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The stress process in neighborhood context

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Abstract

The positive relation between socio-economic status (SES) and health, both mental and physical, is examined within a stress-process framework. Telephone survey data of adults age 45–74 are analyzed to test the roles of stressors and resources as mediators of the SES–health relation. Next, the stress process is tested in neighborhood context by splitting the sample in half according to residence in lower- or higher-SES neighborhoods. The relative impact of stressors on mental and physical health, and effectiveness of resources in protecting mental and physical health, are tested separately for both types of neighborhoods. The results indicate that social support is only protective of mental and physical health among residents of higher-SES neighborhoods. The implications of the results for future research are discussed. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Socio-economic status; Stressors; Resources; Depression; Health; Neighborhoods

1. Introduction

A substantial body of research has established a strong and consistent positive relation between socio-economic status (SES) and both mental and physical health (Cleary, 1998; Eaton and Mutaneer, 1999). Explanations of the relation range from biological (e.g. Kelly et al., 1997) to behavioral (e.g. Taylor and Repetti, 1997) to social-structural (e.g. Turner et al., 1995). The current study focuses on socially-structured mediators of the SES–health relation within the framework of the stress process paradigm. The stress process approach emphasizes two key mediators in the relationship between SES and health: stressors and resources. Individuals are differentially exposed to stressors, such as financial strain, and differentially

equipped with resources to combat stressors, such as social support, as a function of their SES. Stressors impact health directly, and indirectly by influencing resources. Resources affect health, in part, by blunting the effects of stressors (Pearlin, 1999).

Most research on the stress process has been conducted on an individual level only, thereby treating the process as invariant across diverse social settings (Gallant and Connell, 1998; Noh and Avison, 1996; Pearlin et al., 1997; Pearlin et al., 1981; Scheck et al., 1995). However, the social environment itself is a potential source of stressors and resources, as well as an arena that may influence the impact of stressors, and the effectiveness of resources, on health. The purpose of this study is to explore variability in the stress process between lower- and higher-SES neighborhoods. More specifically, this study examines the differential impact on health of stressors and the differential effectiveness of resources to protect health, by neighborhood SES.

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2. Development of the research problem

2.1. *Socio-economic inequalities in health*

Over the past century, advanced industrial societies have experienced dramatic improvements in the material conditions of life. These changes have led to equally dramatic increases in life expectancy. However, overall improvements in population health have not reduced health inequalities among socio-economic groups. In fact, between 1960 and 1986 in the US, SES differentials in mortality have actually widened (Pappas et al., 1993). The relationship between SES and health has been documented in all advanced industrial societies. Regardless of how it is measured (e.g. income, education, occupation, or some combination of the three), SES is a powerful predictor of morbidity and mortality differences (Cleary, 1998; House et al., 1992; Marmot et al., 1998; Susser et al., 1984; Whitehead, 1992; Wilkinson, 1986).

The SES–health relation holds across a variety of physical and mental health outcomes. Research indicates that SES is positively related to life expectancy, and negatively related to overall mortality rates (Adler et al., 1993; Kitagawa and Hauser, 1973). SES is also inversely related to infant, neonatal and perinatal mortality (Antonovsky and Bernstein, 1977; Stockwell et al., 1988); to mental disorders, ranging from depression to schizophrenia (Dohrenwend et al., 1980; Eaton and Mutaneer, 1999; Hollingshead and Redlich, 1958; Kessler et al., 1994; Liem and Liem, 1978); to most cause-specific sources of mortality, such as coronary heart disease and some types of cancer (Marmot and McDowell, 1986; Marmot et al., 1984; Whitehead, 1992; Wilkinson, 1986); to susceptibility to illness and overall poor health (Blaxter, 1990; Syme and Berkman, 1976); and to numerous measures of morbidity, including accidents and injuries (Kristiansen, 1985; Lerner, 1975; Newacheck et al., 1985).

Why do SES inequalities in health persist despite absolute increases in the material conditions of life? Economic growth and prosperity are typically distributed unevenly within societies. For example, in the US, income and wealth are becoming increasingly polarized as the economy continues to grow (Mishel et al., 1996; Wolff, 1995). Thus, health disparities by SES may persist and increase alongside growth in the relative size and impoverishment of the poorest segment of society. Furthermore, health inequalities may be continually reproduced as long as lower-SES individuals have less access to preventive health care and health-care innovations, such as mammograms (Link et al., 1998).

A popular explanation of persistent SES–health inequalities is the observation that low SES individuals are more likely to engage in unhealthy behaviors than their higher-SES, and healthier, counterparts. How-

ever, behavioral risk factors such as smoking and alcohol consumption explain little of the SES–health relation (Lantz et al., 1998). The explanation adopted in this study derives from the unequal distribution of stressors and resources according to SES, which is at the heart of the stress process approach to the SES–health relation.

2.2. *The stress process*

The stress process approach breaks down the SES–health relation across levels of social reality, and across time. The first level in the process consists of macro-systems of inequality in which individuals are situated according to characteristics such as SES (Pearlin, 2000). This level, usually measured by individual SES, then exposes individuals to the second “meso” level: SES-related stressors embedded in the conditions of everyday life. Resources, primarily personality dispositions and social support, are also linked to SES, in part by the proximate conditions of daily life that are influenced by SES (Kohn and Slomczynski, 1990; Kohn and Schooler, 1983; Turner, 1999). Individuals, at the micro-level, are differentially faced with stressors, and equipped with resources to combat stressors as a function of their SES. Over time, a stressful event may proliferate into “secondary” stressors, such as when losing one’s job results in ongoing financial strain and marital conflict (Pearlin, 1999). The combination of greater exposure to stressors and fewer resources to cope with stressors may result in a deterioration of mental and physical health statuses.

In addition to directly affecting health, stressors and resources may interact in determining individuals’ health responses to stressful experiences. The “differential vulnerability” hypothesis posits that lower SES individuals are not only exposed to more stressors, but are also more vulnerable to their harmful effects owing to their limited resources. For instance, increased vulnerability to stressors may be caused by meager financial resources, limited social support and personality characteristics that lead to ineffective coping (McLeod and Kessler, 1990).

The “differential vulnerability” hypothesis has been criticized for exaggerating the importance of vulnerability and understating the direct impact of stressors by only testing a limited range of them (Turner et al., 1995). In fact, stress research has been repeatedly criticized for assuming that the most relevant stressors are major life events (Aneshensel, 1992). Researchers have argued that a broader range of stressors must be incorporated into stress research to assess the full impact of stress on health. Examples of non-event like stressors include role strain, economic strain, status inconsistency, daily hassles, non-events and ambient strains (Pearlin, 1989; Wheaton, 1994, 1999). Ambient strains

are those that encircle individuals in their everyday lives across a number of roles they play. Strains that inhere in one's neighborhood represent this category of stressor, and are the focus of the present analysis.

There is a growing interest among stress process researchers in the role played by neighborhood context in the stress process (Pearlin, 2000). Neighborhoods introduce a new set of stressors and resources, and may influence the impact of other stressors and resources on health. Thus, an analysis of the influence of neighborhoods could potentially test both the differential exposure and differential vulnerability hypotheses. Neighborhood context has not yet been studied directly in the stress process literature, with the exception of Aneshensel and Sucoff (1996). Empirical support for the incorporation of neighborhood context into the stress process approach is provided by growing evidence that neighborhood properties affect health, over and above the effects of individual characteristics.

2.3. *Neighborhoods and health*

Research on neighborhoods and health have linked a number of characteristics of census-defined areas to individual health outcomes, net of individual characteristics. Anderson et al. (1997) found that mortality risks are substantially higher in relatively low-SES neighborhoods (measured by median family income at the census-tract level), after adjusting for household income. Similarly, Waitzman and Smith (1998) found that residence in a poverty area (defined by proportion of families with low income, substandard housing, female-headed families, unskilled males in the labor force and adults with low educational attainment) is associated with elevated mortality risk among adults age 25–54 net of individual and household characteristics. Robert (1998) linked the percentage of individuals on public assistance at the census-tract level to individual-level self-reported health, net of individual- and family-level SES. LeClere et al. (1998) found that death by heart disease is more common among women living in neighborhoods with relatively high rates of female-headed families.

An important next step in the study of neighborhoods and health is to explore the specific mechanisms that link neighborhood properties to individual mental and physical health (Robert, 1999). The stress process approach provides the conceptual tools for doing so.

2.4. *The stress process in neighborhood context*

Properties of neighborhoods may be conceived as analogous to individual stressors and resources (Aneshensel and Sucoff, 1996). For instance, a high incidence of crime is likely to be stressful, whereas

community services such as health clinics or soup kitchens are resources that individual residents may call upon. Thus, stress research should include neighborhood-level stressors and resources when assessing the impact of stress on health.

The effects of neighborhoods stressors on health may be additive, and they may interact with individual characteristics. If the effects are additive, then models that include neighborhood stressors alongside individual-level stressors should reveal a greater overall impact of stress on health than models with individual-level stressors only. If the effects are interactive, the results may reveal that the differential vulnerability of low-SES individuals is partially dependent on characteristics of their social environments.

The social environment may affect vulnerability to stressors by influencing individuals' perceptions of stressful conditions, and by providing variable sources of social support and other resources to cope with stressors (Kessler, 1979a). Individuals in poorer neighborhoods may perceive their own problems to be worse than they would seem in less stressful social environments, and may find relatively fewer environmental resources to help them cope with their problems.

The multiple paths through which neighborhood properties may affect health will be illustrated by example. Neighborhood stressors directly affect health when an individual resident of a high-crime area becomes a victim of a violent crime. Neighborhood resources directly affect health when a hungry or sick person cannot find food or health care within commuting distance. Neighborhood stressors and resources may increase individual vulnerability to stress when an unemployed person becomes increasingly depressed in response to job scarcity and widespread joblessness. And finally, neighborhood stressors and resources may increase individual vulnerability to stress by reducing the effectiveness of individual resources, such as when the combination of rampant crime and scarce police protection render neighborhood residents impotent against these larger forces, regardless of their personal sense of control.

An alternative view of the differential vulnerability hypothesis was presented by Wheaton (1982). He argued that groups who are exposed to relatively high amounts of chronic stressors become desensitized to their effects, or *less* vulnerable, because they have developed "immunity" from stress. In support of this view, he found that Mexican-Americans, in comparison to Anglos, were simultaneously exposed to more chronic stress and were less vulnerable to the effects of chronic stressors on depression, after taking into account personal coping resources (Wheaton, 1982). In a similar vein, Kessler (1979b) found that persons in the lowest social classes were less likely to respond to comparable stressors with extreme distress than their

higher social class counterparts. He, too, interpreted this finding as potential evidence of experience-based stress immunity. However, neither study explicitly modeled neighborhood properties, or analyzed variation in the stressor/health relation according to neighborhood SES.

The few studies that assess stress and health in neighborhood context suggest that residents of lower-SES neighborhoods tend to be *more*, rather than less, vulnerable to stressors. Fleming et al. (1987) found that individuals exposed to overcrowding in their neighborhoods had relatively high cardiovascular reactivity to the challenge of an embedded figures test. Aneshensel and Sucoff (1996) found that adolescents' perceptions of ambient hazards and lack of social cohesion in their neighborhoods were positively associated with symptoms of depression. These limited findings support the expectation that residents of relatively lower-SES neighborhoods tend to be more vulnerable to stressors.

2.5. Conceptual model and hypotheses

Fig. 1 portrays the conceptual model of the stress process in neighborhood context. Neighborhood SES is portrayed as a setting in which the individual-level stress process takes place. Individual SES indirectly affects mental and physical health via stressors (b), and resources (c). Stressors directly affect mental and physical health (d), and resources directly affect mental and physical health (e). The residual association between SES and health (a), represents the association between SES and health that cannot be explained by the stressors and resources measured in this study. Neighborhood context enters the process at the far right, affecting the *effects* on mental and physical health of stressors (f) and of resources (g). Neighborhood-level stressors and resources are not directly examined in the present study because measures are not available. Instead, it is assumed that lower-SES neighborhoods are typically more stressful and less resourceful than higher-SES neighborhoods. Furthermore, the potential

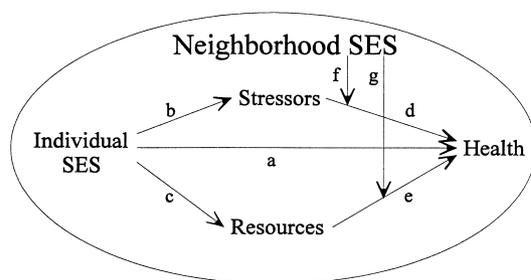


Fig. 1. The stress process in neighborhood context.

reciprocal effects between stressors and resources are not tested since that data for this study are cross-sectional.

The key hypotheses to be tested involve the differential effects of stressors and resources according to neighborhood SES. Specifically, it is hypothesized that individual stressors will have stronger ill-health effects on residents of lower-SES neighborhoods than on residents of higher-SES neighborhoods. This hypothesis is based on the expectation that neighborhood stressors intensify the impact of individual stressors on health by increasing individuals' perceptions of the severity of their own problems. Secondly, it is hypothesized that resources will have stronger positive health effects on residents of *higher*-SES neighborhoods than on residents of lower-SES neighborhoods. This hypothesis is based on the expectation that individual resources become less effective as neighborhood SES goes down, because lower-SES neighborhoods lack the infrastructure to support the effective use of individual resources.

3. Data and methods

3.1. The data

This analysis uses telephone survey data collected in the Fall of 1997 in the Washoe and Clark counties of Nevada from 395 adults age 44–75. Washoe and Clark counties are primarily urban, including Nevada's two major cities — Reno and Las Vegas — and with populations of 308,700 and 1,192,200 in July of 1997, respectively. The sample has a limited age range because its original purpose was to study variations in the SES–health relation between the middle-aged and elderly. The respondents who were interviewed for the present study were a sub-sample of individuals who were either interviewed or enumerated in a state-wide behavioral risk factors survey (Center for Applied Research, 1997). The original sample was selected via random-digit dialing from a sampling frame of English-speaking adults with working telephones in the state of Nevada. The sub-sample had a response rate of 75%.

The demographic data on the sample were compared to estimates of population demographics for Clark and Washoe counties. The data under-represent persons of Hispanic origin, most likely because the interviews were conducted in English only. The Clark county data over-represent women by 5.5%, whereas the Washoe county data under-represents women by about 4%.

The final sample size for these analyses is 361, with 178 individuals residing in lower-SES neighborhoods, and 183 in higher-SES neighborhoods. This sample

size is on the low end of providing sufficient statistical power to detect between-group differences. Typically, a minimum of 100 cases are needed to compare statistical estimates between groups (Rea and Parker, 1997). In the context of SEM, recommendations for sample size range from as low as five respondents for each observed variable to as high as 100 (Jaccard and Wan, 1996). In this case, there are 15 respondents per variable in the one-group model, and seven respondents per variable in the two-group model, suggesting relatively low statistical power. Thus, any group differences that are found likely understate the actual effect sizes.

3.2. Measurement

3.2.1. Socio-economic status

SES was measured by annual household income, years of formal education completed, and occupational status of the respondent's current or most recent job over the past five years. Occupational status was measured with a scale developed by Hauser and Warren (1997) matched to 1990 census occupational codes. Of those who were not currently employed, only six individuals had not been employed over the past five years.

3.2.2. Stressors

Financial strain was measured with a three-item scale developed by Mirowsky and Ross (1996), which measures the frequency over the past 12 months that respondents did not have enough money to buy food, clothes or other things their household needed, not have enough money to pay for medical care and had trouble paying the bills. Marital stress was assessed with two items presented originally in Pearlin and Schooler (1978), which ask respondents to report the frequency with which they feel happy versus frustrated or anxious when they think about the pleasures and problems of daily life with their spouse or partner.

Two additional stressors were also measured: (1) fear of neighborhood, measured by a single item that assesses respondents' relative sense of safety walking in their neighborhoods day and night; and (2) life events, measured by counting the number of major life events that have occurred to the respondent over the past year. However, neither bore significant relations to depression or physical health in the causal models and were therefore deleted. The single-item measure of fear of neighborhood may have not been sensitive enough to capture variation in the presence of threatening behaviors at the neighborhood level. The eclectic mixture of events may have attenuated the relation between exposure to particular events and health. However, the small sample size and relative infre-

quency of each discrete event necessitated collapsing them into a single measure.

3.2.3. Resources

Sense of control was measured with an eight-item scale developed by Mirowsky and Ross (1991). Respondents are asked their extent of agreement or disagreement with statements such as: "The really good things that happen to me are mostly luck" and "I am responsible for my own successes". Two domains of social support were assessed: (1) frequency of social interaction, hereby referred to as "social integration", based on measures presented in House et al. (1992); and (2) presence of a confidant, using measures developed by Mirowsky and Ross (1997). Items for the social integration scale assess the frequency with which respondents talk on the phone with friends, go out with friends or visit in each other's homes, or attend religious services associated with church or non-religious meetings or programs, clubs or organizations. To measure the presence of a confidant, respondents are asked their level of agreement with two statements: (1) You have someone you can turn to for support and understanding when things get rough; and (2) You have someone you really like to talk to.

3.2.4. Mental health

Depression was measured with a ten-item short version of the CES-D depression scale (Radloff, 1977), which asks respondents how many days over the past week they have experience various symptoms of depression such as "felt sad" and "had trouble getting to sleep or staying asleep". Values on the scale range from an absence of depressive symptoms, to some symptoms of depression to multiple symptoms of depression.

3.2.5. Physical health

The physical health outcome measure combined a subjective self-report of respondent's overall health ranging from poor to excellent, a self-report scale of functional limitations such as difficulty climbing stairs, and a count of respondent's chronic conditions such as cancer or high blood pressure.

3.2.6. Neighborhood SES

The SES of neighborhoods was measured with 1990 US census data aggregated at the zip-code level. Five indicators were combined into a standardized index: median income, percent black, percent of households on public assistance, percent of households female-headed and percent of female-headed households in poverty. The reliability of the index is 0.67. When neighborhood properties are measured with aggregates of individual characteristics, there is a risk that the two will so highly related that their effects will be con-

founded. The correlations between the index of neighborhood SES and individual indicators of SES are small to moderate, ranging from 0.087 to 0.267, indicating that SES on the neighborhood and individual levels are two independent phenomena with potentially unique effects on individual health status.

Although zip-code areas are not optimal approximations of neighborhoods, correlations between SES measures aggregated at the zip-code level (with an average of 25,000 residents) and SES measured aggregated at the census-tract area (with an average of 5000 residents), tend to be moderate to high (Geronimus and Bound, 1998). Furthermore, differences between zip-code and census-tract level measures of SES in terms of their effects on individual health or overall goodness of fit of models tend to be small (Geronimus and Bound, 1998). Nonetheless, the index of neighborhood SES is a proxy measure of a far more complex phenomenon including neighborhood-level stressors and resources. Therefore, though the results of this study highlight the role of neighborhood SES in the determination of health outcomes, they do not specify the precise properties responsible for the neighborhood effects.

3.3. Univariate and multivariate normality

All indicators were inspected for skewness and kurtosis. Several of the indicators of depression, two indicators of financial strain and one indicator of marital stress, were substantially skewed. The depression items became normal when squared, but the indicators of financial strain and marital stress remained skewed despite a variety of transformation attempts. Thus, in the causal analysis, the depression items were squared, and only the non-skewed indicators of financial strain and marital stress were included, such that financial strain and marital stress were each measured with a single, normally distributed, item.

Univariate normality is a necessary but not sufficient condition for multivariate normality (Jaccard and Wan, 1996). In this case, despite univariate normality, the data were not multivariate normal. When data are not multivariate normal, it is possible that results based on maximum likelihood estimation will produce biased standard errors and an ill-behaved overall χ^2 test. Nonetheless, maximum likelihood estimation is robust to violations of multivariate normality in a variety of instances (Jaccard and Wan, 1996).

Hoyle (1995) suggests that when data are not multivariate normal, the asymptotic distribution-free estimator (ADF) developed by Browne (1984) should be used instead of maximum likelihood. However, ADF could not be used for this study because it requires a much larger sample. Thus, maximum likelihood estimation was used, with the caveat that the standard errors and

overall χ^2 test may be biased, and should be interpreted with caution.

3.4. Missing data

The final sample of 361 individuals excludes the 34 respondents who did not report their zip codes, precluding measurement of their neighborhood properties. *T*-test comparisons of means between the 361 in the sample and the 34 excluded revealed only two significant differences: those excluded were significantly younger (mean of 56 vs. 58), and were more likely to report having someone to talk to.

Of the remaining variables in the analysis, the percentage of cases missing data ranged from 0 to 5%, with the exception of household income, which was missing for 10% of cases and marital stress. The inclusion or exclusion of household income (with the mean value substituted for the missing cases) in the SES-measurement model did not change the substance or significance of the results. Therefore, given the high rate of missing data, household income was not included in the analyses. In the case of marital stress, 31% of the sample had valid missing data because they were not married. The mean value for marital stress was substituted for the non-married and a dummy variable indicating marital status was controlled for in all analysis to overcome any corresponding bias (Cohen and Cohen, 1983). All remaining missing values were estimated by AMOS (the statistical package employed to estimate structural equation models), which computes full information maximum likelihood estimates in the presence of missing data (Arbuckle and Wothke, 1999).

3.5. Sample demographics

Descriptive statistics of all demographic variables are presented in Table 1. The respondents were fairly evenly distributed across the age range and slightly more than half the sample was female. Only 15% of the respondents were members of disadvantaged minority groups, and of these, 11% were African-American, 1% was Native-American and 3% were Hispanic. Of the remaining 85%, 2% were Asian and the remainder were Caucasian.

Fifty-six percent of the sample were currently employed and 69% were married. The mean occupational status was 39.34, which is slightly above the mean status of 36.81 measured across all occupations (Hauser and Warren, 1997). The average education level of 4.6 falls between the categories of "some college, but no degree" and "associates degree", and the mean household income of 5.88 falls between the categories of "\$25,000–\$34,999" and "\$35,000–\$49,000," which is roughly near the median household income in

Table 1
Sample demographics

	<i>N</i> = 361	Minimum	Maximum	Mean	SD
Age	359	44	75	58.45	8.67
Female	361	0	1	0.52	0.50
Minority	357	0	1	0.15	0.36
Employed	361	0	1	0.56	0.50
Married	360	0	1	0.69	0.46
Occupational status	351	14.40	80.53	39.32	13.48
Education	359	1	8	4.60	1.62
Income	326	1	8	5.88	1.73

the US in 1996 of \$35,492 (US Bureau of the Census, 1998).

3.6. Methods

Multiple-item measures were modeled in confirmatory factor analysis, which improves measurement reliability by separating shared variance among items from measurement error. The improved reliability, in turn, reduces the biasing effect of measurement error on the estimation of regression coefficients and their associated tests of statistical significance (Maruyama, 1998).

Causal models of depression and health were estimated with structural equation modeling (SEM) using the maximum likelihood estimation method, and an SPSSx system file as input to AMOS, to allow for tests of direct and indirect effects without assuming the absence of measurement error (Maruyama, 1998). Initially, measurement and causal models of depression and health were estimated for the entire sample. Next, the sample was split into two groups, one at or below the median value of neighborhood SES, i.e. “lower-SES” neighborhoods, and the other above the median value of neighborhood SES, i.e. “higher-SES” neighborhoods. Ideally, the sample would have been divided into more groups to reflect more detailed gradations in neighborhood SES. However, the sample size of 361 limited the sub-group analysis to two groups.

A two-group model in which all measurement model factor loadings and error variances were fixed to be equal was estimated to establish a baseline χ^2 goodness of fit measure. Then each factor loading was freed, one at a time, to test for differential factor structures between groups. When the fit of the model did not improve significantly upon freeing a factor loading, that loading was considered to be equal between the two groups. However, when the model fit did significantly improve, the factor loading in question was noted as significantly different between groups.

In the two-group causal model, all factor loadings were fixed to be equal between groups so that tests of

differential effects between groups would be measuring effects of the same underlying constructs. Subsequently, each causal path connecting stressors and resources to depression and health was freed to vary between groups, one at a time, to test for differential effects between lower- versus higher-SES neighborhoods.

4. Results

4.1. Measurement models

Results from the confirmatory factor analyses for the sample as a whole are presented in Table 2. Only items that were significantly related to the underlying construct were retained in the measurement models.

The results of the two-group measurement modeling revealed that five factor loadings varied significantly according to neighborhood SES. In all cases, the loadings were significant for both types of neighborhoods, but varied in strength. Occupational status was more strongly related to individual SES for residents of higher-SES neighborhoods, and having someone “you really like to talk to” was more strongly related to presence of a confidant for residents of higher-SES neighborhoods. Number of chronic conditions was more negatively related to physical health for residents of lower-SES neighborhoods. Of the ten indicators of depression, “worried a lot about little things” and “felt lonely” were more strongly related to depression among residents of higher-SES neighborhoods while “felt restless” was slightly more related to depression among residents of lower-SES neighborhoods.

4.2. Descriptive statistics

Table 3 presents mean levels of stressors, resources and health outcomes by the two measures of SES. As SES increases, stressors decrease, resources increase and health outcomes improve. Financial strain decreases as SES rises. Sense of control and social sup-

Table 2
Measurement model^a

Unobserved variables	<i>b</i>	β	CR
Socio-economic status:			
Education	1.00	0.73	
Occupational status	8.27	0.76	5.15
Social integration:			
How often do you talk on the phone with friends?	1.00	0.61	
How often do you go out with friends...?	1.71	0.83	5.20
How often do you attend religious services...	0.45	0.19	3.11
Presence of a confidant:			
You have someone you can turn to...	1.00	0.76	
You have someone you really like to talk to	0.94	0.75	6.13
Sense of control:			
There is no sense planning a lot	1.00	-0.44	
The really good things that happen to me are mostly luck	-0.86	-0.44	-5.33
Most of my problems are due to bad breaks	-1.23	-0.71	-6.36
I have little control over the bad things that happen to me	-1.26	-0.64	-6.29
I am responsible for my own failures	0.27	0.16	2.47
Distress:			
Felt you just couldn't get going	1.00	0.53	
Felt sad	1.19	0.63	8.73
Felt tense or anxious	1.39	0.64	8.41
Had trouble getting to sleep or staying asleep	1.31	0.56	8.13
Worried a lot about little things	1.36	0.61	8.57
Felt that everything was an effort	1.28	0.64	8.56
Felt lonely	1.17	0.61	8.57
Felt restless	1.49	0.71	9.40
Felt you couldn't shake the blues	1.08	0.70	9.35
Had trouble keeping your mind on what you were doing	1.13	0.57	8.26
Health:			
Self-reported health	1.00	0.71	
Functional limitations	-3.88	-0.83	-11.23
Chronic conditions	-1.12	-0.59	-9.64

^a Overall fit: $\chi^2 = 533$, $df = 260$, $\chi^2/df = 2.05$, NFI = 0.968, IFI = 0.983, CFI = 0.983, RMSEA = 0.054.

port both increase with SES. Only marital stress breaks the pattern by being slightly higher in the higher-SES categories. Physical health is positively related to SES and depression is negatively related. The linear trends for financial strain, sense of control, physical health and depression are statistically significant. Thus, the data support existing research by indicating that the lower one's SES, the more likely one is to be exposed to hardships or stressors, to be unhealthy, and to be depressed, and the less likely one is to be equipped with resources to cope with hardships. In addition, they indicate that the same pattern holds according to neighborhood SES.

4.3. Causal model of health and depression

Next, a causal model of depression and physical health was estimated using SEM. Control variables that were not significantly related to either health out-

come are omitted. Control variables with significant effects included the negative effects of age and body mass on physical health, the positive effects of marital status, employment status and physical exercise on physical health. The inclusion or exclusion of these control variables does not substantially affect the coefficients of the theoretical variables.

The overall fit of the final model had a χ^2/df ratio of 2.23 is considered an acceptable fit (Carmines and McIver, 1981). The normative fit index of 0.956, incremental fit index of 0.975, comparative fit index of 0.975 and RMSEA of 0.058 all meet the standard statistical criteria of good fit (Maruyama, 1998).

The standardized path coefficients are presented in Fig. 2. The direct or main effect of neighborhood SES on individual health is not included as a predictor because when aggregate-level variables in which individuals are clustered are modeled as though they are individual-level variables, their standard errors tend to be underestimated (Bryk and Raudenbush, 1992).

Table 3
Mean levels of stressors, resources, and health outcomes by individual and neighborhood SES

	SES					
	Individual			Neighborhood		
Stressors, resources, and health outcomes	Confidence interval (95%) of the mean difference	Low	High	Confidence interval (95%) of the mean difference	Low	High
Stressors:						
Financial strain ^{a,b}	0.14 to 0.41	1.49	1.22	0.08 to 0.35	1.47	1.25
Marital stress	-0.15 to 0.10	1.72	1.74	-0.09 to 0.16	1.75	1.72
Resources:						
Sense of Control ^{a,b}	-0.32 to -0.15	2.78	3.01	-0.23 to -0.05	2.83	2.96
Social integration	-0.34 to 0.03	3.28	3.43	-0.32 to -0.05	3.28	3.42
Presence of a confidant	-0.16 to 0.09	3.37	3.40	-0.25 to 0.002	3.32	3.45
Health outcomes:						
Physical health index ^{a,b}	-0.27 to -0.07	-0.08	0.51	-0.25 to -0.04	-0.07	0.07
Depression ^{a,b}	0.18 to 0.74	1.37	0.91	0.05 to 0.62	1.32	0.98

^a T-test of between-group mean differences according to individual SES is significant at 0.05.

^b T-test of between-group mean differences according to neighborhood SES is significant at 0.05.

Unfortunately, there are not enough individuals within each zip-code area to perform multi-level analysis.

In the model depicted in Fig. 2, SES is inversely related to financial strain, and positively related to sense of control and the presence of a confidant. Financial strain and marital stress directly increase depression and worsen health. Social integration has a positive effect on physical health but not depression, whereas presence of a confidant is not significantly related to health or depression. Sense of control is negatively related to depression, but not related to physical health.

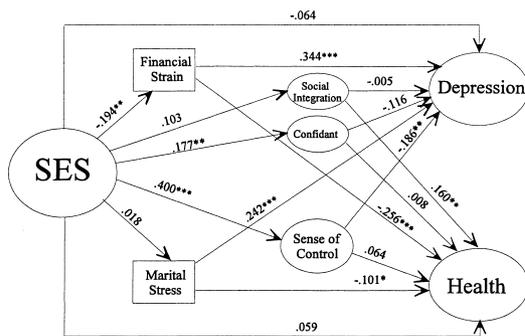
Although SES was significantly related to both depression and physical health in the bivariate case, its effects became non-significant in the causal model. The results suggest that financial strain mediates the effects

of SES on depression and physical health, while sense of control mediates the effect of SES on depression.

4.4. Differential effects of SES, stressors and resources by neighborhood SES

The next stage of analysis compared the same process of depression and health determination in two markedly different neighborhood contexts: neighborhoods that fall at or below the median value of SES and neighborhoods that are above median SES. Comparisons were made between the two types of neighborhoods of the effects of stressors and resources on health and depression. These comparisons test multiplicative interactions, i.e. the dependence of the effects of stressors and resources on the level of neighborhood SES. Although it is quite conceivable that neighborhood and individual SES have additive effects on health, additive effects could not be analyzed without treating neighborhood SES as though it were an individual-level variable.

In order to compare the effects of stressors and resources between neighborhood types, it was necessary to fix all factors loadings to be equal between groups. However, results presented earlier revealed that five factor loadings varied significantly between groups. Differential factor loadings between neighborhoods may suggest that different concepts are being measured in each setting, calling into question the wisdom of comparing causal effects between groups. Because the differential loadings were relatively small in size, they were fixed to be equal in the two-group causal model. The final two-group causal model was



*Standardized effects, controlling for the effects on health of marital status, age, employment status, physical exercise and body mass index.

Fig. 2. Structural equation model of the effects of SES on depression and physical health.

Table 4
Differential effects of stressors and resources by neighborhood SES^a

	Lower-SES neighborhoods	Higher-SES neighborhoods	P-Value ^b
<i>Stressors</i>			
Effects on physical health:			
Financial strain	−0.200***	−0.094*	0.092
Marital stress	−0.140	−0.067	0.468
Effects on depression:			
Financial strain	0.139***	0.172***	0.470
Marital stress	0.191**	0.146**	0.531
<i>Resources</i>			
Effects on physical health			
Sense of control	0.190	−0.038	0.251
Having a confidant	0.044	−0.061	0.212
Social integration	0.061	0.306***	0.028
Effects on depression			
Sense of control	−0.284*	−0.116	0.249
Having a confidant	−0.073	−0.044	0.630
Social integration	0.074	−0.117*	0.018

^a Coefficients are unstandardized.

^b Chi² test of between-neighborhood difference in effects.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

re-tested with the significantly different between-group factor loadings allowed to vary to verify the final results. The substance and significance of results were unchanged.

Table 4 presents the effects of stressors and resources on physical health and depression separately for lower- and higher-SES neighborhoods. The column on the far right indicates which effects were significantly different between the two neighborhood types. The results indicate that social integration has differential effects on both physical health and depression according to neighborhood SES. Social integration does not protect or improve lower-SES neighborhood residents' physical health as it does for residents of higher-SES neighborhoods. Similarly, social integration only protects residents of higher-SES neighborhoods from depression. Several other effects appear different, but do not meet the stringent Chi² difference test. However, the negative effect of financial strain on physical health is significantly greater for residents of lower-SES residents at the 0.10 level of significance.

5. Discussion

This study tested a stress process model of physical and mental health on an individual level and proceeded to test the relative effects of stressors and resources on health by neighborhood SES. The individual-level model revealed that financial strain mediates the relation between individual SES and both

mental and physical health. Furthermore, sense of control mediates the relation between SES and mental health. The results of the neighborhood-SES model suggest that social integration is only protective of mental and physical health for residents of higher-SES neighborhoods.

Two of the effects found in the individual-level model hold for one health outcome, but not the other. Sense of control reduces depression, but apparently bears no relation to physical health, whereas social integration improves physical health, but is unrelated to depression. One possibility is that the causal direction is improperly specified, and the true effect flows in the opposite direction with depressed individuals tending to lose their sense of control and healthy individuals being more likely to socialize. A second possibility is that the effect of personality on health is more long-term and not apparent in cross-sectional data, whereas its relation to mental health is relatively immediate. Similarly, social isolation may hasten physical deterioration, eventually resulting in reduced mental health in response to physical illness.

In this analysis, social integration was measured on an individual level. However, social integration is actually a property of the individuals who provide it, not its recipients (Pearlin, 2000). Since individuals are likely to socialize with others who are similarly situated to themselves, it is also likely that residents of lower-SES neighborhoods tend to socialize with their own neighbors, or people in similar neighborhoods, while residents of higher-SES neighborhoods tend to

socialize with their neighbors, or people in similar neighborhoods to them. Thus, the *sources* of social integration may vary according to neighborhood SES.

The absence of a relation between social integration and health among lower-SES neighborhood residents is consistent with the argument that the effectiveness of social support is contingent on its source. In poorer neighborhoods, one's social support network is likely to consist of individuals who are relatively burdened and needy themselves, and therefore less able to provide the sort of support that improves health. In contrast, the friends and family who surround residents of higher-SES neighborhoods are likely to be relatively stable, and more able to set aside their problems and be supportive when the need arises.

The differential vulnerability hypothesis suggests that individuals of lower SES may be differentially vulnerable to stress owing to both constitutional factors, and to aspects of their environments (Kessler, 1979a). The results presented here suggest that some individuals are differentially vulnerable because of unmeasured aspects of their neighborhood environments. It may be that lower-SES neighborhoods lack the resources that foster healthy socialization among individuals. For example, the relative lack of safe meeting places, such as parks and restaurants (Troutt, 1993), may hinder efforts to relax and enjoy the company of others. Similarly, the presence of stressors, such as the threat of crime, may impose limitations on group activities that reduce their capacity to improve health. However, since stressors and resources were not measured directly on a neighborhood level in this analysis, these interpretations are purely speculative.

As with all cross-sectional research, this study is limited in its efforts to establish causal direction. The conceptual model of the stress process in neighborhood context is consistent with existing theory and research on the effects of SES, stressors and resources on mental and physical health. However, it is plausible that these concepts are reciprocally related, or that the primary causal direction is the reverse of what has been assumed in this paper. For example, ill health may erode resources, increase exposure to stressors and ultimately reduce SES.

A second limitation of this study involves the measurement of neighborhoods. The combination of a small sample and a multi-group SEM approach forced the artificial split of neighborhoods into two types. Furthermore, the analysis was not sensitive to the possibility that some respondents had only recently moved into their current neighborhoods from very different environments, or had lived in a variety of neighborhoods throughout their lives.

This study was further limited by its small sample size and limited statistical power. More group differences in the effects of stressors and resources might

have been significant with a larger sample. Thus, the results may actually underestimate the dependence of the stress process on neighborhood properties. On the other hand, since the data were not multivariate normal, and maximum likelihood estimation was used, standard errors may have been underestimated. In either case, the results should be interpreted as suggestive of important neighborhood effects to be further studied with improved data.

Researchers should continue to conceptualize neighborhoods as critical arenas in which the stress process is played out. However, studies that treat neighborhood properties as though they were individual-level phenomena run the risk of confounding neighborhood and individual determinants of health. In order to model the distinct effects of neighborhoods on health, samples should include sufficient numbers of individuals (i.e. at least 20) clustered within meaningful geographic units with known properties. When geographic units are relatively small and homogenous, they may more reasonably be conceived of as neighborhoods. With sufficient numbers of individuals clustered within a range of neighborhoods, neighborhood SES may be treated as a continuum rather than a dichotomy as in this study. Ideally, properties of neighborhoods other than SES alone should be measured, such as the incidence of violent crime, accessibility to public services, and so on.

Multi-level data of individuals within neighborhoods with rich measures of stressors and resources at both levels of analysis will allow a wealth of new hypotheses to be tested. For instance, the independence of neighborhood- and individual-level determinants of health, as well as the dependence of individual-level effects on neighborhood properties, may be studied.

The results of this study suggest that efforts to attenuate health inequalities will be of limited success if they target only individuals. Conditions associated with the SES of neighborhoods must be targeted as well. However, the specific attributes of neighborhoods that cause health effects, and the mechanisms through which they operate, are not well understood. The present study goes beyond earlier research by modeling the effects of stressors and resources in neighborhood context. With improved multi-level data, the specific properties of neighborhoods that affect health, and that condition the individual stress process, may be isolated and targeted in public health policy interventions.

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