Neighborhood Problems as Sources of Chronic Stress: Development of a Measure of Neighborhood Problems, and Associations With Socioeconomic Status and Health

Andrew Steptoe, D.Sc. and Pamela J. Feldman, Ph.D.
University College London

ABSTRACT

The impact of the residential neighborhood on health and well-being is being increasingly recognized in behavioral medicine, with evidence for neighborhood-level effects that are independent of the individual characteristics of residents. This study addressed the possibility that the effects of neighborhood are due in part to exposure to community-wide stressors rather than variations in protective factors such as social capital. A questionnaire survey including a 10-item neighborhood problems scale and measures of self-reported health, health behaviors, and social capital was completed by 419 residents of 18 higher socioeconomic status (SES) neighborhoods and 235 residents of 19 lower SES neighborhoods. Data were analyzed using regression and multilevel methods. Neighborhood problem scores were greater in lower than higher SES neighborhoods, positively associated with individual deprivation, and negatively correlated with social capital. Neighborhood problems were not related to smoking, diet, alcohol consumption, or physical activity. However, neighborhood problems were associated with poor self-rated health, psychological distress on the General Health Questionnaire, and impaired physical function, independent of age, sex, neighborhood SES, individual deprivation, and social capital. Adjusted odds ratios for the highest versus lowest neighborhood problem quartiles ranged from 2.05 (confidence interval = 1.15–3.69) for poor self-rated health to 3.07 (1.63–5.79) for impaired physical function. The results provide preliminary evidence that residential neighborhood problems constitute sources of chronic stress that may increase risk of poor health.

(**Ann Behav Med** 2001, *23*(3):177–185)

INTRODUCTION

There have been considerable advances in the measurement of life stress in health psychology and psychosocial epidemiology (1). The emphasis in the psychiatric literature on acute life events has been complemented by assessments of chronic stressors of several types. Measurements have been established of financial strain (2), work stress (3), family environment and marital conflict (4,5), and minor daily stressors (6).

In the sociological literature, there has been a particular interest in measuring chronic strain, as it is believed to play a more influential role in mediating the relation between socioeconomic status (SES) and physical health than acute stress (7,8). There is substantial evidence that people of lower SES are more likely to experience high job strain, low job control, financial strain, and other forms of chronic life stress than are higher SES individuals (9–11). From a sociological standpoint, chronic strain can be linked to various levels of social structure that place low SES individuals at greater risk of stress exposure in their work and family lives, as well as in their local environments. Socially stratified groups are exposed to different levels of persistent community-wide strain that may exert independent effects on health or interact with individual stressors to influence health outcomes (e.g., 12). Communities of lower income individuals, particularly in urban areas, experience higher levels of chronic stress in the form of crime, unemployment, and violence (13). In addition, these communities may encounter higher levels of environmental stressors such as noxious chemicals and pollution which introduce pathogens and carcinogens into the environment (14). Thus far, few measures of chronic community-wide strain have been developed. However, it may be particularly important to examine the impact of chronic community-wide stressors on health, as they are largely uncontrollable, occur throughout the life course, and are transferred across generations for those living in poorer communities.

Recent research has highlighted the role of neighborhood and place of residence in determining health and well-being (15). Evidence is accumulating that overall mortality and health problems in different age groups are predicted by area of residence, over and above individual deprivation levels and psychosocial characteristics, in both the United States and the United Kingdom (16–18). For example, Waitzman and Smith (19) showed that residing in a poverty area was associated with elevated risk of all-cause, cardiovascular, and cancer mortality over a 13- to 16-year period, independent of individual-level factors including household income and baseline health status. Effects were particularly marked for younger people (25–54 years of age) at baseline. Effects have been observed for a range of other outcomes, including adolescent mental health (20), parenting behavior (21), and adult depression and self-rated health (22). Relationships have been identified between area of residence and health behaviors such as smoking and physical activity, independent of individual SES (23,24), which may help to explain some of the relationship between neighborhood context and individual health (25).

This research was supported by the Medical Research Council, United Kingdom.

We are grateful to Sally Macintyre from the Social and Public Health Sciences Unit at the University of Glasgow, and to Carol Thomas from the Department of Applied Social Science at the University of Lancaster, for their help in formulating the measure of neighborhood problems.

Reprint Address: A. Steptoe, D.Sc., Psychobiology Group, Department of Epidemiology and Public Health, University College London, 1–19 Torrington Place, London WC1E 6BT, United Kingdom.

Efforts to understand the impact of neighborhood and area of residence on health have centered around characterizing areas in terms of SES and around collective-level variables such as social capital and social cohesion (26). Various measures of positive aspects of neighborhoods have been developed, such as assessments of neighborhood cohesion (27), psychological sense of community (28), and informal social control at the neighborhood level (13). In contrast, there has been relatively little work on evaluating the experience of living in particular neighborhoods in terms of health psychology constructs like daily stress. Neighborhood stressors have been included in general measures of life stress, as in the Life Stressors and Social Resources Inventory (29), and in studies of local environments and health (30,31). However, separate measures of neighborhood problems would enable researchers to examine whether the adverse effects of living in certain neighborhoods are due in part to repeated exposure to community-wide stressors as well as to deficits in community-level protective phenomena such as social capital.

To investigate this possibility, we developed a simple questionnaire measure of neighborhood stress that could be used to supplement assessments of other sources of chronic stress and investigated its associations with neighborhood characteristics and health outcomes. We predicted that neighborhood stress would be independently associated both with affluence of the area of residence and with individual-level markers of material deprivation. We therefore administered the questionnaire to people living in higher and lower SES areas as defined by the dominant resident occupational group. To demonstrate that ratings of neighborhood problems were similar among people living in the same neighborhoods, several higher and lower SES neighborhoods were sampled, and neighborhood-level effects were analyzed using multilevel modeling (32). High neighborhood stress was expected to be associated with lower levels of social cohesion and informal social control, so we hypothesized that scores on the neighborhood problem scale would be inversely associated with social capital. As noted earlier, health behaviors have been associated with neighborhoods and may help to explain their impact on health outcomes. It is possible that this relationship is due to the chronic strain produced by neighborhood problems because relationships have been identified between unhealthy lifestyles and other types of stress (33). Thus, we examined whether more neighborhood stress is associated with more smoking and alcohol use, less physical activity, and poorer diet. Finally, we assessed whether neighborhood stress is associated with three health outcomes (self-rated health, psychological distress, and impaired physical function) and whether associations were independent of neighborhood SES characteristics, individual deprivation levels, and social capital differences.

METHOD

Sample Information and Survey Method

The sample was composed of 658 survey respondents—282 men (43%) and 375 women (57%) with gender missing for 1 respondent—living in the London area. Participants were between 18 and 94 years of age (M = 52, SD = 18.0). The majority of the sample was married (60%). Over half of the sample was employed full time (52%), and a large portion of the sample was retired (33%).

A postal survey was sent to an original sample of 2,788 people with approximately half identified as living in higher SES and half in lower SES neighborhoods in the London area with mixed ethnic composition. The SES of neighborhoods was defined by occupational class of residents using the MOSAIC geodemographic postcode segregation system administered by a commercial information service (Experian, U.K.). This system uses databases such as the national census and the applications database of the national Universities and Colleges Admissions Service to build a profile of occupational status of residents in U.K. postal sectors. Neighborhoods were defined as postal sectors (e.g., E16 1), and 18 higher SES and 19 lower SES sectors were surveyed. On average, postal sectors are composed of 2,600 households. To examine relationships between neighborhood variables and health measures at the neighborhood level, surveys were sent to a number of adults living in each postal sector. The mean number of respondents living in the same postal sector was 18, with a range from 3 to 47. The number of years that respondents lived in their neighborhoods averaged 22 years (SD = 16.6), ranging from less than 1 year to 78 years.

Of the 2,788 potential respondents, 658 completed and returned the questionnaire. There was a substantial difference in response rates from higher and lower SES neighborhoods because 64% lived in higher SES (middle class) and 36% lived in lower SES (working class) neighborhoods. The majority of nonresponders simply failed to return the questionnaire. A minority of uncompleted questionnaires were returned because the recipient had moved home (n = 45), refused (n = 3), had died (n = 10), was blind (n = 1), or gave no information (n = 5). Thus, 56 respondents were unable to complete the form due to death, disability, and having moved addresses. The response rate for the sample was 24%.

Measures

Individual Deprivation Level

In addition to comparing higher and lower SES neighborhoods, deprivation was also estimated at the individual level. Respondents were rated on three criteria: (a) whether they owned their home, (b) had access to a car, and (c) lived in crowded conditions (one or more persons per room). Each person was given a score ranging from 0 (*low deprivation*) to 3 (*high deprivation*). This measure is an adaptation at the individual level of the Townsend index widely used in studies of SES and health (34).

Financial strain was assessed with an adaptation of the economic strain measure devised by Pearlin, Menaghan, Lieberman, and Mullan (2). Eight items (e.g., "Do you have enough money for the kind of clothing you and your family should have?") were presented, with response options ranging from 1 (*no difficulty*) to 3 (*very great difficulty*). The item concerning medical expenses from the original questionnaire was

omitted because of the existence of the National Health Service in the United Kingdom. Total scores were calculated with a range from 8 (low financial strain) to 24 (very high strain). The internal consistency (α) of the scale in this study was .93.

Measure of Neighborhood Problems

Several features of neighborhoods that may cause chronic strain have been identified in previous studies, including traffic density and pollution, dirt and noise, the antisocial behavior of residents, the absence of local facilities and amenities, the decaying fabric of the built environment, limited local transport, and perceived threats to self and property. Building on previous work (30), we set out to devise a short measure suitable for a range of urban environments that would briefly cover a range of potential problems while being comprehensible to people of limited literacy. Respondents were given a list of 10 items (detailed in Table 2) described as problems that could arise in any area. They were asked to rate the extent of each area's problem, using a 3-point scale from 1 (*not a problem*) to 2 (*some problem*) to 3 (*serious problem*).

Social Capital Measures

Two measures of collective efficacy developed for the Project on Human Development in Chicago Neighborhoods were administered (13). Social cohesion was assessed with five items (e.g., "People in this neighborhood do not share the same values"), each of which was rated on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Scores on the scale could range from 5 to 25, with higher scores reflecting greater social cohesion. The internal consistency (α) in this sample was .76. Informal social control was assessed with five items (e.g., "How likely is it that your neighbors could be counted on to intervene if children were spray painting graffiti on a local building?") on a 5-point scale ranging from 1 (*very unlikely*) to 5 (*very likely*). Again, scores could range from 5 to 25, with higher values indicating greater informal social control. The Cronbach's alpha value for the scale was .80.

Health Behaviors

Cigarette smoking. Participants were asked if they were current smokers, ex-smokers, or nonsmokers. If they were current smokers, they indicated how many cigarettes they smoked per day.

Alcohol consumption. Respondents were asked if they drank alcohol, and they estimated the number of days per week on which they drank and the number of units of alcohol consumed on average. Respondents who drank four or more units on at least 3 days per week were defined as heavy drinkers.

Physical activity. Participants were asked if they had carried out any vigorous physical activity such as sport, jogging, or dancing over the past 2 weeks. Those who had not done so were defined as inactive.

Diet. Fat intake was not assessed because fat consumption has been found not to be related to SES in many surveys in the United Kingdom (35). Instead, respondents were asked how many pieces of fruit and how many servings of vegetables (excluding potatoes) they ate on a typical day. Low intake was defined as eating one or fewer portions of fruit or vegetables per day.

Health Outcomes

Self-rated health. Participants rated their health in general into one of five categories: *excellent, very good, good, fair,* or *poor.* This procedure is widely used, and associations between self-rated health and mortality have been observed in more than 25 studies (36). In logistic analyses, respondents were classified as having impaired self-rated health if they gave a rating of *fair* or *poor,* as used in other studies (36).

Psychological distress. Psychological well-being was assessed using the 12-item General Health Questionnaire (GHQ) (37). This addresses respondents' feelings about their health over the past few weeks, with each item (e.g., "Have you recently been feeling unhappy and depressed") being rated on 4-point scales ranging from 1 (*not at all*) to 4 (*much more than usual*). Cronbach's alpha of the GHQ in this sample was .91. The GHQ was scored using the categorical scoring system (with significant psychological distress defined as a score greater than or equal to 3), as recommended by Goldberg and Williams (38).

Physical function. Activities of daily living were assessed with the Physical Function Scale from the Short Form–36 (SF–36) Health Survey (39). Participants were asked the extent to which each of 10 activities (e.g., bending, kneeling, or stooping) was limited by their health. The standard scoring system was used, such that 0 represents minimal and 100 maximal function. Cronbach's alpha score for the scale in this sample was .93. Impaired physical function was defined as a score of less than 75, as described elsewhere (40).

Statistical Analysis

The characteristics of respondents in the higher and lower SES neighborhoods were compared using chi-square and analysis of variance (ANOVA) methods as appropriate. The relationships between neighborhood problems and social capital measures were assessed with product–moment and partial correlations. Neighborhood problem scores in relation to neighborhood SES and individual deprivation were analyzed using ANOVA methods as well as multilevel modeling techniques. We used multilevel modeling to examine whether there were effects of individual deprivation and neighborhood SES on measures of social cohesion, social control, and neighborhood problem scores at the neighborhood level. A general two-level model was tested with individual deprivation (individual level) and neighborhood SES (neighborhood level) entered as fixed variables into the model. The restricted iterative generalized least squares estimation procedure was used to estimate model parameters and residuals because normality was assumed (32).

The intralevel, two-unit correlation or intraneighborhood correlation for each measure was also calculated. This correlation indicates the proportion of the total variance that is between neighborhoods. Multilevel modeling was carried out using MlwiN software (41).

Associations of neighborhood problems with health behaviors (cigarette smoking, physical activity, and fruit and vegetable consumption) and health outcomes (self-rated health, psychological distress, and physical function) were analyzed using logistic regression, with binary dependent variables as detailed earlier. The neighborhood problems scale was divided into quartiles for these analyses, and the other independent variables in the models were age, sex, neighborhood SES, and individual deprivation scores. Odds ratios and 95% confidence intervals (CIs) for neighborhood problem quartiles, adjusted for all other variables, were calculated with the lowest neighborhood problem quartile as the reference category.

RESULTS

Characteristics of the Sample

The characteristics of respondents from higher and lower SES neighborhoods are summarized in Table 1. There was a higher proportion of men among the higher (46.8%) than lower (36.2%) SES area respondents, $\chi^2(1, N = 654) = 6.42$, $p = .011$, and the lower SES area respondents were slightly younger on average, $F(1, 652) = 6.43$, $p = .011$. The proportion of respondents in paid employment was similar, but more of those living in higher than lower SES areas were retired (39.7% vs. 31.6%), whereas fewer individuals from higher SES neighborhoods were unemployed (1.0% vs. 5.2%), $\chi^2(1, N = 649) = 11.1$, $p = .002$. Overall, the sample was 90% White, 6% Asian, and 4% Black, with the proportions being 90% White, 8% Asian, and 2% Black in the higher SES areas, and 88% White, 5% Asian, and 7% Black in the lower SES areas.

TABLE 1
Characteristics of Higher and Lower SES Area Participants

	Higher SES[a]	*Lower SES*[b]	*Difference Between SES Groups (p)*
Men/Women	196/223	85/150	.011
Age	53.5 (18.1)	49.8 (17.2)	.011
Educational attainment (%)			
Less than high school	58.6	73.8	.001
High school	20.2	13.8	
University or further education	21.2	12.4	
Deprivation scores (%)			
0	72.6	27.1	.001
1	23.4	34.3	
2	4.0	29.7	
3	0.0	8.9	
Financial strain	11.1 (3.4)	14.0 (4.7)[c]	.001
Social cohesion	17.2 (2.3)	15.3 (3.2)[c]	.001
Informal social control	15.8 (4.3)	14.7 (4.2)[c]	.003

Note. Standard deviations are in parentheses. SES = socioeconomic status.
[a]$n = 419$. [b]$n = 235$. [c]Values adjusted for age and sex.

The educational attainment of the sample was low on average, with 61% having only basic educational qualifications (less than high school). However, more respondents from higher than lower SES neighborhoods had advanced educational qualifications, $\chi^2(2, N = 587) = 14.1$, $p < .001$. The individual deprivation scores are detailed in Table 1. More than half the respondents (56%) were in the lowest deprivation category, with 27% having one deprivation marker, 13% having two, and 3% being in the highest deprivation category. As may be expected, individual deprivation scores were strongly associated with neighborhood SES, $\chi^2(3, N = 655) = 183.8$, $p < .001$. The majority of higher SES area respondents had deprivation scores of zero, whereas the lower SES area group was distributed across all levels of deprivation. Financial strain was greater on average in the lower SES areas, $F(1, 636) = 86.8$, $p < .001$.

There were also neighborhood SES differences for the social capital measures: social cohesion, $F(1, 635) = 62.8$, $p < .001$, and informal social control, $F(1, 625) = 8.82$, $p = .003$. Respondents from lower SES areas reported lower social cohesion and lower informal social control in their neighborhoods than did those from more affluent areas.

Multilevel modeling was used to examine whether both individual deprivation and neighborhood SES impacted on the social capital measures at the neighborhood level. The results showed that higher individual-level deprivation predicted reporting of lower social capital ($B = –.38$, $SE = .15$) and that SES neighborhood level also predicted social capital ($B = 1.55$, $SE = .34$), with individuals in higher SES neighborhoods reporting greater social capital than those living in lower SES neighborhoods. Five percent of the variation in social capital lies between the 36 neighborhoods. For informal social control, higher individual-level deprivation predicted lower social control ($B = –.52$, $SE = .24$), whereas neighborhood SES was not predictive of social control. Thus, the association between neighborhood SES and informal social control summarized in Table 1 was due to the presence of more individually deprived respondents in the lower SES neighborhoods, and not to independent neighborhood-level effects.

Neighborhood Problems Scale

The individual items with their mean scores are shown in Table 2. Principle components analysis of the neighborhood problems indicated that all 10 items loaded on a single factor. The factor loadings are presented in Table 2 and ranged from .455 to .706. The internal consistency (Cronbach's alpha) for the scale was .79 and was not improved by exclusion of any item. A neighborhood problems score was therefore computed for each individual by summing items; scores could range from 10 to 30, with higher scores indicating greater neighborhood problems. The mean score for this population was 15.4 ($SD = 3.9$).

TABLE 2
Neighborhood Problems Scale: Items and Factor Loading

Item	*M*	*SD*	*Factor Loading*
Litter in the streets	1.68	.66	.639
Smells and fumes	1.47	.64	.661
Walking around after dark	1.58	.68	.662
Problems with dogs	1.53	.64	.455
Noise from traffic or other homes	1.51	.65	.589
Lack of entertainment (cafes, cinemas, pubs, etc.)	1.44	.66	.491
Traffic and road safety	1.67	.66	.579
Places to shop	1.43	.65	.468
Vandalism	1.73	.67	.706
Disturbance by neighbors or youngsters	1.46	.63	.649

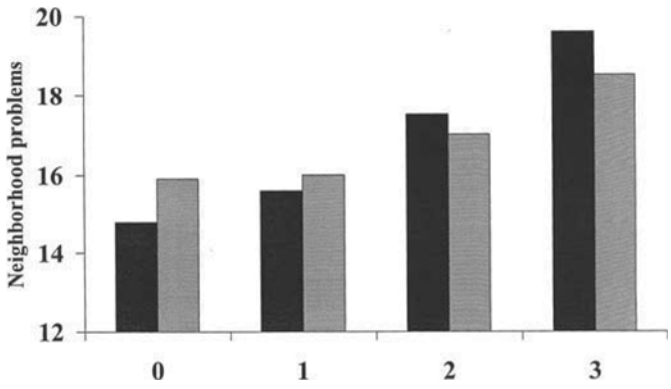

FIGURE 1 Mean neighborhood problem scores for participants at low (0) through high (3) individual deprivation levels. Solid bars represent scores adjusted for age and sex, and hatched bars represent scores adjusted for age, sex, and neighborhood SES.

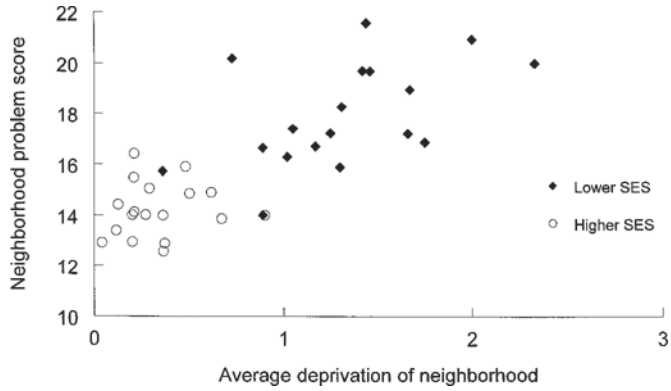

FIGURE 2 Neighborhood problem scores averaged across all respondents in each of the 37 postal sector areas, plotted against mean individual deprivation scores for respondents in those areas. Higher and lower SES neighborhoods are distinguished.

Neighborhood Problems, SES Level of Residence, and Deprivation

Neighborhood problem scores averaged 14.2 (*SD* = 3.0) in the higher SES area participants and 17.6 (*SD* = 4.4) in the lower SES areas, $F(1, 626) = 127.2$, $p < .0001$. Thus, as predicted, people living in less well off areas reported more problems with the neighborhoods in which they lived. This effect remained significant after adjustment for individual deprivation level (adjusted means 14.5 vs. 17.3, $p < .001$). Separate analysis of the individual items indicated that differences between SES areas were significant for all 10 items ($p < .001$). Women had somewhat higher neighborhood problem scores than men (*M*s = 16.0 vs. 14.8), $F(1, 624) = 8.77$, $p = .003$. There was no association between age and neighborhood problem scores, once neighborhood SES and sex had been taken into account.

Neighborhood problem scores were also associated with individual deprivation level. ANOVA of neighborhood problem scores across the four levels of deprivation showed a significant effect of deprivation, after controlling for age and sex, $F(3, 623) = 20.7$, $p < .001$. This effect is shown in Figure 1, where it is apparent that neighborhood problems were rated as more intense by respondents with higher deprivation scores. In pairwise comparisons, the differences in neighborhood problems were significant for all adjacent deprivation levels. When SES area was included as a covariate, the effect of deprivation level was still significant, $F(3, 619) = 4.05$, $p = .007$, although the gradient was somewhat diminished (see Figure 1).

Multilevel modeling was used to examine the contributions of neighborhood SES and individual-level deprivation to the reporting of neighborhood problems. The results showed that higher individual level deprivation predicted reporting of more neighborhood problems ($B = .54$, $SE = .20$) and neighborhood SES also predicted neighborhood problems ($B = –3.09$, $SE = .53$), with individuals in higher SES neighborhoods reporting fewer problems than those living in lower SES neighborhoods. Some 11% of the variation in neighborhood problems lies between the 36 neighborhoods. These effects are illustrated in Figure 2, where the average neighborhood problem score for all respondents in each neighborhood is plotted against the average deprivation level of individuals in that neighborhood.

Neighborhood Problems and Social Capital

The associations between the neighborhood problems scale and measures of social capital were analyzed by product–moment correlations and partial correlation. Neighborhood problem scores were inversely associated with social cohesion ($r =$

–.40, $p < .001$) and informal social control ($r = –.18$, $p < .001$). When the analyses were repeated after partialling out SES neighborhood and individual deprivation, the strength of associations was reduced, but the correlations remained significant ($r = –.31$ and –.13 for social cohesion and social control, respectively; $p < .005$). These analyses indicate that although neighborhood problems are related to measures of social capital, the shared variance did not exceed 16%, suggesting that distinct constructs are being assessed.

Neighborhood Problems and Health Behavior

The proportion of current cigarette smokers was 20.3%; of these, 63.4% smoked 11 or more cigarettes a day, on average. The incidence of smoking was greater in lower SES (31.9%) than higher SES (14.7%) neighborhoods, $\chi^2(1, N = 626) = 24.5$, $p < .001$. It was also associated with individual deprivation scores, $\chi^2(3, N = 629) = 36.0$, $p < .001$, ranging from 16.1% for the least deprived to 68.8% in the most deprived respondents. However, smoking was not associated with neighborhood problem scores, once age, sex, and neighborhood SES had been taken into account.

The proportion of respondents defined as heavy drinkers was 8.5%. The proportion decreased with age, and was greater in men than women (16.0 vs. 2.9%), $\chi^2(1, N = 657) = 33.4$, $p < .001$. Heavy drinking was not related to neighborhood SES but was more common among less deprived individuals, $\chi^2(3, N = 658) = 14.2$, $p = .003$. However, there was no association between neighborhood problems and heavy drinking.

Sixty-two percent of respondents had not engaged in any vigorous physical activity over the past 2 weeks. The proportion was marginally smaller in the higher than lower SES neighborhoods (59.8% vs. 67.7%), $\chi^2(1, N = 644) = 3.63$, $p = .057$, and was more consistently associated with individual deprivation scores, $\chi^2(3, N = 647) = 7.70$, $p = .006$; across deprivation levels, inactivity increased from 58.3% through 66.3% and 69.8% to 78.9% in the most deprived group. Physical inactivity was not associated with neighborhood problems.

The proportion of respondents who ate fruit or vegetables less than daily was 53.8%. The frequency of eating fruit or vegetables was unrelated to neighborhood SES, individual deprivation, and neighborhood problems.

Neighborhood Problems and Health Outcomes

Twenty-five percent of respondents rated their health as *fair* or *poor.* The proportion increased significantly with age ($p < .001$) and with individual deprivation score (odds ratio = 1.43, C.I. = 1.10–1.85, $p = .007$). Self-rated health was not independently associated with sex or neighborhood SES. The adjusted odds ratios for neighborhood problem scores are shown in Table 3. Compared with the lowest neighborhood problem quartile, the odds of fair and poor self-rated health were 2.04 in the highest quartile ($p = .017$). The proportion of participants reporting fair or poor health, adjusted for other variables, was 20.7% in the lowest neighborhood problem quartile, increasing to 33.6% in the highest quartile.

The incidence of significant psychological distress as indexed by GHQ scores above threshold was 29.8%. This proportion was not related to age, sex, or neighborhood SES in the logistic regression model. However, the incidence of psychological distress increased with individual deprivation score (odds ratio = 1.36, C.I. = 1.06–1.73, $p = .014$). Significant psychological distress was also associated with neighborhood problems; as shown in Table 3, the odds for respondents in the highest neighborhood problem quartile were 2.74 ($p < .001$). The adjusted proportion of respondents reporting significant psychological distress was 21.5% in the lowest neighborhood problem quartile, increasing to 42.2% in the highest quartile.

Twenty-nine percent had physical function scores on the SF–36 of less than 75. The proportion increased substantially with age ($p < .001$) and with individual deprivation score (odds ratio = 1.82, C.I. = 1.37–2.43, $p < .001$). Impaired physical function was also associated with neighborhood problems (see Table 3), with significant odds ratios increasing from 1.85 ($p = .047$) for the third quartile to 2.98 ($p < .001$) for the highest quartile. The proportion of respondents with impaired physical function increased from 20.9% in the lowest to 37.2% in the highest neighborhood problem quartile (adjusted for other variables).

The final set of analyses assessed whether neighborhood problems continued to be independently associated with health outcomes after social capital measures had been included in the models. The social cohesion and informal social control scales were each divided into quartiles and included as independent variables in logistic regressions on health outcomes, along with

TABLE 3
Neighborhood Problems and Health Outcomes

	Fair and Poor Self-Rated Health			*GHQ Distress*			*Impaired Physical Function*		
	Odds Ratio	*CI*	*p*	*Odds Ratio*	*CI*	*p*	*Odds Ratio*	*CI*	*p*
Neighborhood problem quartile									
Lowest		1			1			1	
2	1.17	.66–2.08	.58	1.43	.82–2.49	.21	1.16	.62–2.18	.64
3	1.17	.66–2.06	.60	1.48	.86–2.55	.16	1.85	1.00–3.38	.047
Highest	2.04	1.14–3.65	.01	2.74	1.57–4.77	.001	2.98	1.57–5.66	.001
		7							

Note. Odds ratios adjusted for age, sex, SES neighborhood level, and individual deprivation level. GHQ = General Health Questionnaire; CI = confidence interval.

neighborhood problems, age, and sex. In the analysis of self-rated health, the adjusted odds of fair and poor health for people in the highest neighborhood problem quartile were 2.05 (C.I. = 1.15–3.69, $p = .016$), so they were not altered by the inclusion of social cohesion and social control measures in the model.

In the analysis of psychological distress, the odds of significant distress for the highest quartile of the neighborhood problem scale were 2.65 (C.I. = 1.47–4.47, $p = .001$) adjusted for social cohesion and informal social control. Neither social cohesion nor informal social control were themselves associated with psychological distress after adjustment for neighborhood problems.

In the analysis of physical function, both the social cohesion and neighborhood problem scales were independently associated with impaired function. The adjusted odds for respondents in the lowest versus highest social cohesion quartile were 2.31 (C.I. = 1.16–6.63, $p = .018$), whereas the odds of impaired physical function for respondents in the highest neighborhood problem quartile were 3.07 (C.I. = 1.63–5.79, $p < .001$). Thus, for all three health outcomes, independent associations with neighborhood problems were still present after inclusion of social capital measures in the models.

DISCUSSION

The aims of this study were to devise a measure of neighborhood problems that could be used as an indicator of chronic life stress arising from living in different locations and to assess associations with SES, social capital, and health indicators. The postal questionnaire strategy we employed successfully targeted neighborhoods of greater and lesser affluence as indexed by education and individual deprivation scores. The respondents had lived for an average of more than 20 years in their neighborhoods, suggesting a stable residential population.

The neighborhood problem items were selected to reflect an assortment of features of urban living that may be sources of chronic stress. The single factor solution was the best fit for the data, and the internal consistency of the scale was satisfactory. However, several aspects of neighborhood experience were not assessed, such as access to adequate health facilities, public transportation, parks and recreational areas, car parking space, street lighting, and policing. It is likely that a more complex factorial structure would emerge if a broader range of neighborhood issues were included. The scale may also be unsuitable for use in rural neighborhoods. In addition, we did not attempt any objective verification of neighborhood problem ratings. Data concerning crime rates, traffic density, urban noise pollution, and other factors could be used to provide external validation for perceived problems in neighborhoods. Nevertheless, it is interesting that scores on every individual item were greater in respondents from lower than higher SES neighborhoods and that ratings also varied with individual deprivation level.

If a neighborhood problem scale is to have any meaning, then there should be some resemblance between the ratings given by people from a single neighborhood. We used multilevel modeling to demonstrate that neighborhood problem scores did not simply vary with neighborhood SES or deprivation considered at the individual level. The multilevel analysis indicated that 11% of the variance in neighborhood problem scores was attributable to differences associated with postal sector neighborhoods in London. As can be seen in Figure 2, the neighborhoods in which the average level of deprivation of respondents was high tended to be those that also had the most problems. However, this was not invariable because some neighborhoods with relatively deprived residents had only moderately elevated neighborhood problem scores. It is likely that the characteristics of these physical locations and built environments contributed to the perception of which neighborhoods were stressful over and above the deprivation levels of the individuals living within them. These findings are important in establishing a contextual effect of neighborhood problems rather than simply a compositional effect (42).

As predicted, higher SES neighborhoods were rated as having more social capital. These neighborhoods were more socially more cohesive, with higher levels of trust and mutual support. They were also neighborhoods in which informal social controls were stronger. Neighborhood problems would be expected to be greater in residential areas in which informal social controls are loose; for example, concerns about issues such as litter and walking around after dark may be more severe in places in which antisocial behavior is not proscribed. The associations between the neighborhood problem scale and the social cohesion and social control scales were moderate, indicating that the measures addressed overlapping but distinct phenomena. Although the literature has focused on social aspects, these findings suggest that neighborhoods vary along multiple social and psychological dimensions that need to be assessed empirically.

The main reason for interest in neighborhood factors from the perspective of behavioral medicine is because they may constitute a source of chronic stress that impacts on health. This study provides preliminary evidence of such effects. We found that after adjusting for age, sex, neighborhood SES, and individual deprivation scores, high levels of neighborhood problems were associated with poorer self-rated health, psychological distress, and reduced ability to carry out activities of daily living. The odds ratios were substantial, implying effects of some importance. Moreover, the associations between neighborhood problems and health outcomes were independent of measures of social capital. This evidence must be regarded as preliminary because it was based on a cross-sectional self-report survey. Due to the fact that there were no objective markers of health, the results may have been affected by reporting bias. The cross-sectional design prevents any causal inferences from being drawn. It is possible, for example, that people with impaired physical function may rate their neighborhoods as more problematic because of their own mobility limitations. They may be more affected when walking around by obstacles such as litter and find the lack of local places to shop more problematic than would less impaired individuals. Prospective studies involving objective health markers would be desirable to tease out the causal sequences.

The response rate in this study was poor, although greater than that of some recent neighborhood surveys (43). Our aim

was to engage respondents with wide-ranging personal characteristics living in a variety of urban locations rather than to draw generalizations from a representative sample, so the bias resulting from nonresponse does not constitute a major limitation. In addition, our neighborhood measures showed group-level effects in multilevel modeling, indicating that there were sufficient individuals form each neighborhood to assess whether the problems scale truly reflects neighborhood problems. However, a selective bias between higher and lower SES areas is possible, with more dissatisfied residents from lower status areas responding to the questionnaire. The low response rate, therefore, places limits on the confidence with which conclusions can be drawn from the study.

Associations between psychosocial factors and health outcomes are generally regarded as being mediated through either behavioral or psychophysiological pathways (44). We found no significant associations between neighborhood problems and habitual health-related behaviors relevant to health. A relationship, independent of individual characteristics, between area or residence and smoking and physical activity has been described previously. However, data are inconsistent, with different patterns emerging in different neighborhood surveys (23,24). Such effects may be related to other aspects of neighborhoods than those measured in this study. For example, an association between neighborhood of residence and physical activity could be due to factors such as the number of outdoor and indoor recreational facilities in the area; links between neighborhood of residence and smoking or diet could be dependent on the presence of shops selling fresh fruit and vegetables and the density of outlets selling cigarettes. Nonetheless, the absence of associations between neighborhood problems and health behaviors in this survey suggests that psychophysiological processes may be involved in the pathways to health risk. High levels of neighborhood problems could stimulate chronic activation of neuroendocrine, immune and autonomic pathways that, in turn, increase disease risk. Although highly speculative, such a notion suggests that examination of the biological correlates of variations in neighborhood scores may be fruitful in future research.

REFERENCES

(1) Cohen S, Kessler RC, Gordon LU (eds): *Measuring Stress: A Guide for Health and Social Scientists.* New York: Oxford University Press, 1995.

(2) Pearlin LI, Menaghan EG, Lieberman MA, Mullan JT: The stress process. *Journal of Health and Social Behavior.* 1981, *22:*337–356.

(3) Karasek RA, Theorell T: *Healthy Work.* New York: Basic Books, 1990.

(4) O'Brien TB, DeLongis A: Coping with chronic stress: An interpersonal perspective. In Gottlieb BH (ed), *Coping With Chronic Stress.* New York: Plenum, 1997, 161–190.

(5) Moos RH, Moos BS: *Family Environment Scale Manual.* Palo Alto, CA: Consulting Psychologists Press, 1981.

(6) Eckenrode J, Bolger N: Daily and within-day event measurement. In Cohen S, Kessler RC, Gordon LU (Eds), *Measuring Stress: A Guide for Health and Social Scientists.* New York: Oxford University Press, 1995, 80–101.

(7) Pearlin LI: The sociological study of stress. *Journal of Health and Social Behavior.* 1989, *30:*241–256.

(8) Turner RJ, Wheaton B, Lloyd DA: The epidemiology of social stress. *American Sociological Review.* 1995, *60:*104–125.

(9) Marmot MG, Davey SG, Stansfeld S, et al.: Health inequalities among British civil servants: The Whitehall II study. *Lancet.* 1991, *337:*1387–1393.

(10) Lynch JW, Kaplan GA, Shema SJ: Cumulative impact of sustained economic hardship on physical, cognitive, psychological, and social functioning. *New England Journal of Medicine.* 1997, *337:*1889–1895.

(11) Stronks K, van de Mheen H, Looman CW, Mackenbach JP: The importance of psychosocial stressors for socio-economic inequalities in perceived health. *Social Science & Medicine.* 1998, *46:*611–623.

(12) Krieger N: Women and social class: A methodological study comparing individual, household and census measures as predictors of black/white differences in reproductive history. *Journal of Epidemiology and Community Health.* 1991, *45:*35–42.

(13) Sampson RJ, Raudenbush SW, Earls F: Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science.* 1997, *277:*918–924.

(14) Krieger N, Rowley DL, Herman AA, Avery B, Phillips MT: Racism, sexism and social class. Implications for studies of health, disease, and well-being. *American Journal of Preventive Medicine.* 1993, *9*(Suppl.):92–122.

(15) Macintyre S, MacIver S, Sooman A: Area, class and health: Should we be focusing on places or people? *Journal of Social Policy.* 1993, *22:*213–234.

(16) Krause N: Neighborhood deterioration, religious coping, and changes in health during late life. *Gerontologist.* 1998, *38:*653–664.

(17) Leventhal T, Brooks-Gunn J: The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin.* 2000, *126:*309–337.

(18) Sloggett A, Joshi H: Higher mortality in deprived areas: Community or personal disadvantage? *British Medical Journal.* 1994, *309:*1470–1474.

(19) Waitzman NJ, Smith KR: Phantom of the area: Poverty-area residence and mortality in the United States. *American Journal of Public Health.* 1998, *88:*973–976.

(20) Aneshensel CS, Sucoff CA: The neighborhood context of adolescent mental health. *Journal of Health and Social Behavior.* 1996, *37:*293–310.

(21) Klebanov PK, Brooks-Gunn J, Duncan GJ: Does neighborhood and family poverty affect mothers' parenting, mental health, and social support? *Journal of Marriage and the Family.* 1994, *56:*441–455.

(22) Robert SA: Community-level socioeconomic status effects on adult health. *Journal of Health and Social Behavior.* 1998, *39:*18–37.

(23) Ellaway A, Macintyre S: Does where you live predict health related behaviours? A case study in Glasgow. *Health Bull (Edinb).* 1996, *54:*443–446.

(24) Ross CE: Walking, exercising and smoking: Does neighborhood matter? *Social Science and Medicine.* 2000, *51:*265–274.

(25) Robert SA: Neighborhood socioeconomic context and adult health. The mediating role of individual health behaviors and psychosocial factors. *Annals of the New York Academy of Sciences.* 1999, *896:*465–468.

(26) Kawachi I: Social capital and community effects on population and individual health. *Annals of the New York Academy of Sciences.* 1999, *896:*120–130.

(27) Buckner JC: The development of an instrument to measure neighborhood cohesion. *American Journal of Community Psychology.* 1988, *16:*771–791.
(28) Brodksy AE, O'Campo PJ, Aronson RE: PSOC in community context: Multi-level correlates of a measure of psychological sense of community in low-income, urban neighborhoods. *Journal of Community Psychology.* 1999, *27:*659–679.
(29) Moos RH, Fenn CB, Billings AG: Life stressors and social resources: An integrated assessment approach. *Social Science and Medicine.* 1988, *27:*999–1002.
(30) Sooman A, Macintyre S: Health and perceptions of the local environment in socially contrasting neighbourhoods in Glasgow. *Health and Place.* 1995, *1:*15–26.
(31) Ellaway A, Macintyre S: Does housing tenure predict health in the UK because it exposes people to different levels of housing related hazards in the home or its surroundings? *Health and Place.* 1998, *4:*141–150.
(32) Goldstein H: *Multilevel Statistical Models* (2nd Ed.). New York: Wiley, 1995.
(33) Steptoe A: Health behavior and stress. In Fink G (ed), *Encyclopedia of Stress.* San Diego: Academic, 2000, 322–326.
(34) Krieger N, Williams DR, Moss NE: Measuring social class in US public health research: concepts, methodologies, and guidelines. *Annual Review of Public Health.* 1997, *18:*341–378.
(35) Bennett N, Dodd T, Flatley J, Freeth S, Bolling K: *Health Survey for England 1993.* London: HMSO, 1995.
(36) Idler EL, Benyamini Y: Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior.* 1997, *38:*21–37.
(37) Goldberg D: *Manual of the General Health Questionnaire.* Windsor, UK: NFER-Nelson, 1972.
(38) Goldberg D, Williams P: *A User's Guide to the General Health Questionnaire.* Windsor, UK: NFER-Nelson, 1988.
(39) Ware Jr. JE, Sherbourne CD: The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care.* 1992, *30:*473–483.
(40) Jenkinson C, Layte R, Wright L, Coutler A: *The U.K. SF-36: An Analysis and Interpretation Manual.* Oxford, England: Health Services Research Unit, 1996.
(41) Rasbash J, Browne W, Goldstein H, et al.: *A User's Guide to MLwiN Version 2.1.* London: Institute of Education, 2000.
(42) Kawachi I, Berkman L: Social cohesion, social capital, and health. In Berkman L, Kawachi I (eds), *Social Epidemiology.* New York: Oxford University Press, 2000, 174–190.
(43) Dunn JR, Hayes MV: Social inequality. population health, and housing: a study of two Vancouver neighborhoods. *Social Science and Medicine.* 2000, *51:*563–587.
(44) Adler N, Matthews K: Health psychology: Why do some people get sick and some stay well? *Annual Review of Psychology.* 1994, *45:*229–259.