vulnerable to neighborhoods with poor social climates (low income, unsafe, lacking cohesion) than others.

Chapter 2, titled, "Neighborhood cohesion and daily well-being: Results from a diary study", examines daily well-being. In this study, daily aspects of health (e.g., positive and negative affect and self-reported physical symptoms) and reactivity to daily stressors were assessed in the context of neighborhood SES and perceptions of neighborhood cohesion. It was hypothesized that neighborhood income and perceptions of neighborhood cohesion would be association with a) reduced exposure to daily stressors (e.g., arguments), b) increased daily well-being (negative and positive affect, and physical symptoms), and c) reduced reactivity to these daily stressors.

Chapter 3 is entitled, "Neighborhood Features and Physiological Risk: An Examination of Allostatic Load." This study examined how cumulative physiological risk, as measured by allostatic load, is related to perceptions of the neighborhood and neighborhood SES. Neighborhood perceptions were hypothesized to partially account for relations between neighborhood SES and allostatic load. Lastly, residents living in low SES neighborhoods generally report more health compromising behaviors (e.g., smoking; Chuang, Cubbin, Ahn, Winkleby, 2005). For this reason, health behaviors (smoking, exercise, and fast food

consumption) were predicted to partially account for relations between all three neighborhood features (income, safety, cohesion) and allostatic load.

Chapter 4, titled, "Risk and Resiliency in Neighborhoods: An Examination of Allostatic Load" extended the examination of neighborhood SES and perceptions to identity potential personality traits that either exacerbate or attenuate the effects of neighborhood features on physiological risk. Traits that characterize peoples' emotional, cognitive, and behavioral responses to social stressors may explain a great deal of individual variability in their health. However, very few researchers have assessed interactions between personality characteristics of residents and social features of their neighborhoods. As an extension of Study 2, in Study 3 trait levels of positive and negative emotionality – characteristics describing peoples' responses to social tensions – were expected to interact with neighborhood's social climate for allostatic load.

Chapter 2: Neighborhood Cohesion and Daily Well-being: Results from a Diary Study

Abstract

Neighborly cohesiveness has documented benefits for health. Furthermore, high perceived neighborhood cohesion offsets the adverse health effects of neighborhood socioeconomic adversity. One potential way neighborhood cohesion influences health is through daily stress processes. The current study uses participants (n = 2022, age 30-84 years) from The Midlife in the United States II and the National Study of Daily Experiences II, collected between 2004-2006, to examine this hypothesis using a within-person, daily diary design. We predicted that people who perceive high neighborhood cohesion are exposed to fewer daily stressors, such as interpersonal arguments, lower daily physical symptoms and negative affect, and higher daily positive affect. We also hypothesized that perceptions of neighborhood cohesion buffer declines in affective and physical well-being on days when daily stressors *do* occur. Results indicate that higher perceived neighborhood cohesion predicts fewer self-reported daily stressors, higher positive affect, lower negative affect, and fewer physical health symptoms. High perceived neighborhood cohesion also buffers the effects of daily stressors on negative affect, even after adjusting for other sources of social support. Results from the present study suggest interventions focusing on neighborhood cohesion may result in improved well-being and may minimize the adverse effect of daily stressors.

Keywords: United States, positive affect, negative affect, physical symptoms, daily stressors, neighborhood cohesion, multi-level models

Introduction

People are strongly influenced by their environment. Environments marked by chronic stress are related to poorer health outcomes (for review see Diez Roux & Mair, 2010). Conversely, positive aspects of the neighborhood provide health benefits. Social cohesion, considered a group characteristic, refers to resources (e.g., trust) among members of a group (Kawachi, Subramanian, & Kim, 2008). Neighborhood cohesion is related to better self-rated health and lower depressive symptoms (for a review see Murayama, Fujiwara, & Kawachi, 2012). In addition to a direct association, neighborhood cohesion also buffers the effects of neighborhood impoverishment on health (van der Linden, Drukker, Gunther, Feron, & van Os, 2003). The current study examined how an individual's perception of neighborhood cohesion relates to mental and physical health directly as well as indirectly by buffering the effects of daily stressors. We hypothesized that perceived neighborhood cohesion would be related to fewer self-reported daily stressors and physical symptoms, and lower daily negative and higher daily positive affect. We further hypothesized that perceived neighborhood cohesion would buffer the effects of daily stressors on positive and negative affect and physical symptoms.

Neighborhood Cohesion and Health

Several large studies have found associations between neighborhood cohesion and both physical and mental health. Among US adults, individuals' perceptions of neighborhood cohesion and safety are positively associated with self-rated physical and mental health, even after adjusting for sociodemographics and perceived social support (Bures, 2003). In England, older adults living in a deprived neighborhood were individually asked to rate cohesion in their neighborhoods. Among these respondents, people were more likely to report poorer physical and emotional health *if* they perceive their neighborhoods as unsafe. However, safety concerns are

significantly lower among individuals who report higher perceptions of neighborhood cohesion (Greene, Gilbertson, & Grimsley, 2002). In Wales, individuals' greater perceived neighborhood cohesion is directly related to better mental health and buffers the effect of deprivation on health (Fone, Dunstan, Lloyd, Williams, Watkins, & Palmer, 2007). Similarly, neighborhood deprivation is associated with higher rates of mental health service use, but aggregate ratings of neighborhood cohesion as reported by the residents buffers these effects among the Dutch (van der Linden et al., 2003). Another study in the U.S. has found that high aggregate ratings of neighborhood trust is related to low mortality rates, but only after adjusting for neighborhood sociodemographics (Hutchinson, Putt, Dean, Long, Montagnet, & Armstrong, 2009).

Daily Stressors and Health

Although researchers have documented the benefits of neighborhood cohesion, the mechanism underlying this association is unclear. Neighborhood cohesion may lead to better health outcomes by both reducing exposure to daily stressors and by buffering the effects of stressors on health outcomes. Daily stressors people encounter in a routine week such as a work deadline are relatively minor, yet these stressors influence our affective well-being (Almeida, 2005). Positive affect is lower, and negative affect and self-reported physical symptoms are higher, on days when people experience a stressor. Associations between daily stressors and daily positive and negative affect persist even after adjusting for potential confounding characteristics (e.g., neuroticism; Piazza, Charles, Sliwinski, Mogel, & Almeida, 2012). Moreover, the effects of minor stressors accumulate over time and have the potential to create more serious affective disturbances (e.g., anxiety, and depression; Charles, Piazza, Mogel, Sliwinski, & Almeida, 2013) and poorer physical health (Piazza et al., 2012).

Both individual and neighborhood characteristics are related to the frequency with which one experiences stressors (stressor exposure) as well as one's response to those stressors (stressor reactivity). For example, stressor exposure is higher among more educated individuals than those with a high school education, yet higher levels of education are related to less reactivity; on days when a stressor is experienced, negative affect and physical symptoms increase less among more highly educated individuals than their less educated peers (Grzywacz, Almeida, Neupert, & Ettner, 2004). Moreover, older adults report fewer daily stressors than younger adults (Neupert, Almeida, & Charles, 2007). Age shares a more complicated association with reactivity. Older adults are less affectively reactive to some stressors, such as potential arguments that are avoided (Charles, Piazza, Luong, & Almeida, 2009), but are equally reactive to others, such as unavoidable issues relevant to older age (e.g., death; Kunzmann & Gruhn, 2005). In a study assessing a broad range of daily stressors, affective reactivity increased with age (Sliwinski, Almeida, Smyth, & Stawski, 2009).

Neighborhood characteristics may also influence stressor exposure and reactivity. One study found that individuals reporting low neighborhood trust exhibited heightened affective reactivity to daily stressors (Caspi, Bolger, & Echenrode, 1987). This prior study assessed women from low income backgrounds living in Boston. The current study builds on these findings by using a large sample of men and women from across the United States, a more comprehensive assessment of positive and negative affect, and comparing across diverse neighborhoods and people who vary in education level.

Social Support and Stress

One concern with studies examining neighborhood cohesion and health is that findings reflect benefits of social support in general, not social features specific to the neighborhood. A

large literature attests to the protective effects of perceived social support from one's family and friends (for a review see Cohen & McKay, 1984). Psychologists posit that social networks function in many ways, including provision of emotional or instrumental support, companionship, and behavioral control. Although each of these functions has the potential to produce conflict (e.g., when the support provision is poorly timed), social networks often enhance our well-being through psychological, physiological, and behavioral pathways (Rook, August, & Sorkin, 2011).

Our current analyses are situated within the framework suggested by Kawachi et al. (2008), where neighborhood cohesion represents a unique aspect of social support garnered from neighborhoods. Others have similarly defined neighborhood cohesion as exchanges, perceived or received, that occur among members of a neighborhood community (Carpiano, 2006) and considered a 'true' neighborhood social feature (Subramanian, Lochner, & Kawachi, 2003), distinct from other forms of support. The present study examines this neighborhood feature's association with daily stress processes after adjusting for individuals' perceived social support from friends, family, and spouses to identify the unique effects of neighborhood cohesion.

Neighborhood Socioeconomic Status and Health

Neighborhood socioeconomic status (SES), defined as average income, unemployment, or some composite measure, has been implicated in several indices of health. Although studies yield mixed results, lower neighborhood SES is usually related to poorer health (Diez Roux & Mair, 2010) and lower neighborhood cohesion (Murayama et al., 2012). Furthermore, the health benefits of neighborhood cohesion are often enhanced in lower SES neighborhoods (van der Linden et al., 2003). The current study includes neighborhood SES, defined as the average income of a participant's census tract (CT), as a covariate so we may explore unique

contributions of neighborhood cohesion. Additionally, we will explore whether the effects of neighborhood cohesion on daily stress processes persist across the full range of CT income.

The Current Study

The current study uses diary data to explore associations between perceived neighborhood cohesion and daily stress processes. The decision to examine these stressors was based on literature suggesting stressors of an interpersonal nature are reported significantly more often than other types of stressors (Almeida, 2005). Benefits of diary data include analyses of within-person fluctuations in daily well-being and relations between stressor exposure and reactivity in a natural setting. Additionally, diary designs minimize the effects of memory biases on key outcomes because participants report the events the day they occur (Bolger, Davis, & Rafaeli, 2003). In the current study, we hypothesize that perceived neighborhood cohesion is related to both reduced exposure and reactivity to daily stressors in people's personal lives. Consistent with previous research (Bures, 2003; Murayama et al., 2012), we expect that higher perceived neighborhood cohesion will predict fewer daily stressors, lower daily levels of negative affect and physical symptoms, and higher levels of positive affect. We also predict neighborhood cohesion will buffer the effects of daily stressors on these outcomes. In sum, we hypothesize that perceptions of the neighborhood social environment will carry over into people's personal lives, reducing both exposure and reactivity to daily stressors, such as those arising from interpersonal , work, and family-related issues. Data from Midlife in the United States II Survey (MIDUS II) and National Study of Daily Experiences II (NSDE II) are used to test these questions. These data sets provide a unique opportunity to explore these associations among a sample of adults living throughout the U.S. who span fifty years of adulthood.

The present study builds on prior research in three ways. First, the sample's age range will allow for examination of perceived neighborhood cohesion – stressor relationships across most of the adult life span. Considering age differences in stressor exposure (Neupert et al., 2007) and reactivity (e.g., Charles et al., 2009), it is important to examine whether any neighborhood influences vary with age. Second, low SES neighborhoods have significantly lower collective efficacy, a construct including cohesion, than higher SES neighborhoods (Cagney, Browning, & Wen, 2005; Sampson, Raudenbush, & Earls, 1997). Moreover, neighborhood cohesion is lower in more disadvantaged neighborhoods (Murayama et al., 2012). In the present study, we will also explore whether the buffering effect of perceived neighborhood cohesion varies by neighborhood SES. Finally, current analyses include reports of general social support received from friends, family members, and spouses to determine whether our findings remain after adjusting for other aspects of social support.

Method

Sample and Procedures

The Midlife in the United States (MIDUS II) study included a telephone and questionnaire survey of a large sample of U.S. adults. A subset of MIDUS II participants (N = 2621) were successfully contacted by phone and asked to complete the National Study of Daily Experiences II (NSDE II), which consisted of short daily telephone interviews across eight days. Of those invited, 2022 (or 77.15%) agreed to participate. The majority (92%) of the sample was white. Five percent of the sample had less than a high school education, 25% had a high school education, 30% had some college education, 21% had a college degree, and 20% had more than college education. Of the 2022 NSDE II participants, 794 had participated in a first wave of data collection (in 1994). An additional 1048 were added to the second wave of data collection.

Across the 2022 participants, 578 representing 266 families were members of sibling (siblings or twin) pairs. For this reason, we adjusted for any dependency in the analyses (described in the results section). The current study only included people with complete data for questions about neighborhood cohesion in the analyses (N = 1762), ranging from 33 to 84 years-old (M 57 years, SD 12 years, 56% females). The study was completed using ethical guidelines with the approval of The Pennsylvania State University (data collection) and The University of Wisconsin's (data storing) Institutional Boards of Review.

Measures

Neighborhood cohesion. The MIDUS II survey's self-administered questionnaire included two questions about neighborhood cohesion: I could call on a neighbor for help if I needed it; People in my neighborhood trust each other. Participants in this study answered these questions in the larger MIDUS survey, prior to the NSDE II study. Responses were given using a Likert-type scale ranging from 1-4, with higher scores representing less neighborhood cohesion (Keyes, 1998). Items were reversed coded so higher mean scores reflect higher neighborhood cohesion. Cronbach's alpha for this scale was .67.

Neighborhood SES. Median household income at the census tract (CT) from the 2000 US Census was used as a proxy for neighborhood SES. Despite concern that administrative boundaries such as the CT do not always reflect individuals' representation of 'neighborhood' (Basta, Richmond, & Wiebe, 2010), researchers have found similar patterns of results when comparing CTs and smaller 'natural' neighborhoods (Ross, Tremblay, & Graham, 2004). Median household income was mean centered (M = \$48,498, SE = \$20,371). MIDUS II and NSDE II were conducted between 2004-2006, making the time points for these datasets and US Census decennial data an imperfect match, yet the closest match possible.

Stressors. The NSDE II used the Daily Inventory of Stressful Experiences (DISE), administered via telephone interviews, to assess daily stressors across eight days (Almeida, Wethington, & Kessler, 2002). All participants completed the larger MIDUS II survey before completing the dairy study. Participants reported each day whether they had experienced any of seven types of stressors: argument, avoided argument, stressor at work or school, stressor at home, discrimination, a stressor among a member of one's network (i.e., a stressful experience that a person in your social network is experiencing that is stressful to you, e.g., hearing that your daughter is going through a divorce), and any other not mentioned above. Objective raters coded the descriptions to ensure no overlapping content (e.g., an argument with a friend at work was not reported both under an argument and a work stressor), and that an actual event occurred as opposed to an emotional experience (e.g., I felt sad today). Total stressors across categories were then averaged over the eight-day diary period. This averaged score was used as the stressor exposure variable, and as a covariate in analyses of stressor reactivity to adjust for stressor exposure. A dichotomous variable was also created for each day to indicate whether any stressor (one or more) had occurred (yes/no).

Positive and negative affect. NSDE II participants reported in each of the eight telephone interviews how much time (since the last interview) they had felt the following negative (restless, nervous, worthless, so sad nothing could cheer you up, everything was an effort, lonely, afraid, hopeless, jittery, irritable, ashamed, upset, angry, frustrated) and positive emotions (in good spirits, cheerful, extremely happy, calm and peaceful, satisfied, full of life, close to others, like you belong, enthusiastic, attentive, proud, active, confident; Almeida & Kessler, 1998; Mroczek & Kolarz, 1998; Watson, Clark, & Tellegen, 1988). Responses ranged from 0 (None of the Time) to 4 (All of the Time). Items were averaged with higher values

representing higher positive or negative affect. Reliability for the negative and positive affect scales ranged from α=0.83-0.85 and α= 0.92-0.95, respectively, across each of the eight study days.

Physical symptoms. Participants were asked via the eight telephone interviews whether or not (yes, no) they had experienced any of 28 physical symptoms such as headache, nausea, fatigue or muscle weakness, cough, sore throat, chest pain, dizziness, and shortness of breath (Larsen & Kasimatis, 1991). Items were summed so that higher numbers (from 0-20 in this sample) reflect a greater number of physical symptoms.

Perceived general social support. Social support from friends, family not including the spouse, and spouse were each assessed once in the self-administered questionnaire with four nearly identical questions (Grzywacz & Marks, 1999; Schuster, Kessler, & Aseltine, 1990; Whalen & Lachman, 2000). For friend support, participants endorsed items asking, "How much do your friends really care about you? How much do they understand the way you feel about things? How much can you rely on them for help if you have a serious problem? How much can you open up to them if you need to talk about your worries?" using a response scale ranging from 1 (A lot) to 4 (Not at all). Scores were reverse coded so higher scores reflected more perceived support, and an overall mean was created across the 4 items (alpha = .88). The same questions were asked for family support (alpha = .85) and spouse support (alpha = .91), with these relational terms substituted for friends.

Analytic Strategy

Multiple linear regressions were used to examine whether neighborhood cohesion predicted stressor exposure using proc reg in SAS 9.3. Variance inflation factors (VIF) were examined to ensure that multicollinearity was not confounding the results (VIF ranged from 1.05

to 1.50 for all variables in the final model). To examine whether neighborhood cohesion was related to daily well-being, we used a three-level multi-level model (MLM; proc mixed) where Level 1 represented different diary days nested within each participant (Level 2), which in turn were nested in families (Level 3). A priori hypotheses were tested using the traditional $\alpha = .05$ criterion, and the two exploratory tests used the more conservative $\alpha = .01$.

Results

Few people reported very low cohesion within their neighborhoods, with only 8.73% of participants reporting they only agree 'a little' or 'not at all' to either of the two questions. Also, 36.7% of the participants reported the highest rating (a lot) for both items. To adjust for this skewness, neighborhood cohesion was divided into roughly equal tertiles representing those who endorsed the highest rating for both items (1), those who endorsed the two highest (1 and 2) ratings for each question, and those who gave low ratings (3 or a 4) for at least one of the questions (37%, 27%, and 36%, respectively). To dummy code this variable for the multiple linear regression model predicting stressor exposure, three indicator variables were created representing low, moderate, and high neighborhood cohesion (with high cohesion used as the reference group). See Table 1 for associations between neighborhood cohesion and all other variables in the key statistical models. A chi square test indicated there was a significant gender difference in neighborhood cohesion [x^2 (2) = 12.10, $p < .002$]; men were more likely than women to report the lowest neighborhood cohesion (men = 41%, women 34%), slightly less likely to report moderate cohesion (men = 23%, women = 29%) and equally likely to report the highest neighborhood cohesion (men = 36%, women = 37%).

Participants reported between 0 to 3.25 stressors on each of the daily interview days (M = .48). Older age was associated with fewer stressors (r = -.21, $p < .0001$). Both individual

education (r = .24, p < .0001) and CT income (r = .09, p < .0001) were related to more stressors. Women reported significantly more stressors than men [t(13969) = 4.41, p < .0001]. People with higher levels of support from friends (r = -.05, p < .048), family (r = -.09, p < .001), and spouse (r = -.16, p < .0001) reported significantly fewer stressors. As a result, age, gender, CT income, and individual education level were included as covariates in all models predicting key outcomes.

Table 2.1

Correlations Among All Variables

Mean (sd)	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	-											
M = 57 years (12 years)												
2. Gender	-0.03	-										
Male (Ref)												
4. Neighborhood SES	-0.01	0.02	**0.23**	-								
M = $48,498 ($20,371)												
5. Cohesion [a]	**0.14**	**0.07**	**0.09**	**0.06**	-							
6. Friend Support	0.01	**0.21**	**0.07**	0.05	**0.42**	-						
M = 3.30 (0.65)												
7. Family Support	**0.11**	**0.11**	0.05	-0.01	**0.37**	**0.43**	-					
M = 3.56 (0.56)												
8. Spouse Support	**0.10**	**-0.14**	0.02	-0.01	**0.29**	**0.21**	**0.29**	-				
M = 3.62 (0.52)												
9. Negative Affect	**-0.16**	**0.07**	0.01	-0.02	**-0.22**	**-0.11**	**-0.21**	**-0.22**	-			

M = 0.18 (0.30)												
10. Positive Affect	**0.19**	-0.00	**-0.06**	0.02	**0.27**	**0.25****	**0.26**	**0.23**	**-0.51**	-		
M = 2.74 (0.78)												
11. Physical Symptoms	0.02	**0.14**	**-0.11**	**-0.06**	**-0.09**	**-0.07**	**-0.10**	**-0.12**	**0.47**	**-0.35**	-	
M = 1.81 (2.13)												
12. Mean Stressors	**-0.21**	**0.10**	**0.23**	**0.09**	**-0.08**	**-0.05**	**-0.09**	**-0.16**	**0.36**	**-0.27**	**0.22**	-
M = 0.48 (0.40)												

Note. Relationships with neighborhood cohesion reflect polychoric correlations. Confirmatory factor analyses were conducted using MPLUS and demonstrated that all stressor, emotion, and support-related variables represented distinct constructs. The overall CFA model and fit statistics are available upon request to the first author.

[a] 1 = Low, 2 = Moderate, 3 = High

Values in bold are significant at least at at $p < .05$

Stressor Exposure

Model 1 adjusted for age, gender, individual education, and CT income. Results of this model confirmed the hypothesis that higher neighborhood cohesion was related to significantly fewer stressors when compared to low neighborhood cohesion. There was a slight trend for higher CT income individuals to report more stressors. In addition, individuals with more education, women, and younger adults reported significantly greater stressor exposure. To assess whether dependency was influencing the results, a second model was run with only one member from each set of siblings included. The pattern of results remained the same, so only the results of the full model are reported here. See columns 1 and 2 in Table 2. The baseline model explained 11% of the variance in self-reported stressors.

We examined whether the effect of neighborhood cohesion remained after adjusting for other types of perceived social support. In Model 2, the social support measures (i.e., from friends, family, and spouse) were entered. As can be seen in columns 3 and 4 in Table 2, only spouse support was a significant predictor when all support variables were entered in one model, with individuals reporting more spousal support also reporting fewer stressors. Notably, stressors were reported significantly more often among those with low neighborhood cohesion, relative to high cohesion, when friend (β = 0.07, SE = 0.03, p = .04), family (β= 0.07, SE = 0.03, p = .02), or spouse support (β = 0.06, SE = 0.03, p = .04) were entered in the model separately. Not until all three support measures were entered into the model simultaneously did neighborhood cohesion become a non-significant predictor.

Table 2.2

Multiple Linear Regressions Predicting Stressor Exposure

	Model 1 (*N* = 1838)		Model 2 (*N* = 1331)	
Variable	*β*	*SE*	*β*	*SE*
Age	-0.18***	0.00	-0.15***	0.00
Gender [a]	0.12***	0.02	0.11***	0.02
Individual Education	0.22***	0.01	0.22***	0.01
Neighborhood SES	0.04[†]	0.01	-0.00	0.01
Low neighborhood cohesion [b]	0.08**	0.02	0.04	0.03
Moderate neighborhood cohesion [b]	0.04	0.02	0.02	0.03
Friend Support			-0.04	0.02
Family Support			-0.04	0.02
Spouse Support			-0.11**	0.02

[a] 1 = Male (reference), 2 = Female. [b] Relative to high neighborhood cohesion.
[†]$p < .05$; *$p < .01$; **$p<.001$, ***$p <.0001$

Daily Well-Being

Negative affect. As hypothesized, negative affect was significantly higher among individuals with low and moderate neighborhood cohesion compared with those with high neighborhood cohesion (column 1 of Table 3). Negative affect was also higher on stressor days relative to non-stressor days. Older age, higher education levels, and less stressor exposure were also related to less negative affect. A Pseudo *R*-square statistic (Singer and Willett, 2003) was calculated for negative affect which determined that the model explained 53% of the variance in negative affect. A fully unconditional model revealed that 45% of the variability was explained by between-person, 49% by within- person variance, and 6% by variance within families.

In Model 2, we examined whether this effect remained after adjusting for perceived social support. Results from this model suggest that low, but not moderate, levels of neighborhood cohesion (compared to high cohesion) were associated with higher levels of negative affect after adjusting for the support measures. Increased family and spouse, but not friend, support were also related to decreased negative affect. See column 2 of Table 3.

Positive affect. A fully unconditional model revealed that between-person, within-person, and within family variability explained 74%, 24%, and 2% of the variability in positive affect, respectively.

Our initial hypothesis that higher neighborhood cohesion would be associated with higher positive affect was confirmed (Table 3, Model 1); individuals reporting both low and moderate neighborhood cohesion had lower positive affect than those reporting high neighborhood cohesion (column 3). Older age was significantly associated with higher positive affect. Increased self-reported stressors were significantly related to lower positive affect, and positive affect was significantly higher on non-stressor days relative to stressor days. The Pseudo *R*-

square statistics for positive affect suggested that the model explained 26% of the variance in positive affect.

Model 2 (column 4) indicated that, after inclusion of other social support variables, positive affect was still significantly highest among those with the highest neighborhood cohesion.

Physical symptoms. In Model 1 (Table 3), individuals with the highest neighborhood cohesion reported significantly fewer symptoms than those with low and moderate neighborhood cohesion. Older age, increased stressor exposure, and female sex were all associated with significantly more physical symptoms. Higher individual education level and higher CT income were significantly associated with fewer symptoms. Significantly more symptoms were reported on stressor days relative to non-stressor days. The Pseudo *R*-square statistic indicated that the model explained 36% of the variance in physical symptoms. See column 5 of Table 3 for these results.

In model 2, high levels of neighborhood cohesion were significantly related with fewer physical symptoms, and none of the other perceived social support measures was significantly associated with physical symptoms (column 6 in Table 3).

Table 2.3

Multi-Level Models Predicting Daily Well-Being

	Negative Affect		Positive Affect		Physical Symptoms	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	Γ	*Γ*	*Γ*	*Γ*	*Γ*	*Γ*
Variable	*(SE)*	*(SE)*	*(SE)*	*(SE)*	*(SE)*	*(SE)*
Intercept	0.14	0.45	2.79	1.21	1.07	2.22
	(0.03)	(0.06)	(0.09)	(0.19)	(0.25)	(0.52)
Age	-0.00*	-0.00†	0.01***	0.01***	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Gender [a]	-0.02	-0.01	-0.03	0.01	-0.38***	-0.36**
	(0.01)	(0.01)	(0.03)	(0.04)	(0.08)	(0.10)
Individual Education	-0.01**	-0.02**	-0.00	-0.00	-0.22***	-0.23***
	(0.00)	(0.01)	(0.01)	(0.02)	(0.04)	(0.04)
Neighborhood SES	-0.01	0.00	0.02	0.01	-0.10†	-0.06
	(0.01)	(0.01)	(0.02)	(0.02)	(0.04)	(0.05)

Mean Stressors	0.14***	0.13***	-0.35***	-0.24***	1.01***	0.93***
	(0.01)	(0.02)	(0.04)	(0.04)	(0.11)	(0.13)
Any Stressor [b]	0.16***	0.17***	-0.14***	-0.14***	0.32***	0.30***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.03)	(0.03)
Low cohesion [c]	0.06***	0.04*	-0.33***	-0.17***	0.31**	0.24†
	(0.01)	(0.01)	(0.04)	(0.04)	(0.10)	(0.12)
Moderate cohesion [c]	0.04*	0.01	-0.19***	-0.15**	0.35**	0.26†
	(0.01)	(0.01)	(0.04)	(0.04)	(0.11)	(0.12)
Friend Support		0.00		0.14***		-0.06
		(0.01)		(0.03)		(0.08)
Family Support		-0.05***		0.14***		-0.16
		(0.01)		(0.03)		(0.10)
Spouse Support		-0.04**		0.12**		-0.08
		(0.01)		(0.03)		(0.09)
Model Fit -2 Log Likelihood	-660.6	-848.1	17086.3	12491.0	47850.8	35972.1
	N = 1762	*N* = 1328	*N* = 1762	*N* = 1328	*N* = 1762	*N* = 1328

Note. Level 1: study days, Level 2: participant, and Level 3: family

[a] Relative to males. [b] Relative to non-stressor day. [c] Relative to high neighborhood cohesion.
[†]$p < .05$; *$p < .01$; **$p < .001$; ***$p<.0001$

Stressor Reactivity

We had further predicted that neighborhood cohesion would buffer the effects of any stressors on both positive and negative affect and physical symptoms. To this end we included interaction terms of any stressor x cohesion in Model 3. This hypothesis was confirmed only for negative affect; those with the lowest neighborhood cohesion exhibited greater negative affect reactivity (as evidenced by a significant, positive slope) compared to moderate or high levels of neighborhood cohesion (columns 1 and 2 of Table 4). Neighborhood cohesion did not buffer the effects of any stressors on positive affect (Γ = -.02, SE = .02, p = .29 for low cohesion; Γ = .00, SE = .02, p = .83 for moderate cohesion) or physical symptoms [Γ = .10, SE = .07, p = .15 for low cohesion; Γ = -.08, SE = .08, p = .29 for moderate cohesion].

To examine whether neighborhood cohesion is a unique aspect of social support that buffers the effects of stressors on negative affect, we adjusted for the other perceived social support measures (Model 4). Neighborhood cohesion remained significantly associated with affect reactivity (columns 3 and 4 in Table 4). See Figure 1 for an illustration of this interaction effect.

Table 2.4

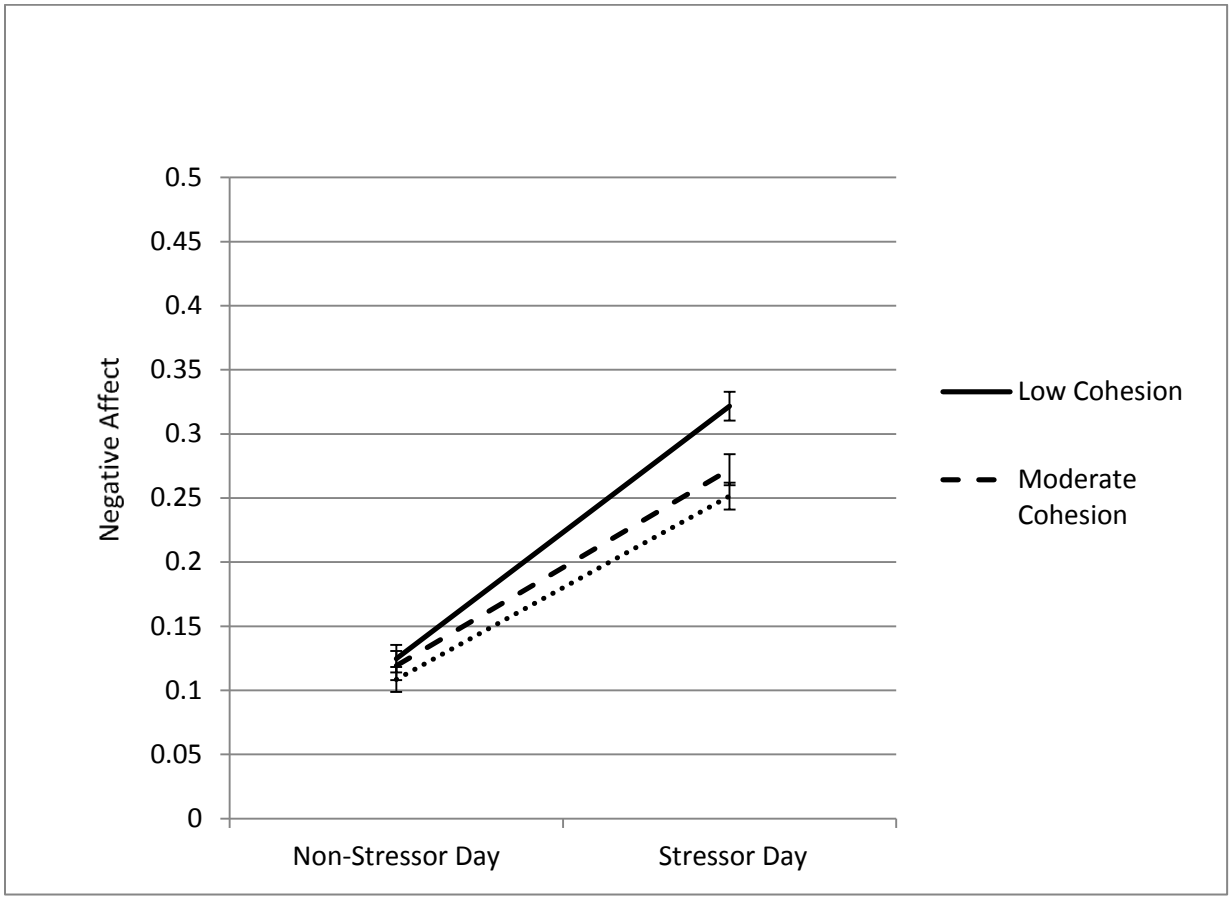
Multi-Level Models Predicting Negative Affect Stressor Reactivity

	Model 3		Model 4		Model 5	
Variable	*Γ*	*(SE)*	*Γ*	*(SE)*	*Γ*	*(SE)*
Intercept	0.45	0.06	0.37	0.07	0.33	0.08
Age	-0.00†	0.00	-0.00†	0.00	-0.00	0.00
Gender[a]	-0.01	0.01	-0.01	0.01	-0.01	0.01
Individual Education	-0.02*	0.01	-0.02	0.01	-0.02*	0.01
Neighborhood SES	0.00	0.01	0.00	0.01	0.00	0.01
Mean Stressors	0.13***	0.01	0.13***	0.02	0.12***	0.02
Any Stressor[b]	0.14***	0.01	0.32***	0.05	0.38***	0.06
Low Cohesion[c]	0.01	0.02	0.02	0.02	0.06	0.07
Moderate Cohesion[c]	0.01	0.01	0.01	0.01	-0.03	0.07
Friend Support	0.00	0.01	-0.00	0.01	-0.00	0.01
Family Support	-0.05***	0.01	-0.04**	0.01	-0.04**	0.01
Spouse Support	-0.03*	0.01	-0.02	0.01	-0.02	0.01

Stressor x Low cohesion [d]	0.07***	0.01	0.05***	0.01	0.15*	0.05
Stressor x Moderate cohesion [d]	0.02	0.01	0.01	0.01	-0.07	0.06
Stressor x Friend Support			0.01	0.01	0.01	0.01
Stressor x Family Support			-0.02*	0.01	-0.02†	0.01
Stressor x Spouse Support			-0.03**	0.01	-0.03**	0.01
Stressor x Low cohesion x Age					-0.00†	0.00
Stressor x Moderate Cohesion x Age					0.00	0.00
Model Fit -2 Log Likelihood	-873.0		-871.3		-839.7	
	N = 1328		*N* = 1328		*N* = 1328	

Note. Level 1: study days, Level 2: participant, and Level 3: family
[a] Relative to males. [b] Relative to non-stressor day. [c] Relative to high neighborhood cohesion.
†$p < .05$; *$p < .01$; **$p < .001$; ***$p<.0001$

Figure 2.1. Negative affect by neighborhood cohesion and the experience of stressors.



Note: The pattern of neighborhood cohesion and stressors on negative affect did not change as a function of neighborhood SES, indicated by a null three-way interaction.

Neighborhood Cohesion in Context

Neighborhood cohesion buffered the effects of any stressor on negative affect. We explored whether this buffering effect on negative affect differed by CT income or age. Because these tests were exploratory, we used a more stringent level of significance for these two three-way interactions (i.e., $\alpha_{bpc} = .01$). The any stressor x neighborhood cohesion x CT income interaction was not significant, but the any stressor x neighborhood cohesion x age interaction was [$F(2) = 4.95$, $p = .007$]. Participants were grouped into age tertiles to further inspect this interaction. Among younger adults, those with low neighborhood cohesion were more reactive to stressors, as measured by negative affect, than were those with high neighborhood cohesion [$t(8573) = -1.99$, $p = .047$]. The middle and oldest age groups did not differ in stressor reactivity regardless of neighborhood cohesion.

Discussion

A growing body of research suggests that features of a neighborhood have health implications, with a large proportion of that literature pointing to the harmful effects of neighborhood deprivation (Diez Roux & Mair, 2010). Results from this study, however, suggest that resources within neighborhoods, namely cohesion, can have protective roles. Neighborhood cohesion predicted fewer daily stressors, lower negative affect, higher positive affect, and fewer physical symptoms over an eight-day period. Furthermore, people living in more cohesive neighborhoods exhibited less negative affect reactivity to daily stressors. Benefits of neighborhood cohesion are particularly important in light of research indicating the health-compromising effects of daily negative affect and reactivity to stressors (Charles et al., in press; Piazza et al., 2012).

Stressor Exposure

Daily stressors were reported less often among those with higher neighborhood cohesion. This association may have important health implications, given that stressors of an interpersonal nature, such as those reported in the current study, are the most frequently reported stressors among most adults (Almeida, 2005). Even when each individual measure of social support was taken into account, neighborhood cohesion predicted fewer daily stressors. However, after introducing all three support measures to the model, this relationship was no longer significant. Support from one's spouse had the strongest association with stressors, with fewer stressors reported among individuals with more spousal support. This finding is consistent with a large body of research on marriage and health (Kiecolt-Glaser & Newton, 2001).

A marginal trend pointed to higher CT income relating to a greater number of self-reported stressors. It is possible this trend can be explained by similar arguments people have used to explain the same findings for individual SES; individuals with more education generally report more stressors given the role demands of their higher paying jobs. Results of the current study replicate others (Grzywacz et al., 2004; Almeida, Neupert, Banks, & Serido, 2005), where education and stressors were positively associated.

Negative Affect: Daily Levels and Reactivity

Greater perceived neighborhood cohesion was associated with lower levels of negative affect, even after adjusting for social support and other sociodemographics. Furthermore, perceiving the neighborhood as more cohesive buffered the effect of daily stressors on negative affect. The buffering effect persisted after taking into account the protective roles of other forms of social support. This finding underscores the unique role of neighborhood cohesion within our social support systems that contributes independently to well-being.

Positive Affect and Physical Symptoms

Findings from this study also suggest important relationships between neighborhood cohesion and both positive affect and physical symptoms. Higher neighborhood cohesion was associated with more positive affect even after adjusting for other forms of perceived social support. This association is important, given the health-enhancing role of positive emotions (e.g., Pressman & Cohen, 2012). Physical symptoms were reported significantly less frequently among those with higher levels of neighborhood cohesion as well. This finding further suggests the importance of this neighborhood social feature for quality of life. Although neighborhood cohesion buffered the effects of any stressors on negative affect, the same was not true for positive affect or physical symptoms. One explanation for this finding may be that stressors result in a greater change (increase) in negative affect than either positive affect (decrease) or physical symptoms (increase). As can be seen in Table 1, there is a stronger correlation between stressors and negative affect than positive affect or physical symptoms in this sample. Other studies have yielded similar results (Almeida et al., 2002).

Census Tract Income and its Role in Neighborhood Cohesion

Prior research suggests that neighborhood cohesion is more beneficial to the health of individuals living in deprived, relative to affluent, areas (Veenstra, Luginaah, Wakefield, Birch, Eyles, & Elliot, 2005). In the current study however, neighborhood SES had no effect on the protective role of neighborhood cohesion for daily stressors. The buffering effect of neighborhood cohesion on negative affect was evident across the full sampled range of CT income.

The stress process is one hypothesized pathway linking neighborhood cohesion to health outcomes. Attempts to increase this neighborhood resource may have health benefits in areas

across a large range of SES. Some evidence indicates that interventions aimed at increasing mobilization, or the ability of members of a neighborhood to act together, may help to reduce health-compromising behaviors among youth (Cheadle et al., 2001) as well as to minimize traffic, drug-use, and crime within neighborhood areas (Donnelly & Kimble, 2006).

Age and its Role in Neighborhood Cohesion

Findings from this study also indicated an important role of age in terms of neighborhood cohesion and stressors. Although neighborhood cohesion buffered negative affect from daily stressors among younger adults, the same effect was not found among the middle-aged and oldest adults. One possible explanation for this finding can be drawn from research investigating the social networks of older adults. Social networks – both their size and quality – change over the life span (Luong, Charles, & Fingerman, 2011). Peripheral social partners are pruned from older adults' network, with increasing time spent with one's close network members (e.g., family). The simple correlations between age and our social support measures indicated that older age was related to lower ratings of perceived support from friends, which is also consistent with prior literature (Carstensen, 1992). These findings suggest that older adults may rely less on peripheral network members for support, including from neighbors, than do younger adults.

Context or Composition? Contributions of Neighborhood and Individual SES

One concern regarding studies of neighborhoods and health is that outcomes are driven not by neighborhood features (i.e., context) per se, but rather the characteristics of the people living in the neighborhood (i.e., composition; Subramanian et al., 2003). In the present analyses, individual education, chosen as a proxy for individual SES given its value in predicting later occupational status and income and its relative stability over time (Grzywacz et al., 2004), was included in all analyses. Although increased education was significantly associated with lower

negative affect and fewer physical symptoms, CT income was not. This finding suggests that, at least for daily well-being, neighborhood SES adds little to our understanding above individual effects.

Limitations. Findings from the current study contribute knowledge regarding the protective role of neighborhood cohesion for daily well-being. Future studies need to address whether this neighborhood feature reduces risk of more serious health outcomes, such as depression and anxiety. One limitation of the current study was the cross-sectional design. Examining the moderating effect of neighborhood cohesion on the stressor-affect relationship using measurement burst designs, a longitudinal design taking into account both longer- and shorter- term periods, would provide a more stringent test of neighborhood cohesion and its ability to buffer heath.

Another limitation is the reliance on subjective ratings of perceived neighborhood cohesion, and a cohesion measure that included only two items. The self-reported nature of the outcome variables raises further concern about potential response bias. However, the findings reported here - that perceived neighborhood cohesion predicts daily outcomes even after adjusting for other forms of social support – reduced concern that these self-report measures reflect an overarching report bias. In fact, the current study adjusted for several of the important individual-level factors (i.e., age, sex, and education) that have been proposed to confound self-reports of neighborhood cohesion (Subramanian et al., 2003). Nonetheless, future research should attempt to replicate the current findings using a more comprehensive and objective assessment of neighborhood cohesion and health indicators ascertained from objective indicators.

Third, few individuals in the current sample reported extremely low neighborhood cohesion. Additional research is needed to assess whether the benefits of neighborhood cohesion extend to other areas where cohesion is extremely low, and in situations where neighborhood-related stressors are common. Lastly, the sample in the current study is predominantly white. Several previous studies provide evidence to suggest that race may influence the findings presented in the current study. For example, some researchers have found that living in ethnically homogenous areas is health-enhancing for some minorities (e.g., Latino background) because of the social resources afforded to them (Bond Huie, Hummer, & Rogers, 2002). Conversely, other research demonstrates that, for African Americans, living in primarily black neighborhoods is actually worse for health outcomes (LeClere, Rogers, & Peters, 1997). Additional research will help to shed light on whether neighborhood cohesion is beneficial with ethnically diverse samples.

Conclusion. Neighborhood cohesion is good for our health (Murayama et al., 2012). The current study suggests that daily stress processes represent one potential pathway connecting perceptions of neighborhood cohesion and health outcomes. Stressors and physical symptoms are reported less frequently, negative affect is lower and positive affect is higher, and people are less reactive to stressors when they perceive higher neighborhood cohesion.

Chapter 3: Neighborhood Features and Physiological Risk: An Examination of Allostatic Load

Abstract

People living in low socioeconomic status (SES) neighborhoods have an increased risk for poor physical health and mortality. One reason for this relation may be that low SES neighborhoods are often perceived as unsafe and less cohesive, and these perceptions may create a heightened state of vigilance. In the present study, we examined allostatic load, a physiological marker of wear and tear, in the context of objective (SES) and subjective (perceptions of safety and perceptions of cohesion) neighborhood social features. Allostatic load is a composite measure representing structure and functioning across multiple physiological systems which play central roles in physical health and disease development. We tested the hypothesis that low neighborhood safety and low neighborhood cohesion would explain relations between neighborhood SES and allostatic load. We further examined whether health-compromising behaviors, such as smoking, getting inadequate exercise, and eating fast food represent health behaviors linking these neighborhood social features and allostatic load. We used data from the Biomarker Project of the second wave of the Midlife in the United States (MIDUS II) study, a national survey of men and women aged 34-84 years from across the United States and the 2000 Census. Results indicate that living in a neighborhood with lower income and lower perceived safety is associated with higher allostatic load, even after adjusting for individual income, age, and sex. Subjective safety perceptions did not explain the relation between objective neighborhood income and allostatic load. However, health behaviors partially explained relations between allostatic load and *both* neighborhood income and safety perceptions.

Keywords: United States, allostatic load, neighborhoods, socioeconomic status

Introduction

Neighborhood features have important implications for the health of the exposed residents. For example, low SES neighborhoods are associated with higher rates of mental and physical health problems (for a review, Diez Roux & Mair, 2010) as well as greater cumulative damage to the body's physiological regulatory systems (e.g., Bird et al., 2010; Merkin et al., 2009). Conversely, chronic health conditions are reported less frequently among people living in neighborhoods with greater concentrated affluence (e.g., Browning & Cagney, 2003). A parallel relationship exists when considering individual SES and health (for a review see Adler & Ostrove, 2006). With every increase along the socioeconomic scale, a person's risk for poor health decreases.

Neighborhood SES is an objective feature defined by the characteristics of its residents (for a review see Cutrona, Wallace, & Wesner, 2006). Psychologists have recently been interested in whether this objective neighborhood feature – SES – is simply a correlate of subjective neighborhood social features. In the current study, we examined peoples' perceptions of two aspects of the social climate of their neighborhoods, namely how safe and cohesive (neighbors help and trust one another) they feel in their neighborhoods. Neighborhoods perceived as less cohesive (for a review see Murayama, Fujiwara, & Kawachi, 2012) and those perceived as unsafe (Meyer, Castro-Schilo, & Aguilar-Gaxiola, 2014) are associated with poor health outcomes. Moreover, low income neighborhoods are generally perceived as less cohesive (Cagney, Browning, & Wen, 2005). Neighborhoods that are less cohesive are often, in turn, less safe (e.g., Greene, Gilbertson, & Grimsley, 2002).

In the present study, we examined whether individuals residing in low income neighborhoods or neighborhoods perceived either as lacking cohesion or as unsafe would be at

greater risk for developing physical health problems as indicated by their allostatic load. Allostatic load is a composite measure posited to capture a person's physiological functioning, with greater allostatic load representing physiological damage and risk for the development of later health problems (McEwen, 2006). We predicted that allostatic load would be higher in these poor neighborhood social climates, even after adjusting for individual SES and other sociodemographic factors. We further examined whether health behaviors, such as smoking, getting inadequate exercise, and eating fast food may partially explain these relations. Individuals living in neighborhoods perceived as unsafe or lacking cohesion may not engage in outdoor physical activities, for example.

Neighborhood SES and Health

Neighborhoods can be characterized by their structural (SES), functional (behaviors among residents), and physical features (Cutrona et al., 2006). The socioeconomic structure of neighborhoods has been the most extensively studied feature for its relation to health. People who reside in low SES neighborhoods report worse health than those living in more affluent neighborhoods (e.g., Browning & Cagney, 2003; Carpiano, 2008; Do, 2009). This pattern has emerged in countries such as the United States (e.g., Browning & Cagney, 2003; Carpiano, 2008; Do, 2009), Brazil (e.g., Giatti, Barreto, & Cesar, 2010), and Canada (Hou & Myles, 2005). Furthermore, associations between neighborhood SES and self-rated health have been observed when using myriad neighborhood socioeconomic measures, including income, affluence or other wealth measures, and the percentage of residents living in poverty (Subramanian, Kubzansky, Berkman, Fay, & Kawachi, 2006).

A number of chronic conditions are reported more often among people living in poor, compared to wealthy, neighborhoods. Researchers have found a relationship between low

neighborhood SES and higher rates of obesity (Dragano et al., 2007; Grafova, Freedman, Kumar, & Rogowski, 2008; Stimpson, Ju, Raji, & Eschbach, 2007; Mondon, van Lenthe, & Machenbach, 2006). Several studies have found higher rates of coronary heart disease in lower income neighborhoods (Diez Roux et al., 2001). Three studies to our knowledge demonstrated a relationship between low neighborhood SES and hypertension (Dragano et al., 2007; Johnson, Corley, Starr, & Deary, 2011; Matthews & Yang, 2010). Self-reported rates of arthritis, cardiovascular disease, diabetes, stroke, respiratory infections, and cancer were higher in poorer relative to more affluent neighborhoods (Johnson et al., 2011; Mustard, Derksen, Bethelot, &Wolfson, 1999). Matthews & Yang (2010) found that asthma, heart problems, diabetes, and arthritis were observed more frequently among people in poorer, compared to wealthier, neighborhoods. In one intervention study (Ludwig et al., 2011), a group of 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 the prevalence rates of diabetes.

Several studies have identified physical conditions that may underlie the associations between more severe chronic conditions and neighborhood SES. For example, two studies have found a relation between low neighborhood SES and elevated cholesterol (Johnson et al., 2011; Matthews & Yang, 2010). Similarly, researchers have found that lower neighborhood SES is related to higher levels of triglycerides (Stimpson et al., 2007). In addition, a few studies have indicated inverse relations between neighborhood SES and allostatic load (Bird et al., 2010; Brody, Lei, Chen, & Miller, 2014; Merkin et al., 2009; Theall, Drury, & Shirtcliff, 2012), a composite measure capturing structural and functional abnormalities within certain physiological systems that include the two physiological factors just described, among others.

It is possible that relations between neighborhood SES and health are partially explained by health behaviors. A plethora of studies demonstrate that residents of poorer neighborhoods engage in health-compromising behaviors, such as smoking and eating fast food more and exercising less (e.g., Chuang et al., 2005; Hanson & Chen, 2007). Of note, many of these behaviors are associated with cardiovascular health problems, many of which are disproportionality represented among individuals living in lower SES neighborhoods. Furthermore, these behaviors are associated with physiological dysfunction (McEwen, 2006).

Another potential explanation for link between neighborhood SES and health is individual SES. Neighborhood SES is typically captured as an aggregate of the SES of its residents. Therefore, researchers have questioned whether observed associations between neighborhood SES and health simply reflect the risk conferred by low individual SES, such as poor access to healthcare or low health literacy. However, some studies have found that greater neighborhood socioeconomic deprivation is associated with poorer functional health among older adults, even after statistically adjusting for individual education level (Lang, Hubbard, Andrew, Llewellyn, Melzer, & Rockwood, 2009). Similarly, lower neighborhood SES was associated with greater allostatic load even after adjusting for individual SES (Bird et al., 2010). Identifying unique effects of neighborhood SES thus requires adjusting for individual SES (e.g., income, education, or occupation; Oaks, 2004), in addition to a large sample from a range of neighborhoods that vary in SES and a reliable indicator of physical health status.

Neighborhood SES, Safety, and Cohesion

Some researchers have suggested that the reason why the socioeconomic structure of neighborhoods is linked with health stems from more proximal, functional neighborhood features. For example, low SES neighborhoods are generally less cohesive (Cagney et al., 2005)

and are sometimes less safe (Greene et al., 2002) than higher SES neighborhoods. Furthermore, perceptions of both neighborhood safety and neighborhood cohesion are related to various health outcomes (e.g., Meyer et al., 2014; Murayama et al., 2012). 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. Moreover, perceiving one's neighborhood as cohesive may have similar stress-buffering effects as observed among individuals with higher levels of perceived social support from friends and family members (Rook, August, & Sorkin, 2011).

One study demonstrated that the relation between low neighborhood SES and elevated allostatic load was partially explained by higher crime rates (Theall et al., 2012), a factor inherently related to the safety of the neighborhood. Another study similarly found that the relation between neighborhood poverty and allostatic load was partially explained by perceptions of neighborhood issues including gang activity, shootings, and theft (Schulz, Mentz, Lachance, Johnson, Gaines, & Israel, 2012). Few studies to our knowledge, however, have examined relations between allostatic load and how safe residents feel walking out alone in their neighborhoods during the day or at night.

To our knowledge, no studies have examined relations between neighborhood cohesion and physiological indicators of health. Nonetheless, several studies indicate the potential importance of this neighborhood social feature for several health-related outcomes. People living in neighborhoods perceived as less cohesive self-report worse health (Bures, 2003). A recent study also found that people living in more cohesive neighborhoods are less affectively reactive to daily hassles such as arguments (Robinette, Charles, Mogel, & Almeida, 2013). Peoples' idiosyncratic responses to stress, including the degree to which they react to stressors, are

associated with physiological wear and tear (McEwen, 2006). Whether neighborhood cohesion is associated with wear and tear, often captured by allostatic load, however, remains relatively unexplored.

Neighborhood Social Climates and Allostatic Load

Allostatic load represents a summary of individuals' physiological assessments that together produce an indicator of future risk for poor health and mortality (McEwen, 2006). 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, nervous, neuroendocrine, immune and metabolic systems (e.g., Gruenewald et al., 2012; Seeman, Singer, Rowe, Horwitz, & McEwen, 1997). Data on an array of biomarker indicators of these systems is 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.

Several lifestyle, psychosocial, and behavioral factors contribute to increased allostatic load. Smoking, lack of exercise, and eating unhealthful foods, for example, are associated with increased allostatic load (McEwen, 2006). Additionally, 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, 2006; Seeman et al., 1997). In the short term, physiological arousal is adaptive as it assists the person in preparation for a response to the 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, 2006).

Increased allostatic load has been associated with poorer health, such as reduced cognitive and physical functioning, and greater incidence of cardiovascular disease (Seeman et al., 1997). As such, people with higher allostatic load scores represent individuals at greater risk for the development of chronic health conditions. And, poor neighborhood social climates may put residents at greater risk for physiological damage through psychological, social, and physical means (Cutrona et al., 2006). Examining allostatic load in the context of neighborhood social climates has the potential for identifying individuals at the greatest risk for later health problems, and therefore early detection and intervention.

The Present Study

Few researchers have examined allostatic load, a measure of physiological health, in the context of more than one neighborhood social feature. Allostatic load is generally elevated among individuals living in low SES neighborhoods (Bird et al., 2010), and we hypothesized that perceptions of the functional features of low income neighborhoods (i.e., safety and cohesion) might partially account for this relationship. Although other researchers have demonstrated that crime rates (Theall et al., 2012) and other safety issues (theft; Schulz et al., 2012) may be associated with allostatic load, we examined associations between allostatic load and perceptions of safety (and therefore psychological fear) more directly. To our knowledge, this was the first test of an association between neighborhood cohesion and allostatic load. In testing these hypotheses, we were interested in identifying relations between allostatic load and social climates unique to the neighborhood. Lower individual SES and older age are both associated with higher allostatic load (Gruenewald et al., 2012; Seeman, Gruenewald, & Eaton, 2006). As such, we included these theoretically important individual characteristics in our models as covariates to ensure that they would not serve as confounds in our models.

As previously mentioned, different pathways may contribute to gradual, cumulative physiological damage as captured by allostatic load. Among those pathways, health-compromising behaviors have been implicated – low SES is associated with inadequate exercise, poor dietary habits, and smoking (e.g., Hanson & Chen, 2007). In the present study we examined whether these health-compromising behaviors, such as smoking, exercise habits, and fast food consumption, might partially explain links between aspects of a neighborhood's social climate and allostatic load.

Method

Sample and Procedures

The Midlife in the United States (MIDUS) longitudinal study included a telephone and self-administered questionnaire survey of a large sample of U.S. adults. The aim of this survey was to assess the behavioral, psychological, and social factors that explain age-related differences in mental and physical well-being. At the second wave of this study (MIDUS II), a subset of the original MIDUS participants (N = 1043) also completed the Biomarker Project, which consisted of an overnight stay in one of three General Clinical Research Centers (GCRC; at University of California, Los Angeles; University of Wisconsin; and Georgetown University). During the overnight stay in the GCRC, participants provided blood, urine, and saliva samples. These samples allowed for the assessment of an array of biomarker indicators of the cardiovascular, sympathetic nervous, parasympathetic nervous, hypothalamic pituitary adrenal axis, inflammatory, lipid metabolism, and glucose metabolism systems. The purpose of the Biomarker Project was to examine the physiological processes involved in health outcomes observed in this large sample of midlife adults. Some participants (n = 309) were members of sibling (siblings or twin) pairs, representing 152 families in the data set. The study was

completed using ethical guidelines with the approval of the University of California, Los Angeles, the University of Wisconsin-Madison, and Georgetown University Institutional Review Boards.

Measures

Allostatic load. A total of 24 physiological indices were assessed to calculate seven separate scales comprising the cardiovascular, sympathetic nervous, parasympathetic nervous, hypothalamic pituitary adrenal axis, inflammatory, lipid metabolism, and glucose metabolism systems (Gruenewald et al., 2012). Values on each of the 24 biomarker indicators of each separate physiological index were categorized into membership in the highest risk quartile range of the biomarker distribution. For all but two indices, the highest quartile was considered the quartile 'at risk' (higher values represent more physiological wear-and-tear). For the two exceptions, DHEA-S and HDL cholesterol, lower scores were more health-compromising, so the lowest quartiles were considered the quartile 'at risk.' The average of the dichotomous (0/1) high-risk indicators was computed for the biomarkers representing each system so that the average score essentially represented the proportion of biomarker indicators for which participant values fell into high-risk ranges (i.e., scores could range from 0 to 1, with a score of "0" indicating that no biomarker indicators fell into high-risk ranges, a score of "0.5" indicating that 50% of biomarker indicators fell into high-risk ranges, a score of "1" indicating that all biomarker indicators fell into high-risk ranges, etc.). Scores were then summed across these seven subscales to create an overall allostatic load score, which ranged from 0 (no physiological systems have any at risk indices) to 7 (all indices within all seven systems are at risk).

Neighborhood income. Neighborhood SES was operationalized as median household income at the census tract (CT) level, collected from the 2000 US Census. Although some

researchers have argued that administrative boundaries such as the CT do not always reflect people's representation of 'neighborhood' (Basta, Richmond, & Wiebe, 2010), others have demonstrated similar results using both CTs and smaller 'natural' neighborhoods (Ross, Tremblay, & Graham, 2004). An incremental census tract variable was created so that estimates in our models could be interpreted as the change in allostatic load for every $10,000 increase in census tract income. MIDUS II was conducted between 2004-2006 and the Biomarker Project was conducted between 2004-2009. The time points for these datasets and the US Census decennial data are therefore an imperfect match, yet the closest match possible.

Neighborhood safety. The self-administered questionnaire included two questions assessing safety in the participants' neighborhoods during the day and night time: I feel safe being out alone in my neighborhood during the daytime; I feel safe being out alone in my neighborhood at night (Keyes, 1998). Using a Likert-type scale, participants rated these questions with 1 = a lot, 2 = a little, 3 = some, and 4 = not at all. Items were reversed coded so that higher mean scores represented more neighborhood safety. A median split was not possible due to the strong positive skew of this variable (many people reported feeling safe in their neighborhood), but people were categorized into two groups based on safety reports. All people in the unsafe category scored a 0 (37.82%) and those in the safe category scored a 1 (62.18%).

Neighborhood cohesion. Participants were asked two questions assessing their perceptions of cohesion in their neighborhoods: I could call on a neighbor for help if I needed it; People in my neighborhood trust each other (Keyes, 1998). Using a Likert-type scale, participants rated these questions with 1 = a lot, 2 = a little, 3 = some, and 4 = not at all. Items were reversed coded so that higher mean scores represented more neighborhood cohesion.

Scores were converted to an ordinal scale, dividing people into roughly equal tertiles (low = 0, 35.93%; moderate = 1, 25.65%; and high = 2, 38.42%) to correct for positive skew.

Individual SES. Median household income reported in MIDUS II was used as our measure of individual SES. The household income variable used in the present analyses represented a composite of self-reported income from personal wages, pensions, social security, and government assistance for both the participant and his or her spouse combined. We created a variable that represented individual income in $10,000 increments so that we could report changes in allostatic load based on $10,000 increments.

Additional Covariates. Several sociodemographic variables were considered as covariates based on their association with allostatic load in prior research. An incremental age variable was created so that estimates represented the difference in allostatic load based on five-year increments. Gender was dichotomized with 1 = male and 2 = female.

Health behaviors. Three health behaviors known to influence allostatic load (McEwen, 2006) were included as potential mediators. Participants were asked about their diet with one question, 'In an average week, how often do you eat at a fast food restaurant or order food for takeout or delivery?' Response options ranged from 1 (never) to 5 (7 or more times per week). Another question asked participants whether or not (0 = no, 1 = yes) they regularly engage in light (e.g., light housekeeping, easy walking), moderate (e.g., leisurely sports, brisk walking), or vigorous (e.g., competitive sports, running) exercise for 20 minutes or more at least three times per week. Cigarette smoking was asked with the question, 'Have you ever smoked cigarettes regularly?' Responses were either no (0) or yes (1).

Statistical Analyses

We tested all of our hypotheses conducting generalized estimating equations (GEE). The use of GEEs allowed for adjustment of any sibling dependency in the data. Our first goal was to test the hypothesis that higher neighborhood income would be associated with lower allostatic load, independent of individual sociodemographics. To this aim, we adjusted for individual income, age, and sex in Model 1. Next, we conducted a GEE that additionally included tobacco and fast food consumption and exercise habits[1] (Model 2) so that we could examine whether these behaviors partially explain the association between neighborhood income and allostatic load.

In Model 3 we tested whether perceptions of neighborhood safety might partially account for relations between neighborhood income and allostatic load. As such, we returned to our base model (i.e., removed health behaviors) and entered neighborhood safety to Model 3. Health behaviors were reintroduced to Model 4 so that we could examine whether these behaviors partially explain any links between perceptions of neighborhood safety and allostatic load. In Models 5 and 6 we tested analogous hypotheses regarding perceptions of neighborhood cohesion (i.e., instead of neighborhood safety). Models 5 and 6 mimicked Models 3 and 4; first we examined whether perceptions of neighborhood cohesion partially explain associations between neighborhood income and allostatic load (Model 5), and we next examined whether health behaviors may partially explain potential relations between perceptions of neighborhood cohesion and allostatic load (Model 6).

Results

Of the 1043 Biomarker participants for whom allostatic load variables could be calculated (i.e., values were available for at least half of the biomarkers in the physiological

system), 1002 were included in the analyses. Of the 41 participants who were excluded, six were missing addresses making it impossible to link census tract-level income data. An additional 30 MIDUS II participants were missing household income information. One participant did not respond to the question assessing fast food consumption and four participants did not respond to questions regarding perceptions of safety or cohesion in their neighborhoods. The majority (93.29%) of the sample was white, ranging from 34 to 84 years old (*M* 55 years, *SD* 12 years), and 54.59% were women.

Means and standard deviations for the variables used in all analyses for the participants in the study can be found in Table 3.1. As can be seen in Table 3.1, neighborhood and individual income levels spanned wide ranges. The majority of the sample reported exercising regularly, and just below half of the participants reported that they had smoked at some point in their lives. On average, participants reported eating fast food between two and three times per week.

Table 3.1

Description of participants (N = 1002)

	M (SD)	*Range*
Allostatic Load	1.71 (1.04)	0-5.03
Household Income	$76,531.52 ($59,985.64)	$0-300,000
Age	55.22 (11.79)	34-84
Gender (% Male)	45.41	
Exercise (% Who exercise regularly) [a]	79.04	
Ever Smoked (% Who smoke) [b]	44.21	
Fast Food [c]	2.44 (0.91)	1-5
Neighborhood Income	$50,260.10 ($20,902.77)	$10,457-200,001

[a] Compared to those who don't exercise regularly
[b] Compared to those who have never smoked
[c] 1 = never, 2 = less than once a week, 3 = 1-2 times per week, 4 = 4-6 times per week, 5 = 7 or more times per week

Table 3.2 lists the physiological indices used in the calculation of allostatic load and reports the quartile cut-offs used in the present study for classifying physiological indices as ‘at risk.’ Consistent with previous studies (Gruenewald et al., 2012), a physiological index was considered to be 'at risk' if the value were at or above the 75th percentile for that index (except in the case of DHEA and HDL cholesterol for which the 'at risk' quartile was at or below the 25th percentile for that index). Clinical cut-offs, where available, are also reported. Comparison of the quartile and clinical cut-offs indicates that the values used in the present study for classifying an index as ‘at risk’ were similar to those used in clinical practice. Table 3.2 also reports the percentage of participants with one or more indices ‘at risk’ in each of the seven physiological systems.

Table 3.2

Physiological indices with 'at risk' values

	Quartile Cut-Offs (Clinical Cut-Offs)	At Least 1 Index 'At Risk' (%)
Cardiovascular		48.70
SBP	≥143.00 (≥140)	
DBP	≥82.00 (≥90)	
HR	≥77.00 (>90)	
HPA		42.91
Cortisol	≥21.00	
DHEA-S	≤51.00	
Inflammatory		63.97
CRP	≥3.18	
Fibrinogen	≥390.00	
IL-6	≥3.18	
e-Selectin	≥50.58	
ICAM-1	≥329.65	
Metabolic Glucose		44.13
Glycosylated Hemoglobin	≥6.10 (≥7)	
Fasting Glucose	≥105.00 (≥126)	
Insulin Resistance (HOMA-IR)	≥4.05	
Metabolic Lipids		64.34
HDL	≤41.37 (<40)	
LDL	≥128.00 (≥160)	
Triglycerides	≥160.00 (≥200)	

BMI	≥32.31 (≥30)	
WTH	≥0.97 (>1)	
Parasympathetic		38.37
Low Frequency Spectral Power	≤113.96	
High Frequency Spectral Power	≤54.16	
Standard Deviation of IBIs	≤23.54	
RMSSD	≤11.83	
Sympathetic		37.17
Epinephrine	≥2.54	
Norepinephrine	≥33.33	

Multivariate Analyses

To test our main hypotheses that higher neighborhood income would be associated with lower allostatic load after adjusting for individual income and other demographic characteristics, we conducted a series of multivariate GEE models (see Table 3.3 for these results). Model 1 confirmed our first hypothesis that higher neighborhood income was significantly associated with lower allostatic load even after adjusting for individual income, age, and sex.

For every $10,000 increase in neighborhood income there was a 0.05 decrease in allostatic load. When we compared allostatic load scores among participants living in low, middle, and high income neighborhoods, those living in low (M = 1.78; estimate = 0.20, p = .0036) and moderate (M = 1.76; estimate = 0.18, p = .0095) income neighborhoods had significantly higher allostatic load than those in high (M = 1.58) income neighborhoods. Higher individual income and younger age were also associated with lower allostatic load.

In Model 2 we examined whether three health behaviors, smoking, exercise, and fast food consumption, partially explains this link between neighborhood income and allostatic load. These health behaviors accounted for approximately 20% of the association between neighborhood income and allostatic load. People who exercised regularly and who reported eating less fast food had significantly lower allostatic load. Smoking was not significantly associated with allostatic load.

Our hypothesis that perceptions of neighborhood safety would partially explain the relation between neighborhood income and allostatic load was not confirmed in Model 3. Nevertheless, people who lived in neighborhoods perceived as safe (M = 1.66) had significantly lower allostatic load than people who perceived their neighborhoods as unsafe (M = 1.79) even after adjusting for neighborhood income, individual income, age, and sex. The relation between

perceptions of neighborhood safety and allostatic load persisted, but was reduced by approximately 11% in Model 4 when we added smoking, exercise, and fast food consumption to the model.

Results of Model 5 indicated that neighborhood cohesion neither significantly associated with allostatic load nor accounted for any of the relation between neighborhood income and allostatic load. All other variables in the model maintained their significant relations with allostatic load in this model.

Table 3.3

Multivariate models predicting overall allostatic load

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	0.17 (0.21)	-0.24 (0.25)	0.37 (0.22)	-0.07 (0.26)	0.13 (0.21)	-0.26 (0.25)
Individual						
Income	-0.01* (0.01)	-0.01* (0.01)	-0.01* (0.01)	-0.01* (0.01)	-0.01* (0.01)	-0.01* (0.01)
Age	0.16*** (0.01)	0.17*** (0.01)	0.15*** (0.01)	0.17*** (0.01)	0.16*** (0.01)	0.17*** (0.01)
Gender [a]	0.10 (0.06)	0.15* (0.06)	0.05 (0.07)	0.10 (0.07)	0.11 (0.06)	0.15* (0.06)
Exercise [b]		-0.23* (0.07)		-0.22* (0.08)		-0.23* (0.07)
Smoking [c]		0.07 (0.06)		0.07 (0.06)		0.07 (0.06)

Fast Food [d]		0.15*** (0.03)		0.15*** (0.03)		0.15*** (0.03)
Neighborhood						
Income	-0.05** (0.01)	-0.04** (0.01)	-0.05** (0.01)	-0.04** (0.01)	-0.05** (0.01)	-0.04** (0.01)
Safe [e]			-0.18* (0.07)	-0.16* (0.07)		
Low Cohesion [f]					0.06 (0.07)	0.03 (0.07)
Moderate Cohesion [f]					-0.04 (0.07)	-0.06 (0.07)

Note. Values shown in the table are regression estimates (SE)
[a] Males = 1, Females = 2
[b] Compared to those who don't exercise regularly
[c] Compared to those who have never smoked
[d] 1 = never, 2 = less than once a week, 3 = 1-2 times per week, 4 = 4-6 times per week, 5 = 7 or more times per week
[e] Compared to not safe
[f] Compared to high cohesion
[†] $p < .05$; *$p < .01$; **$p < .001$; ***$p<.0001$

Discussion

In the current report, we examined associations between several neighborhood social features and allostatic load, a measure posited to capture the cumulative effects of physiological wear-and-tear. Our results indicated that allostatic load is higher in low income neighborhoods and neighborhoods perceived as unsafe, but was not significantly associated with perceptions of neighborhood cohesion. We observed these relationships using a large national sample of men and women representing a large age range, even after adjusting for a range of neighborhood and individual sociodemographics. Our results also indicated that health behaviors, including exercise habits and the consumption of fast food partially accounted for these relations between allostatic load and neighborhood income and perceptions of safety.

Allostatic Load: Comparing Relations with Multiple Neighborhood Features

Researchers often examine only socioeconomic aspects of a neighborhood in relation to health, making it difficult to discern what features of low income neighborhoods link them to poor health. We examined allostatic load in the context of three neighborhood social features, income, perceptions of safety, and perceptions of cohesion. Allostatic load is generally elevated in low income neighborhoods (Bird et al., 2010), and we tested the hypothesis that perceptions of neighborhood safety and neighborhood cohesion would partially explain this relation.

Neighborhood income. People who were living in poorer neighborhoods had higher allostatic load than their counterparts in wealthier neighborhoods. This finding is consistent with a large literature indicating that low income neighborhoods are associated with poor health (Diez Roux & Mair, 2010), and higher allostatic load (Bird et al., 2010). In the present study, this relation was partially explained by health-compromising behaviors. Many researchers have described low income neighborhoods as sources of social and physical hazards that potentially

arouse psychological distress and physiological regulation (Schulz et al., 2012). Individuals maintaining residence in these neighborhoods are chronically exposed to these hazards, and our results indicated that this chronic exposure was related to higher allostatic load.

Neighborhood safety. Allostatic load was higher among individuals living in neighborhoods perceived as unsafe compared to those who perceived their neighborhoods as safe even after adjusting for the constellation of social and physical factors encompassed in neighborhood SES (captured in the current study as neighborhood income; Cutrona et al., 2006). Similar to living in a low income neighborhood, living in a neighborhood in which one feels unsafe walking alone during the day or at night represents a chronic stress situation that is related to health. Living in fear – even in the absence of discrete events with the potential for harm – may elicit a chronic state of vigilance associated with distress and physiological arousal. Our findings support this notion and indicate that chronic fearfulness in one's neighborhood is related to cumulative physiological damage, captured by allostatic load.

We found evidence to suggest that poor health behaviors, particularly exercise and eating fast food, partially explained the link between perceptions of neighborhood safety and allostatic load. It is possible, for example, that individuals who do not feel safe walking in their neighborhoods alone during the day or at night are less likely to get adequate exercise (i.e., they choose not to walk to the local grocery store, and rather drive). Furthermore, individuals who perceive their neighborhoods as unsafe may prefer to frequent drive-through restaurants so they may remain in their vehicles resulting in a greater likelihood of eating fast food. This neighborhood social feature – perceptions of safety – did not explain the link between neighborhood income and allostatic load. Perceptions of neighborhood safety, however, had a

unique relation with allostatic load above the constellation of other social and physical factors encompassed in a neighborhood's socioeconomic standing (Cutrona et al., 2006).

Neighborhood cohesion. Unlike neighborhood income and perceptions of neighborhood safety, perceptions of neighborhood cohesion were not significantly associated with allostatic load. It is possible that perceptions of cohesion are more related to affective aspects of health, rather than physiological aspects of health. For example, the neighborhood social cohesion literature has largely demonstrated links between this neighborhood feature and self-rated health (Kawachi et al., 1999), and peoples' perceptions of their health are strongly correlated with their affective states (Watson, 1988). Another study found that low perceived neighborhood cohesion was associated with greater depressive symptoms. Recent evidence suggested that high levels of neighborhood cohesion were associated with daily affect and well-being (Robinette et al., 2013).

Future Directions and Conclusions

We found evidence for an association between neighborhood income and perceptions neighborhood safety and allostatic load using a U.S. adult sample representing a wide age range living in census tracts with a wide range of income levels. These results suggest that objective neighborhood characteristics (SES) are not the only health-relevant feature of peoples' environments; subjective features, such as residents' perceptions of how safe their neighborhoods are, are also important for physiological functioning.

Whether this association extends to international samples and samples with younger participants remains unanswered. Cumulative physiological wear-and-tear, and increased allostatic load, is observed in children as young as nine years of age (Evans, 2003), but minors were not included in this study. Additionally, we used median income of the census tract as a proxy for neighborhood SES. Although this variable is frequently used in neighborhood-health

studies, future studies should attempt to replicate our findings using multiple measures of neighborhood SES. Other researchers have already taken this step in examinations of neighborhood SES and self-reported health (Subramanian et al., 2006). Similarly, our findings could be replicated using a more comprehensive assessment of neighborhood safety and cohesion (our measures only consist of two items, respectively). Lastly, although, perceptions of neighborhood cohesion were not associated with allostatic load, these perceptions may be associated with affective and mental aspects of health. Future research should address this question and assess whether individual differences regarding peoples' preferences for cohesion – or the likelihood that people prefer to be with social others in various situations – may play a role for health and health-related outcomes.

In sum, this study demonstrated that people living in poor neighborhood social climates – particularly those characterized as having low SES or safety – are at greater risk for developing chronic health conditions. Lower median income of a person's census tract and perceptions of safety were significantly associated with more allostatic load, a measure capturing a person's physiological functioning. This finding persisted even after adjusting for individual income, age, and sex. Relations between allostatic load and these objective and subjective features of neighborhoods were partially explained by individuals' health behaviors, suggesting that intervention efforts focusing on health behaviors may benefit neighborhood-level physiological well-being. Additionally, our results suggest that there may be alternative pathways explaining links between neighborhood SES and allostatic load, and it is possible that stress processes may play a role.

Footnote

[1] Although we intended to include alcohol consumption as an additional covariate in our models, 320 (31.94%) of participants were missing information on this variable. We therefore excluded this variable. However, when we ran a model with the alcohol variable included, both the relationship between neighborhood income and allostatic load ($\beta = -0.09$, $p = .0019$ without alcohol, $\beta = -0.09$, $p = .0068$ with alcohol) and the relationship between neighborhood safety and allostatic load ($\beta = -0.13$, $p = .0446$ without alcohol, $\beta = -0.16$, $p = .0395$ with alcohol) remained significant.

Chapter 4: Risk and Resiliency in Neighborhoods: An Examination of Allostatic Load

Abstract

The social climate of one's neighborhood is important for health. People living in high income areas or areas perceived as safe as well as cohesive (neighbors trust and count on one another), for example, are generally healthier than those living in neighborhoods with poorer social climates. Emerging evidence suggests, however, that individual characteristics may make some people more susceptible, and others more resilient, to poor quality neighborhoods than others. The present study uses the Midlife in the United States II (MIDUS II) study (n = 1022, age 34-84 years) to examine this question in the context of allostatic load, a measure of physiological functioning that has been associated with the development of chronic physical health conditions. We predicted that trait positive and negative emotionality assessed by the Multidimensional Personality Questionnaire Brief Form (MPQ-BF) would serve as risk and resiliency factors, respectively, in the context of neighborhood income, safety, and cohesion for allostatic load. In partial support of our hypotheses, the association between perceptions of low neighborhood safety and higher allostatic load was exacerbated among individuals with high levels of trait stressor reactivity. Contrary to our hypothesis, higher levels of well-being and lower levels of aggression were associated with higher allostatic load among individuals living in neighborhoods perceived as safe. These findings suggested that characteristics of the neighborhood and those of individuals interact in the relation with long-term physiological wear and tear.

Introduction

Actor Gary Oldman once said, "Growing up in a particular neighborhood… not having much money, all of those things can fire you and can give you an edge, can give you an anger." The observation that exposure to adverse environments can gradually wear an individual down has been substantiated in psychological research. Living in a low income neighborhood, for example, is associated with higher allostatic load (Bird et al., 2010), a composite measure of cumulative damage to the body's physiological regulatory systems (McEwen, 2006). Similarly, living in a neighborhood perceived to be unsafe or a neighborhood in which residents neither trust nor help one another is associated with poor health (Meyer, Castro-Schilo, & Aguilar-Gaxiola, 2014; Murayama, Fujiwara, & Kawachi, 2012). In sum, neighborhoods with poor social climates are health-compromising.

Furthermore, some individual characteristics may make people more susceptible, or more resilient, in these poor social climates than others. Researchers have demonstrated interactions between a neighborhood's features (i.e., socioeconomic status, cohesion) and characteristics of its residents (personality). For instance, one study found that in neighborhoods with low, but not high deprivation, higher levels of neuroticism were associated with higher levels of inflammation (Millar et al., 2013). Similarly, individuals who grow up in low socioeconomic circumstances generally have poorer health, but this relationship is attenuated among those who have a tendency to appraise stressors as more positive than they might actually have been (Chen, Miller, Lachman, Gruenewald, & Seeman, 2012). This nascent literature suggests that certain individual traits may either buffer or exacerbate associations between a neighborhood's features and the health of its residents, but several questions remain unclear. For instance, which neighborhood features might interact with individual characteristics in relation to health? Which individual

characteristics are associated with better health in the context of poor neighborhood social climates? The current study examined some of these questions. Specifically, we predicted that individual trait positive and negative emotionality, traits characterizing peoples' general responses to interpersonal tensions, would interact with the social climate of the neighborhood to predict allostatic load in a large sample of United States adults ranging from midlife to older age.

Neighborhoods and Health

A neighborhood's social climate, including its SES, is relevant for its residents' health (Diez Roux & Mair, 2010). In one study, levels of inflammation were lower in the highest SES compared to the lowest SES neighborhoods (Millar et al., 2013). In addition, individuals living in higher SES neighborhoods have less physiological damage, captured by allostatic load, than their counterparts living in lower SES neighborhoods (e.g., Bird et al., 2010; Merkin et al., 2009).

Higher SES neighborhoods generally have other more desirable social features such as being more cohesive (neighbors trust and count on one another). Neighborhoods characterized as cohesive are good for several aspects of health and health-related outcomes. For example, among a large sample of men and women from across the United States, self-rated health was significantly associated with neighborhood social cohesion (Kawachi, Kenedy, & Glass, 1999). People living in less cohesive neighborhoods were more likely to be depressed, to smoke, and to be physically inactive than their counterparts living in more cohesive neighborhoods (Echeverria, Diez-Roux, Shea, Borrell, & Jackson, 2008).

In addition to levels of cohesion, perceived neighborhood safety is a related feature with similar associations with health and health-related outcomes. Among a racially-diverse sample of women from 20 cities across the United States, lower perceptions of neighborhood safety were associated with a higher prevalence of obesity (Burdette, Wadden, & Whitaker, 2012). Another

study found that older adults with no functional disabilities at baseline were more likely to develop signs of frailty (e.g., difficulties with climbing stairs and walking a half-mile) eight years later if they perceived their neighborhoods as unsafe (Clark et al., 2009). Quality of life was also higher among individuals living in neighborhoods perceived as safe (Friedman, Parikh, Giunta, Fahs, & Gallo, 2012).

Trait Emotionality: Buffering and Exacerbating Effects of Poor Neighborhood Social Climates on Physiological Risk

Despite strong evidence indicating a relation between neighborhoods and health, personality characteristics may influence the strength of this relationship. For example, individuals with higher levels of neuroticism had higher inflammation, but only if they were living in areas of high SES (Millar et al., 2013). In low SES areas, levels of neuroticism were not associated with increased inflammation. This interaction, however, may be even stronger when studying specific aspects of a neighborhood, such as perceived safety or perceived social cohesion. To our knowledge, no studies have examined health and individual traits in the context of neighborhood safety or neighborhood cohesion.

Neighborhoods represent areas in which groups of people live and interact. We hypothesized that trait emotionality, which describes how people differ in terms of their affective, cognitive, and behavioral responses to specific social contexts (Patrick, Curtin, Tellegen, 2002), would interact with neighborhood social climates for health. The Multidimensional Personality Questionnaire Brief Form (MPQ-BF; Tellegen, 1985; Patrick et al., 2002) characterizes individuals' tendencies to behave certain ways and experience different emotions across various social contexts, particularly in the context of interpersonal tensions. We predicted that individuals who handle interpersonal tensions well may be buffered in poor

neighborhood social climates (neighborhoods low in income, safety, or cohesion). Conversely, we predicted that those who are more reactive to interpersonal tensions would be worse off in neighborhoods with more risky interpersonal climates.

The MPQ-BF contains several subscales that assess an individual's perceived negative and positive emotionality. For instance, someone scoring high on trait stressor reactivity (negative emotionality), generally feels that 'minor setbacks sometimes irritate me too much.' Conversely, people with high levels of well-being (positive emotionality) 'usually find ways to liven up [their] day.' These traits are descriptive of peoples' general affective experiences. Positive and negative affect, in turn, have been established as critical factors for health and health-related outcomes (Hu & Gruber, 2008). Additionally, individuals with high levels of negative affectivity, such as those with higher levels of neuroticism, are generally more reactive to stressors (Bolger & Schilling, 1991). Taken together, trait emotionality, as assessed by the MPQ-BF, may buffer or exacerbate the stress of living in poor neighborhood social climates through affective, cognitive, and behavioral means. To our knowledge, these questions have yet to be tested and are the focus of the current study.

The Present Study

The present study builds on this small but growing literature by examining characteristics both at the individual and neighborhood levels. At the neighborhood-level, we examined objective neighborhood income and subjective neighborhood safety and cohesion. At the individual-level, we examined traits from the MPQ-BF that capture positive (well-being and achievement) and negative (stressor reactivity, aggression, and alienation) emotionality. Our first hypothesis was that higher positive emotionality would buffer, and higher negative emotionality would exacerbate, low neighborhood income for allostatic load. Similarly, our second hypothesis

was that perceptions of low neighborhood safety would be buffered by positive, and exacerbated by negative emotionality. Third, we predicted that higher positive and negative emotionality would interact with neighborhood social cohesion for allostatic load, with predictions in the same directions as those for neighborhood safety.

Researchers often question whether health is uniquely related to a neighborhood's features per se or whether characteristics of its residents drive associations with various health outcomes (Subramanian, Lochner, & Kawachi, 2003). This question is germane to a study examining individual-neighborhood interactions on allostatic load. In light of this issue, we adjusted for individual education, age, sex and health behaviors in all of our statistical models.

Method

Sample and Procedures

Data for this study came from the Midlife in the United States II (MIDUS II) longitudinal study. A large random sample of U.S. adults completed a telephone interview and two self-administered questionnaires. A small subset (N = 1043) of the original MIDUS I participants also completed the Biomarker project at the second wave of data collection. The purpose of the Biomarker Project was to assess the physiological factors responsible for age differences in health. Biomarker Project participants spent the night in one of three General Research Centers (GRC) at University of California, Los Angeles; University of Wisconsin, Madison; and Georgetown University. During the overnight stay in the GRC, participants provided blood, urine, and saliva samples. These samples allowed for the assessment of an array of biomarker indicators of the hypothalamic pituitary adrenal axis, and the cardiovascular, inflammatory, lipid metabolism, glucose metabolism, and sympathetic and parasympathetic nervous systems.

Of the 1043 participants, 1022 were included in the present study; 7 participants were lost due to missing data on MPQ-BF traits, 5 were missing information on either neighborhood safety or neighborhood trust, an additional 8 did not have information on neighborhood or individual SES, and one person did not respond to the item assessing fast food consumption. Participants were primarily white (93.35%) and were well-educated (3.62% less than high school, 20.55% high school degree or GED, 29.16% some college, 22.99% 4-year degree, 23.68% post college degree). Among the 1022 participants in this study, there were 303 siblings representing 149 families. See the Analytic Strategy section for a description of how these family clusters were treated in key statistical models. The study was conducted using ethical guidelines with the approval of the University of Wisconsin, Madison; the University of California, Los Angeles; and Georgetown University Institutional Review Boards.

Measures

Allostatic load. A total of 24 physiological indices were assessed to calculate seven separate scales comprising the cardiovascular, sympathetic nervous, parasympathetic nervous, hypothalamic pituitary adrenal axis, inflammatory, lipid metabolism, and glucose metabolism systems (Gruenewald et al., 2012). See Table 4.1 for a list of these system scales and their indices. Values on each of the 24 biomarker indicators of each separate physiological index were categorized into membership in the highest risk quartile range of the biomarker distribution. For all but two indices, the highest quartile was considered the quartile 'at risk' (higher values represent more physiological wear and tear). For the two exceptions, DHEA-S and HDL cholesterol, lower scores were more health-compromising, so the lowest quartiles were considered the quartile 'at risk.' The average of the dichotomous (0/1) high-risk indicators was computed for the biomarkers representing each system so that the average score essentially

represented the proportion of biomarker indicators for which participant values fell into high-risk ranges (i.e., scores could range from 0 to 1, with a score of "0" indicating that no biomarker indicators fell into high-risk ranges, a score of "0.5" indicating that 50% of biomarker indicators fell into high-risk ranges, a score of "1" indicating that all biomarker indicators fell into high-risk ranges, etc.). Scores were then summed across these seven subscales to create an overall allostatic load score, which ranged from 0 (no physiological systems have any at risk indices) to 7 (all indices within all seven systems are at risk).

Table 4.1

Physiological indices with 'at risk' values

	Quartile Cut-Offs (Clinical Cut-Offs)	At Least 1 Index 'At Risk' (%)
Cardiovascular		49.02
SBP	≥143.00 (≥140)	
DBP	≥82.00 (≥90)	
HR	≥77.00 (>90)	
HPA		42.47
Cortisol	≥21.00	
DHEA-S	≤51.00	
Inflammatory		63.89
CRP	≥3.18	
Fibrinogen	≥390.00	
IL-6	≥3.18	
e-Selectin	≥50.58	
ICAM-1	≥329.65	
Metabolic Glucose		44.35
Glycosylated Hemoglobin	≥6.10 (≥7)	
Fasting Glucose	≥105.00 (≥126)	
Insulin Resistance (HOMA-IR)	≥4.05	
Metabolic Lipids		64.25
HDL	≤41.37 (<40)	
LDL	≥128.00 (≥160)	
Triglycerides	≥160.00 (≥200)	

BMI	≥32.31 (≥30)	
WTH	≥0.97 (>1)	
Parasympathetic		38.26
Low Frequency Spectral Power	≤113.96	
High Frequency Spectral Power	≤54.16	
Standard Deviation of IBIs	≤23.54	
RMSSD	≤11.83	
Sympathetic		36.63
Epinephrine	≥2.54	
Norepinephrine	≥33.33	

MPQ-BF. The MPQ-BF (Patick et al., 2002; Tellegen, 1985) assesses three broad, structural dimensions of personality: positive emotionality, negative emotionality, and constraint. We were interested in testing whether positive and negative emotionality, given their affective and socioemotional nature, would moderate relations between aspects of a neighborhood's social climate and allostatic load.

Seven subscales of the MPQ-BF, four assessing positive emotionality and three assessing negative emotionality, were included on the MIDUS II self-administered questionnaire. Positive emotionality was assessed with the well-being (WB), social potency (SP), social closeness (SC), and achievement (AC) scales. The WB scale assessed individuals' positivity with three items, such as, 'I usually find ways to liven up my day.' SP assessed peoples' tendencies to dominate in social exchanges, and was measured with four items including, 'I am very good at influencing people.' Participant's perceived SC measured the desire to be with others, and included four items, e.g., 'When I am unhappy about something, I tend to seek the company of a friend rather than remaining alone.' Levels of AC, indicating a person's ambitiousness, were assessed with four items, for example, 'I like hard work.'

Negative emotionality was assessed with stressor reactivity (SR), aggression (AG), and alienation (AL) scales. Three questions, including 'I sometimes get myself in a state of tension and turmoil as I think of the day's events,' assessed participants' SR, indicating their likelihood of experiencing volatile emotions. Participants rated their levels of AG, or their desire to harm others, with four items, including 'When I get angry I am often ready to hit someone.' AL was assessed with three items, including 'People often try to take advantage of me,' and assessed participants' beliefs about others' negative intensions. Participants used a Likert-type scale ranging from 1 = True of you to 4 = False. Negatively worded items were reversed coded, and all

items were summed so that higher scores represented higher standing in the characteristic. Cronbach's alpha for WB, SP, SC, AC, SR, AG, and AL were .72, .29, -.16, .66, .75, .65, and .62, respectively. Given the poor reliability of the SP and SC scales, these traits were not included in the present study.

Neighborhood Income. Data on participants' neighborhood income came from the 2000 US Census. Census tract-level median household income was used as our proxy for neighborhood SES. An interval neighborhood income variable was created so that estimates could be interpreted as the change in allostatic load for every $10,000 increase in neighborhood income. The 2000 Census was the closest match to the MIDUS II data used in the present study, which was conducted between 2004-2006.

Neighborhood cohesion. Participants responded to two questions on the self-administered questionnaire asking about cohesion in their neighborhoods: I could call on a neighbor for help if I needed it; People in my neighborhood trust each other (Keyes, 1998). Using a Likert-type scale, participants rated these questions with 1 = a lot, 2 = a little, 3 = some, and 4 = not at all. Items were reversed coded so that higher mean scores represented more neighborhood cohesion. To correct for positive skew, an ordinal neighborhood cohesion variable was created so that roughly equal numbers of participants were represented in the three groups (low = 0, moderate = 1, and high = 2).

Neighborhood safety. Two questions on the self-administered questionnaire were asked about safety in the participants' neighborhoods: I feel safe being out alone in my neighborhood during the daytime; I feel safe being out alone in my neighborhood at night (Keyes, 1998). Using a Likert-type scale, participants rated these questions with 1 = a lot, 2 = a little, 3 = some, and 4 = not at all. Items were reversed coded so that higher mean scores represented more

neighborhood safety. Given the positive skew of this variable (most people reported feeling safe in their neighborhoods) a median split was not possible. However, a dichotomous neighborhood safety variable was created based on peoples' safety reports with roughly equal numbers of participants represented in the Not Safe = 0 and Safe = 1 categories.

Health behaviors. One question asked participants whether or not (0 = no, 1 = yes) they regularly engage in light (e.g., light housekeeping, easy walking), moderate (e.g., leisurely sports, brisk walking), or vigorous (e.g., competitive sports, running) exercise for 20 minutes or more at least three times per week. Cigarette smoking was asked with the question, 'Have you ever smoked cigarettes regularly?' Responses were either no (0) or yes (1). Participants were asked about their diet with one question, 'In an average week, how often do you eat at a fast food restaurant or order food for takeout or delivery?' Response options ranged from 1 (never) to 5 (7 or more times per week).

Individual education and other demographics. Our measure of household SES was the respondent's level of education. Education was coded as 1 = less than a high school degree through 9 = some graduate school or higher. Age was coded in years and sex was coded as male = 1 female = 2.

Analytic Strategy

Hypotheses were tested using generalized estimating equations (GEE). GEE models allow for an a priori specification of correlation matrices that allow for siblings to be clustered within families. Three sets of GEEs were run to examine interactions between allostatic load and neighborhood income, safety, and cohesion separately. In all three series of GEEs, we statistically adjusted for individual education, age, sex, smoking status, exercise habits, and fast food consumption.

To test the hypothesis that MPQ-BF traits moderate relations between these neighborhood features and allostatic load, we conducted separate two-way interactions, one for positive and one for negative emotionality. Next, we conducted a series of two-way interactions, one for each of the five specific MPQ BF traits. Models 1-3 examined our hypothesis that positive emotionality (and the separate positive emotionality traits, WB and AC) would buffer poor social climates (low income, perceptions of low safety, perceptions of low cohesion) for allostatic load. Models 4-7 assessed our hypothesis that negative emotionality (and the separate negative emotionality traits, SR, AG, AC) would exacerbate these relationships.

Results

Means, standard deviations, and bivariate correlations among study variables are shown in Table 4.2. Higher neighborhood income and perceived neighborhood safety, but not neighborhood cohesion, were significantly associated with lower allostatic load. Individuals living in lower income neighborhoods were more likely to smoke. People who perceived their neighborhoods as safer and more cohesive also reported exercising regularly. Those living in more cohesive neighborhoods were also less likely to eat fast food.

People with higher levels of positive emotionality perceived their neighborhoods as significantly safer and more cohesive. Conversely, people with higher levels of negative emotionality perceived their neighborhoods as not safe and lacking cohesion. Regarding the separate positive and negative emotionality traits, people with higher WB and AC and lower levels of SR perceived their neighborhoods as safer and more cohesive. People who perceived themselves as less aggressive were generally living in neighborhoods with more income and neighborhoods perceived as more cohesive. People with higher allostatic load were typically living in low income neighborhoods and neighborhoods perceived as unsafe and lacking

cohesion. Neither the overall positive nor the overall negative emotionality domains were significantly associated with allostatic load. However, higher trait AC, but not WB, was associated with lower allstatic load. None of the negative emotionality traits were significantly associated with allostatic load. In terms of overall emotionality, people with higher levels of positive emotionality were more likely to exercise and less likely to eat fast food. Those with higher levels of negative emotionality were more likely to smoke and eat fast food. When looking at the separate emotionality traits, higher levels of AG and AL were related to a greater likelihood of smoking. Lower AC and higher SR were both related to more frequent fast food meals, and higher AC was related to a greater likelihood of exercising.

Table 4.2

Correlations among all variables

Mean (sd)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Allostatic Load	-														
M = 1.7 (1.1)															
2 Age in Years	**0.38**	-													
M = 55.2 (11.8)															
3 Sex[a]	0.02	-0.06	-												
4 Education	**-0.18**	**-0.07**	**-0.06**	-											
M = 2.4 (1.2)															
5 Ever Smoked[b]	**0.06**	**0.09**	**-0.10**	**-0.15**	-										
6 Exercise[c]	**-0.12**	-0.05	0.01	**0.09**	-0.05	-									

7 Fast Food[d]	0.04	**-0.21**	**-0.12**	-0.04	**-0.13**	**-0.10**	-						
8 WB	0.04	**0.13**	0.01	0.06	0.00	-0.00	-0.05	-					
M = 9.1 (1.7)													
9 AC	**-0.07**	0.00	**-0.07**	**0.09**	0.03	**0.08**	**-0.08**	**0.44**	-				
M = 12.4 (2.1)													
10 SR	-0.05	**-0.23**	-0.01	**-0.08**	0.04	-0.02	**0.10**	**-0.33**	**-0.11**	-			
M = 6.1 (2.3)													
11 AG	-0.04	**-0.12**	**-0.14**	**-0.10**	**0.09**	-0.00	0.04	**-0.18**	**-0.06**	**0.48**	-		
M = 5.3 (1.7)													
12 AL	0.04	**-0.14**	-0.01	**-0.22**	**0.08**	-0.06	0.04	**-0.19**	-0.03	**0.44**	**0.38**	-	
M = 5.0 (1.8)													
13 Income	**-0.12**	-0.02	0.02	**0.23**	**-0.08**	0.03	0.03	0.00	-0.00	-0.00	**-0.06**	**-0.12**	-
M=50339 (20821)													

14 Cohesion [e]	0.04	**0.20**	0.03	**0.07**	-0.05	**0.06**	**-0.09**	**0.21**	**0.09**	**-0.21**	**-0.17**	**-0.19**	0.06	-
15 Safe [f]	**-0.10**	-0.01	**-0.30**	**0.09**	-0.01	**0.07**	0.03	**0.11**	**0.14**	**-0.06**	-0.00	**-0.10**	0.01	**0.24**	-

Note. Correlations in bold are significant at least at $p < .05$.
[a] 1 = male, 2 = female; [b] Compared to never smoked; [c] Compared to those who don't exercise regularly; [d] 1 = never, 2 = less than once a week, 3 = 1-2 times per week, 4 = 4-6 times per week, 5 = 7 or more times per week; [e] 0 = Low, 1 = Moderate, 2 = High; [f] Compared to not safe
WB = well-being; AC = achievement; SR = stressor reactivity; AG = aggression; AL = alienation

Trait Emotionality: Buffering and Exacerbating Poor Neighborhood Social Climates

Table 4.3 shows the results of the interactions between trait emotionality and neighborhood income for allostatic load. Although individuals living in lower income neighborhoods had significantly higher allostatic load, this was less so among individuals with higher levels of positive emotionality (Model 1; interaction not shown). When looking at the separate positive emotionality traits, a significant interaction between neighborhood income and trait AC (Model 3) indicated that, in general, higher neighborhood income was associated with lower allostatic load. However, among individuals with lower levels of AC, allostatic load was higher among those living in middle income neighborhoods than people living in low or high income neighborhoods. See Figure 4.1 for this neighborhood income x AC interaction. None of the other emotionality traits – or the overall negative emotionality scale - significantly associated or interacted with neighborhood income for allostatic load.

Interactions between neighborhood safety and trait emotionality are shown in Table 4.4. In partial support of our hypothesis, there was a significant interaction between neighborhood safety and overall positive emotionality (Model 1). Among individuals living in neighborhoods perceived as safe, higher levels of positive emotionality were associated with lower allostatic load. Positive emotionality was not associated with allostatic load among people living in neighborhoods perceived as not safe (interaction not shown). When examining separate positive emotionality traits, a different pattern of results emerged. Among individuals living in neighborhoods perceived as safe, higher levels of trait WB were associated with higher allostatic load (Model 2; see Figure 4.2), and WB was not associated with allostatic load among people living in neighborhoods perceived as not safe. There was no significant interaction between perceptions of safety and levels of AC.

Overall negative emotionality did not significantly interact with perceptions of neighborhood safety in models examining allostatic load. When examining the separate negative emotionality traits, we found partial support for our hypothesis; results of Models 5 suggested that the relationship between low neighborhood safety and higher allostatic load was stronger among those with higher levels of trait SR (see Figure 4.3). Contrary to our hypothesis, however, those who perceived themselves as AG had lower allostatic load, but only among people living in neighborhoods perceived as safe (see Figure 4.4). There was no significant interaction between neighborhood safety and trait AL (Model 7). None of the MPQ-BF traits interacted with neighborhood cohesion in models where allostatic load was the outcome variable.

Table 4.3

Generalized estimating equations for associations between neighborhood income, emotionality, and allostatic load

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-0.77 (0.39)	0.11 (0.45)	1.08 (0.52)	-0.13 (0.59)	-0.18 (0.34)	0.09 (0.37)	-0.32 (0.34)
Neighborhood Income	0.06 (0.05)	-0.10 (0.07)	-0.22[*] (0.08)	-0.00 (0.11)	-0.04 (0.04)	-0.07 (0.05)	-0.05 (0.04)
Positive	0.33[†] (0.03)						
Positive x Income	-0.05[†] (0.03)						
WB		-0.03 (0.04)					
WB x Income		0.01 (0.01)					
AC			-0.10[*] (0.04)				
AC x Income			0.01[*] (0.01)				
Negative				-0.02 (0.17)			
Negative x Income				-0.01 (0.03)			
SR					0.01 (0.03)		
SR x Income					0.00 (0.01)		
AG						-0.04 (0.05)	
AG x Income						0.01 (0.01)	

AL							0.02 (0.04)
AL x Income							0.00 (0.01)
	N = 1033	*N* = 1030	*N* = 1031	*N* = 1033	*N* = 1029	*N* = 1030	*N* = 1031

Note. All models were statistically adjusted for age, sex, individual education, and health behaviors. WB = Well-being; AC = Achievement; SR = Stressor Reactivity; AG = Aggression; AL = Alienation; $^{\dagger}p < .05$; $*p < .01$; $**p < .001$; $***p<.0001$

Table 4.4

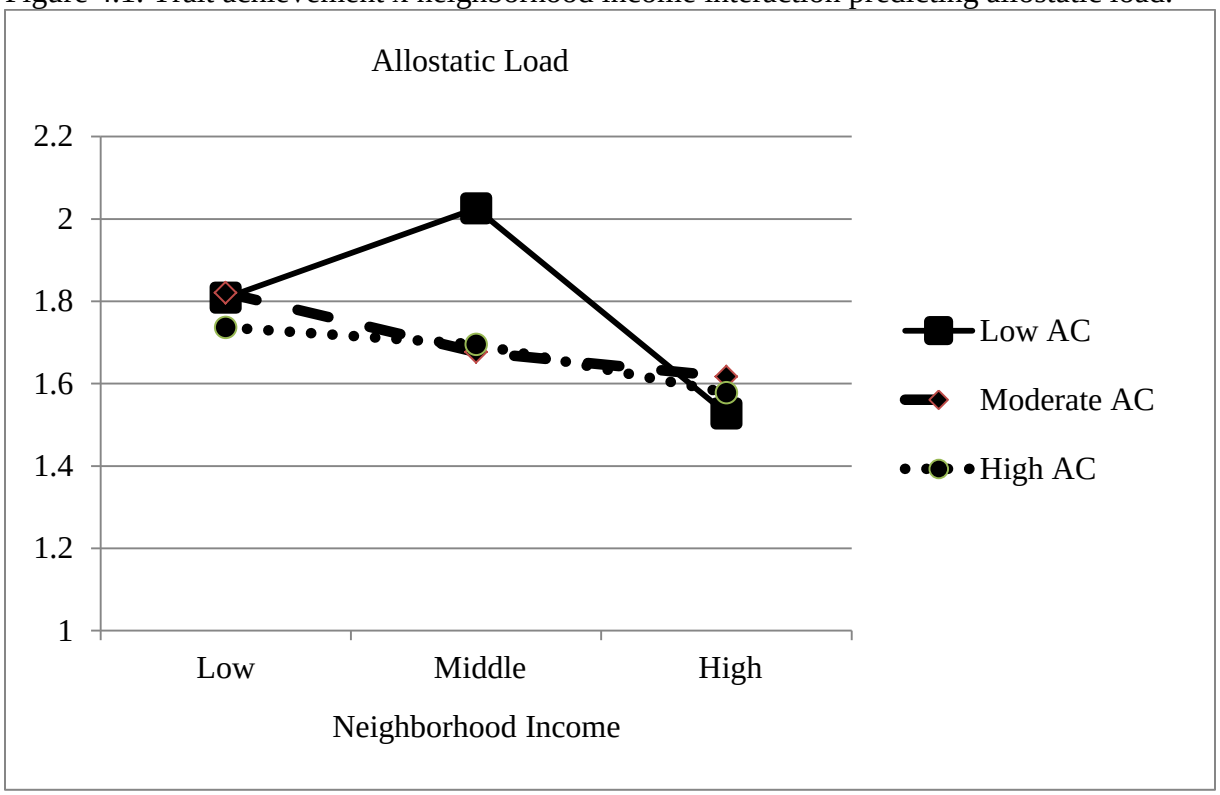
Generalized estimating equations for associations between neighborhood safety, emotionality, and allostatic load

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-0.57 (0.33)	0.27 (0.35)	0.41 (0.39)	0.42 (0.43)	-0.33 (0.30)	-0.35 (0.33)	-0.24 (0.31)
Safe [a]	0.45 (0.26)	-0.96** (0.32)	-0.69† (0.36)	-0.82 (0.46)	0.16 (0.18)	0.28 (0.21)	-0.35 (0.18)
Positive	0.22† (0.11)						
Positive x Safe [a]	-0.31* (0.13)						
WB		-0.04 (0.03)					
WB x Safe [a]		0.09* (0.03)					
AC			-0.04 (0.02)				
AC x Safe [a]			0.04 (0.03)				
Negative				-0.17 (0.11)			
Negative x Safe [a]				0.20 (0.14)			
SR					0.04 (0.02)		
SR x Safe [a]					-0.05† (0.03)		
AG						0.05 (0.03)	
AG x Safe [a]						-0.08† (0.04)	

AL							0.01 (0.03)
AL x Safe [a]							0.04 (0.03)
	N = 1035	*N* = 1026	*N* = 1027	*N* = 1035	*N* = 1025	*N* = 1026	*N* = 1027

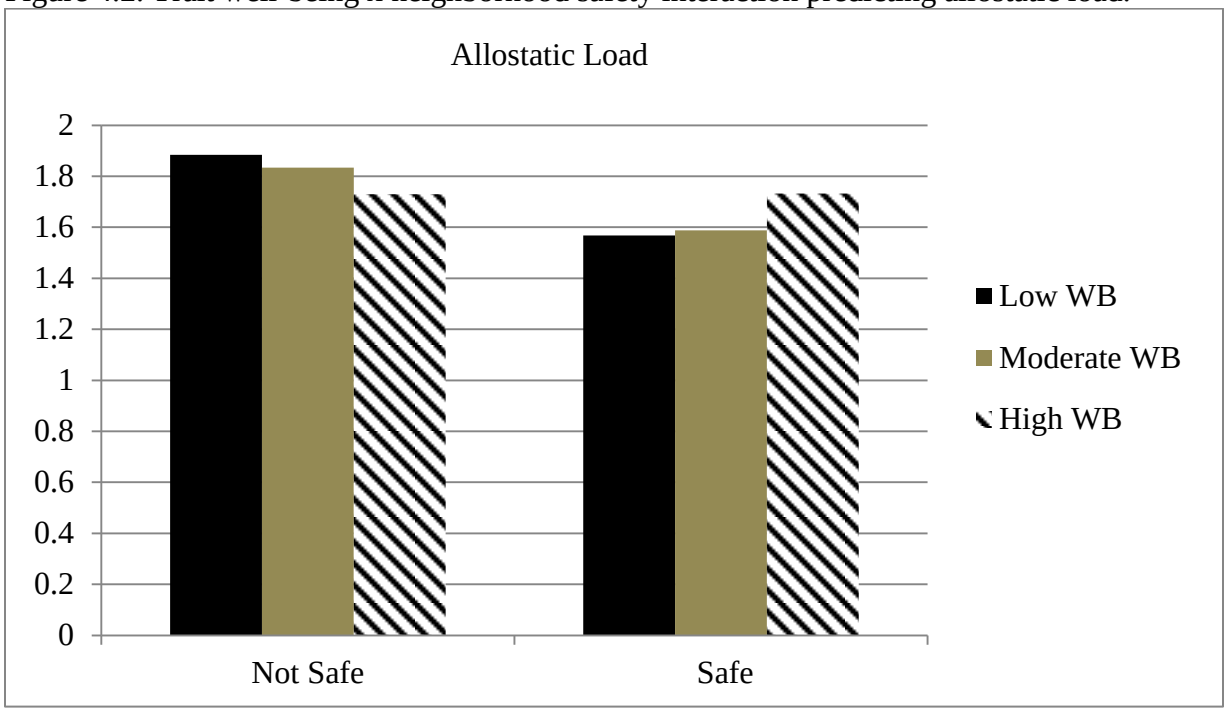
Note. All models were statistically adjusted for age, sex, individual education, health behaviors, and neighborhood income. [a] Compared to not safe; WB = Well-being; AC = Achievement; SR = Stressor Reactivity; AG = Aggression; AL = Alienation; $^{\dagger}p < .05$; $*p < .01$; $**p < .001$; $***p<.0001$

Figure 4.1. Trait achievement x neighborhood income interaction predicting allostatic load.



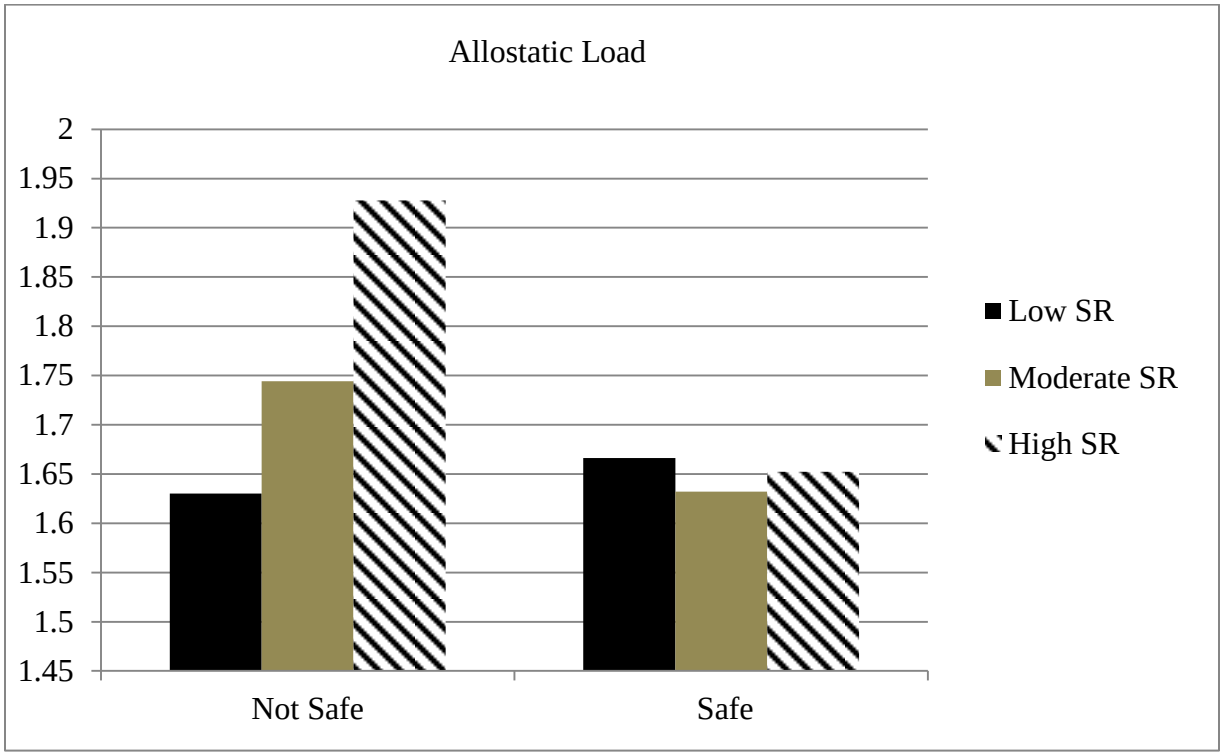
Note. Interaction depicted in Figure 1 was adjusted for age, sex, individual education, and health behaviors. Tertile achievement and neighborhood income variables were created for visualization purposes only.

Figure 4.2. Trait well-being x neighborhood safety interaction predicting allostatic load.



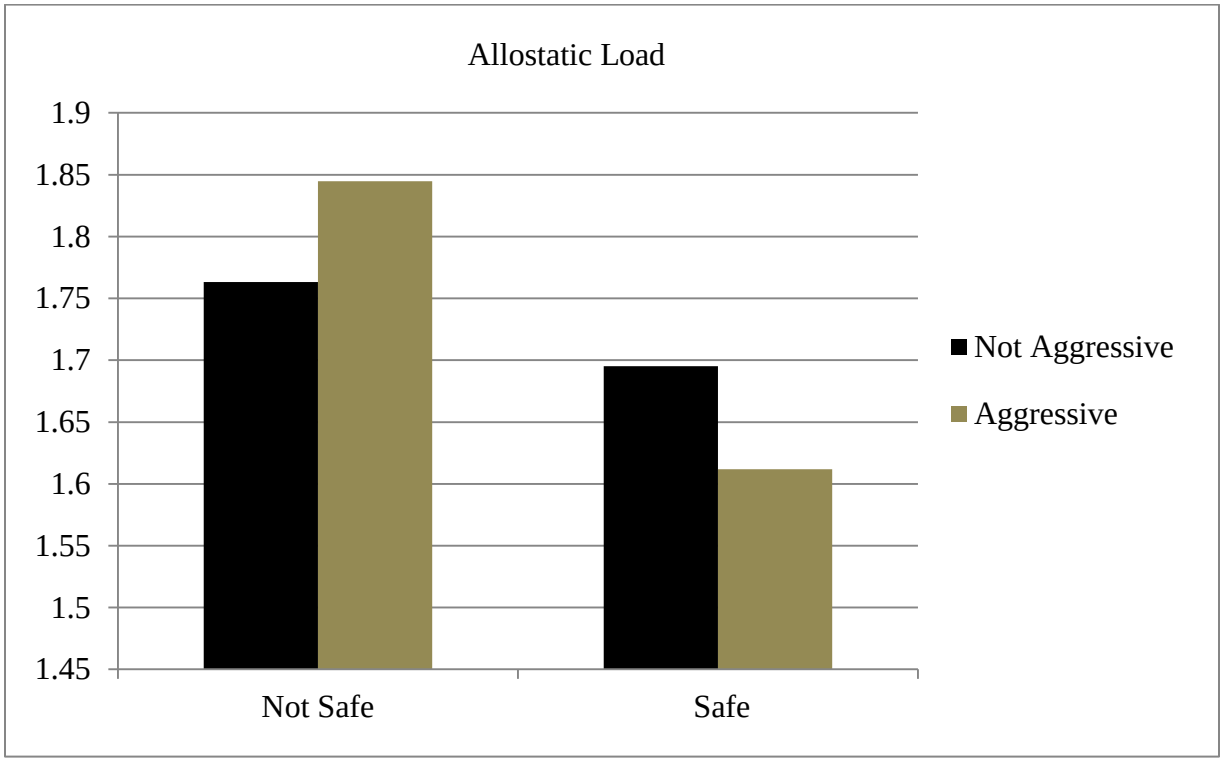
Note. Interaction depicted in Figure 2 is adjusted for age, sex, individual education, health behaviors, and neighborhood income. A tertile well-being variable was created for visualization only.

Figure 4.3. Trait stressor reactivity x neighborhood safety interaction predicting allostatic load.



Note. Interaction depicted in Figure 3 is adjusted for age, sex, individual education, health behaviors, and neighborhood income. A tertile stressor reactivity variable was created for visualization only.

Figure 4.4. Trait aggression x neighborhood safety interaction predicting allostatic load.



Note. Interaction depicted in Figure 4 is adjusted for age, sex, individual education, health behaviors, and neighborhood income. A dichotomous aggression variable was created for visualization only.

Discussion

In the current study, we examined how allostatic load, a measure of cumulative physiological wear and tear, varied based on the neighborhood's social climate and personality characteristics related to emotion regulation within interpersonal contexts. We believe that living in poor neighborhood social climates is a chronic stress condition, and this chronic stressor may result in physiological damage. Moreover, given that living in poor neighborhood social climates is chronically stressful, we hypothesized that peoples' trait emotionality, characteristics describing how people generally respond to interpersonal tensions, would interact with these neighborhood social features in relation to their allostatic load.

Replicating prior analyses (Study 2), people who were living in low income neighborhoods or neighborhoods perceived to be unsafe experienced more physiological wear and tear. Furthermore, individual differences in trait positive and negative emotionality significantly moderated the degree to which these poor neighborhood social climates associate with physiological health.

Individuals with higher levels of positive emotionality – those who are achievement oriented or who maintain a positive outlook on life –in neighborhoods perceived as safe had lower allostatic load than their less positive peers. But, this personality domain was unrelated to physiological wear and tear in neighborhoods perceived as not safe. Conversely, our findings suggest that people with higher levels of SR who experience strong affective responses to minor annoyances had particularly high allosatatic load in neighborhoods perceived as not safe. These findings add strength to the theory that the MPQ-BF traits interact with neighborhood social climates by buffering or exacerbating the chronic stress associated with living in poor neighborhood social climates.

Neighborhood Safety

The positive and negative emotionality traits assessed in the current study were differentially associated with separate features of a neighborhood's social climate (safety, cohesion, or income). In general, neighborhoods perceived as not safe were associated with higher allostatic load compared to neighborhoods perceived as safe. This finding was qualified by a significant safety x WB interaction, however. Contrary to our hypothesis, higher levels of WB were associated with higher allostatic load among individuals living in neighborhoods perceived as safe and were not associated with allostatic load among those living in neighborhoods perceived as not safe.

We interpret this finding to suggest that living in a neighborhood perceived as not safe is strongly related to physiological wear and tear, and trait levels of WB do not add significant explanatory information. Conversely, among individuals living in neighborhoods perceived as safe, high levels of WB may confer a sense of invincibility that may lead to long term problems for their physical health. People with higher levels of WB generally feel that life is an adventure. Perhaps these individuals ignore doctors' advice, downplay physical symptoms they may experience, or engage is risky behaviors (e.g., thrill-seeking activities) to a greater extent than people with lower levels of this trait.

Individuals with higher levels of trait SR, on the other hand, experienced greater physiological wear and tear in neighborhoods perceived as not safe during the day or at night. People with high levels of SR generally report experiencing 'tension and turmoil' when they think about days that have been particularly stressful. Perhaps neighborhoods perceived as not safe represent environments that create states of vigilance among their residents. Individuals with

high levels of SR may be particularly aroused by these environments, and this theory would explain their higher allostatic load.

Contrary to our hypothesis, people who perceived themselves to be AG had lower allostatic load than those who did not perceive themselves of AG, but only in neighborhoods perceived as safe. It is possible that, in the absence of perceived safety concerns, having an aggressive attitude may confer a sense of empowerment or control which confers a health-related advantage. This speculation may explain the lower levels of allostatic load among current participants living in neighborhoods perceived as safe.

Neighborhood Cohesion

Perceptions of neighborhood cohesion were not significantly associated with allostatic load. Furthermore, there were no significant interactions between neighborhood cohesion and any of the MPQ-BF traits. Neighborhood income and neighborhood safety represent chronic stress situations, and we observed that many of the MPQ-BF traits interact with these neighborhood features. It is possible that neighborhood cohesion, one the other hand, is more beneficial during exposure to discrete, stressful events than for chronic stress situations. A recent study found evidence for this relation (Robinette, Charles, Mogle, & Almeida, 2013). When people experienced a daily stressor such as an argument their negative affect increased, and this negative affect reactivity was heightened among individuals who perceived their neighborhoods as lacking cohesion.

Neighborhood Income

Lower neighborhood income was significantly associated with higher allostatic load even after adjusting for age, sex, individual education, and health behaviors. This association, however, was not consistent across levels of AC; higher neighborhood income was associated

with lower allostatic load among those with moderate and high levels of AC. Individuals with the highest allostatic load, however, were those living in middle income neighborhoods with the lowest levels of AC.

One possible explanation for the findings in the current study may be that individuals living in middle income neighborhoods face many unexpected and unpredictable financial hardships (e.g., cost of health care), and yet are not poor enough to qualify for federal assistance programs. Although they have more money than their lower income peers, the unknown and precarious position of the middle-class in today's economy may result in a more unstable and unpredictable environment for these people. The AC scale in the current study assessed peoples' drive and motivations. It is possible that having low levels of this trait exacerbates the financial burdens associated with living in middle income neighborhoods.

None of the negative emotionality traits significantly interacted with neighborhood income for allostatic load. These null interactions may be partially explained by examining associations between objective neighborhood income and subjective social features of a neighborhood (e.g., perceptions of safety). In the current study, although perceptions of safety were associated with allostatic load, neighborhood income and neighborhood safety were not significantly associated. Indeed, low income neighborhoods are not necessarily unsafe. We hypothesized that MPQ-BF traits – given their social nature – would interact with social features of a neighborhood. Perceptions of safety or cohesion in a neighborhood, for example, characterize the daily interactions among people living in a neighborhood. It is possible that neighborhood income per se does not accurately capture these more proximal neighborhood features, rendering individuals' trait negative emotionality less relevant for allostatic load in the context of neighborhood SES.

Future Directions and Conclusion

Some features of neighborhood social disadvantage – low income and safety – are associated with greater physiological damage, captured by allostatic load. Our findings suggest that features of a neighborhood interact with characteristics of their residents. We interpret the results as indicating that higher negative emotionality exacerbates associations between perceptions of safety and allostatic load.

Assessing allostatic load in the context of neighborhoods has multiple benefits. Our allostatic load variable was calculated using a wide range of objectively-measured physiological indices spanning seven physiological regulatory systems. Use of this variable not only reduces many of the issues related to the self-report of one's health, but also provides a comprehensive assessment of physiological functioning. Furthermore, higher allostatic load is associated with the later development of chronic physical health conditions. Our findings inform areas of intervention to be implemented prior to clinical diagnosis. Perhaps those at the greatest risk – those with low levels of positive or high levels of negative emotionality and simultaneously living in poor social climates – can be identified prior to the development of end-stage conditions.

Of course, our findings are cross-sectional in nature. Our interpretations, in contrast, suggest causal mechanisms that are not tested. We based our hypothesis on a theoretical rationale that living in neighborhoods perceived as unsafe and low in social cohesion would create a chronically stressful situation. This chronic stress, then, would lead to higher allostatic load. We further posited that this pathway would be influenced by personality. The analyses, however, relied on cross-sectional data and therefore only allowed us to test associations that would be consistent with such a causal assumption. Longitudinal studies are needed to truly test our

hypotheses, ruling out the possibility that individuals may be selecting into neighborhoods with specific social features based on their own health status or personality characteristics. Recent evidence suggests that certain characteristics (e.g., openness to experience) cluster in specific neighborhoods (Jokela, Bleidorn, Lamb, Gosling, & Rentfrow, 2014). Furthermore, individuals high in openness to experience reported higher life satisfaction when they were living in areas with large numbers of others who also scored high on this characteristic. These findings suggest that individuals prefer to live in areas with like-personality others, and are generally happier when they are able to do so. Additionally, researchers should attempt to replicate the current findings using both self-reports alongside more objective measures of neighborhood safety and neighborhood cohesion, such as those ascertained by crime reports, or by third-party raters. These data would allow us to examine whether self-perceptions and objective indicators are related to one another, or whether they represent different yet equally important information factors related to health and well-being.

Chapter 5: General Discussion

General Discussion

Neighborhoods, the context within which people reside and function, are uniquely related to daily, cumulative, and long-term health-related outcomes. At the daily level, people who lived in socially cohesive neighborhoods had higher levels of well-being, experienced fewer daily stressors such as arguments, and were less affectively reactive to those stressors. Neighborhood features were also uniquely associated with long-term, cumulative physiological functioning captured by allostatic load. People living in higher income neighborhoods and neighborhood perceived as safe had lower allostatic load than those living in neighborhoods with less desirable social climates. Trait levels of positive and negative emotionality interacted with these features of the neighborhood; higher levels of positive emotionality buffered, and higher levels of negative emotionality exacerbated links between low neighborhood income and perceptions that one's neighborhood is not safe for allostatic load.

A large literature has demonstrated that a neighborhood's structural characteristics, such as its socioeconomic standing, are associated with health above the well-established links with individual resources (i.e., individual SES). Much less attention has been directed to links between functional, social neighborhood characteristics and health. The present results indicated that perceptions of neighborhood cohesion and safety, examples of neighborhood social features, are uniquely associated with different aspects of daily and longer term functioning even after taking into account the neighborhood's structure, i.e., its SES.

Examining individual traits and neighborhood features simultaneously has the potential to inform early intervention efforts. Results of Study 1 indicated, for example, that community interventions aimed at increasing trust and cooperation among neighbors may improve health by mitigating the impact of daily stressors on affective well-being. Findings from Study 2 suggested

that individuals living in low income or unsafe neighborhoods have higher allostatic load, indicating greater risk for developing chronic health conditions. Moreover, income and safety were not associated with one another in our analyses, suggesting that safety cannot be assumed from neighborhood SES and must be assessed as well. Identification of these 'at risk' individuals – and directing them to proper resources and treatment – may defer diagnosis with chronic health problems. This study also indicated that engaging in poor health behaviors (e.g., lack of exercise and eating fast food) partially explained links between neighborhood features and physiological functioning, suggesting that intervention efforts could focus on these behaviors. Lastly, Study 3 demonstrated that individuals living in low income or unsafe neighborhoods who also tend to react strongly to stressors, may be in particular need for psychological or other intervention efforts.

Study One: Neighborhoods and Daily Stress Processes

In Study 1, social cohesion at the neighborhood level was assessed for its relationship with daily stress processes, including exposure and reactivity to stressors. Hypotheses were confirmed; men and women who perceived a high degree of social cohesion, assessed by questions asking whether their neighbors are trustworthy and helpful, reported experiencing fewer daily stressors than those who felt less positive about their neighbors. Additionally, in neighborhoods perceived to be cohesive, people generally reported higher levels of positive affect, lower levels of negative affect, and fewer physical symptoms.

People were also less affectively reactive to daily stressors such as arguments when they perceived high levels of neighborhood cohesion. On days when a stressor was reported, people living in cohesive neighborhoods experienced less of an increase in negative affect than those

living in less cohesive neighborhoods. These findings persisted even after adjusting for the buffering effect of perceived support from friends, family members, and spouses.

These findings were qualified, however, by an age x stressor x neighborhood cohesion interaction. Neighborhood cohesion only buffered stressors for negative affect among younger adults, and not middle-aged or older adults. It is possible that younger adults rely more on peripheral social network members than successively older adults, who may have a broader network of social partners that are not necessarily located close by. Social cohesion was not associated with positive affect reactivity (that is, the decrease of positive affect after experiencing a stressor), or to increases in physical symptoms in response to a stressor.

Study Two: Neighborhoods and Cumulative Physiological Damage

Results from Study 1 indicated relationships between neighborhood cohesion and stressor exposure and reactivity. Greater exposure and heightened reactivity to stressors, in turn, are posited to lead to poorer physiological functioning (McEwen, 2006). As such, in Study 2 I tested the hypothesis that neighborhood features would be related to allostatic load, a measure of gradual, accumulated physiological damage. This hypothesis was confirmed in the context of neighborhood income and safety. Participants who were living in lower income neighborhoods or neighborhood perceived as unsafe had higher allostatic load than their counterparts in higher income or safer neighborhoods. My hypothesis that perceptions of neighborhood safety or perceptions of neighborhood cohesion would partially explain the relation between neighborhood income and allostatic load was not supported. Results did indicate, however, that neighborhood safety was uniquely associated with allostatic load.

Contrary to my hypothesis, perceptions of neighborhood cohesion were not associated with allostatic load. It is possible that this neighborhood social characteristic – cohesion – is most

beneficial at the time stressful events occur, which would be consistent with the stress buffering hypothesis guiding much of the social support literature. Perhaps living in a low income neighborhood, and one perceived as unsafe, represents a chronic condition associated with hypervigilance. This theory may explain why neighborhood income and safety, but not cohesion, are associated with allostatic load. My hypothesis that health behaviors would partially explain links between neighborhood features and allostatic load was supported. People who exercise less and regularly consume fast food had significantly higher allostatic load, and these behaviors partially explained relations between allosatatic load and both neighborhood income and perceptions of neighborhood safety.

Study Three: Neighborhoods, Allostatic Load, and Emotionality

Study 2 demonstrated the importance of two neighborhood features – objective income and subjective safety – for a measure of physiological functioning that plays a key role in the development of chronic health conditions. In Study 3, I examined whether peoples' trait levels of positive and negative emotionality interacted with these neighborhood features for allostatic load. Positive emotionality buffered unsafe neighborhoods for physiological functioning. In addition, individuals with high levels of negative emotionality (e.g., stressor reactivity) exhibited even greater physiological damage (i.e., had higher allstatic load scores) when they were also living in neighborhoods perceived to be unsafe.

Results from Study 3 indicated that broad domains of personality (i.e., emotionality) moderated relations between neighborhood features and allostatic load. The degree to which specific traits (e.g., well-being, achievement, stressor reactivity, aggression, and alienation) moderated these relations depended on whether we were examining objective neighborhood characteristics (i.e., income) or subjective neighborhood characteristics (i.e., safety). Our results

suggest that trait levels of achievement interacted with neighborhood income in their relations with allostatic load. Individuals with lower levels of this trait reported that they did not enjoy hard work and persisting under conditions of challenge. I speculate that having lower levels of AC and maintaining a residence in a middle class neighborhood may act synergistically in their relation with allostatic load.

The pattern of results differed when considering the context of neighborhood safety. Higher trait levels of well-being were associated with more physiological wear and tear in the context of neighborhoods perceived as safe. This characteristic of positive emotionality is associated with views of life as an adventure. It is possible that this outlook is associated with a greater likelihood of engaging in thrill-seeking behaviors, a lack of adherence to doctor recommendations, or lack of attention to physical symptoms. Each of these factors may have long-term relations with the physiological indices captured in allostatic load.

Relations between neighborhood safety and allostatic load were exacerbated by higher levels of stressor reactivity. Stressor reactivity characterizes individuals' affective responses to social tensions. And, perceptions of safety represent a social neighborhood characteristic; perceiving one's neighborhood as unsafe may be indicative of social tensions present in one's neighborhood. Results of Study 3 suggest that neighborhoods in which people perceive tension – lack of safety among one another – are associated with even greater physiological damage among individuals with heightened responses to social tensions.

Conclusions and Future Directions

Neighborhood SES has received substantial attention for its associations with health. The present studies suggest that neighborhood SES is only one neighborhood characteristic to consider for health outcomes. Perceptions of neighborhood cohesion and perceptions of

neighborhood safety similarly maintain relations with daily and cumulative health-related outcomes. Moreover, the strength of these associations differ between individuals; peoples' trait-like negative and positive emotionality serve as risk and resiliency factors in the context of one's neighborhood.

Questions still remain concerning the mechanisms linking various neighborhood features with health and health-related outcomes. Although the current studies suggest that health behaviors partially explain relations between neighborhood income and allostatic load, they do not completely explain these relations. Results of the present study suggest a possible stress pathway, such that neighborhood features were associated with daily stress processes as well as a measure of physiological functioning hypothesized to indicate stress-related wear and tear. Given that living in neighborhoods with poor social climates (e.g., low income, unsafe) may represent a chronic stress condition, it is possible that perceived stress may partially explain the current findings. Additionally, given the social nature of several of the emotionality traits assessed in the present studies, it may be that individuals' social network – outside the neighborhood – may also play a role. Future research should explore some of these alternative pathways.

References

Adler, N.E. & Ostrove, J. M. (2006). Socioeconomic status and health: What we know and what we don't. *Annals of the New York Academy of Sciences, 896*(1), 3-15. doi: 10.1111/j.1749-6632.1999.tb08101.x

Almeida, D.M. (2005). Resilience and vulnerability to daily stressors assessed via diary methods. *Current Directions in Psychological Science*, 14(2), 62-68. doi: 10.1111/j.0963-7214.2005.00336.x

Almeida, D. M., & Kessler, R. C. (1998). Everyday stressors and gender differences in daily distress. *Journal of Personality and Social Psychology*, 75(1), 670-680. doi: 10.1177/002214650404500101

Almeida, D. M., Neupert, S. D., Banks, S. R., & Serido, J. (2005). Do daily stress processes account for socioeconomic health disparities? *Journals of Gerontology: Social Science, 60*, 34-39. doi: 10.1093/geronb/60.Special_Issue_2.S34

Almeida, D.M., Wethington, E., & Kessler, R.C. (2002). The daily inventory of stressful events: An interview-based approach for measuring daily stressors. *Assessment*, 9(1), 41-55. doi: 10.1177/1073191102091006

Alvarez, K. J. & Levy, B. R. (2012). Health advantages of ethnic density for African American and Mexican American elderly individuals. *American Journal of Public Health, 102*, 2240-2242. doi: 10.2105/AJPH.2012.300787

Arnett, J. J. (2004). *Emerging adulthood: The winding road from the late teens through the twenties*. New York: Oxford University Press.

Bagot, R. C., Tse, Y. C., Nguyen, H. B., Wong, A. S., Meaney, M., & Wong T. (2012). Maternal

care influences hippocampal N-methyl-D-aspartate receptor function and dynamic regulation by corticosterone in adulthood, *Biological Psychiatry*, 72(6), 491-498.

Basta, L.A., Richmond, T.S., Wiebe, D.J. (2010). Neighborhoods, daily activities, and measuring health risks experienced in urban environments. *Social Science and Medicine*, 71(11), 1943-1950. doi: 10.1016/j.socscimed.2010.09.008

Bennett, G. G., McNeill, L. H., Wolin, K. Y., Duncan, D. T., Puleo, E. & Emmons, K. M. (2007). Safe to walk? Neighborhood safety and physical activity among public housing residents. *PLOS Medicine, 4*(10), 1599-1607. doi: 10. 1371/journal.pmed.0040306

Bird, C. E., Seeman, T., Escarce, J. J., Basurto-Davila, R., Finch, B. K., Dubowitz, T., Heron, M., Hale, L., Merkin, S. S., Weden, M., Lurie, N., Alcoa, P.O. (2010). Neighbourhood socioeconomic status and biological 'wear and tear' in a nationally representative sample of US adults. *Journal of Epidemiology and Community Health, 64*, 860-865. doi: 10.1136/jech.2008.084814

Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology, 54*, 579-616. doi: 10.1146/annurev.psych.54.101601.145030

Bolger, N. & Schilling, E. A. (1991). Personality and the problems of everyday life: The role of Neuroticism in exposure and reactivity to daily stressors. *Journal of Personality*, *59*(3), 355-386.

Bond Huie, S.A., Hummer, R.A., & Rogers, R.G. (2002). Individual and contextual risks of death among race and ethnic groups in the United States. *Journal of Health and Social Behavior, 43*, 359-381. Last accessed at http://www.jstor.org/stable/3090209

Booth, J., Ayers, S. L., & Marsiglia, F. F. (2012). Perceived neighborhood safety and psychological distress: Exploring protective factors. *Journal of Sociology and Social*

Welfare, XXXIX, 137-156.

Bradley, R. H. & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*, 371-399. doi: 10.1146/annurev.psych.53.100901.135233

Brody, G. H., Lei, M., Chen, E., and Miller, G. E. (2014). Neighborhood poverty and allostatic Load in African American youth. *Pediatrics*. doi: 10.1542/peds.2014-1395

Bronfenbrenner, U. (1989). Ecological systems theory. *Annals of Child Development, 6*, 187-249.

Browning, C. R. & Cagney, K. A. (2003). Moving beyond poverty: Neighborhood structure, social processes, and health. *Journal of Health and Social Behavior, 44*(4), 552-571.

Burdette, H. L., Wadden, T. A., & Whitaker, R. C. (2006). Neighborhood safety, collective efficacy, and obesity in women with young children. *Obesity, 14*, 518-525. doi:10.1038/oby.2006.67

Bures, R.M. (2003). Childhood residential stability and health at midlife. *Research and Practice*, 93(7), 1144-1148. doi: 10.2105/AJPH.93.7.1144

Cagney, K.A., Browning, C.R., & Wen, M. (2005). Racial disparities in self-rated health at older ages: What difference does the neighborhood make? *Journal of Gerontology: Social Sciences*, 60B(4), S181-S190. doi: 10.1093/geronb/60.4.S181

Carpiano, R.M. (2006). Toward a neighborhood resource-based theory of social capital for health: Can Bourdieu and sociology help? *Social Science and Medicine*, 62(1), 165-175. doi: 10.1016/j.socscimed.2005.05.020

Carpiano, R. M. (2008). Actual or potential neighborhood resources and access to them: Testing hypotheses of social capital for the health of female caregivers. *Social Science and Medicine, 67*, 568-582.

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: Support for socioemotional selectivity theory. *Psychology and Aging, 7,* 331–338. doi:10.1037/0882-7974.7.3.331

Caspi, A., Bolger, N., & Echenrode, J. (1987). Linking person and context in the daily stress process. *Journal of Personality and Social Psychology*, 52(1), 184-195. doi: 10.1037/0022-3514.52.1.184

Charles, S.T., Piazza, J., Luong, G., & Almeida, D.M. (2009). Now You See it, Now You Don't: Age Differences in Affective Reactivity to Social Tensions. *Psychology & Aging*, 24(3), *645-653.* doi: 10.1037/a0016673

Charles, S.T., Piazza, J., Mogel, J., Sliwinski, M.J., & Almeida, D.M. (in press). The wear-and-tear of daily stressors on mental health. *Psychological Science*.

Cheadle, A., Wagner, E., Walls, M., Diehr, P., Bell, M., Anderman, C., McBride, C., Catalano, R.F., Pettigrew, E., Simmons, R., & Neckerman, Hbird. (2001). The effect of neighborhood-based community organizing: Results from the Seattle Minority Youth Health project. *Health Services Research,*36(4), 671-689. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1089251/pdf/hsresearch00005-0018.pdf

Chen, E., Miller, G. E., Lachman, M. E., Gruenewald, T. L., & Seeman, T. E. (2012). Protective factors for adults from low childhood socioeconomic circumstances: The benefits of shift-and-persist for allostatic load. *Psychosomatic Medicine, 74*(2), 178-186. doi: 10.1097/PSY.0b013e31824206fd

Chuang, Y. C., Cubbin, C., Ahn, D., & Winkleby, M. A. (2005). Effects of neighbourhood socioeconomic status and convenience store concentration on individual level smoking. *Journal of Epidemiology and Community Health, 59,* 568-573.

Clark, C. R., Kawachi, I., Ryan, L., Ertel, K., Fay, M. E., & Berkman, L. F. (2009). Perceived neighborhood safety and incident mobility disability among elders: The hazards of poverty. *BMC Public Health, 9*(162). doi: 10.1186/1471-2458-9-162

Cohen, S. & McKay, G. (1984). Social support, stress, and the buffering hypothesis: a theoretical analysis. In Baum, A., Taylot, S.E., & Singer, J.E. (Eds.), *Handbook of Psychology and Health*. New Jersey: Lawrence Erlbaum Publishing.

Curtis, L. J., Dooley, M. D., & Phipps, S. A. (2004). Child well-being and neighbourhood quality: Evidence from the Canadian National Longitudinal Survey of Children and Youth. *Social Science nad Medicine, 58*, 1917-1927. doi: 10.1016/j.socscimed. 2003.08.007

Cutrona, C. E., Wallace, G., & Wesner, K. A. (2006). Neighborhood characteristics and depression. *Current Directions in Psychological Science, 15*, 188-192. doi: 10.1111/j.1467.8721.2006.00433.x

Desai, M. & Begg, M. D. (2008). A Comparison of regression approaches for analyzing clustered data. *American Journal of Public Health, 98*(8), 1425-1429.

Diez Roux, A.V. & Mair, C. (2010). Neighborhoods and health. *Annals of the New York Academy of Sciences*, 1186, 125-145. doi: 10.1111/j.1749-6632.2009.05333.x

Diez Roux, A. V., Merkin, S. S., Arnett, D., Chambless, L., Massing, M., Nieto, J., … Watson, R. L. (2001). Neighborhood of residence and incidence of coronary heart disease. *The New England Journal of Medicine, 345*, 99-106. doi: 10.1056/NEJM200107123450205

Do, D. P. (2009). The dynamics of income and neighborhood context for population health: Do long-term measures of socioeconomic status explain more of the black/white

health disparity than single-point-in-time measures? *Social Science and Medicine, 68,* 1368-1375.

Donnelly, P.G. & Kimble, C.E. (2006). An evaluation of the effects of neighborhood mobilization on community problems. *Journal of Prevention and Intervention in the Community*, 32(1-2), 61-80. doi: 10.1300/J005v32n01_05

Dragano, N. et al. (2007). Neighbourhood socioeconomic status and cardiovascular risk factors: a multilevel analysis of nine cities in the Czech Republic and Germany. *BMC Public Health, 7,* 255.

Echeverria, S., Diez-Roux, A. V., Shea, S., Borrell, L. N., & Jackson, S. (2008). Associations of neighborhood problems and neighborhood social cohesion with mental health and health behaviors: The multi-ethnic study of atherosclerosis. *Health & Place, 14*(4), 853-865. doi: 10.1016/j.healthplace.2008.01.004

Evans, G. W. (2003). A multimethodological analysis of cumulative risk and allostatic load among rural children. *Developmental Psychology*, 39(5), 924-933.

Fone, D., Dunstan, F., Lloyd, K., Williams, G., Watkins, J., & Palmer, S. (2007). Does social cohesion modify the association between area income deprivation and mental health? A multilevel analysis. *International Journal of Epidemiology*, 36(2), 338-345. doi:10.1093/ije/dym004

Friedman, D., Parikh, N. S., Giunta, N., Fahs, M. C., & Gallo, W. T. (2012). The influence of Neighborhood factors on the quality of life of older adults attending New York City Senior centers. Results from the health indicators project. *Quality of Life Research, 21,* 123-131. doi: 10.1007/s11136-011-9923-6

Gallo, L. C. (2009). The reserve capacity model as a framework for understanding psychosocial

factors in health disparities. *Applied Psychology: Health and Well-Being, 1*, 62-72. doi: 10.1111/j.1758-0854.2008.01000.x

Giatti, L., Barreto, S. M., & Cesar, C. C. (2010). Unemployment and self rated health: Neighborhood influence. *Social Science and Medicine, 71*, 815-823.doi:10.1016/ j.socscimed.2010.05.021

Grafova, I. B., Freedman, V. A., Kumar, R., & Rogowski, J. (2008). Neighborhoods and obesity in late life. *American Journal of Public Health, 98*(11), 2065-2071.

Greene, G., Gilbertson, J.M., & Grimsley, M.F.J. (2002). Fear of crime and health in residential tower blocks. *European Journal of Public Health*, 12(1), 10-15. doi: 10.1093/eurpub/ 12.1.10

Gruenewald, T. L., Karlamangla, A. S., Hu, P., Merkin, S. S., Crandall, C., Koretz, B., & Seeman, T. E. (2012). History of socioeconomic disadvantage and allostatic load in later life. *Social Science and Medicine, 74*(1), 75-83. doi:10.1016/j.socscimed.2011.09.037

Grzywacz, J.G., Almeida, D.M., Neupert, S.D., & Ettner, S.L. (2004). Socioeconomic status and health: A micro-level analysis of exposure and vulnerability to daily stressors. *Journal of Health and Social Behavior*, 45(1), 1-16. doi: 10.1177/002214650404500101

Grzywacz, J.G. & Marks, N.F. (1999). Family solidarity and health behaviors: Evidence from the National Survey of Midlife Development in the United States. *Journal of Family Issues, 20*, 2, 243-268. doi: 10.1177/019251399020002004

Hackman, D. A., Betancourt, L. M., Brodsky, N. L., Hurt, H., & Farah, M. J. (2012). Neighborhood disadvantage and adolescent stress reactivity. *Frontiers in Human Neuroscience, 6*, 1-11. doi: 10.3389/fnhum.2012.00277

Hanson, M. D. & Chen, E. (2007). Socioeconomic status and health behaviors in adolescence: A

review of the literature. *Journal of Behavioral Medicine, 30,* 263-285. doi: 10.1007/s10865-007-9098-3

Hou, F. & Myles J. (2005). Neighbourhood inequality, neighbourhood affluence and population Health. *Social Science and Medicine, 60,* 1557-1569. doi:10.1016/j.socscimed.2004.08.033

Hu, J. & Gruber K.J. (2008). Positive and negative affect and health functioning indicators among older adults with chronic illnesses. *Issues in Mental Health Nursing, 29,* 895-911.

Hudson, D. L., Puterman, E., Bibins-Domingo, K., Matthews, K. A., & Adler, N. E. (2013). Race, lifecourse socioeconomic position, racial discrimination, depressive symptoms, and self-rated health. *Social Science and Medicine, 97,* 7-14. doi: 10.1016/j.socscimed.2013.07.031

Hutchinson, R.N., Putt, M.A., Dean, L.T., Long, J.A., Montagnet, C.A., & Armstrong, K. (2009). Neighborhood racial composition, social capital and black all-cause mortality in Philadelphia. *Social Science and Medicine,* 68(10), 1859-1865. doi:10.1016/j.socscimed.2009.02.005

Johnson, W., Corley, J., Starr, J. M., & Deary, I. J. (2011). Psychological and physical health at age 70 in the Lothian birth cohort 1936: Links with early life IQ, SES, and current cognitive function and neighborhood environment. *Health Psychology,* 30(1), 1-11. doi: 10.1037/a0021834

Jokela, M., Bleidorn, W., Lamb, M. E., Gosling, S. D., & Rentfrow, P. J. (2014). Geographically varying associations between personality and life satisfaction in the London metropolitan area. *PNAS, 112*(3), 725-730. doi: 10.1073/pnas.1415800112

Kawachi, I., Kennedy, B. P., & Glass, R. (1999). Social capital and self-rated health: A

contextual analysis. *American Journal of Public Health, 89*(8), 1187-1193. doi:10.2105/AJPH.89.8.1187

Kawachi, I., Subramanian, S.V., & Kim, D. (2008). *Social capital and health*: A decade of progress and beyond. In Kawachi, I., Subramanian, S.V., & Kim, D. (Eds.), *Social Capital and Health*. New York: Springer.

Keyes, C. L. M (1998). Social well-being. *Social Psychology Quarterly*, 61, 121-137. Retrieved from http://www.jstor.org/stable/2787065

Kiecolt-Glaser, J.K. & Newton, T.L. (2001). Marriage and health: His and hers. *Psychological Bulletin*, *127*(4), 472-503. doi: 10.I037//0033-2909.127.4.472

Kunzmann, U., Gruhn, D. (2005). Age differences in emotional reactivity: the sample case of sadness. Psychology and Aging, 20(1), 47–59. doi: 10.1037/0882-7974.20.1.47

Labonte, B., Suderman, M., Maussion, G., Navaro, L., Yerko, V., Mahar, I., … & Turecki, G. (2012). Genome-wide Epigenetic Regulation by Early-Life TraumaGenome Epigenetic Regulation by Early-Life Trauma, *Arch Gen Psychiatry*, 69(7), 722-731.

Lang, I. A., Hubbard, R. E., Andrew, M. K., Llewellyn, D. J., Melzer, D., & Rockwood, K. (2009). Neighborhood deprivation, individual socioeconomic status, and frailty in older adults. *Journal of the American Geriatrics Society*, *57*, 1776-1780. doi: 10.1111/j.1532-5415.2009.02480.x

Larsen, R. J., & Kasimatis, M (1991). Day-to-day physical symptoms: Individual differences in the occurrence, duration, and emotional concomitants of minor daily illnesses. *Journal of Personality*, 59(3), 387-423. doi: 10.1111/j.1467-6494.1991.tb00254.x

Lazarus, R.S. & Folkman, S. (1984). *Stress, Appraisal, and Coping.* New York: Springer.

LeClere, F.B., Rogers, R.G., & Peters, K.D. (1997). Ethnicity and mortality in the Untied States:

Individual and community correlates. *Social Forces, 76*(1), 169-198. Last accessed at http://www.jstor.org/stable/2580322

Ludwig, J., Sanbonmatsu, L., Gennetian, L., Adam, E., Duncan, G. J., Katz, L. F., … McDade, T. W. (2011). Neighborhoods, obesity, and diabetes – A randomized social experiment. *The New England Journal of Medicine, 365*, 1509-1519. doi: 10.1056/NEJMsa1103216

Luong, G., Charles, C.T., & Fingerman, K.L. (2011). Better with age: Social relationships across adulthood. *Journal of Social and Personal Relationships,* 28(1), 9-23. doi: 10.1177/0265407510391362

Matthews, S. A. & Yang, T. (2010). Exploring the role of the built and social neighborhood Environment in moderating stress and health. *Annals of Behavioral Medicine, 39*, 170-183. doi: 10.1007/s12160-010-9175-7

McCarthy, A. M., Dumanovsky, T., Visvanathan, K., Kahn, A. R., &Schymura, M. J. (2010). Racial/ethnic and socioeconomic disparities in mortality among women diagnosed with cervical cancer in New York City, 1995-2006. *Cancer Causes and Control, 21*, 1645-1655. doi: 10.1007/s10552-010-9593-7

McCulloch, A. (2003). An examination of social capital and social disorganisation in neighbourhoods in the British household panel study. *Social Science and Medicine, 56*, 1425-1438.

McEwen, B. S. (2006). Stress, adaptation, and disease: Allostasis and allostatic load. *Annals of the New York Academy of Sciences, 840*(1), 33-45.

McEwen, B. S. & Stellar, E. (1993). Stress and the individual. Mechanisms leading to disease. *Archives of Internal Medicine, 153,* 2093-2101. doi: 10.1001/archinte.1993.00410180039004

Meltzer, H., Vostanis, P., Goodman, R., & Ford, T. (2007). Children's perception of neighbourhood trustworthiness and safety and their mental health. *Journal of Child Psychology and Psychiatry, 48*(12), 1208-1213. doi: .1111/j.1469-7610.2007.01800.x

Menec, V. H., Shooshtari, S., Nowicki, S., & Fournier, S. (2010). Does the relationship between neighborhood socioeconomic status and health outcomes persist into very old age? A population-based study. *Journal of Aging and Health, 22*(1), 27-47. doi: 10.1177/0898264309349029

Merkin, S. S., Basurto-Davila, R., Karlamangla, A., Bird, C., Lurie, N., Escarce, J., & Seeman, T. (2009). Neighborhoods and cumulative biological risk profiles by race/ethnicity in a National sample of U.S. adults: NHANES III. *19,* 194-201. doi: 10.1016/j.annepidem.2008.12.006

Meyer, O. L., Castro-Schilo, L., & Aguilar-Gaxiola, S. (2014). Determinants of mental health and self-rated health: A model of socioeconomic status, neighborhood safety, and physical activity. *American Journal of Public Health, 104,* 1734-1741. doi: 10.2105/AJPH.2014.302003

Millar, K., Lloyd, S. M., McLean, J. S., Batty, G. D., Burns, H., Cavanagh, J., et al. (2013). Personality, socio-economic status and inflammation: Cross-sectional, population-based Study. *PLoS One, 8,* 1-10.

Miller, G. E. & Blackwell, E. (2006). Turning up the heat: Inflammation as a mechanism linking chronic stress, depression, and heart disease. *Current Directions in Psychological Science, 15,* 269-272. doi: 10.1111/j.1467-8721.2006.00450.x

Miller, G. E., Chen, E., Fok, A. K., Walker, H., Lim, A., Nicholls, E. F. et al. (2009). Low early-

life social class leaves a biological residue manifested by decreased glucocorticoid and increased proinflammatory signaling. *Proceedings of the National Academy of Sciences, 106*(34), 14716-14721

Mondon, C. W. S., van Lenthe, F. J., &Machenbach, J. P. (2006). A simultaneous analysis of Neighbourhood and childhood socio-economic environment with self-assessed health and health-related behaviours. *Health and Place, 12,* 394-403. doi:10.1016/j.healthplace.2005.03.003

Mroczek, D. K., & Kolarz, C. M. (1998). The effect of age on positive and negative affect: A developmental perspective on happiness. *Journal of Personality and Social Psychology*, 75, 1333-1349. doi: 10.1037/0022-3514.75.5.1333

Muhajarine, N., Vu, L., & Labonte, R. (2006). Social contexts and children's health outcomes: Researching across the boundaries. *Critical Public Health, 16*(3), 205-218. doi: 10.1080/09581590600986432

Mujahid, M. S., Diez Roux, A. V., Morenoff, J. D., Raghunathan, T. E., Cooper, R. S., Ni, H., & Shea, S. (2008). Neighborhood characteristics and hypertension. *Epidemiology, 19*, 590-598. doi: 10.1097/EDE.0b013e3181772cb2

Murayama H, Fujiwara Y, Kawachi, I. (2012). Social Capital and Health: A Review of Prospective Multilevel Studies. *Journal of Epidemiology*, 22, 179-187. doi: 10.2188/jea.JE20110128

Mustard, C. A., Derksen, S., Bethelot, J., &Wolfson, M. (1999). Assessing ecologic proxies for household income: A comparison of household and neighbourhood level income measures in the study of population health status. *Health and Place, 5*, 175-171.

Neupert, S., Almeida, D.M., & Charles, S.T. (2007). Age differences in reactivity to daily

stressors: The role of personal control. *Journals of Gerontology: Series B: Psychological and Behavioral Sciences, 62,* 116-122. doi: http://dx.doi.org/10.1093/geronb/62.4.P216

Oaks, J. M. (2004). The (mis)estimation of neighborhood effects: causal inference for a practicable social epidemiology. *Social Science and Medicine, 58*(10), 1929-1952.

Pampalon, R., Hamel, D., Koninck, M., & Disant, M. (2007). Perception of place and health: Differences between neighborhoods in the Quebec City Region. *Social Science and Medicine ,* 65, 95-111. doi: 10.1016/j.socscimed.2007.02.044

Patrick, C. J., Curtin, J. J. & Tellegen, A. (2002). Development and validation of a brief form of the multidimensional personality questionnaire. *Psychological Assessment, 14*(2), 150-163.

Pearson, T. A., Mensah, G. A., Alexander, R. W., Anderson, J. L., Cannon, R. O., Criqui, M., ...& Vinicor, F. (2003). Markers of inflammation and cardiovascular disease application to clinical and public health practice: a statement for healthcare professionals from the centers for disease control and prevention and the American Heart Association. *Circulation, 107*(3), 499-511.

Piazza, J.R., Charles, S.T., Sliwinski, M.J., Mogel, J., & Almeida, D.M. (2012). Affective reactivity to daily stressors and long-term risk of reporting a chronic physical health condition. *Annals of Behavioral Medicine*. doi: 10.1007/s12160-012-9423-0

Pickett, K.E. & Pearl, M. (2001). Multilevel analyses of neighborhood socioeconomic context and health outcomes: A critical review. *Journal of Epidemiology and Community Health*, 55, 111-122. doi:10.1136/jech.55.2.111

Pressman, S.D. & Cohen, S. (2005). Does positive affect influence health? *Psychological* Bulletin, 131, 925-971. doi: 10.1037/0033-2909.131.6.925

Pressman, S.D. & Cohen, S. (2012). Positive emotion word use and longevity in famous deceased psychologists. *Health Psychology, 31*, 297-305. doi: 10.1037/a0025339

Razani, B., Chakravarthy, M. V., & Semenkovich, C. F. (2008). Insulin resistance and atherosclerosis. *Endocrinology Metabolism Clinics of North America*, *37*, 603-621. doi:10.1016/j.ecl.2008.05.001

Repetti, R., Flook, L., & Sperling, J. (2011). Family influences on development across the life span. In K. L. Fingerman, C. A. Berg, J. Smith, & T. C. Antonucci (Eds), *Handbook of Life-Span Development* (pp. 745-775). New York: Springer Publishing.

Robinette, J. W., Charles, S. T., Mogle, J. A., & Almeida, D. M. (2013). Neighborhood cohesion and daily well-being: Results from a diary study. *Social Science and Medicine, 96*, 174-182. doi: 10.1016/j.socscimed.2013.07.027

Rook, K. S., August, K. J., & Sorkin, D. H. (2011). Social network functions and health. In R. Contrada & A. Baum (Eds.), *Handbook of stress science: Biology, psychology, and health* (pp. 123-135). New York: Springer.

Ross, C. E. & Mirowsky, J. (2001). Neighborhood disadvantage, disorder, and health. *Journal of Health and Social Behavior, 42*(3), 258-276.

Ross, C. E. & Mirowsky, J. (2008). Neighborhood socioeconomic status and health: Context or composition? *City and Community, 7*(2), 163-179.

Ross, N.A., Tremblay, S., & Graham, K. (2004). Neighborhood influences on health in Montreal, Canada. *Social Science and Medicine*, 59, 1485-1494. doi:10.1016/j.socscimed.2004.01.016

Ruel, E. & Robert, S. A. (2009). A model of racial residential history and its association with

self-rated health and mortality among black and white adults in the United States. *Sociological Spectrum, 29*, 443-466. doi: 10.1080/02732170902904616

Sampson, R.J., Raudenbush, S.W., & Earls, F. (1997). Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science*, 277, 918-924. DOI: 10.1126/science.277.5328.918

Scheier, M. F. & Carver, C. S. (1985). Optimism, coping, and health: Assessment and Implications of generalized outcome expectancies. *Health Psychology, 4*, 219-247. doi: 10.1037/0278-6133.4.3.219

Schulz, A. J., Mentz, G., Lachance, L., Johnson, J., Gaines, C., & Israel, B. A. (2012). Associations between socioeconomic status and allostatic load: Effects of neighborhood poverty and tests of mediating pathways. *American Journal of Public Health, 102,* 1706-1714.

Schuster, T.L., Kessler, R.C., & Aseltine, R.H. (1990). Supportive interactions, negative interactions, and depressive mood. *American Journal of Community Psychology, 18:* 423-438. doi: 10.1007/BF00938116

Seeman, T. E., Gruenewald, T. L., & Eaton, W. W. (2006). Allostasis and allostatic load over the life course. In T. E. Seeman, T. L. Gruenewald, & W. W. Eaton (Eds.), *Medical and psychiatric comorbidity over the course of life* (pp. 179-196). Arlington, VA: American Psychiatric Publishing, Inc.

Seeman, T. E., Singer, B. H., Rowe, J. W., Horwitz, R. I., & McEwen, B. S. (1997). Price of adaptation: Allostatic load and its health consequences. *Archives of Internal Medicine, 157*(19), 2259-2268. doi:10.1001/archinte.1997.00440400111013

Shavit, Y., & Blossfeld, H.-P. (Eds.). (1993). Persitent inequality: Changing educational

attainment in thirteen countries. Boulder: Westview Press.

Signorello, L. B., Cohen, S. S., Williams, D. R., Munro, H. M., Hargreaves, M. K., & Blot, W. J. (2014). Socioeconomic status, race, and mortality: A prospective cohort study. *American Journal of Public Health, 104*, e98-e107.

Singer, J.D. & Willett, J.B. (2003). *Applied longitudinal data analysis*.New York: Oxford.

Sliwinski, M. J., Almeida, D. M., Smyth, J., & Stawski, R. S. (2009). Intraindividual change and variability in daily stress processes: Findings from two measurement-burst diary studies. *Psychology and Aging, 24*(4), 1-26. doi: 10.1037/a0017925

Steptoe, A., Dockray, S., & Wardle, J. (2009). Positive affect and psychobiological processes relevant to health. *Journal of Personality, 77*(6), 1747-1776. doi: 10.1111/j.1467-6494.2009.00599.x

Stimpson, J. P., Ju, H., Raji, M. A. & Eschbach, K. (2007). Neighborhood deprivation and health risk behaviors in NHANES III. *American Journal of Health Behavior, 31*(2), 215-222.

Subramanian, S. V., Kubzansky, L., Berkman, L., Fay, M., & Kawachi, I. (2006). Neighborhood effects on the self-rated health of elders: Uncovering the relative importance of structural and service-related neighborhood environments. *Journal of Gerontology: Social Sciences, 61B*(3), 153-160.

Subramanian, S.V., Lochner, K.A., & Kawachi, I. (2003). Neighborhood differences in social capital: A compositional artifact or a contextual construct? *Health and Place*, 9, 33-44. doi: http://dx.doi.org/10.1016/S1353-8292(02)00028-X

Taylor, C. B., Ahn, D., & Winkleby, M. A. (2006). Neighborhood and individual socioeconomic determinants of hospitalization. *American Journal of Preventative Medicine, 31*(2), 127-134. doi: 10.1016/j.amepre.2006.03.025

Tellegen, A. (1985). Structure of mood and personality and their relevance to assessing anxiety, with an emphasis on self-report. In A. H. Tuma & J. D. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 681-706). Hillsdale, NJ: Erlbaum.

Theall, K. P., Drury, S. S., & Shirtcliff, E. A. (2012). Cumulative neighborhood risk of psychosocial stress and allostatic load in adolescents. *American Journal of Epidemiology, 176*, S164-S174. doi: 10.1093/aje/kws185

van der Linden, J., Drukker, M., Gunther, N., Feron, F., & van Os, J. (2003). Children's mental health service use, neighborhood socioeconomic deprivation, and social capital. *Social Psychiatry and Psychiatric Epidemiology*, 38, 507-514. doi: 10.1007/s00127-003-0665-9

Veenstra, G., Luginaah, I., Wakefield, S., Birch, S., Eyles, J., & Elliot, S. (2005). Who you know, where you live: Social capital, neighborhood and health. *Social Science and Medicine*, 60, 2799-2818. doi: http://dx.doi.org/10.1016/j.socscimed.2004.11.013

Veitch, J., Salmon, J., & Ball, K. (2008). Children's active free play in local neighborhoods: A behavioral mapping study. *Health Education Research, 23*(5), 870-879. doi: 10.1093/her/cym074

Watson, D. (1988). Intraindividual and interindividual analyses of positive and negative affect: Their relation to health complaints, perceived stress, and daily activities. *Journal of Personality and Social Psychology, 54*, 1020-1030. doi: 10.1037/0022-3514.54.6.1020

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070. doi: 10.1037/0022-3514.54.6.1063

Whalen, H.R. & Lachman, M.E. (2000). Social support and strain from partner, family and friends: Costs and benefits for men and women in adulthood. *Journal of Social and*

Personal Relationships, *17*, 1, 5-30. doi: 10.1177/0265407500171001

Zanstra, Y. J., Johnston, D. W., & Rasbash, J. (2010). Appraisal predicts hemodynamic reactivity in a naturalistic stressor. *International Journal of Psychophysiology, 77*, 35-42.