The joint contribution of neighborhood poverty and social integration on mortality risk in the United States

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Abstract:

**Purpose:** A well-established literature has shown that social integration strongly patterns health, including mortality risk. However, the extent to which living in high-poverty neighborhoods and having few social ties jointly pattern survival in the United States has not been examined.  
**Methods:** We analyzed data from the Third National Health and Nutrition Examination Survey (1988–1994) linked to mortality follow-up through 2006 and census-based neighborhood poverty. We fit Cox proportional hazards models to estimate associations between social integration and neighborhood poverty on all-cause mortality as independent predictors and in joint-effects models using the relative excess risk due to interaction to test for interaction on an additive scale. **Results:** In the joint-effects model adjusting for age, gender, race/ethnicity, and individual-level socioeconomic status, exposure to low social integration alone was associated with increased mortality risk (hazard ratio [HR]: 1.42, 95% confidence interval [CI]: 1.28–1.59) while living in an area of high poverty alone did not have a significant effect (HR: 1.10; 95% CI: 0.95–1.28) when compared with being jointly unexposed. Individuals simultaneously living in neighborhoods characterized by high poverty and having low levels of social integration had an increased risk of mortality (HR: 1.63; 95% CI: 1.35–1.96). However, relative excess risk due to interaction results were not statistically significant. **Conclusions:** Social integration remains an important determinant of mortality risk in the United States independent of neighborhood poverty.

**Keywords:** Social determinants of health | Social support | Neighborhood | Mortality

**Article:**

**Introduction**

Several decades of research has shown that social relationships have a profound effect on health [1], [2], [3], [4], [5], [6], [7], [8], and social integration, defined as engagement with
others through social ties and institutional connections, has been associated with a range of chronic health conditions and mortality [1], [7], [9], [10]. Berkman and colleagues [11] developed a conceptual framework for understanding how social relationships influence health and described a cascading effect of social contexts on relationships, health behaviors, and ultimately population health.

A similarly robust literature links neighborhood of residence to health showing that living in deprived areas increases risk of cardiovascular disease, physiological stress, health-damaging behaviors, and mortality [12], [13], [14], [15], [16], [17]. Moreover, there has been an increased interest in elucidating how neighborhood contexts shape the formation and maintenance of social relationships [4], [18], [19], [20], [21], [22] and how they interact with individual-level exposures to potentially modify the development of disease [15], [23], [24].

Despite the consistent and large body of evidence on neighborhoods and social integration as independent predictors of health, fewer studies have explicitly examined how social integration is patterned by broader neighborhood contexts [25], [26], [27], [28], [29]. Investigations of whether neighborhood conditions and social integration may have a synergistic effect on health seem to be missing entirely. Evidence from the Whitehall cohort study [30] showed that men with higher socioeconomic position (SEP) had better quality social relationships and better health than those with lower SEP; the association between SEP and mortality was partly explained by social integration. However, this and other research investigating social integration's impact on mortality did not include neighborhood socioeconomic condition [30], [31].

Informed by the evidence base, we examined if neighborhood poverty and social integration synergistically influenced mortality risk in a national sample of the US population. We used the conceptual framework proposed by Berkman et al. [11] to guide the study and hypothesized that individuals living in impoverished neighborhoods and having low levels of social integration have a mortality risk greater than what may be expected from the additive effects of exposure to each factor alone.

**Material and methods**

**Data sources**

Data are drawn from the Third National Health and Nutrition Examination Survey (NHANES III). The survey, conducted by the Centers for Disease Control and Prevention, used a complex, multistage, stratified sampling design intended to recruit a nationally representative sample of the non-institutionalized, civilian US population. NHANES III was conducted from October 1988–1994 and included individuals from age 2 months. Data collection consisted of an in-home interview and a series of examinations [32]. The data for the present study were taken from the household interviews.

The NHANES III Linked Mortality File contains follow-up data for NHANES III participants through December 31, 2006. Mortality status was identified using the National Death Index,
primarily through probabilistic record matching. This is considered to be a reliable source of mortality follow-up [33].

NHANES III participants' home addresses were geocoded and matched to 1990 Census tracts. Data were geocoded by the Westat Geocoding Service Center for the National Center for Health Statistics (NCHS) [34] Geocoded NHANES III data are available for restricted use which assures confidentiality of the study participants. The 1990 Census file used for this study was compiled by The Public Health Disparities Geocoding Project at the Harvard School of Public Health [35], [36]. It contains a measure of the percent of residents in each census tract living below the poverty line. In addition to review and approval by the Research Data Center at NCHS, the study protocol was approved by the authors' University Institutional Review Board.

Measures

**Social integration.** Previously published studies [9], [37], [38] have used items from NHANES III to create a modified Social Network Index (SNI) that captures the four domains first assessed by Berkman and Syme [1]. This index was chosen for use in the present study to allow our work to be placed within the context of the research that has already been done that uses this modified SNI with the NHANES III [9], [37], [38], [39]. It is computed as follows: 1 point was assigned for married or living as married, 1 point was assigned for >156 contacts with friends and family in the past year, 1 point was assigned if at least four religious services were attended in the past year, and participation in a voluntary organization was assigned 1 point. A total score, ranging from 0 to 4, was created by summing the four items. This approach has been shown to have good predictive validity in that it is associated with health outcomes in a similar manner to the original SNI [1], [9], [37], [38]. The SNI was dichotomized into high (2–4) and low (0–1), where the high-score category represented a favorable level of social integration. This categorization is consistent with other studies where 0 and 1 have been combined to create a low social integration group and compared with the remaining categories [9], [10], [38]. We also conducted sensitivity analyses to assess if results differed based on our choice of categorization (data not shown). We found minor differences in risk across the original categories of 2, 3, and 4 and thus combined these categories to represent “high” social integration. Furthermore, creating two categories of social integration facilitated fitting the joint-effect models described below.

**Neighborhood socioeconomic condition.** Census tracts served as proxies for neighborhoods. Census tracts are commonly used in the investigation of area-level socioeconomic factors due to their consistent use in government and health research and relevance to public policy decisions for resource allocation [27], [36], [40], [41]. Neighborhood socioeconomic condition was measured via neighborhood poverty, which has been shown to be a reliable measure of socioeconomic inequality in health studies [35]. A two-level classification was created based on the federal definition of poverty areas [40], [42]. Low-poverty areas were defined as <20% of residents living below the federal poverty line and high-poverty areas where ≥20% of the residents live below poverty.

**Mortality.** The outcome of interest was time-to-death due to all-cause mortality or, more specifically, person-months of follow-up from the interview to December 31, 2006. There were 12–18 years of follow-up for the sample depending on the year of NHANES interview with a
mean of 167 months (95% confidence interval [CI]: 162–172) for the weighted sample. There were 20,024 participants eligible for the linkage and 5,360 deaths.

**Covariates.** Age, sex, race/ethnicity, and individual SEP were adjusted for in the multivariable models due to their demonstrated associations with mortality. Race/ethnicity was self-reported and classified as non-Hispanic white, non-Hispanic black, Mexican-American, and other [32]. Individual SEP was based on years of education completed (<8, 9–11, 12, and 13+ years) and the participants' household poverty income ratio (PIR; <1, 1–1.99, 2–2.99, 3–3.99, and >4) [15], [25], [27], [32], [43].

Statistical analysis

Descriptive statistics summarize the characteristics of the whole sample and by neighborhood poverty. We used Cox proportional hazards regression to model the relationship between SNI and time-to-death while adjusting for covariates. If no death was recorded, subjects were censored at the end of the follow-up period. The proportional hazards assumption was examined using Kaplan-Meier curves [44]. We assumed that death occurred in this sample at a steady rate equal to that in the general US population and that participation did not alter their mortality risk.

In planning these analyses, we considered how to address both the multilevel nature of the study variables and the complex sample design of NHANES III. We opted to use the sample design variables but assume that the neighborhoods are adequately captured because the primary sampling units were areas which contain several census tracts and are the higher-level grouping [28].

Effect modification was assessed in two ways. First, the Cox regression models were stratified by level of neighborhood poverty to examine differences in the hazard ratios (HRs) which assesses multiplicative interaction between neighborhood poverty and social integration. Next, a four-level dummy variable was inserted into the regression model combining social integration and neighborhood poverty to assess additive interaction [45]. The referent category in this joint-effects model consisted of individuals with the least risk, that is, high SNI and low neighborhood poverty (labeled dR). The other three categories were high SNI/high neighborhood poverty (labeled d1), low SNI/low neighborhood poverty (labeled d2), and low SNI/high neighborhood poverty (highest risk group labeled d3). While the referent group represents the absence of the main effects, the high risk group represents the joint effects and the other two variables represent the independent effect of each risk. The HRs of each group compared with the referent group are reported and were used to calculate the following measures of deviation from additivity [45], [46]: relative excess risk due to interaction (RERI), the synergy index, and attributable proportion due to interaction (AP). These measures were calculated as follows—RERI = HR_{d3} − HR_{d2} − HR_{d1} + 1; S = HR_{d3}−1/(HR_{d2}−1) + (HR_{d1}−1); AP = RERI/HR_{d3}. The RERI and AP are equal to 0 if there is no effect modification, greater than 0 for positive or less than 0 for negative, and the synergy index is equal to 1 with exact additivity. CIs and P-values were calculated using a spreadsheet developed by Knol [47] for the delta method of standard error estimation.

The full sample of adults interviewed as part of NHANES III and eligible for subsequent follow-up was 20,024. Respondents were excluded if their addresses at the time of the interview were
not able to be geocoded \( (n = 2778) \). To ensure that individuals had an opportunity to have their health shaped by the neighborhood where they lived, those who lived in their city/town/area for less than one year were excluded \( (n = 1202) \). The final analytic sample consisted of 16,044 respondents. In addition, the sample size is less than 16,044 for analyses where observations had missing data. A total of 1699 observations were missing income data, and these cases were more likely to be from the extremes in the age spectrum, racial/ethnic minorities, less educated, and lived in their areas for shorter periods of time when compared with those where income is provided. All analyses were conducted using SUDAAN, version 10 [48] and were weighted to account for the complex sample design using the appropriate demographic weight, strata, and primary sampling unit variables.

Table 1. Weighted descriptive summary statistics for the total sample \( (n = 16,044) \) and by neighborhood poverty category

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total sample</th>
<th>0–19.9% Neighborhood poverty</th>
<th>≥20% Neighborhood poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (SE)</td>
<td>81.3 (1.2)</td>
<td>18.7 (1.2)</td>
</tr>
<tr>
<td>All</td>
<td>100 (0.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual-level predictors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17–19 years</td>
<td>4.8 (0.35)</td>
<td>4.5 (0.4)</td>
<td>6.0 (0.51)</td>
</tr>
<tr>
<td>20–29 years</td>
<td>19.8 (0.81)</td>
<td>18.6 (0.8)</td>
<td>24.8 (1.55)</td>
</tr>
<tr>
<td>30–39 years</td>
<td>23.7 (0.75)</td>
<td>24.0 (0.9)</td>
<td>22.6 (1.33)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>17.9 (0.62)</td>
<td>18.4 (0.7)</td>
<td>15.5 (1.06)</td>
</tr>
<tr>
<td>50–59 years</td>
<td>11.9 (0.41)</td>
<td>12.4 (0.5)</td>
<td>9.7 (0.63)</td>
</tr>
<tr>
<td>60–69 years</td>
<td>10.9 (0.49)</td>
<td>11.0 (0.6)</td>
<td>10.2 (0.74)</td>
</tr>
<tr>
<td>70–79 years</td>
<td>7.6 (0.41)</td>
<td>7.7 (0.5)</td>
<td>7.4 (0.62)</td>
</tr>
<tr>
<td>80 + years</td>
<td>3.4 (0.29)</td>
<td>3.3 (0.3)</td>
<td>3.7 (0.39)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>47.1 (0.47)</td>
<td>47.9 (0.6)</td>
<td>43.6 (0.92)</td>
</tr>
<tr>
<td>Female</td>
<td>52.9 (0.47)</td>
<td>52.1 (0.6)</td>
<td>56.4 (0.92)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>73.6 (1.35)</td>
<td>80.7 (1.5)</td>
<td>42.4 (2.30)</td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>12.3 (0.74)</td>
<td>7.4 (0.7)</td>
<td>33.5 (2.07)</td>
</tr>
<tr>
<td>Mexican-American</td>
<td>5.6 (0.48)</td>
<td>4.0 (0.5)</td>
<td>12.6 (1.06)</td>
</tr>
<tr>
<td>Other</td>
<td>8.5 (0.93)</td>
<td>7.8 (1.1)</td>
<td>11.5 (1.72)</td>
</tr>
<tr>
<td>Living below poverty (PIR &lt; 1)</td>
<td>12.7 (0.90)</td>
<td>8.8 (0.8)</td>
<td>30.6 (1.86)</td>
</tr>
<tr>
<td>Highest year of school completed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–8 years</td>
<td>11.1 (0.61)</td>
<td>8.4 (0.6)</td>
<td>22.7 (1.11)</td>
</tr>
<tr>
<td>9–11 years</td>
<td>14.8 (0.60)</td>
<td>13.2 (0.7)</td>
<td>21.7 (0.90)</td>
</tr>
<tr>
<td>12 years</td>
<td>32.8 (0.83)</td>
<td>33.0 (1.0)</td>
<td>31.9 (1.48)</td>
</tr>
<tr>
<td>13 + years</td>
<td>41.3 (1.27)</td>
<td>45.4 (1.4)</td>
<td>23.8 (1.29)</td>
</tr>
<tr>
<td>How long lived in city/town/area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole life</td>
<td>26.8 (1.14)</td>
<td>25.6 (1.3)</td>
<td>31.9 (1.35)</td>
</tr>
<tr>
<td>&gt;20 years</td>
<td>26.6 (0.89)</td>
<td>26.6 (1.0)</td>
<td>26.8 (1.45)</td>
</tr>
<tr>
<td>11–20 years</td>
<td>15.6 (0.72)</td>
<td>16.1 (0.8)</td>
<td>13.3 (1.03)</td>
</tr>
<tr>
<td>5–10 years</td>
<td>14.6 (0.76)</td>
<td>15.2 (0.8)</td>
<td>11.9 (0.97)</td>
</tr>
<tr>
<td>3–4 years</td>
<td>7.6 (0.48)</td>
<td>7.6 (0.5)</td>
<td>7.6 (1.00)</td>
</tr>
<tr>
<td>1–2 years</td>
<td>8.7 (0.59)</td>
<td>8.8 (0.6)</td>
<td>8.4 (1.45)</td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assumed deceased</td>
<td>17.2 (0.70)</td>
<td>16.3 (0.8)</td>
<td>21.2 (1.05)</td>
</tr>
</tbody>
</table>

SE = standard error.
This table displays column percentages.
**Results**

Table 1 presents the weighted descriptive statistics for the full sample and by neighborhood poverty groups. Approximately half of those sampled were women (53%), the majority (74%) were non-Hispanic white, and most (74%) had completed at least a high school education. Most of the sample lived above the poverty line (87%) and over half (53%) lived in their area of residence over 20 years or their whole life. Over half (61%) were between 20 and 49 years of age.

Those who lived in the highest poverty neighborhoods were more likely to be female, of a racial/ethnic minority group, live below the poverty line themselves and were less educated than those in the areas with less poverty. The mean person-months of follow-up are steady across categories of neighborhood poverty.

Figure 1A and Table 2 show the main effects of social integration on mortality. Individuals in the low SNI group had a consistently greater risk of death than the high SNI group. The group with low SNI scores had 1.30 (95% CI: 1.17–1.49) times the risk of death when compared with those with high SNI scores. After adjustment for age, gender, race, PIR, and years of education, the HR increased to 1.44 (95% CI: 1.31–1.58).

![Kaplan-Meier curves](image.png)

**Fig. 1.** (A) Cumulative survival for the social network index (SNI) groups. (B) Cumulative survival for effect modification of social network index score by neighborhood poverty.

<p>| Table 2. Cox proportional hazards regression models of the association between social network index score and mortality |</p>
<table>
<thead>
<tr>
<th>Social network index</th>
<th>Model 1: crude model (unadjusted)</th>
<th>Model 2: adjusted for age, gender, race/ethnicity, individual poverty income ratio, and years of education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hazard ratio  95% CI</td>
<td>Hazard ratio  95% CI</td>
</tr>
<tr>
<td>Low (0,1)</td>
<td>1.30  1.17–1.49</td>
<td>1.44  1.31–1.58</td>
</tr>
<tr>
<td>High (2–4)</td>
<td>1.00  ref</td>
<td>1.00  ref</td>
</tr>
</tbody>
</table>

When the adjusted models are stratified by neighborhood poverty (Table 3 marginals), those with low SNI scores within the low-poverty strata have a HR of 1.41 (95% CI: 1.27–1.58) and in the
high-poverty group the HR is 1.45 (95% CI: 1.18–1.78). These similar HRs provide little evidence for multiplicative interaction. The joint-effects model using the dummy variables (Table 3) showed that there was an increased risk for all three risk groups when compared with the referent. This is also depicted in the Kaplan-Meier curves (Fig. 1B). Individuals living in poor neighborhoods and having low levels of social integration had 1.63 times the risk of the referent group (95% CI: 1.35–1.96). A smaller risk of death was found for those living in nonpoor neighborhoods and having low levels of social integration (HR: 1.42; 95% CI: 1.28–1.59) and nonsignificant findings were observed for those living in high-poverty neighborhoods with high levels of social integration (HR: 1.10, 95% CI: 0.95–1.28). Although the RERI was positive, it was small and not statistically significant (RERI = 0.11, 95% CI: −0.25 to 0.46).

**Table 3.** Cox regression models examining the joint contribution of neighborhood poverty (NP) and social network index (SNI) score on mortality

<table>
<thead>
<tr>
<th>Neighborhood poverty</th>
<th>High SNI score</th>
<th>Low SNI score</th>
<th>HRs (95% CI) for low SNI score within strata of NP</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20%</td>
<td>1.00 (referent)</td>
<td>1.42 (1.28–1.59)</td>
<td>1.41 (1.27–1.58)</td>
</tr>
<tr>
<td>≥20%</td>
<td>1.10 (0.95–1.28)</td>
<td>1.63 (1.35–1.96)</td>
<td>1.45 (1.18–1.78)</td>
</tr>
</tbody>
</table>

Measures of effect modification on additive scale: RERI (95% CI) = 0.11 (−0.25 to 0.46) \( P = .55 \); SI = 1.21 (0.66–2.20) \( P = .54 \); AP = 0.07 (−0.14 to 0.27) \( P = .53 \).

HRs are adjusted for age, gender, race/ethnicity, individual poverty income ratio, education.

**Discussion**

We examined the joint effect of living in high-poverty neighborhoods and having low social integration on the risk of mortality in a national sample of US adults. We first confirmed the known association between social integration and mortality risk in our study population. We found that those who were socially isolated had a 44% increased risk of death than those more socially integrated. Adjusted hazards regression models showed that the joint effect of social integration and neighborhood poverty on mortality risk may be larger than the effect that is expected if each were acting independently. Specifically, individuals living in high-poverty neighborhoods and with low social integration had 1.63 times the risk of mortality compared with individuals living in low-poverty neighborhoods and having high social integration. However, tests of interaction on an additive scale using RERI were small and not statistically significant.

Few studies have examined if exposure to both low social integration and neighborhood poverty increases mortality risk above independent effects, and what the implications of this would be for public health action [49]. Our findings support prior work indicating an independent inverse relationship between social integration and mortality [1], [5], [30], [31], [50]. In adjusted hazards regression models, we also showed that individuals jointly exposed to high poverty and low social integration had an increased risk of mortality compared with the referent group of no exposure to either risk factor. Nonetheless, further examination of the public health impact of this association showed a small and statistically nonsignificant effect. We presented interaction results as recently advocated in the field to allow for a more complete assessment of potential interaction effects across multiple scales and strata [46], [51]. The use of these methods can
advance public health research by specifying groups of the population that are most at risk, and identifying potentially causal relationships to develop more targeted interventions [49].

The fact that our joint-effect results in hazards models (i.e., multiplicative interaction) suggested an increased risk but tests for additive interaction were not statistically significant, leaves open the question of the causal and public health implications of living in high-poverty neighborhoods and being socially isolated. Nonetheless, we suggest that a practical implication of our findings may be that supporting the development of neighborhood-level initiatives that address structural barriers such as racial segregation, housing stock and quality, employment opportunities, and quality education, while also working with residents to build community ties and bonds is a worthwhile investment (as evidenced by independent effects). The challenge remains for future research using stronger study designs (longitudinal data) to better elucidate how and if these types of interventions are causally related to health and if they lead to improved health outcomes.

In our study, neighborhood poverty had an independent effect on mortality as consistently shown in prior work [25], [27], [28], [29]. However, neighborhood poverty did not modify observed associations between social integration and mortality, and in fact social integration remained the stronger predictor of mortality in independent associations and in joint-effect models. Other work has suggested that neighborhood socioeconomic condition shapes social relationships and that this contribution can account for differences that are typically attributed to disparities by race/ethnicity [27], [28]. Future research is needed to examine if neighborhoods influence social integration by race/ethnicity and over the life course, which we were not able to examine in the present study. This research would help demonstrate if well-off neighborhoods provide the infrastructure for building social relationships that may be particularly relevant for racially/ethnically diverse and immigrant groups who often live in racially and/or ethnically segregated areas, or for the elderly who may be more limited in their mobility and hence rely on their immediate neighborhood context for well-being. Given that neighborhood poverty and social relationships are distal factors on the causal pathway to mortality and yet appear to exert an independent effect on health, improving these elements of the living environment could potentially offer substantial population health benefits [52]. As an example, Galea and colleagues [38] estimated that 323,044 deaths among adults in the United States in 2000 may have been attributable to low social integration and 39,330 deaths may have been attributable to area-level poverty, supporting our study findings of considerable mortality burden due to these social determinants.

Despite the strengths of our study, some limitations should be considered. One is that the covariates and main effect variables were captured at baseline only and thus time-dependent variables that may have influenced mortality were not assessed. For example, social integration and neighborhood of residence could change over time and evidence suggests that the timing of exposures determines health and differs over the life course [21]. Furthermore, the covariates that were included in our multivariable models likely do not account for all the potential confounders of the associations investigated. Residual and unmeasured confounding are important considerations. Another limitation is that we only examined all-cause mortality and not specific causes of death that may have indicated differential health effects of the neighborhood context and social relationships. We also chose to exclude missing data from the analysis instead of exploring methods of imputation for those values. This may have impacted
our findings as most of the missing data were for individuals living in neighborhoods with higher concentrations of poverty, likely underestimating our findings. Furthermore, the nature of the data did not allow us to test if the observed associations differed for distinct subgroups of the population marked by neighborhood segregation and/or varying levels or types of social relationships. Social integration is strictly a measure of the quantity of relationships and does not consider their quality, an important part of the path between social relationships and health. In addition, characterizing neighborhoods using census data at the census tract level may not correspond with respondents' assessment of the neighborhood (i.e., spatial mismatch). The effect of this lack of precision is unclear. However, the fact that we still found increased mortality risk despite these limits highlights the need for future research on this topic as it may have important implications for minority groups who tend to live in racially and/or ethnically segregated neighborhoods [40], [53], which often are characterized by poverty and low levels of social integration and beneficial social ties that can be used to effect change [16].

The strengths of this study include its large sample size and the inclusion of measures at the individual and neighborhood levels. To the best of our knowledge, this study is the first to include a national sample of the US population, introducing new evidence of the relationship between neighborhoods, social integration, and health. Associations were found in a diverse population and with distal social determinants—neighborhood poverty and social integration. In addition, our approach for examining how neighborhood poverty interacts with social integration is a methodological advancement in the literature that should stimulate further research on this and related topics.

Conclusion

Our results warrant further research to establish how living in poor neighborhoods structures social connections among individuals and how these exposures influence the duration of life of vulnerable groups.

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