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A prospective investigation of neighborhood socioeconomic deprivation and self-rated health in a large US cohort

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ABSTRACT

Background: Neighborhood characteristics play a critical role in health. Self-rated health (SRH) is an important indicator of quality of life and a strong predictor of premature death. Prospective study on neighborhood deprivation and SRH is limited.

Methods: We examined neighborhood socioeconomic deprivation with reporting fair/poor SRH at follow-up (2004–2006) in 249,265 men and women (age 50–71) who reported SRH as good or better at baseline (1995–1996) in the NIH-AARP Health and Diet Study. Baseline addresses were geocoded and linked to 2000 Census. Census tract level variables were used to generate a socioeconomic deprivation index by principle component analysis.

Results: Residents of more deprived neighborhoods had a higher risk of developing poor/fair SRH at follow-up, even after adjusting for individual-level factors (Odds ratio (95% confidence interval) $_{Q5\ vs\ Q1}$: 1.26 (1.20, 1.32), *p-trend*: *< 0.0001*). The results were largely consistent across subgroups with different demographics, health behaviors, and disease conditions and after excluding participants who moved away from their baseline address.

Conclusion: Neighborhood disadvantage predicts SRH over 10 years.

1. Introduction

Macroenvironmental factors have been increasingly recognized as important determinants of health (Ham, 2012). A growing body of literature has shown that people living in more deprived neighborhoods have higher risks for a variety of adverse health conditions, including diabetes (Ludwig et al., 2011), cardiovascular diseases (Diez Roux et al., 2001), cancer (Doubeni et al., 2012a; Palmer et al., 2012), and premature death (Major et al., 2010). Understanding the influence of social and environmental characteristics on people's health has become an important objective of public health research.

Self-rated health (SRH) is a commonly used, single-item subjective measure of health. It is considered an important indicator of quality of life (Alonso et al., 2004) and is a strong predictor of mortality (DeSalvo et al., 2006), especially in the older population (Lyyra et al., 2009; Lee, 2000; Mossey and Shapiro, 1982). As such, SRH is tracked by the e U.S. Department of Health and Human Services in Healthy People 2020 as an indicator of the general health of the US population (Healthy People 2020). SRH is a unique measure of overall health status as it integrates multiple aspects of health and provides insight on individual's perception of their health conditions, which cannot be fully captured by medical conditions alone (Jylha, 2009). It has been theorized that neighborhood environment can shape multiple aspects of health, including health behaviors and psychological state, which not only influence specific disease risk but can also affect overall health appraisal (Chen and Miller, 2013). Therefore, neighborhood conditions may have a particularly strong effect on SRH.

More than 40 studies have investigated the cross-sectional association of neighborhood socioeconomic status with SRH, and the majority of these studies showed lower SRH among residents of neighborhoods with more severe deprivation (Riva et al., 2007). There has been few prospective studies on neighborhood socioeconomic deprivation and SRH and their findings were mixed (Glymour et al., 2010) (Jokela, 2014, 2015), making it a high priority for researchers to exploit longitudinal data to investigate the health effects of neighborhood characteristics. Another gap in literature is lack of investigation on what individual-level factors may influence the neighborhood effects on SRH. Understanding this may help elucidating the mechanisms that link neighborhood environment to health outcomes, and identifying vulnerable population that is most at risk for the adverse effects of

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neighborhood socioeconomic deprivation.

In a large cohort of middle-to-old aged men and women with over 10 years of follow-up, we examined the association between neighborhood socioeconomic deprivation and the risk of developing fair or poor SRH among those who reported good or better SRH at baseline. Additionally, we further evaluated the influence of individual-level factors, including individual socioeconomic status, health-related behaviors, and chronic disease status, on the neighborhood effect on SRH.

2. Methods

2.1. Study population

Details of the NIH-AARP Diet and Health study were reported previously (Schatzkin et al., 2001). Briefly, the study was established in 1995–1996 by mailing the baseline questionnaire to AARP members (age 50–71) in six US states (California, Florida, Louisiana, New Jersey, North Carolina, and Pennsylvania) and two metropolitan areas (Atlanta, Georgia, and Detroit, Michigan). In total, 566,399 people satisfactorily completed the questionnaire. In 2004––2006, a follow-up questionnaire was mailed to baseline participants. SRH was reported in both baseline questionnaire and follow-up questionnaire. Of the 318,713 participants who completed both questionnaires, we excluded those who had no information on neighborhood socioeconomic deprivation (N=327), and those who had missing baseline (N=3,683) and follow-up SRH (N=38,860). To assess the risk of developing poor or fair SRH over follow-up, we further excluded those who reported poor or fair SRH at baseline (N=26,578) for the main analysis. The final analytic cohort included 249,265 men and women.

2.2. Area-level socioeconomic deprivation

The baseline (1995–1996) addresses were geocoded into geographical coordinates and linked to the 2000 US Census at the tract level. We adopted the method developed by Messer et al. (2006) to generate an empirical neighborhood socioeconomic deprivation index (Doubeni et al., 2012b). In brief, we selected 19 census tract-variables that were related to seven components of the neighborhood environment (housing characteristics, residential stability, poverty, employment, occupation, racial composition, and education). We performed principal component analysis (PCA) on these 19 variables in each state and evaluated consistency across states for high-loading variables in the first principle component. Eventually, we retained ten variables with high loadings. The neighborhood socioeconomic deprivation index was constructed for each census tract by summarizing the PCA scores of these 10 variables. The list of ten census variables and their loadings and distribution across quintiles of neighborhood socioeconomic deprivation index are presented in Table 1.

2.3. SRH and covariates

Participants were asked "would you say your overall health is…" and were instructed to choose one response from five categories (excellent, very good, good, fair, poor). This question was asked in both baseline and follow-up questionnaires. The baseline questionnaire also ascertained information on a broad range of covariates, including demographic characteristics; lifestyle factors, including smoking history, and physical activity; height and weight; medical history including cancer, cardiovascular disease, renal disease, emphysema, and diabetes; and the use of dietary supplements, non-steroidal anti-inflammatory drugs, and menopausal hormone therapy in women. Diet was measured using a 124-item food-frequency questionnaire, and we calculated the Healthy Eating Index–2005 (HEI-2005) as a measure of overall diet quality (Guenther et al., 2008). Incident cancer cases were identified through linkage to state cancer registry databases. In the follow-up questionnaire, participants reported again on medical conditions.

2.4. Statistical analysis

Socioeconomic deprivation was categorized into quintiles, and the first quintile representing the least deprived census tract served as the reference. We used multivariate logistic regression to estimate the odds ratio and 95% confidence interval for reporting poor or fair health at follow-up, comparing participants living in more deprived neighborhood (2nd through 5th quintile) at baseline with the reference group (1st quintile). We took a stepwise approach to evaluate the impact of multiple covariates. The base model included age, sex and baseline SRH health. In the second model, we adjusted for individual-level SES indicators (race/ethnicity and education), which are potential confounders of the association between neighborhood SES and SRH. Because lifestyle may play an important role in mediating the effects of neighborhood deprivation on SRH, we introduced several important lifestyle factors (smoking, BMI, physical activity, alcohol and diet) separately in our model to examine their potential mediating effects. Our final model included all aforementioned variables. We also conducted stratified analysis by baseline SRH, age, sex, education, race, smoking, BMI, physical activity and status of chronic conditions.

We conducted a series of sensitivity analysis. To examine the influence of baseline chronic conditions (diabetes, cancer, cardiovascular disease, emphysema, renal disease, hypertension, and hypercholesterolemia), we ran our analysis by additionally adjusting for these conditions and by excluding participants who had these conditions at baseline. We also performed analysis by restricting to participants who did not move from their neighborhood between baseline and follow-up (defined as < 1 km in distance between the follow-up address and baseline address). Finally, we used a propensity score method to account for the potential impact of the large proportion (44%) of baseline participants who did not complete the follow-up questionnaire

Table 1
Neighborhood characteristics according to quintiles of deprivation index among 17,969 census tracts, National Institutes of Health-AARP Diet and Health Study, 1995–1996.

Neighborhood characteristics[a], mean (SD)	Neighborhood socioeconomic deprivation index					Loading
	Q1 (high SES)	Q2	Q3	Q4	Q5 (low SES)	
Unemployed, % total population	2.8 (1.8)	3.6 (2.1)	4.4 (2.6)	5.4 (3.1)	10.3 (6.0)	0.30
Less than high school, % total population	4.9 (2.6)	9.1 (3.4)	13.6 (4.3)	19.6 (6.2)	34.4 (13.2)	0.33
Management occupations, % male	60.7 (9.4)	45.2 (8.9)	34.8 (8.7)	26.5 (8.3)	17.4 (8.3)	0.30
Management occupations, % female	56.9 (8.0)	46.3 (7.3)	39.2 (7.0)	33.1 (7.4)	25.0 (8.2)	0.30
Income < 30k$, % total households	12.1 (5.3)	19.0 (6.6)	26.0 (7.3)	34.3 (8.2)	50.1 (12.9)	0.35
Income below poverty, % total households	3.2 (2.1)	4.8 (2.8)	6.5 (3.3)	9.4 (3.8)	21.0 (10.2)	0.36
No car, % total households	2.9 (3.1)	4.5 (4.5)	5.8 (4.7)	7.7 (5.8)	18.2 (13.6)	0.30
Living on public assistance, % total households	0.8 (0.8)	1.3 (1.1)	1.8 (1.3)	2.8 (2.0)	7.2 (5.2)	0.33
Female headed with dependent children, % total households	3.0 (1.6)	4.0 (2.1)	4.8 (2.3)	6.0 (2.9)	11.5 (6.6)	0.32
Non-Hispanic blacks, % total population	2.4 (3.3)	3.9 (5.6)	5.2 (8.2)	8.0 (12.4)	28.5 (31.0)	0.24

[a] Assessed by variables from Census 2000.