

Objective and perceived neighborhood environment, individual SES and psychosocial factors, and self-rated health: An analysis of older adults in Cook County, Illinois

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Abstract

This article investigates the relationship among objectively assessed neighborhood socio-economic status (SES), subjective perceptions of neighborhood environment, individual SES and psychosocial factors, and self-rated health among middle-aged and older adults. Analysis of data from a representative sample of adults, aged 50–67 years in Cook County, Illinois, shows a significant association between objective neighborhood SES and self-rated health after controlling for age, gender, and race/ethnicity, but the effect is substantially explained by individual SES and neighborhood perceptions. By contrast, perceived neighborhood quality (i.e., subjective ratings of neighborhood physical, social, and service environments) exhibits a significant effect after controlling for individual socio-demographic factors as well as neighborhood SES. In turn, the effects of perceived neighborhood environment on health are partially explained by the psychosocial factors of loneliness, depression, hostility, and stress, but not by perceived social support or social networks. In sum, the research supports a model in which the effects of neighborhood SES on self-rated health act through sequential pathways of individual SES, perceptions of neighborhood quality, and psychosocial status.

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Introduction

Recent years have witnessed an exponentially growing literature that documents the relationship between place of residence and physical and/or mental health (Kawachi & Berkman, 2003a, b). The majority of these studies have used census-based

socio-economic status (SES) information to tap the material circumstances of local neighborhoods (Pickett & Pearl, 2001; Robert, 1999). Although to a lesser extent, previous research has also examined how neighborhood perceptions affect residents' health (Aneshensel & Sucoff, 1996; Ellaway, Macintyre, & Kearns, 2001; Wilson et al., 2004). Some evidence shows that residents' self-reports of their neighborhood environment may be less revealing than are objective assessments (Macintyre & Ellaway, 2003). Yet other studies suggest that perceived neighborhood environment exerts a unique

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effect and may be a more telling indicator for individual health than objective neighborhood characteristics (Caughy, O'Campo, & Muntaner, 2003; Christie-Mizell, Steelman, & Jennifer, 2003; Hadley-Ives, Stiffman, Elze, Johnson, & Dore, 2000; Ross, 2000; Sooman & McIntyre, 1995). For example, worries about crime and actual experience of crime do not necessarily coincide geographically (Sooman & McIntyre, 1995), and fear of crime appears to be a better predictor of physical inactivity than actual crime rates (Kawachi & Berkman, 2003a). Clearly, simultaneous examination of both objective and subjective measures of neighborhood environment is needed to advance our knowledge about how neighborhood affects health.

The current study simultaneously investigates the relationships among objectively assessed neighborhood SES, subjective perceptions of neighborhood environment, individual SES and psychosocial factors, and self-rated health in a population-based sample of middle-aged and older adults. Specifically, we first examine the effects of neighborhood SES and perceived neighborhood quality on self-rated health after controlling for individual socio-demographic background. We then explore the psychosocial attributes of individuals as explanatory factors connecting neighborhood environment with health.

Background

Neighborhood environment and health

Both objective and perceived neighborhood measures have been used to capture neighborhood effects on health. Perceived neighborhood environment is typically assumed to be largely reflective of objective neighborhood conditions, and to some extent, this assumption has been empirically borne out. Ellaway et al. (2001) showed that neighborhood of residence strongly predicted perceptions of problems and neighborhood cohesion in the area. Similarly, Sampson and Raudenbush (2004) showed that independently rated neighborhood disorder was positively and significantly correlated with perceived disorder. On the other hand, Sampson and Raudenbush's study also revealed that the objective neighborhood context was not the only source of neighborhood perception, and that perceived disorder was affected by a range of individual and neighborhood socio-structural factors (e.g.,

age, race, concentrated poverty) after controlling for objective disorder.

Independent effects of objective and subjective neighborhood conditions are not surprising given that objective indices of neighborhood condition, such as census tract information, characterize the neighborhood as a whole (e.g., schools, police, emergency personnel, roads, parks, public transportation, and parking), whereas residents may differentially value individual aspects of the neighborhood. Moreover, the same neighborhood problem, for example, pitted sidewalks, may appear more annoying to elderly persons who are more likely than younger people to have functional limitations. This perceptual difference could, in turn, be associated with differential health outcomes if, for example, the elderly individual consequently hesitates to go for walks, socialize with neighbors, or see the doctor. Hence, objective conditions of residential neighborhood may, to some extent, impact health via residents' subjective perceptions of the neighborhood environment. This hypothesis has received some support from recent research (Ross, 2000; Stiffman, Hadley-Ives, Elze, Johnson, & Dore, 1999).

A growing body of research shows that neighborhood perceptions contribute to mental and physical well-being. For example, Aneshensel and Sucoff (1996) found that negative perceptions of the neighborhood environment were associated with elevated depressive symptoms, anxiety, and other mental health problems among adolescents. Ellaway et al. (2001) similarly reported that self-rated health, mental health, and recent symptoms were all associated with perceived local problems and neighborhood cohesion. Likewise, a British study showed that fear of crime played a key role in explaining area differences in self-rated health (Chandola, 2001).

Longitudinal evidence has further shown that neighborhood perceptions may have a causal effect on mental health. In a 10-year follow-up survey from Norway, perceived improvement in social environment paralleled the improvement in mental health (Dalgard & Tambs, 1997). A recent study in the US also demonstrated that neighborhood perceptions prospectively influenced the risk of depressed affect after controlling for baseline demographic and health measures (Latkin & Curry, 2003). The effect of neighborhood perceptions is not limited to mental outcomes. Using longitudinal data from the Alameda County Study, Blafour and

Kaplan (2002) found that perceived neighborhood problems—including traffic, noise, crime, trash and litter, lighting, and public transportation—were linked to higher risk of overall functional loss a year later among people aged 55 years and older after controlling for their baseline health, suggesting a causal impact of neighborhood perceptions on physical functional health.

Despite ready evidence of the link between health and neighborhood environment, whether measured objectively or subjectively, surprisingly little research has evaluated the relative implications for health of objective environment and subjective perceptions of local neighborhoods. Based on prior findings and our theoretical framing, we hypothesize that health status will be more strongly affected by neighborhood perceptions than by objective neighborhood environment, and that neighborhood perceptions may mediate the effect of objectively assessed neighborhood environment on health.

Mechanisms

Broadly, there are two levels of mechanisms underlying the link between residence and health, one at the neighborhood level and the other at the individual level. At the *neighborhood* level, physical, social, and service environments, among others, have been proposed to contribute to the link between neighborhood SES and health (Kawachi & Berkman, 2000; Macintyre, Ellaway, & Cummins, 2002; Macintyre, Maciver, & Sooman, 1993; Robert, 1998; Wen, Browning, & Cagney, 2003). At the *individual* level, perceptions of these environmental aspects may serve as pathways linking neighborhood SES to health.

Also at the individual level, psychosocial characteristics may help to explain how perceived or objective neighborhood environment influences individual health. For instance, it is well-known that marriage is beneficial to both physical health and mental well-being (Waite, 1995) and social integration (e.g., number of social ties) tend to have a positive effect on health (Berkman, Glass, Brissette, & Seeman, 2000). Social ecological conditions of local neighborhoods may influence the extent and nature of individual social ties. For example, in a place where environmental hostility and social mistrust prevail, even an outgoing, flexible, and well-connected person may have difficulty finding friends. Physical features of the community such as house and street design, as well as social features

such as level of trust and safety, directly encourage or discourage neighborly networking (Cattell, 2001; Mollenkopf et al., 1997). Thus for most people, the lack of local social ties may signal a substantial deficiency in accessible personal social resources. In this light, the link between neighborhood and health may be explained by the impact of neighborhood physical and social environment on individual social networking.

Although poor urban areas can be tightly integrated with extensive patterns of social interaction (Glass & Balfour, 2003; Stack, 1974), the level of perceived social support among persons living in impoverished neighborhoods may be low if they have limited resources to support each other (Wen, Cagney, & Christakis, 2005). Social support tends to buffer the damaging health impact of major life events and chronic strains (Cohen & Wills, 1985), suggesting that this may be one mechanism by which neighborhood environment affects health. Moreover, socially isolated and/or poorly supported individuals may perceive themselves to be lonely. The objective state of social isolation and subjective perceptions of loneliness and lack of support may exert joint as well as unique psychological pressure and chronic stress that could potentially harm health. Loneliness (Cacioppo, Hughes, Waite, Hawkey, & Thisted, 2006) and neighborhood SES (Aneshensel & Sucoff, 1996; Latkin & Curry, 2003) also predict depressive symptoms, which may, in turn, increase risk for all-cause mortality and cardiovascular disease specifically (Gallo & Matthews, 2003; Rozanski, Blumenthal, & Kaplan, 1999; Wulsin, Vaillant, & Wells, 1999). Psychosocial states such as loneliness and depression, therefore, could underlie the association between neighborhood with health.

Moreover, low-SES environments, signaling overall life hardship that includes living in a distressed, unsafe, and unpleasant neighborhood, may be reflected in perceptions of stress and feelings of anger and hostility. It is conceivable that the higher prevalence of a sense of powerlessness, fatalism, frustration, and low self-efficacy among low-SES people living in poor neighborhoods (Mirowsky & Ross, 2003; Wilson, 1996) may lead to higher risk for negative emotions and attitudes which can be health-compromising in the long run.

Lastly, personality characteristics such as optimism may play an additional role in contributing to the link between neighborhood and health. Better neighborhood perceptions are associated

with optimism (Greenberg & Schneider, 1997) and optimism has been linked to better health via pathways such as better coping among caregivers (Gottlieb & Rooney, 2004) and healthier lifestyles (Kelloniemi, Ek, & Laitinen, 2005).

These discussions underscore the importance of psychosocial factors for understanding contextual effects on health. Indeed, in recent syntheses of social and biological explanations for health, scientists have shown that the nervous, endocrine, and immune systems do not function autonomously outside the reach of the social environment but are exquisitely responsive to social realities by way of psychosocial processes that include depressive symptoms, loneliness, social support, perceived stress, and hostility (Cacioppo, Berntson, Sheridan, & McClintock, 2000; Kiecolt-Glaser, Speicher, Holliday, & Glaser, 1984; McEwen, 1998; Uchino, Cacioppo, & Kiecolt-Glaser, 1996; Williams, 2002). The “accelerated aging hypothesis” further specifies that psychological and physiological responses to demanding environmental stimuli operate as key mechanisms linking social conditions with health (Berkman & Kawachi, 2000; Cassel, 1976).

The current study was designed to test the relationships among neighborhood objective SES, perceived environment, and self-rated health; and to explore the psychosocial mechanisms at the individual level that can potentially help explain these relationships. In other words, when we explore the link between place and health, not only do we examine the objective neighborhood position in the societal structure (i.e., census-based measures of neighborhood SES) and subjective ratings of neighborhood quality, but we also attempt to capture the individual-level psychosocial mechanisms underlying these neighborhood effects.

Methods

Participants

A population-based sample of 229 English-speaking Blacks/African Americans (37 males, 44 females), non-black Latinos (33 males, 33 females), and non-Hispanic Caucasians (39 males, 43 females) between the ages of 50 and 67 years and from Cook County, Illinois, USA, were successfully recruited to participate in a longitudinal study of social isolation and health. The sampling design and recruitment strategies have been reported elsewhere (Cacioppo

et al., 2006; Hughes, Waite, Hawkey, & Cacioppo, 2004).

Dependent variable

Self-rated health was assessed using a single item from the SF-36 (see review by Bailis, Segall, & Chipperfield, 2003). We asked subjects “In general, would you say your health is: (1) excellent, (2) very good, (3) good, (4) fair, or (5) poor?” Self-rated health has high predictive validity for mortality, physical disability, chronic disease status, health behaviors, and health care utilization (Ferraro, Farmer, & Wybraniec, 1997; George, 2001; Idler & Angel, 1990; Idler & Benyamini, 1997; Malmstrom, Sundquist, & Johansson, 1999; Patrick & Erickson, 1993), is highly congruent with and a stronger predictor of mortality than physician-assessed health (Maddox & Douglass, 1973; Mossey & Shapiro, 1982), and has been used in prior studies of neighborhood context and health (Cagney, Browning, & Wen, 2005; Chandola, 2001; Krause, 1996). Preliminary findings indicate that its predictive capacity is comparable for Latinos, African Americans, and Whites (Finch, Hummer, Reindl, & Vega, 2002; Johnson & Wolinsky, 1994). We dichotomized the measure of self-rated health into good health versus fair/poor health, and treated it as a binary outcome to deal with its highly negatively skewed distribution.

Independent variables: objective and perceived neighborhood context

Objectively assessed neighborhood SES was constructed from the 2000 US Census at the census tract level. Measures of neighborhood SES included the percentage of individuals in a neighborhood that were below the federal poverty threshold, the percentage of high school graduates, and the percentage of college-educated residents. The three variables at the census tract level were highly correlated, and were thus combined into a composite index labeled *neighborhood SES*, weighted by factor loadings that in absolute value ranged from 0.77 (% of residents in poverty) to 0.96 (% of high school graduates). The coefficient alpha was 0.85.

Subjective perceptions of neighborhood quality were measured by three subscales tapping the perceived physical, social, and service environments, and by a composite scale comprising the three subscales. Specifically, *perceived physical environment*

Table 1
Correlation matrix of neighborhood variables and self-rated health*

	<i>N</i> -SES	<i>N</i> -Physical	<i>N</i> -Social	<i>N</i> -Service	<i>N</i> -Quality	Self-rated health
1. <i>N</i> -SES	1					
2. <i>N</i> -Physical	0.447	1				
3. <i>N</i> -Social	0.457	0.635	1			
4. <i>N</i> -Service	0.502	0.565	0.675	1		
5. <i>N</i> -Quality	0.537	0.814	0.919	0.858	1	
6. Self-rated health	0.249	0.360	0.253	0.303	0.341	1

N = 214.

*All the correlation coefficients are statistically significant with *p* values < 0.0001.

1. *N*-SES is the objectively assessed (Census-based) measure of neighborhood SES; higher score represent higher SES.
2. *N*_Physical: a factor score based on items tapping neighborhood physical environment; higher scores represent better perceived physical condition.
3. *N*_Social: a factor score based on items tapping neighborhood social environment; higher scores represent better perceived social environment.
4. *N*_Service: a factor score based on items tapping neighborhood service environment; higher scores represent better perceived service environment.
5. *N*_Quality: a composite scale measuring perceived neighborhood context based on subscales of perceived neighborhood physical, social, and service environment; higher scores represent better overall neighborhood quality as rated by subjects.

was represented by a five-item Likert-type scale that asked subjects how they would describe their neighborhood as it is now with regard to affordable and comfortable housing, public parks or open spaces, noise, crowdedness, and air quality. Responses to these items were aggregated into a composite index for the perceived physical environment. Factor analysis showed a single dominant factor underlying these items with a coefficient alpha of 0.8. Factor loadings ranged from 0.63 for air quality to 0.74 for the extent of crowdedness.

Perceived social environment was tapped by a six-item Likert-type scale (excellent, good, fair, poor). We asked subjects to rate friendliness/helpfulness of neighbors, residents' attachment to the neighborhood, self-esteem and morale of the residents, personal safety, opportunity to participate in local government, and access to alderman/local officials. Responses to these items were aggregated into a composite index for the perceived social environment with a coefficient alpha of 0.88. Factor analysis showed a single dominant factor underlying these items. Factor loadings ranged from 0.68 (access) to 0.84 (morale).

The measurement of *perceived local services* was achieved by asking respondents to evaluate their neighborhoods' quality of schools, access to public transportation, policing, hospital/medical care, shopping, lighting, and garbage pickup/snow removal. Factor analysis showed that public trans-

portation was quite incongruent with other items. Excluding public transportation, the items constituted a scale with high internal consistency with a coefficient alpha of 0.85. Factor loadings for the service scale ranged from 0.63 for lighting to 0.77 for policing.

Finally, the *perceived general neighborhood quality* was captured by a composite factor score based on the physical, social, and service subscales, with higher scores representing higher levels of perceived neighborhood quality. Factor loadings for this scale were 0.75, 0.82, and 0.76 for the physical, social, and service subscales, respectively. The composite scale had high internal reliability with a coefficient alpha of 0.84.

Table 1 shows the correlation matrix of all neighborhood-related measures and self-rated health. The objective neighborhood SES measure was significantly correlated with the subjective perceptions of neighborhood quality, but the size of the correlation coefficients (around 0.4–0.5) indicates sizeable non-overlapping variance between the objective and subjective indices of the neighborhood environment. This is consistent with the abovementioned idea that individuals may differ in the value they place on the same objective neighborhood circumstances, and that individual differences in neighborhood perceptions may make unique contributions to health. The perceived neighborhood physical, social, and service environments were highly correlated with each other ($r = 0.6–0.7$; $p < 0.0001$). As expected, each of these

neighborhood factors was also significantly and positively linked to self-rated health.

Independent variables: individual social and psychological status

Individual SES was measured by educational level and by self-reported household income before taxes, including income from all sources. *Marital status* was indicated by a dichotomous variable with married or living with partner versus separated, divorced, widowed, or never married. Other psychosocial variables include social network, social support, loneliness, depressive symptoms, hostility, perceived stress, and optimism. We also constructed a composite measure of *overall psychosocial risk* based on principal component analysis of the measures of social support, loneliness, depressive symptoms, hostility, perceived stress, and optimism. The composite measure of psychosocial risk represents the total burden of advantageous and disadvantageous psychosocial characteristics. Table 2 illustrates the description and internal reliability of these psychosocial variables. Table 3 presents the correlations among these psychosocial variables, neighborhood perceptions, and self-rated health.

The summary statistics are listed in Table 4. Seventeen percent of these subjects rated their health as either poor or fair. The average age for our sample was 57.6 (SD = 4.4). The sample is roughly balanced between Whites and Blacks with slightly fewer Latinos. Among the three racial/ethnic groups, Latino participants tended to have a poorer command of the English language, contributing to a lower survey completion rate. About 53% of the subjects are college educated. More than half of the subjects were either married or cohabiting (61%).

Analysis

After excluding missing data,¹ we have 214 cases in the analysis. We tested whether cases with

¹Cases with missing self-rated health and objective neighborhood SES measures were excluded. For household income, perceived neighborhood social, physical, and service scales, and all the psychosocial variables, predicted values of multivariate regression models were used to fill missing values. Household income was imputed based on age, gender, race/ethnicity, marital status, and education. All other psychological variables were imputed by age, gender, race/ethnicity, marital status, household income, and education. Imputation reduced the percentage of missing cases, and 214 subjects were able to be included in the analysis.

missing data differed from cases with no missing value for self-rated health and the key neighborhood predictors. We found no significant variations in the results. Since we have a relatively small sample across a large geographic area (Cook County, Illinois), the majority of census tracts (79%) included in the study were not represented by more than one case. Our analysis is thus conducted only at the individual level. Individuals who live in the same neighborhood share the same objective reality, so neighborhood SES was conceptualized as an *individual* property that reflects residence in an area whose structural position in the society is assessed independently in the decennial census. To adopt a conservative strategy, however, we used the Huber-White robust method of calculating the variance-covariance matrix to obtain standard errors for the model coefficients that account for correlation among individuals in the same census tract (Fuller, 1975; Rogers, 1993).

We fit logit models to empirically test our conceptual framework. First, we examined effects of the census-based measure of neighborhood SES after controlling for age, gender, race/ethnicity, and individual SES. Next, we explored the effect of perceived neighborhood quality after taking individual socio-demographic factors and neighborhood SES into account. Third, we investigated the role of individual psychosocial variables in the link between neighborhood environment and self-rated health. The results of the analyses are presented in Tables 5 and 6. No serious collinearity problem was found in any models based on the variance inflation factor (VIF) diagnostics (Weisberg, 1980). None of the VIFs was greater than 2.

Results

Table 5 includes the logit estimates and the standard errors for the effect of neighborhood SES and perceived neighborhood quality on the risk for fair/poor self-rated health. Model 5.1 (Table 5, Model 1) shows that neighborhood SES has a significant effect on self-rated health controlling for age, gender, and race/ethnicity. However, according to Model 5.2, this effect was considerably accounted for by individual SES. After including additional controls of educational background and household income into the model, the effect of neighborhood SES was reduced 45% and rendered statistically insignificant at the 5% level. This indicated that our analysis failed to reject the null-hypothesis that

Table 2
Description of psychosocial variables in the study

Psychosocial variables	Description	Coefficient alpha
Social network index	Constructed following the procedures described by Berkman (1977). Ties captured in this index include friends, relatives, marriage, religious group affiliation, and group membership. This is a categorical index that differentially weights four components. So an alpha for the social network index is not meaningful.	
Social support	The 12-item interpersonal support evaluation list (ISEL) assesses the degree to which individuals feel they are socially supported (Cohen & Wills, 1985). Examples of items are, "I feel that there is no one I can share my most private worries and fears with," and "There is someone I can turn to for advice about handling problems with my family." Participants respond to each item on a scale from 1 (definitely false) to 4 (definitely true). Appropriate items were reverse-coded before summing all items to produce a total score. Total scores ranged from 12 to 48, with higher scores representing a greater degree of perceived social support.	0.86
Loneliness	Revised UCLA Loneliness Scale (R-UCLA), a 20-item questionnaire measuring general feelings of social isolation, loneliness, and dissatisfaction with one's social interactions (Russell, Peplau, & Cutrona, 1980). The questionnaire consists of a list of statements such as "People are around me but not with me," "I lack companionship," and "There are people I can turn to." Subjects are asked to rate how often they feel the way described by the items on a scale ranging from 1 (never) to 4 (very often). Once certain items are reverse-scored, all of the items are summed to tabulate loneliness scores for each participant, with higher scores indicating greater loneliness.	0.92
Depressive symptoms	The 20-item Center for Epidemiologic Studies Depression (CES-D) Scale (Radloff, 1977). This scale consists of a list of items such as "I felt depressed," and "I enjoyed life." Subjects were asked to rate how often they felt the way described by the items during the past week on a scale ranging from 0 (rarely or none of the time) to 3 (most or all of the time). After specific items are reverse coded, all of the items are summed to calculate depression scores for each participant, with higher scores indicating higher levels of depressive symptoms. The item about "feeling lonely" in the CES-D was deleted prior to calculating the CES-D total score to avoid inflating the relationship between the constructs due to item-content overlap (results were unchanged by inclusion of this item).	0.89
Hostility	Cook-Medley Hostility Scale (CMHo). The CMHo (Cook & Medley, 1954) is a 50-item scale developed from the Minnesota Multiphasic Personality Inventory (MMPI). For each item, participants were asked to read the accompanying statement and indicate whether or not it applied to them by making either true (1) or false (0). After reverse scoring appropriate items, responses were summed to general a hostility score for each participant. Scores range from 0 (low) to 50 (high).	0.85
Perceived stress	The Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Hoberman, 1983) is a 10-item self-report questionnaire that asks participants to indicate how often they felt or thought a certain way during the past week (see http://www.psy.cmu.edu/~scohen for item content and scoring instructions). Responses to each item were recorded using a five-point Likert scale that ranged from 0 (never) to 4. (very often) Scale scores for each participant were calculated by summing the responses to all items, yielding a scale range of 0 (low) to 40 (high).	0.84
Optimism	Revised Life Orientation Test (LOT-R). The LOT-R is a 10-item questionnaire that asks participants to rate their agreement with each statement on a five-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). Four items served as filler items, and the scale score was calculated by summing the responses to the remaining six items. The range for the scale score is 0 (low optimism) to 24 (high optimism). See Scheier, Carver, & Bridges (1994) for scale design and psychometric properties.	0.73
Psychosocial status (composite)	Finally, we constructed a measure of overall psychosocial status. A composite scale was created by factor scores of social support, loneliness, depressive symptoms, hostility, perceived stress, and optimism, using principal component factor analysis. The composite index of psychosocial status did not include the social network index because it did not fit well in this group.	0.82

neighborhood SES did not have a contextual effect on self-rated health over and above individual SES. Model 5.3 served the purpose of testing the relative influence on health between census-based neighbor-

hood SES and subjective ratings of neighborhood quality. After controlling for neighborhood SES and individual socio-demographic factors, perceived neighborhood quality appeared to be a strong

Table 3
Correlation matrix of self-rated health, perceived neighborhood quality, and psychosocial variables

	1	2	3	4	5	6	7	8	9
1 Self-rated health	1.000								
2 <i>N</i> _Quality ^a	0.341 (0.000)	1.000							
3 Social network index	0.144 (0.036)	0.172 (0.012)	1.000						
4 Social support	0.164 (0.016)	0.253 (0.000)	0.219 (0.001)	1.000					
5 Loneliness	−0.158 (0.021)	−0.262 (0.000)	−0.213 (0.002)	−0.598 (0.000)	1.000				
6 Depressive symptoms	−0.244 (0.000)	−0.308 (0.000)	−0.164 (0.016)	−0.401 (0.000)	0.579 (0.000)	1.000			
7 Hostility	−0.206 (0.002)	−0.230 (0.001)	−0.078 (0.253)	−0.356 (0.000)	0.325 (0.000)	0.383 (0.000)	1.000		
8 Perceived stress	−0.224 (0.001)	−0.315 (0.000)	−0.127 (0.065)	−0.435 (0.000)	0.480 (0.000)	0.711 (0.000)	0.338 (0.000)	1.000	
9 Optimism	0.290 (0.000)	0.235 (0.001)	0.130 (0.058)	0.422 (0.000)	−0.468 (0.000)	−0.516 (0.000)	−0.380 (0.000)	−0.455 (0.000)	1.000

N = 214.

**P* values are presented in the parentheses.

^a*N*_Quality: a composite scale measuring perceived neighborhood context based on subscales of perceived neighborhood physical, social, and service environment. The higher the score in the scale of general quality, the higher the neighborhood quality as rated by subjects.

correlate of self-rated health with one unit decrease in the neighborhood quality scale corresponding to a 70% higher risk of reporting fair or poor health (Model 5.3). In addition, the effect of neighborhood SES was reduced 69% by including perceived neighborhood quality in the model (from Model 5.2 to Model 5.3). Next, we examined the three specific dimensions of perceived neighborhood quality simultaneously in Model 5.4. We found that it was mainly the perceived physical environment (i.e., affordable and comfortable housing, public parks or open spaces, noise, crowdedness, and air quality) that drove the observed relationship between perceived neighborhood quality and self-rated health. According to Model 5.4, a one unit increase in the physical environment subscale was associated with an 85% lower risk for self-rated poor health.

As was shown in Table 3, individual psychosocial factors were each significantly correlated with self-rated health and with perceived neighborhood quality, suggesting that these psychosocial variables may play an intervening role in the link between

neighborhood perceived quality and self-rated health. Table 6 includes models testing the mediating effects of individual psychosocial variables for neighborhood effects. Model 6.1 (Table 6, Model 1) is identical to Model 5.3 (Table 5, Model 3) and is put here as the baseline reference model. Model 6.2 through Model 6.9 examine two indicators of individual social resources (marriage and social network index) and six measures of psychological status (perceived social support, loneliness, depressive symptoms, hostility, perceived stress, and optimism), respectively.

Psychological status measured by each of the five psychological factors helped to explain the association between perceived neighborhood environment and self-rated health after controlling for individual as well as neighborhood SES. Loneliness, depressive symptoms, hostility, perceived stress, and optimism reduced the coefficient for perceived neighborhood quality, and explained from 7% to 24% of the perceived neighborhood effect on self-rated health (models 6.5, 6.6, 6.7, 6.8, and 6.9, respectively). In addition, depressive symptoms, hostility, and

Table 4
Descriptive statistics for variables in the analysis

Variables	Mean/proportions	St. dev.
<i>Self-rated physical health</i>		
Poor/Fair	0.17	0.38
<i>Socio-demographic background</i>		
Age	57.56	4.43
Male	0.47	0.50
<i>Race/Ethnicity</i>		
White	0.35	0.48
Black	0.36	0.48
Latino	0.29	0.46
<i>Annual household income</i>		
<\$5,000	0.02	0.14
\$5,001–\$10,000	0.01	0.10
\$10,001–\$15,000	0.06	0.24
\$15,001–\$20,000	0.07	0.25
\$20,001–\$30,000	0.10	0.30
\$30,001–\$40,000	0.10	0.30
\$41,000–\$50,000	0.14	0.35
\$51,000–\$75,000	0.19	0.40
\$75,001– \$100,000	0.16	0.37
\$100,001–\$200,000	0.12	0.32
Over \$200,000	0.03	0.18
<i>Education</i>		
Less than HS	0.14	0.34
HS Grad/GED	0.32	0.47
Some college	0.23	0.42
College graduate (BA/BS)	0.14	0.35
Graduate study or degree	0.16	0.39
Married/cohabiting	0.61	0.49
<i>Psychological variables</i>		
Social network index	2.92	0.89
Social support (ISEL)	38.43	6.39
Loneliness (R-UCLA)	36.19	9.76
Depression (CES-D)	9.95	8.45
Hostility (CMHo)	17.80	7.51
Perceived stress (PSS)	13.34	6.39
Optimism	16.41	3.83

$N = 214$.

optimism were associated with self-rated health independently of neighborhood effects, suggesting that these psychological characteristics also operate directly or through some other pathways to influence self-rated health. Individual reserves of social resources, on the other hand, made little contribution to the observed link connecting perceived neighborhood quality with health. The coefficient of perceived neighborhood quality was hardly changed with the inclusion of marriage, social networks, and perceived social support. Finally, we examined a composite index of overall

Table 5
Neighborhood effects on self-rated fair/poor health

	(1)	(2)	(3)	(4)
Age	0.063 (0.046)	0.036 (0.041)	0.052 (0.045)	0.044 (0.046)
Male	−0.771** (0.382)	−0.620 (0.404)	−0.701* (0.410)	−0.573 (0.431)
Black	1.744** (0.709)	1.624** (0.687)	1.624** (0.686)	1.642** (0.696)
Latino	1.905*** (0.714)	1.676** (0.688)	1.846*** (0.685)	1.750*** (0.676)
N_SES^a	−0.470* (0.259)	−0.258 (0.266)	−0.080 (0.274)	−0.018 (0.279)
Education		−0.279 (0.203)	−0.188 (0.210)	−0.171 (0.208)
HH income		−0.254** (0.101)	−0.225** (0.106)	−0.243** (0.113)
$N_Quality^b$			−0.528** (0.265)	
$N_Physical^c$				−0.613** (0.312)
N_Social^d				0.016 (0.309)
$N_Service^e$				−0.039 (0.310)

$N = 214$.

Robust standard errors in parentheses.

*Significant at 10%; ** significant at 5%; *** significant at 1%.

^a N_SES : neighborhood SES.

^b $N_Quality$: a composite scale measuring perceived neighborhood context based on subscales of perceived neighborhood physical, social, and service environment.

^c $N_Physical$: a factor score based on items tapping neighborhood physical environment.

^d N_Social : a factor score based on items tapping neighborhood social environment.

^e $N_Service$: a factor score based on items tapping neighborhood service environment.

psychosocial risk in model 6.10. This variable was also independently associated with self-rated health, and it helped to explain 30% of the effect of perceived neighborhood quality.²

One interesting finding regards racial/ethnic differences in self-rated health. The disadvantage of Blacks and Latinos persisted even after controlling for individual SES, neighborhood SES, neighborhood perceptions, and the composite index of psychosocial status. The only possible explanatory

²Because we found that perceived physical environment was the most significant component in the perceived neighborhood quality scale for self-rated health, we substituted neighborhood perceived quality with perceived physical environment in the analysis. The pattern of results was not changed (data not shown).

Table 6
Perceived neighborhood quality, individual psychosocial factors, and self-rated fair/poor health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age	0.052 (0.045)	0.051 (0.045)	0.052 (0.046)	0.052 (0.045)	0.055 (0.046)	0.073 (0.048)	0.042 (0.044)	0.053 (0.045)	0.050 (0.046)	0.057 (0.046)
Male	−0.701* (0.410)	−0.676 (0.447)	−0.698* (0.409)	−0.687* (0.414)	−0.827* (0.427)	−0.713* (0.412)	−0.964** (0.452)	−0.687* (0.409)	−0.673 (0.420)	−0.819* (0.423)
Black	1.624** (0.686)	1.620** (0.691)	1.640** (0.676)	1.624** (0.686)	1.605** (0.685)	1.454** (0.676)	1.560** (0.696)	1.663** (0.696)	1.706** (0.691)	1.588** (0.690)
Latino	1.846*** (0.685)	1.833*** (0.707)	1.830*** (0.695)	1.870*** (0.703)	1.706** (0.710)	1.600** (0.704)	1.847*** (0.715)	1.726** (0.692)	1.735** (0.710)	1.616** (0.709)
Education	−0.188 (0.210)	−0.194 (0.206)	−0.188 (0.209)	−0.185 (0.212)	−0.183 (0.206)	−0.158 (0.219)	−0.103 (0.228)	−0.220 (0.211)	−0.112 (0.217)	−0.160 (0.213)
HH income	−0.225** (0.106)	−0.218* (0.119)	−0.215* (0.117)	−0.232** (0.113)	−0.183 (0.114)	−0.184 (0.113)	−0.223** (0.113)	−0.183* (0.110)	−0.203* (0.112)	−0.165 (0.116)
<i>N</i> _SES ^a	−0.080 (0.274)	−0.082 (0.276)	−0.086 (0.275)	−0.077 (0.274)	−0.126 (0.283)	−0.153 (0.285)	−0.127 (0.267)	−0.087 (0.280)	−0.184 (0.289)	−0.157 (0.285)
<i>N</i> _Quality ^b	−0.528** (0.265)	−0.525** (0.262)	−0.523** (0.264)	−0.541** (0.266)	−0.441* (0.266)	−0.438 (0.279)	−0.493* (0.273)	−0.401 (0.272)	−0.416 (0.269)	−0.368 (0.269)
Married		−0.088 (0.509)								
Social network (SNI)			−0.083 (0.258)							
Social support				0.007 (0.035)						
Loneliness					0.034 (0.023)					
Depressive Symptoms						0.055** (0.024)				
Hostility							0.068** (0.029)			
Perceived stress								0.062 (0.040)		
Optimism									−0.127** (0.053)	
Psychological Status (composite)										−0.513** (0.218)

N = 214; Robust standard errors in parentheses.

*Significant at 10%; **significant at 5%; ***significant at 1%.

^a*N*_SES: neighborhood SES.

^b*N*_Quality: a composite scale measuring perceived neighborhood context based on subscales of perceived neighborhood physical, social, and service environment.

factor was depressive symptoms which contributed about 10% and 13%, respectively, to the effect of being Black or Latino. Additional research will be needed to address the question of why ethnic minorities rate their health lower than Whites among middle-aged people in the US.

Discussion

Evidence from our population-based study indicated that neighborhood environment, as assessed by a composite index of neighborhood SES from

2000 Census data, is associated with self-rated health after controlling for age, gender, and race/ethnicity. Furthermore, this effect seems to be explainable by individual SES and neighborhood perceptions. That is, low-SES neighborhoods have worse health outcomes partly because low-SES people live in these neighborhoods and partly because local residents' negative perceptions of neighborhood environment are more proximally related to health. Indeed, perceived neighborhood quality exhibited a prominent and unique impact on self-rated health even after controlling for

demographic factors and SES at both individual and neighborhood level. This finding lends support to the argument that objective neighborhood context and neighborhood perceptions are linked yet distinct constructs, both of which are on the pathway from place to health with neighborhood perceptions seemingly more proximate to health.

One practical implication of these findings is that exclusive reliance on census-based measures of neighborhood is insufficient to capture the whole picture and may weaken the observed link between place of residence and health. As Sampson and Raudenbush (2004) argued, and as is supported by this study, neighborhood perceptions carry extra meaning that is relevant to individual well-being, and perceptions should not be viewed and treated as unambiguous indicators of objective neighborhood environment.

In the present study, the correlations between the objective neighborhood SES and each of the three dimensions of neighborhood perception were comparably modest. This finding suggests that people's experiences in the same neighborhood can be quite different. There are at least two sets of reasons for these differences in objective and subjective neighborhood measurements. One is that a given individual's perceptions of a given objective standard (e.g., neighborhood feature) are influenced by differences in exposure to objective neighborhood features, dispositional differences (e.g., neuroticism), differences in prior personal experiences, cognitive and social capacities, and social comparisons. Second, the "objective" measures are aggregate measures (e.g., neighborhood level crime stats) whereas the subjective neighborhood measures are not aggregated to the neighborhood level but represent individual-level data. Just as modest correlations might be expected when correlating individual item values with total score values, differences in the level of aggregation between the objective and subjective measures may underestimate the true covariation between these domains. If a respondent has been victimized multiple times, their "subjective" neighborhood crime rating may fit well with an objective crime measure restricted to others who have been similarly victimized but because most people in the neighborhood are not victimized, the "objective" aggregate neighborhood crime may look lower than the respondent's subjective measure. This problem is inherent in current objective and subjective neighborhood measurements unless the latter can be secured from

all of the residents, or at least from a representative sample of participants, within each neighborhood. These issues warrant attention in future research.

Among the three dimensions of neighborhood context, perceived physical environment seemed to play a bigger role than perceptions of social and service environments in contributing to the link between neighborhood and health. This is consistent with prior research showing that cosmetic features, crowdedness, air pollution, noise, housing condition, and open space are physical environmental factors that are associated with health (Blafour & Kaplan, 2002; Cummins, Stafford, Macintyre, Marmot, & Ellaway, 2005; Halpern, 1995; Wright & Fisher, 2003). However, that perceived physical environment is a stronger correlate of self-rated health than perceived social environment is a relatively new finding. Only a few studies have systematically investigated and compared health effects of physical and social dimensions of neighborhood environment (Ståhl et al., 2001; Wen et al., 2003; Wilson et al., 2004), but one such study is particularly relevant. Wilson et al. (2004) investigated associations among perceptions of neighborhood physical and social characteristics and three health outcomes including self-rated health in Hamilton, Canada. They found that perceptions of the physical environment seemed more important for health than those of social concerns in all neighborhoods. The authors speculated that the dominance of physical concerns over social ones may have resulted from the industrial nature of Hamilton. Indeed, it may be the case that social and physical characteristics have differential levels of importance for different health outcomes, for different populations, and in different neighborhoods (Wilson et al., 2004). How different dimensions of neighborhood contexts and perceptions of these neighborhood contexts operate to influence health is a complex issue that merits further investigation.

Examination of our second research question, whether neighborhood effects were mediated by psychological factors, indicated that loneliness, depressive affect, hostility, perceived stress, and optimism separately and jointly explained some variance in the association between neighborhood and self-rated health. This research therefore supports a theoretical model in which neighborhood SES affects self-rated health through sequential pathways of individual SES, perceptions of neighborhood quality, and psychosocial status.

At odds with theoretical expectations, marital status, social networks, and perceived social support provided no additional explanatory power after taking individual socio-demographic factors and neighborhood variables into account. One possible explanation is that there tends to be a greater extent of social integration in underdeveloped urban neighborhoods than in affluent neighborhoods in the US (Stack, 1974; Wilson, 1996). Moreover, Caughy et al. (2003) showed that social capital may in fact be health-inhibiting in deprived neighborhoods. That social network is not a mechanism underlying the link between place and health is also supported by some other recent work testing the contextual and prospective effects of neighborhood environment on mental health and mortality (Latkin & Curry, 2003; Wen et al., 2005).

The key findings from this research may shed some light on the current debate concerning the relative roles of psychosocial and material factors in the etiology of health outcomes and inequalities (Lynch, Davey Smith, Kaplan, & House, 2000; Macleod, Smith, Metcalfe, & Hart, 2005; Marmot & Wilkinson, 2001). As argued previously, psychosocial and material factors can operate simultaneously to jointly and sometimes independently contribute to neighborhood effects on health (Kawachi & Berkman, 2003a). Specifically, this study shows that psychosocial factors and perceptions of neighborhood quality may operate as pivotal pathways linking objective neighborhood material circumstances to health. A social psychological approach therefore seems to be a promising addition to the urban inequality research that in recent years has been heavily reliant on structuralist research (Sampson & Raudenbush, 2004).

Although this research underscores the importance of psychosocial factors and perceptions for understanding urban inequality in health, purely changing people's perceptions about their neighborhood is not sufficient without also improving neighborhood objective conditions. Perceptions are important because they influence psychosocial processes that affect health, but objective material conditions are also important because they contribute substantially to perceptions and because in some situations they can have unique effects on health over and above the effect of perceptions (Sooman & McIntyre, 1995). Recognizing the importance of psychosocial factors for neighborhood effects on health is not to "blame the victim". Rather, as argued by Marmot and Wilkinson,

"recognizing that the socioeconomic structure has powerful psychosocial as well as material effects means that it is more, not less, important to identify and tackle the structural issues. Added urgency comes from the fact that psychosocial factors, unlike many of the direct effects of material factors, exacerbate other social problems, including levels of violence and the gradient in educational performance" (2001, p. 1235).

Attempts to reduce disorder and promote a "psychological sense of community" by making cosmetic changes, improving neighborhood amenities, and strengthening social control are potentially fruitful approaches to improving urban neighborhoods. Making changes to the features of neighborhoods that are amenable to modification and could influence perceptions may augment the effectiveness of the intervention because not only are neighborhood material conditions enhanced, but improvements in neighborhood image and reputation may be reflected in improved neighborhood perceptions. Physical disorder and crime are two such neighborhood features for which intervention could have particularly beneficial effects (Ross & Mirowsky, 2001; Sampson & Raudenbush, 2004; Sampson, Raudenbush, & Earls, 1997; Sooman & McIntyre, 1995).

Several limitations to this study are noteworthy. First, the choice of self-rated health rather than objectively measured health as a dependent variable may have introduced shared method variance with our subjective predictors (e.g., perceived neighborhood quality, psychosocial variables). Response bias may also be an issue. People in poorer health tend to feel more negative about their neighborhoods, and pessimistic people are more likely to view both their health and neighborhoods as poor (Ellaway et al., 2001). However, we controlled for poverty and other individual socio-demographic variables that are linked to both self-rated health and perceived neighborhood quality, and significant associations between health and perceived neighborhood were seen net of these statistical controls. Independently assessed objective health markers may reduce such bias further. On the other hand, self-rated health may be preferable to objective health markers when attempting to capture the overall subjective experience of mental and physical well-being. Self-rated health is closer to the WHO's definition of health in which health is more than simply the absence of disease but also includes mental, physical, and social dimensions of well-being (Hill, Ross, & Angel, 2005).

A second limitation is the cross-sectional nature of the study. We thus do not claim that the associations detected here are causal in the hypothesized direction. Limited longitudinal evidence is consistent with our conceptual framework and suggests that objective and perceived neighborhood environment causally and contextually determine subsequent mental and physical health (Blafour & Kaplan, 2002; Dalgard & Tambs, 1997; Latkin & Curry, 2003). Nevertheless, more longitudinal studies and possibly semi-experimental studies are definitely needed to further disentangle the reciprocal influences between place of residence, neighborhood perceptions, psychosocial pathways, physiological processes, and health.

Third, although our sample is population-based, our analysis is focused on middle-aged and older residents in Cook County, Illinois, the United States, and thus cannot be easily generalized to other populations and geographic locations. On the other hand, large metropolitan areas in the US resemble one another to some extent in terms of population characteristics and socio-economic structure. Moreover, contextual neighborhood effects on health have been documented in a variety of settings, including US, Britain, Australia, Sweden, China, and South Korea (Luo & Wen, 2002; Malmström, Johansson, & Sundquist, 2001; Pickett & Pearl, 2001; Robert & Lee, 2002; Young, Russell, & Powers, 2004; Ziersch, Baum, MacDougall, & Putland, 2004). We thus believe that our results may be elucidating for other urban settings with spatially based inequalities in health-promoting resources and health-jeopardizing hazards.

Fourth, investigation of pattern differences among age, gender, and race/ethnicity subgroups was limited by our sample size. Larger-scale studies would be valuable to assess whether our findings are replicable and consistent across subpopulations. In addition, we have no knowledge of how long subjects have lived in the neighborhood, and duration of residency is bound to make a difference, both in neighborhood perceptions and in health.

The support found for a model in which the effects of neighborhood SES on self-rated health act through sequential pathways of individual SES, perceptions of neighborhood quality, and psychosocial status illustrates the value of a multi-level and multi-dimensional approach to addressing health problems in contemporary society. While it is crucial to understand how neighborhood forces affect health, it is also important to disentangle the

psychosocial processes through which the larger social milieu gets into our body and takes a toll on our health. As Diez Roux noted: "...because disease is expressed at the level of the individual, neighborhood factors necessarily exert their effect through individual-level processes, including behaviors and biological precursors of disease" (2001, p. 1786). The current research provides some initial evidence of the role of psychosocial factors in the link between neighborhood and health and determines some of the relevant psychosocial variables on which to focus in longitudinal studies. Future investigations are warranted to test additional pathways at the individual and/or neighborhood levels and to examine cross-level interactive effects of these complex and dynamic mechanisms to further elucidate the link between neighborhood and health.

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