9-2010

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Brian K. Finch

D. Phuong Do
University of South Carolina - Columbia, phuongdo@mailbox.sc.edu

Melonie Heron

Chloe E. Bird

Teresa Seeman

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Author(s)

Brian K. Finch, D. Phuong Do, Melonie Heron, Chloe E. Bird, Teresa Seeman, and Nicole Lurie

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Brian K. Finch, Ph.D.[*],
San Diego State University

D. Phuong Do, Ph.D.,
University of South Carolina

Melonie Heron, Ph.D.,
National Center for Health Statistics

Chloe Bird, Ph.D.,
RAND

Teresa Seeman, Ph.D., and
UCLA

Nicole Lurie, M.D., M.S.P.H.
RAND

Abstract

We investigate an alternative conceptualization of neighborhood context and its association with health. Using an index that measures a continuum of concentrated advantage and disadvantage, we examine whether the relationship between neighborhood conditions and health varies by socio-economic status. Using NHANES III data geo-coded to census tracts, we find that while largely uneducated neighborhoods are universally deleterious, individuals with more education benefit from living in highly educated neighborhoods to a greater degree than individuals with lower levels of education.

Introduction

Nearly all previous studies of neighborhood influences on health explore the effects of neighborhood *deprivation* and investigate whether the effects of neighborhood deprivation compound the effects of individual-level poverty, creating a *double jeopardy* effect (Pickett & Pearl, 2001; Morenoff & Lynch, 2004) Although often inferred from these studies, the absence of neighborhood poverty or disadvantage does not necessarily imply that the neighborhood is affluent or has the protective attributes associated with socioeconomic

[*]Corresponding Author: Brian K. Finch, Professor, Department of Sociology College of Arts and Letters San Diego State University 5500 Campanile Drive San Diego, CA 92182-4423 bfinch@mail.sdsu.edu Phone: 1-619-594-6502 Fax: 1-619-594-1325.

advantage. Further, very few studies have *explicitly* examined whether concentrated advantage (Sampson, Morenoff, & Earls, 1999) does, in fact, confer additional salutary effects on health. Moreover, few studies have examined whether the potentially salutary effects of neighborhood advantage are similar for individuals who themselves are advantaged or disadvantaged and whether these effects are similar for the full range of neighborhood advantage/disadvantage.

Research Questions

Using a measure that incorporates the full distribution of advantage and disadvantage simultaneously, we examine whether the relationship between neighborhood conditions and health varies by an individual's level of education. We hypothesize that, due to differences in levels of personal resources that may either bolster the advantage or exacerbate the disadvantage of individual-level education, the magnitude of the association between neighborhood context and health differs between the more and less educated

Data

We used data from a specially geocoded version of the Third National Health and Nutrition Examination Survey (NHANES III), merged with data from the U.S. Census. NHANES III is a nationally representative, multiple-year-cross-sectional sample of the civilian non-institutionalized population of the contiguous United States. Conducted between 1988 and 1994, it includes information on the health and nutritional statuses of individuals collected through interviews and direct physical examinations at mobile examination centers.

We use census tracts as proxies for neighborhoods. Tract locations of approximately 86% percent of the sample were identified via address or street intersection matches; tract locations of the remaining 14% (largely rural residents) were dropped from the analyses. Neighborhood contextual factors were derived from 1990 and 2000 Decennial Census data —by linearly interpolating across decennial census years and assuming a constant rate of change in neighborhood conditions—then linked to individual respondents in the NHANES III sample via tract identifiers. The final sample consists of 13,827 multi-ethnic (NH White, NH Black, and Mexican-American) respondents over age 20.

Measures and Method

Our health outcome is an index of cumulative physiologic stress, termed allostatic load. The construct of allostatic load reflects a multi-systems view of health as a function of the cumulative impact of wear and tear on the body's various regulatory systems (McEwen & Seeman, 1999; Seeman, McEwen, Rowe, & Singer, 2001). Extending previous work on individual SES and AL using NHANES III data (Seeman et al, 2006), we used an AL index from eleven biomarkers composed of inflammatory, metabolic and cardiovascular indicators. These measures include the following biomarkers: systolic blood pressure, diastolic blood pressure, pulse/heart rate, waist-to-hip ratio, total cholesterol, HDL cholesterol, triglycerides, plasma glucose, C-reactive protein, fibrinogen, and serum albumin. Continuous measures of each biomarker were dichotomized to values of 0/1, with 1 reflecting a clinically accepted "high risk" level of the biomarker (Seeman, Merkin, Crimmins, Koretz, & Karlamangla, 2006). Biomarkers were summed for each individual to create the AL index (range: 0–11). Higher levels of allostatic load (AL) are associated with increased risk of cardiovascular disease and mortality as well as declines in levels of cognitive and physical functioning (Seeman, McEwen, Rowe, & Singer, 2001).

Our key predictor variables include 1) individual-level educational attainment as a marker of SES: no high school diploma {reference category}, high school/some college graduate, and

college graduate) and 2) the education index of concentration at the extremes (ICE), which measures a continuum of concentrated advantage and disadvantage. Originally proposed by Massey (2001) for use with neighborhood income, the ICE incorporates measures of both concentrated advantage and disadvantage to capture the level of socioeconomic polarization in a neighborhood. In this study, we use the number of residents in a census tract with a college degree as an indicator of advantage and the number of census tract residents without a high school degree as an indicator of disadvantage. The education ICE is mathematically defined as: $ICE = \left(\frac{CollegeGrads - NoHS}{TotalPopulation} \right) \times 100$. This measure captures the full range of the balance of neighborhood educational composition, adjusted for the total neighborhood population, and ranges from −100 (extremely disadvantaged: all high school dropouts) to +100 (extremely advantaged: all college graduates). We specify a two-level hierarchical linear model and estimate the cross-level interaction between educational ICE (census tract-level) and educational achievement (individual-level). We choose education as our primary socio-economic status marker for two reasons; first, education is very accurately measured compared with income, and second, educational data exist as a continuously measured variable in census data while income is only reported in the Census for various ranges.

Results

Model results (see Table 1) indicate the expected negative association between individual-level education and AL. Estimates from our cross-level interaction demonstrate that, while neighborhood disadvantage is deleterious and neighborhood advantage is salutary, neighborhood advantage is further associated with a significantly greater health benefit for individuals who are more educated (see Figure 1). Moreover, disadvantaged neighborhoods (i.e., those with a large proportion of high school dropouts) are deleterious and overwhelms the individual-level education effects (see far left distribution of Figure 1). In addition, for those without a high school diploma, neighborhood education is fairly independent of AL, and these high-school dropouts benefit only nominally from living in more advantaged neighborhoods. Finally, various specification tests of the functional form between neighborhood ICE and health (not reported here) indicate that these effects are indeed linear on average, and for each educational grouping. That is, neighborhood advantage and disadvantage—as proxied by our neighborhood educational ICE measure—is both linearly related to health in a fairly smooth continuum, and this linear relationship is consistent for each individual-level of education.

Conclusions

Our results indicate that 1) neighborhood advantage is associated with lower (healthier) levels of AL and 2) the magnitude of association between neighborhood advantage and lower AL is stronger for those with more education. Specifically, college graduates experience similar predicted AL levels to high-school dropouts when living in disadvantaged neighborhoods. However, while all individuals benefit from living in more advantaged neighborhoods, the more educated reap a greater benefit from advantaged neighborhoods. The robustness of the results to alternative model specifications suggest that those with more education are better positioned to take greater advantage of the protective features offered by advantaged neighborhoods but unable to stave off the deleterious effects of disadvantaged neighborhoods. On the other hand, relationships between cruder measures of poverty that are more frequently used, do tend to capture the linear relationships observed here. However, the complex interaction and additional benefit that the well-educated receive from living in socio-economically advantaged (i.e., educationally segregated) neighborhoods would not be uncovered using traditional measures of poverty. This brief study highlights

the need for modeling and considering the full distribution of neighborhood advantage and disadvantage that the ICE measure offers and emphasizes the potential health gains that neighborhood educational segregation garners for more educated individuals who are better positioned to take advantage of neighborhood resources.

Acknowledgments

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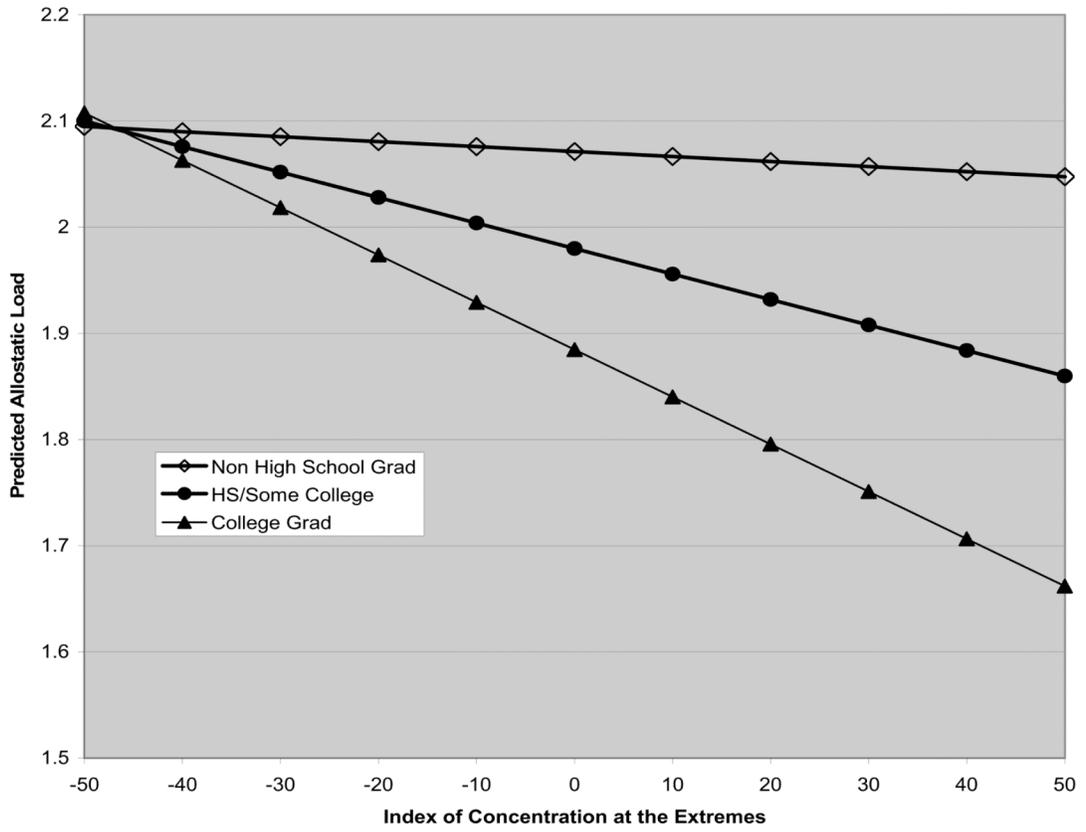
Figure 1.
Predicted Allostatic Load Score by Educational ICE: Stratified by Individual Education

Table 1

Regression of Allostatic Load on Tract-level Educational ICE and Individual-level Educational Attainment (N=13,827)

Variable	b	p-value
Tract-Level Measure		
Education ICE	−0.005	0.486
Cross-Level Interaction		
[Education ICE × Non High School Graduate]		
Education ICE × High School Graduate/Some College	−0.019	0.035
Education ICE × College Graduate	−0.040	<.0001
Individual-Level Measures		
Family Income Poverty Ratio	−0.032	<.0001
Race [Non-Hispanic White]		
Non-Hispanic Black	0.074	0.016
Mexican American	0.225	<.0001
Other Race	0.053	0.374
Gender [Female]		
Male	0.247	<.0001
Age	0.096	<.0001
Age Squared	−0.001	<.0001
Employment Status [Unemployed]		
Employed	−0.093	0.039
Not In the Labor Force	0.055	0.248
Education Level [Non High School Graduate]		
High School Graduate/Some College	−0.091	0.005
College Graduate	−0.187	<.0001
Nativity [U.S. Born]		
Foreign born	−0.116	0.000
Marital Status [Married]		
Single	−0.029	0.367
Other Marital Status	−0.024	0.390

Note: This model also adjusts for survey year; coefficients not reported.

Education ICE estimates reflect a hypothetical 10 point change.