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Do Neighborhood Economic Characteristics, Racial Composition, and Residential Stability Predict Perceptions of Stress Associated with the Physical and Social Environment? Findings from a Multilevel Analysis in Detroit

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ABSTRACT *As the body of evidence linking disparities in the health of urban residents to disparate social, economic and environmental contexts grows, efforts to delineate the pathways through which broader social and economic inequalities influence health have burgeoned. One hypothesized pathway connects economic and racial and ethnic inequalities to differentials in stress associated with social and physical environments, with subsequent implications for health. Drawing on data from Detroit, Michigan, we examined contributions of neighborhood-level characteristics (e.g., poverty rate, racial and ethnic composition, residential stability) and individual-level characteristics (e.g., age, gender) to perceived social and physical environmental stress. We found that neighborhood percent African American was positively associated with perceptions of both social and physical environmental stress; neighborhood percent poverty and percent Latino were positively associated with perceived physical environmental stress; and neighborhood residential stability was negatively associated with perceived social environmental stress. At the individual level, whites perceived higher levels of both social and physical environmental stress compared to African American residents of the same block groups, after accounting for other variables included in the models. Our findings suggest the importance of understanding and addressing contributions of neighborhood structural characteristics to perceptions of neighborhood stress. The consistency of the finding that neighborhood racial composition and individual-level race influence perceptions of both social and physical environments suggests the continuing importance of understanding the role played by structural conditions and by personal and collective histories that vary systematically by race and ethnicity within the United States.*

KEYWORDS *Perceived social environmental stress, Perceived physical environmental stress, Residential stability, Urban health*

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INTRODUCTION

Disentangling the social processes that shape urban environments and the health of their residents is central to understanding and addressing health inequalities.[1,2] The burgeoning literature on neighborhood effects has contributed to our understanding of relationships between neighborhood characteristics (e.g., poverty level) and a wide range of social and health outcomes.[3–8] The majority of these analyses have been conducted in urban or metropolitan neighborhoods and have established clear relationships between concentrated structural disadvantage and poor health outcomes.[6,9–12]

Attention has increasingly turned to understanding more clearly the pathways or processes through which unequal urban contexts are created, reproduced, and translated into differential health outcomes.[13–15] In this article, we examine one hypothesized pathway: differentials in stress associated with neighborhood contexts. Drawing on data from Detroit, Michigan, we examine contributions of neighborhood-level characteristics (e.g., poverty rate, residential stability) and individual-level characteristics (e.g., age, gender) to perceptions of stress associated with the social and physical environment. In addition, we consider the extent to which poverty in adjacent neighborhoods influence perceptions of social and physical environmental stress, above and beyond the immediate residential neighborhood. Finally, we consider the contributions of individual-level characteristics and the extent to which they are modified by neighborhood characteristics.

BACKGROUND

Substantial evidence links structural inequalities to health and suggests that the disproportionate concentration of African Americans and Latinos in urban neighborhoods that have experienced economic divestment contribute to racial and ethnic health disparities.[16–18] Among the potential pathways linking structural inequalities to health disparities are differential exposures to adverse social and physical environments, combined with differential access to social and economic resources that promote health. While a number of studies have examined relationships between neighborhood characteristics and health, relatively few studies have examined the factors that contribute to perceptions of social and physical environmental stress. Below, we briefly review the literature on stress process models that provides the overarching conceptual framework for this study. We then examine the literature specific to the relationships of particular interest concerning neighborhood characteristics (e.g., poverty, racial, and ethnic composition, neighborhood stability), perceived stress associated with social and physical environments, and health.

Conceptual Models of Inequality, Stress, and Health Stress process models[19–25] conceptualize stress as a complex and dynamic process in which social and physical environmental conditions conducive to stress (or stressors) influence but do not fully determine perceptions of stress. Stressors, perceived stress (i.e., stressors perceived as bothersome or worrisome, or that result in physiological adaptational responses), behavioral or physiological responses (e.g., smoking, tenseness), and conditioning variables or protective factors (e.g., social support, personal control, physical activity) influence each other and long-term health outcomes (e.g., cardiovascular disease).[20,26,27] These processes are conceptualized as dynamic and complex, influenced by both contextual and individual characteristics and histories. Thus,

stress process models explicitly distinguish between stressors (conditions conducive to stress) and perceptions of stress, recognizing that both may influence health independently[28,29] and that no one observed stressor is likely to have the same impact on all who encounter it.[30,31] For example, differences in access to economic, educational, or social resources may influence perceptions of stress and behavioral or physiological responses, together shaping implications for health outcomes.[19,21–25,32]

Neighborhood Characteristics, Stress, and Health Population-based evidence has established relationships between socioeconomic position (SEP), exposure to stressors, perceptions of stress, physiological responses, and mental and physical health.[20,24,26,27,33,34] Several studies have shown that residents of neighborhoods with higher poverty rates encounter environments that are more conducive to some types of stressors compared to residents of more affluent neighborhoods,[35–40] and that these contexts are, in turn, associated with child development outcomes,[13] self-rated health,[41–43] depression,[12,44,45] physical functioning,[42,46] and mortality.[47] Adolescents and adults residing in communities with higher levels of poverty report higher levels of a variety of indicators of chronic stress.[29,35–38,48–50] and perceptions of stress substantially mediate neighborhood-level variations in mental and physical health.[51–53]

There is evidence that perceptions of neighborhoods are associated with racial and ethnic composition. Neighborhoods with higher concentrations of African Americans and Latinos have higher levels of physical environmental contaminants than economically comparable neighborhoods with higher concentrations of white residents[54,55] thus potentially influencing perceptions of stress among residents. Perceptions of neighborhood conditions also appear to be influenced by subjective attributions associated with race and ethnicity. For example, a recent study of Chicago neighborhoods reported that neighborhood percent poverty, African American, and Latino, were each independently associated with perceptions of "neighborhood disorder" after adjusting for compositional effects.[48] This study found that whites reported higher levels of neighborhood disorder than African Americans in the same neighborhood and that Latinos were more sensitive to changes in percent African American compared to whites. These findings are consistent with theoretical and conceptual models that emphasize the joint contributions of objective conditions (stressors) and subjective responses to those conditions in shaping perceived stress. They suggest that perceptions of social and physical environmental conditions are influenced by both structural conditions and by personal and collective histories that vary systematically by race and ethnicity within the United States.[48,56,57]

Residential Stability, Stress, and Health Neighborhoods with high levels of residential stability may be conducive to strong ties among residents, lower levels of perceived stress, and more positive health outcomes. Conversely, high levels of residential turnover can disrupt existing social networks, contribute to tensions between long term and newer residents, and increase vulnerability to citing of noxious land uses.[54] These factors may influence perceptions of the neighborhood and ultimately health. Despite these hypothesized relationships, we are not aware of any empirical research that directly examines the effects of residential stability on perceptions of the neighborhood environment.

Evidence regarding relationships between residential stability and health is mixed, reflecting in part differences in measures and levels of analysis (e.g., the proportion of census tract residents who have moved versus individual change in residence in a given time period). There is some evidence that neighborhood residential stability may be protective of mental[58] and physical[52,59] health. Two recent studies found a positive association between neighborhood residential stability and mental well-being only for residents of affluent neighborhoods,[5,60] and one found a negative relationship to mental health among an older adult population in an urban neighborhood.[61] Together, this body of work suggests that neighborhood residential stability may be protective of health under some conditions or in some populations, but less positive or even detrimental in others. Better understanding relationships between residential stability and perceptions of neighborhood environments may help to clarify pathways and conditions under which residential stability contributes to health.

Research Questions We use multilevel, multivariate models to build on the extant literature in several important ways. First, we test the hypothesis that neighborhood percent poverty, percent African American and percent Latino are positively associated with perceptions of social and physical environmental stress, adjusting for individual-level characteristics. Second, we test the hypothesis that residential stability is negatively associated with perceived social and physical environmental stress, and if so, whether relationships are modified by neighborhood economic characteristics. Third, we test whether the mean poverty rate of adjacent neighborhoods is positively associated with perceived social and physical environmental stress. Fourth, we test the extent to which individual-level racial and ethnic differences in perceived social and physical environmental stress are mediated or moderated by neighborhood-level characteristics.

DATA AND METHODS

Sample Data for this study are drawn from the Healthy Environments Partnership (HEP) community survey, one component of a community-based participatory research study conducted with a multiethnic sample of adults in Detroit, Michigan, and from 2000 census data. Academic, health care provider, and community-based organizational partners were actively involved in each step of the research process, including decisions about study design, implementation, methodology, interpretation, and dissemination of findings (see Acknowledgements for list of partners).[62] The University of Michigan Institutional Review Board for Protection of Human Subjects approved the HEP study in January 2001.

The HEP survey is a stratified two-stage probability sample of occupied housing units designed for 1,000 completed interviews of adults aged 25 years and older in three areas of Detroit. The final study sample consisted of 919 face-to-face interviews: interviews were completed with 75% of households in which an eligible respondent was identified and 55% of households estimated to have an eligible respondent.[63]

Measures Dependent variables included indicators of perceived social and physical environmental stress, informed by focus groups conducted with neighborhood residents.[29,62,64] Perceived *social environmental stress* was the mean of six items assessing the frequency with which the respondent indicated that each of the

following were a problem in their neighborhood: gang activity, drug dealing or drug dealers, gunfire or shootings, prostitution, loitering or hanging around, or theft, vandalism, or arson. Response categories ranged from 1=never to 5=always (Cronbach's alpha=0.83). Perceived *physical environmental stress* was the mean of seven items assessing agreement with the following statements: houses in my neighborhood are generally well maintained (reverse coded); there is heavy car or truck traffic in my neighborhood; my neighborhood has a lot of vacant lots or vacant houses; there is air pollution like diesel from trucks or pollution from factories or incinerators in my neighborhood; streets, sidewalks, and vacant lots in my neighborhood are kept clean of litter and dumping (reverse coded); there is a lot of loud noise from cars, motorcycles, music, neighbors, or airplanes in my neighborhood; and there is contaminated land in my neighborhood. Response categories ranged from 1=strongly disagree to 5=strongly agree. (Cronbach's alpha=0.69).

Individual-level independent variables included in the models were: age in years; gender (0=male, 1=female); marital status (0=not currently married, 1=currently married), number of people in the household, self-reported race and ethnicity (categorized as: African American; white; and Latino, including participants of any race and who reported Hispanic/Latino ethnicity. African American was used as the referent group), household income (<$10,000, $10,000–19,999, $20,000–34,999, >$35,000, with >$35,000 as the referent group); education (<12 years, 12 years, >12 years, with >12 as the referent group); labor force participation (0=not currently working, 1= currently working), number of years of residence in the neighborhood, and home ownership (0=not a home owner; 1=home owner).

Neighborhood-level independent variables included indicators of poverty, racial and ethnic composition, and residential stability of the census block groups (used as proxies for respondents' neighborhoods). These data are drawn from the 2000 Census Summary Files 1 or 3. Respondents lived in 69 census block groups. Percent poverty, percent African American, and percent Latino were continuous variables defined as the percent of households with incomes below the poverty line, residents who identified their race as African American, and residents who identified their ethnicity as Latino, respectively. Residential stability was a continuous variable defined as the percent of census block group residents who had been living at the same address for 5 years or more. We also created a measure of the mean percent poverty in neighborhoods adjacent to (sharing a common border with) each neighborhood in which survey respondents resided.

Analysis Two-level weighted hierarchical generalized regression models were estimated using HLM 6.02 (Scientific Software International, Lincolnwood IL, 2005). Level 1 was the individual level; level 2 was the neighborhood. We first estimated unconditional random effect models to determine the percent of the total variability in perceived physical environmental stress and perceived social environmental stress explained at the neighborhood level. Next, we ran grand mean centered regression models to test the effects of neighborhood-level variables, accounting for individual-level compositional effects. Model 1 included neighborhood percent poverty, African American and Latino, adjusted for individual characteristics (age, gender, marital status, race and ethnicity, education, income, number of persons in the household, labor force participation, years of residence in the neighborhood, and home ownership) to test the hypothesis that neighborhood percent poverty, percent African American, and percent Latino are

positively associated with perceptions of social and physical environmental stress. Model 2 added neighborhood residential stability to test the hypothesis that residential stability is negatively associated with perceived social and physical environmental stress, above and beyond the effects of neighborhood economic conditions, and racial and ethnic composition. To test the hypothesis that the mean poverty rate of adjacent neighborhoods is positively associated with perceived social and physical environmental stress, above and beyond the effects of neighborhood poverty, racial and ethnic composition, and residential stability, in model 3, we added the mean percent poverty in surrounding neighborhoods. We ran group mean centered models to test the hypothesis that individual-level characteristics predict perceptions of social and physical environmental stress within neighborhoods, accounting for neighborhood-level characteristics. Finally, we modeled interaction terms to test the hypothesis that: (1) effects of neighborhood residential stability are contingent on neighborhood poverty; and (2) individual-level racial differences are contingent upon neighborhood racial composition or poverty. All models are adjusted for sample weights for unequal probabilities of selection and to match the sample to Census 2000 population distributions for the study areas.

RESULTS

Descriptive statistics illustrating study variables adjusted for the sample weights are shown in Table 1. Participants' mean age was 46 years, 52% were female, 26% were currently married, and 57% were African American, 22% Latino, and 19% White. Thirty-three percent reported education beyond high school, and 23% reported annual household incomes of >$35K. There was an average of 2.8 persons per housing unit, the average years of residence in the neighborhood at the individual level was 18.5 years, and 65% of participants were currently in the labor force. The mean level of perceived physical environmental stress was 2.9, and the mean level of perceived social environmental stress was 2.7 (both variables on a five-point scale). Neighborhoods, on average, were 66.8% African American and 15.1% Latino. The mean poverty rate was 34.6 in the residential neighborhoods and 32.7 in the surrounding (adjacent) neighborhoods. The mean score for residential stability was 56.1% (i.e., 56% of neighborhood residents lived in the same house in which they had lived 5 years previously).

Neighborhood Effects Based on results of fully unconditional models, 18% of the variability in perceived physical environmental stress and 14% of perceived social environmental stress was at the neighborhood level (not shown). Tables 2 and 3 present results for grand mean centered models testing neighborhood effects on perceived *physical environmental stress* and perceived *social environmental stress*, respectively. In grand mean centered models, neighborhood-level variables are interpreted as the effect of one unit of variation from the grand mean (across neighborhoods) for that variable.

Perceived Physical Environmental Stress Results presented in Table 2 suggest that neighborhood percent poverty ($p = .003$), percent African American ($p = .009$), and percent Latino ($p = .012$) were each positively and independently associated with perceived *physical environmental stress*, above and beyond individual-level effects. These effects remained significant after adjusting for neighborhood residential stability ($p = .670$; model 2). Neighborhood percent African American and Latino remained significant after adjusting for mean percent poverty in surrounding

TABLE 1 Descriptive tables of demographic variables

Individual-level variables	*N*	Percent	Mean	SD
Age	919		46.3	0.8
Gender				
Male	287	47.7		
Female	632	52.3		
Marital status				
Married	230	26.4		
Not currently married	689	73.6		
Race/ethnicity				
Hispanic	182	22.2		
White	199	18.8		
Black	522	56.8		
Other	16	2.3		
Annual household income				
<$10,000	250	27.3		
$10,000-$19,999	238	26.0		
$20,000–34,999	230	23.6		
$35,000 or more	201	23.0		
Education				
<12 years	327	36.9		
12 years	259	29.1		
>12 years	321	32.8		
Other	12	1.2		
Number of members in HU	919		2.8	0.1
Length of residence in neighborhood	919		18.5	0.7
In labor force				
No	339	35.1		
Yes	580	64.9		
Home owner				
Yes	424	51.5		
No	495	48.5		
Perceived social environmental stress	919		2.7	0.1
Perceived physical environmental stress	919		2.9	0.0
Neighborhood-level variables				
Percent poverty	69		34.6	12.6
Percent African American	69		66.8	36.0
Percent Latino	69		15.1	26.3
Residential Stability	69		56.1	14.3
Mean percent poverty, surrounding neighborhoods	69		32.7	7.7

neighborhoods (p=.085; model 3). Tests of interactions between neighborhood residential stability and neighborhood poverty rate were not significant (results not shown).

Perceived Social Environmental Stress Results shown in Table 3 indicate that percent African American was significantly associated with perceived *social environmental stress* (p=.016; model 1), adjusting for individual-level characteristics. After adjusting for residential stability (p=.072; model 2), the coefficient for percent African American increased (p=.004). Neighborhood percent poverty and percent Latino

TABLE 2 Perceived physical environment stress regressed on neighborhood characteristics, adjusting for individual characteristics (grand mean centered models, individual-level variables not shown)

	Model 1			Model 2			Model 3		
Parameter	Est	SE	*p* value	Est	SE	*p*-value	Est	SE	*p* value
Intercept	3.131	0.058	<0.001	3.131	0.058	<0.001	3.128	0.059	<0.001
Neighborhood level									
Percent poverty	0.017	0.006	0.003	0.018	0.006	0.003	0.011	0.006	0.063
Percent African American	0.006	0.003	0.009	0.009	0.003	0.005	0.008	0.003	0.013
Percent Latino	0.011	0.004	0.012	0.012	0.004	0.007	0.010	0.004	0.017
Residential stability				−0.002	0.004	0.670	−0.004	0.005	0.441
Surrounding percent poverty (adjacent block groups)							0.019	0.011	0.085
Neighborhood-level variance	0.513	0.513	0.512						
Individual-level variance	0.095	0.098	0.094						
ICC	0.157	0.160	0.156						

were not significant predictors of perceived *social environmental stress*, after adjusting for the other variables included in the models. After adjusting for the mean percent poverty in surrounding neighborhoods ($p=.235$), residential stability was negatively significantly associated with perceived *social environmental stress* ($p=.050$). The relationship between residential stability and perceived *social environmental stress* was not modified by neighborhood percent poverty (results not shown). To more clearly understand relationships between residential stability, percent African American, and mean poverty in surrounding neighborhoods, we regressed residential stability on percent African American and found a significant positive relationship ($p<.001$, results not shown). In other words, in neighborhoods with higher percent of African American residents, a larger proportion of residents had lived in their current household for 5 years or more. We also regressed residential stability on percent poverty in surrounding neighborhoods and found a significant positive relationship ($p=.013$, results not shown), with greater residential stability in neighborhoods with higher mean levels of poverty in surrounding block groups.

Individual Effects Tables 4 and 5 present individual-level effects, using group mean centered models for perceived *physical* and *social environmental stress*, respectively. For each dependent variable, model 1 shows group mean centered individual-level effects, unadjusted for neighborhood characteristics; model 2 includes neighborhood percent poverty, African American and Latino; and model 3 adds neighborhood residential stability. Individual-level effects did not change with the addition of surrounding neighborhood poverty (not shown). In group mean centered models, individual-level variables are interpreted in comparison to other residents of the same neighborhood. Thus, for example, a significant effect of race is interpreted as the effect of being white versus African American within the same neighborhood.

As shown in Table 4, white participants reported significantly higher levels of perceived *physical environmental stress* compared with African American participants in the same neighborhoods ($p<.001$). This difference remains after controlling for the neighborhood characteristics described above. Results presented in Table 5 indicate that older ($p=.028$), female ($p=.007$), and African American ($p=.005$) participants reported lower levels of *social environmental stress* compared with those in the same neighborhood who were younger, male, and white (model 1). These differences remained significant after accounting for neighborhood-level variables (models 2 and 3). While Latinos reported higher levels of *social environmental stress* than African Americans ($p=.080$), this relationship was not statistically significant. Interaction terms testing whether relationships between individual-level race and perceived social and physical environmental stress were modified by neighborhood percent poverty, African American, or Latino were not significant (results not shown).

DISCUSSION

Neighborhood Level Our findings that neighborhood percent African American was associated with perceptions of *social* and *physical environmental stress*, and that neighborhood percent poverty and Latino were associated with perceptions of *physical environmental stress* after accounting for individual-level variables, are consistent with results reported elsewhere.[48] The significant relationship between percent African American and perceived *social environmental stress* was evident

TABLE 3 Perceived social environment stress regressed on neighborhood characteristics, adjusting for individual characteristics (grand mean centered models, individual-level variables not shown)

Neighborhood social environment									
	Model 1			Model 2			Model 3		
Parameter	Est	S.E.	p-value	Est	S.E.	p-value	Est	S.E.	p-value
Intercept	2.674	0.073	<0.001	2.675	0.068	<0.001	2.673	0.067	<0.001
Neighborhood level									
Percent poverty	0.004	0.007	0.588	0.005	0.007	0.418	0.001	0.007	0.919
Percent African American	0.010	0.004	0.016	0.013	0.004	0.004	0.012	0.004	0.006
Percent Latino	0.008	0.006	0.178	0.010	0.006	0.073	0.009	0.006	0.107
Residential stability				-0.010	0.006	0.072	-0.012	0.006	0.050
Surrounding percent poverty (adjacent block groups)							0.014	0.012	0.235
Neighborhood-level variance		0.711			0.710			0.709	
Individual-level variance		0.134			0.123			0.125	
ICC		0.158			0.148			0.150	

TABLE 4 Perceived physical environmental stress regressed on individual-level variables, adjusted for neighborhood effects (group mean centered models, neighborhood-level variables not shown)

Perceived physical environmental stress									
	Individual-level variables only			Model 1[a]			Model 2[b]		
Parameter	Est	SE	*p* value	Est	SE	*p* value	Est	SE	*p* value
Intercept	3.076	0.044	<0.001	3.095	0.041	<0.001	3.094	0.041	<0.001
Individual level									
Age	−0.005	0.003	0.105	−0.005	0.003	0.108	−0.005	0.003	0.108
Female (male referent)	−0.015	0.075	0.839	−0.017	0.075	0.816	−0.017	0.075	0.817
Marital status (not married ref)	0.053	0.082	0.518	0.054	0.082	0.513	0.054	0.082	0.512
Race/ethnicity (black ref)									
White	0.474	0.107	<0.001	0.472	0.107	<0.001	0.472	0.107	<0.001
Hispanic/Latino	0.084	0.116	0.470	0.081	0.116	0.484	0.081	0.116	0.483
Education (>12 years referent)									
<12 years	−0.049	0.089	0.580	−0.048	0.089	0.489	−0.048	0.088	0.585
12 years	−0.060	0.074	0.417	−0.067	0.074	0.369	−0.067	0.074	0.369
Income (>35K referent)									
<10K	0.052	0.147	0.726	0.052	0.147	0.726	0.051	0.147	0.726
10–<20K	0.020	0.139	0.887	0.019	0.139	0.893	0.019	0.139	0.894
20–<35K	0.177	0.123	0.151	0.177	0.123	0.152	0.177	0.123	0.152
Number in household	0.001	0.027	0.968	0.001	0.027	0.973	0.001	0.027	0.973
In labor force (not in labor force ref)	−0.061	0.098	0.538	−0.058	0.098	0.562	−0.058	0.098	0.562
Length of residence in neighborhood	0.001	0.003	0.658	0.001	0.003	0.673	0.001	0.003	0.674
Home owner (renter ref)	−0.092	0.102	0.369	−0.094	0.102	0.362	−0.093	0.102	0.363
Neighborhood-level variance	0.514			0.513			0.514		
Individual-level variance	0.084			0.068			0.070		
ICC	0.140			0.117			0.120		

[a]Model 1: adjusted for neighborhood percent poverty, percent African American and percent Latino
[b]Model 2: adjusted for neighborhood percent poverty, percent African American, percent Latino and residential stability

TABLE 5 Perceived social environmental stress regressed on individual-level variables, adjusted for neighborhood effects (Group mean centered models, neighborhood-level variables not shown)

Perceived social environmental stress									
	Individual-level variables only			Model 1[a]			Model 2[b]		
Parameter	Est	SE	*p* value	Est	SE	*p* value	Est	SE	*p* value
Intercept	2.631	0.058	<0.001	2.658	0.051	<0.001	2.647	0.049	<0.001
Individual level									
Age	−0.009	0.004	0.028	−0.009	0.004	0.029	−0.009	0.004	0.029
Female (male referent)	−0.269	0.098	0.007	−0.272	0.098	0.006	−0.272	0.098	0.006
Marital status (not married ref)	−0.187	0.099	0.059	−0.188	0.099	0.056	−0.187	0.099	0.059
Race/ethnicity (black ref)									
White	0.444	0.155	0.005	0.447	0.155	0.004	0.450	0.155	0.004
Hispanic/Latino	0.292	0.167	0.080	0.294	0.166	0.076	0.396	0.166	0.075
Education (>12 years referent)									
<12 years	−0.215	0.123	0.079	−0.213	0.123	0.083	−0.217	0.123	0.077
12 years	−0.219	0.127	0.086	−0.225	0.127	0.075	−0.225	0.126	0.074
Income (>35K referent)									
<10K	−0.187	0.160	0.242	−0.187	0.160	0.243	−0.190	0.160	0.236
10–<20K	−0.167	0.146	0.253	−0.167	0.146	0.254	−0.169	0.146	0.249
20–<35K	−0.138	0.152	0.361	−0.139	0.152	0.362	−0.142	0.152	0.350
Number in household	0.016	0.029	0.587	0.016	0.029	0.595	0.016	0.029	0.595
In labor force (not in labor force ref)	−0.064	0.141	0.652	−0.061	0.141	0.669	−0.061	0.141	0.673
Length of residence in neighborhood	−0.003	0.004	0.460	−0.003	0.004	0.456	−0.003	0.004	0.450
Home owner (renter ref)	−0.240	0.132	0.068	−0.244	0.132	0.065	−0.243	0.132	0.066
Neighborhood-level variance	0.714			0.713			0.712		
Individual-level variance	0.125			0.090			0.088		
ICC	0.149			0.112			0.110		

[a]Model 1: adjusted for neighborhood percent poverty, percent African American and percent Latino
[b]Model 2: adjusted for neighborhood percent poverty, percent African American, percent Latino, and residential stability

after accounting for neighborhood residential stability, suggesting that the relationship between percent African American and perceived *social environmental stress* is suppressed until the effects of residential stability are accounted for.[61,65] Said differently, the protective effects of greater residential stability in neighborhoods with a higher proportion of African Americans masked the relationship between percent African American and perceived *social environmental stress*, until those effects were specified. In contrast to others,[48] we do not find a significant association of percent poverty or Latino with perceptions of the *social environment*, although these associations were in the expected direction. These differences may reflect limitations of statistical power, or differences in measures or study samples, discussed in greater detail below.

We found partial support for the hypothesis that neighborhood residential stability is associated with perceptions of the neighborhood environment, with perceived *social* but not *physical environmental stress* declining with increasing residential stability. Furthermore, the protective effects of neighborhood residential stability were not significant until we accounted for mean poverty level in surrounding neighborhoods. The relationship between residential stability and perceived *social environmental stress* was not modified by poverty level in the neighborhood of residence. The finding of a protective effect of residential stability is consistent with the hypothesis that high levels of turnover within neighborhoods may disrupt existing social networks and contribute to tensions between residents who have lived there for longer periods of time and newer residents. If, as some have suggested,[54] residential instability influences physical environments by decreasing residents' capacity to resist citing of noxious land uses, the absence of a significant relationship between residential stability and physical environmental stress may reflect the cross-sectional nature of our data. Such effects may be more visible in panel or longitudinal analyses.

Finally, although relationships are in the expected direction, relationships between mean percent poverty in surrounding neighborhoods and perceived *social* or *physical environmental stress* were not significant. The relationship between residential stability and neighborhood social environmental stress was significant only after accounting for lagged poverty in surrounding neighborhoods, and a similar, although not significant, effect is seen for neighborhood physical environmental stress. Given that relatively few studies have examined the effects of adjacent neighborhoods, the mixed results reported in the literature to date, and our finding of a suppressor effect of mean poverty in surrounding neighborhoods on residential stability, additional studies examining this question in neighborhoods with a wider range of poverty characteristics would be beneficial.

Individual Level Our finding that whites report significantly higher levels of both perceived *social* and *physical environmental stress* compared with African American residents of the same neighborhoods adds to a body of evidence that race influences perceptions of contextual characteristics. These findings are consistent with results reported for a Chicago-based sample[48] which also accounted for observed indicators of the environment, above and beyond neighborhood, and individual-level characteristics included here. Our findings extend those reported elsewhere by demonstrating that racial differences persist after accounting for neighborhood residential stability and concentration of poverty in surrounding neighborhoods. While relatively few studies reported to date have examined this issue, the consistency of the finding of race differences in perceptions of the social and

physical environment after accounting for a range of neighborhood and individual characteristics, with different samples and comparable but not identical measures of neighborhood physical and social conditions, suggests the resilience of these relationships.

Limitations There are several limitations of this analysis. The data are cross-sectional, and hence, we cannot definitively determine the direction of associations between variables. Our model posits a primary direction of association, with for example, higher neighborhood poverty resulting in heightened perceptions of *physical* and *social environmental stress*. While the hypothesized direction of effects is supported by the extant literature, there may be some reciprocal effects. For example, residents who perceive environments as unduly stressful may move out of the neighborhood, with the result that we only record the somewhat lower self-reports of stress among those who remain. Such a selection process would bias the findings reported here in a conservative direction. In addition, we have already noted that some relationships, such as those between residential stability and perceived *physical environmental stress*, may emerge over time. An important consideration for future analyses will be the availability of longitudinal data to further disentangle the direction and dynamic nature of these relationships.

The addition of self-reported data for perceived *physical* and *social environmental stress* has both strengths and limitations. On the one hand, self reports of stress associated with physical and social environments are subjective, and may be influenced by a variety of factors, including objective conditions, personal and collective histories, and life experiences. Stress process models emphasize the importance of assessing individuals' perceptions to capture the subjective nature of these phenomena, with the understanding that individuals act or respond on the basis of their perceptions. On the other hand, indicators of stress used here may be subject to "same source bias" in that they were derived from the same survey instrument as the individual-level independent variables used in the analysis. However, the significant individual-level predictors of perceived *social* and *physical environmental stress* in these models (age, marital status, gender, race, and ethnicity) are relatively stable, minimizing this potential risk. The addition of objective or independently assessed indicators of social and physical environmental conditions would extend the analyses reported here, allowing us to disentangle the contributions of variations in observed indicators and subjective responses to those conditions (see Sampson RJ, Raudenbush SW for an example). [48] Even without such controls, however, the use of group mean centered models for these comparisons helps to reduce this risk, comparing individuals who live in close proximity to each other.

Statistically insignificant results for some neighborhood variables may be due, in part, to the relatively modest sample size (919 individuals nested within 69 neighborhoods). The mean poverty rate for the study neighborhoods (34.6%, SD = 12.6, min = 7.8, max = 63.1) is higher than mean neighborhood poverty rate for the city of Detroit as a whole (28.1%, SD = 14.2). It is also high compared to the national mean (12.7%)[66] as well as those reported in similar studies.[13,48] Our failure to reject the null hypothesis that poverty is associated with perceived social environmental stress and that poverty in adjacent neighborhoods is associated with either measure of perceived environmental stress, may reflect the relatively modest sample size and compressed range of economic variance.

The mean percent African American for block groups included in this analysis was 67% (SD = 36.0, min = 0.0, max = 100.0). While this mean is somewhat lower

than the mean percent African American at the block group level for Detroit city as a whole (77.1%, SD=27.3), it is substantially higher than the national population mean of 12.7% African American.[66] Despite the relatively high proportion of African Americans in this sample, our findings are consistent with those reported by Sampson and Raudenbush in a Chicago-based sample with mean percent African American of 36% (SD=42). However, further research with block groups reflecting a more nationally representative sample will be important to examine the extent to which the findings reported here are applicable to neighborhoods with a broader distribution of racial and ethnic groups.

The mean level of residential stability within block groups included in this analysis (56.1%, SD=14.3, min=21.5, max=87.9) is fairly comparable to the mean for Detroit city (59.6%, SD=12.9) and to the national mean (54%).[66] The mean percent Latino at the block group level for our sample (15.1%, SD=26.3, min=0.0, max=83.7) is higher than the Detroit city block group-level mean (5.6%, SD=14.6) and comparable to the national population mean of 15%.[66] As noted above, these differences may influence our findings, and future studies which include neighborhoods that are more nationally representative, and with larger sample sizes, would help to confirm these results. However, despite these differences, the results reported here are generally consistent with those reported elsewhere in the literature, as described in the following section.

Implications and Concluding Comments The findings reported here contribute to our understanding of relationships between structural conditions (e.g., economic conditions that create areas of concentrated poverty, racial segregation) and residents' perceptions of social and physical environmental stress associated with their neighborhoods. They extend a growing body of evidence linking neighborhood characteristics with a wide range of social and health indicators, over and above the effects of the composition of neighborhood residents. These findings reported here suggest the importance of understanding structural conditions such as concentration of poverty and residential stability, in conjunction with racial and ethnic composition of neighborhoods, and their relationships to perceptions of stress associated with neighborhood environments.

Our findings also suggest dynamic relationships between structural conditions within neighborhoods. The higher levels of residential stability in neighborhoods with proportionately more African American residents may reflect strong neighborhood ties. Conversely, they may reflect suppressed mobility due to limited alternative housing options, an undesirable housing market that limits movement of new residents into the neighborhoods, or some combination of these factors. The positive relationship between residential stability and mean poverty in surrounding neighborhoods may suggest the latter mechanisms. Future efforts to disentangle the mechanisms that account for relationships between residential stability, racial composition, and perceptions of the neighborhood environment, are necessary to shed additional light on the mixed findings reported in the literature on residential stability and health.

Our finding that neighborhood racial composition is associated with perceptions of both social and physical environmental stress, above and beyond the effects of poverty and residential stability, is consistent with a growing body of literature that suggests the critical role of racial composition and racial attitudes or attributions in shaping contemporary urban contexts. Our finding of racial differences in perceived environmental stress, after accounting for neighborhood

characteristics, is consistent with findings reported elsewhere indicating differences between white and African American residents' perceptions of neighborhood characteristics[48,67,68] and neighborhood desireability.[67,69,70] These findings join a body of literature suggesting that negative racial stereotypes shape perceptions of neighborhoods,[67,71] and that among whites, neighborhoods with higher proportions of African American residents are associated with heightened perceptions of crime and fear of victimization, above and beyond actual crime rates.[68,72,73] Together, these findings lend credibility to the suggestion that the personal and collective histories of whites and African Americans in the United States systematically influence interpretations and meanings associated with neighborhood characteristics.[48,74–76] These differential interpretations or perceptions must be considered seriously as contributors to white flight from urban neighborhoods[48,70,74,75] reproducing patterns of racial segregation that define many urban neighborhoods and their suburban surroundings. Our finding that residential stability is negatively associated with perceptions of *social environmental stress* suggests the importance of understanding the potential protective effects of efforts to stabilize urban environments.

Finally, the findings reported here suggest the importance of understanding not only contemporary characteristics of neighborhoods, but the social histories that influence racial and ethnic differences in perceptions or interpretations of those characteristics. The main effects of neighborhood racial composition on perceived social and physical environmental stress across racial and ethnic groups, combined with the persistent difference between white and African American residents of the same block group, suggests the urgency of understanding how racial and ethnic categories and the meanings associated with them influence residents' perceptions of neighborhoods and the actions that they take based on those perceptions.[76] Race is a fundamental category inextricably tied to histories of inequality in the United States, operating through negative racial stereotypes and prejudices.[71,76] It is therefore perhaps not surprising that perceptions of stress associated with neighborhood environments would be associated with neighborhood racial composition. Understanding and addressing the factors that influence urban environments and the health of their residents will require careful attention to both structural conditions that differentially affect racial and ethnic groups in the United States, and histories of race and racism that reflect and continue to drive those inequalities.

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