Published in final edited form as:

Health Place. 2017 May ; 45: 199–207. doi:10.1016/j.healthplace.2017.04.002.

Neighborhood Social Environment as Risk Factors to Health Behavior among African Americans: The Jackson Heart Study

Xu Wang, MS^a, Amy H. Auchincloss, PhD^{a,*}, Sharrelle Barber, ScD, MPH^a, Stephanie L. Mayne, PhD^a, Michael E. Griswold, PhD^b, Mario Sims, PhD^c, and Ana V. Diez Roux, MD, PhD^a

^aDornsife School of Public Health, Drexel University, Philadelphia, PA, USA

^bCenter for Biostatistics and Bioinformatics, University of Mississippi Medical Center, Jackson, MS, USA

^cDepartment of Medicine, University of Mississippi Medical Center, Jackson, MS, USA

Abstract

Background—Few studies have focused on the impact of neighborhood social environment on changes in smoking and alcohol use over time among African Americans.

Method—Jackson Heart Study participants were recruited from the Jackson, MS metropolitan area from 2000–2004. Neighborhood social environment was characterized using census-based neighborhood socio-economic status (NSES) and survey-derived perceptions of neighborhood social cohesion, disorder, and violence. Multinomial logistic regression was used to estimate the associations of neighborhood social environment with prevalence of smoking and alcohol use and with changes in these behaviors over time adjusted for individual sociodemographic characteristics.

Results—Participants (N=3166) resided in 108 census tracts. All neighborhood social environment variables were consistently associated with prevalence of current smoking at baseline (11%) and with persistence of smoking over a median of 8-years follow-up (8%). The odds of being a consistent smoker relative to never smoking was about 30% higher per 1 SD higher neighborhood violence (aOR: 1.30, 95% CI: 1.16–1.46) and disorder aOR: 1.26, 95% CI: 1.08 – 1.47) and at least 16% lower per 1 SD higher in neighborhood social cohesion (aOR: 0.84, 95% CI: 0.74–0.95) and NSES (aOR: 0.79, 95% CI: 0.67–0.95). Heavy alcohol use at baseline (17%) and consistent heavy use over the study period (8%) were negatively associated with higher NSES (aOR: 0.85, 95% CI: 0.73–0.99 per 1 SD increase in NSES).

*Corresponding author. Dornsife School of Public Health, Drexel University, Department of Epidemiology and Biostatistics 3215 Market St., Philadelphia, PA, 19104. Phone: 267.359.6054. Fax: 215.895.5813, aha27@drexel.edu.

Competing Interests:

None

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conclusion—Favorable neighborhood social environments may reduce unhealthy behaviors among African Americans.

Keywords

Smoking; Alcohol; Neighborhood; Social Environment; African American

INTRODUCTION

Smoking and alcohol use are significant public health concerns associated with numerous negative health consequences.^[1, 2] Approximately 17% of African Americans are current smokers (similar to the US population as a whole, 16.8%).^[3] The most recent data on alcohol use (2008–2010) shows approximately 53% of African Americans consume alcohol and 3.6% are heavy alcohol users compared to 65% and 5.4% in the U.S, respectively.^[4] While African American adults are not more likely to be current smokers or heavy alcohol users than the US population as whole, smoking and alcohol use appears to be increasing.^[5] Moreover, literature suggests that high-episode drinking^[3] and alcohol-related injuries/accidents and social consequences are higher than Whites.^[6]

Health damaging behaviors such as smoking and excessive alcohol use do not occur in a vacuum and cannot be fully understood without careful consideration of the contexts in which they occur. Neighborhood environments are an important context to consider, particularly for African Americans, who are differentially exposed to disadvantaged neighborhood contexts^[7] and the adverse social conditions that accompany these settings.^[8] Disadvantaged neighborhoods, characterized by poor economic conditions and adverse social exposures such as violence, high levels of disorder and low levels of social cohesion,^[7] may be sources of chronic stress that lead to adverse coping behaviors such as smoking and excessive alcohol use.^[9] Conversely, favorable social conditions such as high levels of social cohesion may benefit health in a number of ways. For example, favorable social conditions can promote the rapid diffusion of health-relevant information as well as strengthen psychological resources (including mutual respect, self-esteem, optimism and hopefulness) which in turn can reduce stress and reduce the likelihood of using health damaging behaviors as coping mechanisms to mitigate the effects of stressors.^[9–12]

Prior studies have mostly used neighborhood socioeconomic conditions (NSES) as a crude proxy for a range of social environment features often correlated with NSES. In cross-sectional studies, higher neighborhood disadvantage has been linked to more smoking and excess drinking^[13–18]. Longitudinal work has generally confirmed cross-sectional findings, namely that residing in neighborhoods with higher SES is associated with increased rates of smoking cessation^[19, 20] and reduction of excessive alcohol consumption^[21].

A few studies have investigated more specific features of neighborhood social environments. For example, higher neighborhood disorder and violence have been associated with higher prevalence of smoking^[22–24] and higher social cohesion has been linked to lower prevalence of smoking^[25]. Low neighborhood social cohesion has been linked to alcohol initiation and excess alcohol use in adolescents.^[26] However, the vast majority of studies on

neighborhood violence, disorder, or social cohesion and smoking or excessive alcohol outcomes have been cross-sectional.

The present study used data from the Jackson Heart Study (JHS), the largest African American cohort study of cardiovascular disease (CVD) in the United States, to examine the associations of neighborhood social context with health behaviors over a median of 8 years of follow-up. We hypothesized that better neighborhood social environment (higher NSES, higher social cohesion, lower neighborhood violence, lower neighborhood disorder) would be associated with a lower prevalence of unhealthy behaviors, and a lower likelihood of persistence or adoption of unhealthy behaviors over time.

MATERIAL AND METHODS

Study Population

Data comes from JHS, a cohort study designed to examine the etiology of CVD among African Americans. [27, 28] Adults 35–84 residing in the Jackson, MS tri-county area (i.e. Hinds, Rankin, and Madison counties) were recruited via commercially available list of households (17%); volunteers through participant referral or outreach activities (30%); participants in the Jackson field center of the Atherosclerosis Risk in Communities study (31%). In addition, 22% of participants were adult relatives (aged ≥ 21 years) of original participants who enrolled in the JHS Family Sub-Study. [27, 28] The sample is approximately representative of the age and sex distribution of the African American population in the geographic target area. [29] Visit 1 (baseline 2000–2004) involved a home interview and an on-site examination in which extensive clinical, demographic, social, cultural, and behavioral data were obtained. Participant data were also collected approximately five and nine years later (Visit 2: 2005–2008, Visit 3: 2009–2012). In addition, each year, an annual telephone survey was used to obtain additional data on health status, hospitalizations, medication, etc. All JHS participants' addresses collected at baseline visit and during annual follow-up calls through 2008 were geocoded and assigned to Visit 1 and Visit 2 based on the closest time to the visit dates [30]. All participants provided informed consent.

Neighborhood Social Environments

Survey-based neighborhood social environment—In order to characterize the social environment surrounding each JHS participant, the following steps was taken. First, during the third annual follow-up telephone survey (2004–2008), participants were asked to refer to the area around where they live and provide a one-time report on neighborhood social cohesion, violence and physical disorder. Table 1 shows the survey items. The items/scales have been previously validated. [25, 31] Second, survey data were pooled across multiple participants who resided in the same census tract (participants resided in 108 census tracts with a median of 19 per tract). Pooling responses was done to improve the measurement/robustness of the survey-derived exposures and to avoid same-source bias.[32] Consistent with prior work [33, 34], for each survey domain we computed empirical Bayes estimates from a 3-level hierarchical model with individual-level random intercept (to account for within person correlation between survey items within a survey domain answered by the same person) and tract-level random intercept (to account for the within

tract correlation between survey responses answered by different individuals living in the same neighborhoods). In addition we adjusted the empirical Bayes estimates for survey respondent age and gender. The empirical Bayes estimation adjusted for age and gender is preferable to simple tract averages because it eliminates systematic differences across tracts due to respondents' age or gender and the statistical technique improves estimates for tracts with few observations. Lastly, tract-level neighborhood social environment scores were linked to JHS participants via their addresses during 2000–2008 (Visits 1 and 2). The resultant neighborhood scores were time invariant unless a participant moved (to a different census tract, 14%). Higher scores for social cohesion represented more favorable neighborhood conditions while higher scores for neighborhood violence and disorder represented less favorable neighborhood conditions.

Census-based neighborhood socioeconomic environment—Data for NSES came from the 2000 US Census and the American Community Survey (ACS) 2005–2009. A summary socioeconomic index was constructed for each census tract using the following variables: median household income, household wealth (median value of housing units and percent of households with interest, dividend, or net rental income), education, and percent of employed persons 16 and older in executive, managerial, or professional occupation [35]. Skewed variables were log-transformed and all variables were standardized (z-scores) before summing together. A higher score indicated more socioeconomic advantage. Tract level NSES was assigned to participant addresses at Visit 1 (2000–2004) using 2000 Census and to participant addresses at Visit 2 (2005–2008) using ACS 2005–2009.

Health Behaviors

Self-reported smoking and alcohol were collected via interviewer-administered questionnaire at Visit 1 and eight years later at Visit 3.

Smoking Status—At Visit 1, cigarette smoking status was assessed by asking participants if they “smoked more than 400 cigarettes in your lifetime?” and whether they “now smoke cigarettes” [36]. We defined Visit 1 smoking status: “never” as ≤ 400 cigarettes in lifetime; “former” as > 400 cigarettes in lifetime but currently not smoking; “current” as > 400 cigarettes in lifetime and currently smoking. At Visit 3, participants were only asked about any regular use of a tobacco product in the past 12 months (“In the past 12 months have you ever regularly used a tobacco product?”) and separately asked about number of cigarettes smoked per day [PD], cigars smoked per week, pipefuls of pipes smoked per week, pouches of chewing tobacco used per week and cans of dip/snuff used per week (e.g. “In the past 12 months, how many cigarettes did you smoke per day?”). For Visit 3, we defined “current” smoker as regularly used a tobacco product in the past 12 months and smoked at least 1 cigarette PD (only $N=66$ regularly used tobacco product in past 12 months and smoked < 1 cigarette PD).

We classified long-term smoking behavior into five categories: “*never, consistent*” if Visit 1 “never” and Visit 3 not “current”; “*former*” if Visit 1 “former” and Visit 3 not “current”; “*current to former*” if Visit 1 “current” and Visit 3 not “current”; “*never/former to current*” if

Visit 1 “never” or “former” and Visit 3 “current” (in this category, there were only 18 people who were baseline “never”); “*current, consistent*” if “current” at both visits.

Alcohol Use—At Visit 1 and 3 alcohol use was assessed via: in the past 12 months “Have you ever consumed an alcoholic beverage?” and “On average, on the days that you drank alcohol how many drinks did you have a day?”. We classified alcohol into three categories: “heavy”, “moderate”, “none”, following the CDC classification ^[37] where heavy drinking was classified as >1 drink PD for women and >2 drinks PD for men.

We classified long-term alcohol behavior into four categories: “*Moderate/none, consistent*” if both visits were “moderate” or “none”; “*Heavy to moderate/none*” if Visit 1 “heavy” and Visit 3 “moderate” or “none”; “*Moderate/none to heavy*” if Visit 1 “moderate” or “none” and Visit 3 “heavy”; “*Heavy, consistent*” if Visit 1 and 3 were “heavy”.

Covariates

Individual-level sociodemographic data were collected at Visit 1 including age, sex, income, education, occupation and marital status. Self-reported educational attainment was classified into 3 categories: less than high school, high school or general equivalency diploma, and attended vocational/trade school/college. Participants selected their gross family annual income in US dollars from 11 categories ranging from <5,000 to >100,000 and continuous income in US dollars was assigned as the interval midpoint of the selected category. Marital status was chosen from five categories and was coded as a binary variable in the analysis (married vs. not married including divorced, separately, never-married, widowed). Following previous work ^[38], occupation (derived from self-reported jobs) was coded based on the US Census Standard Occupation Classification and then grouped into three categories: production, service, and management.

Statistical analysis

We used multinomial logistic regression to estimate the associations of neighborhood social environment with prevalence and longitudinal changes in status of smoking and alcohol use separately, sequentially adjusting for age, sex, family gross income, marital status, occupation and educational attainment. Neighborhood social environment scales were included as continuous variables in all models and results are reported for one standard deviation (SD) change in neighborhood social environment. Cumulative average measures of the neighborhood social environment were used for analysis of unhealthy behavior change over time. Robust confidence intervals were reported in order to account for potential correlations of samples within the same tract.

All analyses were carried out using SAS software, Version 9.3 (SAS Institute, Inc., Cary, NC).

RESULTS

Participants were eligible to be included in this study if they attended both Visit 1 and 3 (N=3819). Individuals were excluded if they had missing information on smoking or alcohol (N=78) or key covariates (N=562) at Visit 1 and 3, or neighborhood social environment

variables (N=13) at Visit 1 and 2. Compared to those excluded from analyses, those included were generally younger, had higher education and income, and were more likely to be married or living with a partner (not shown). The final analytic dataset included 3166 participants, 64% women and baseline age 54, residing in 108 census tracts at baseline. Median follow-up time was 8 years (range: 6–12).

At baseline, 11% smoked and 67% of those continued to smoke throughout the study period (Table 2). Among baseline smokers, the median number of cigarettes per day was 10 (25th–75th percentile 5–20). Baseline current smokers and those that continued to smoke over follow-up were more likely to have lower family income, live in areas with lower NSES, and have production occupations. Never smokers were more likely to be female and in management occupations (Table 2).

In adjusted analyses, neighborhood social environment was consistently associated with smoking prevalence at baseline and persistence of smoking between visits (ORs adjusted for socio-demographics, marital status, and occupation [aOR], Table 3). Relative to those who never smoked over the 8-year follow-up period, participants living in areas with higher neighborhood *violence* and *disorder* had about 30% greater odds of being consistent smokers (aOR: 1.30, 95% CI: 1.16 – 1.46, aOR: 1.26, 95% CI: 1.08 – 1.47, per 1 SD higher neighborhood violence and disorder, respectively), and those living in areas with higher *social cohesion* and higher *NSES* had at least 16% lower odds of being consistent smokers (aOR: 0.84, 95% CI: 0.74 – 0.95, aOR: 0.79, 95% CI: 0.67 – 0.95, per 1 SD higher neighborhood index, respectively); favorable social environment (NSES and social cohesion) were also associated with lower odds of smoking prior to the study.

At baseline, among participants who reported any alcohol use (48%), median servings per day was 1 (25th–75th percentile 1–2). Over the follow-up period, 9.4% participants reduced their alcohol use from heavy use to none/moderate while 5.5% of the participants increased their use from none/moderate to heavy use (Table 4). Heavy alcohol use at baseline (17%) and consistently heavy use over the study period (8%) were more prevalent among younger ages and production occupations. Moderate drinkers had higher family income. After adjustment for individual sociodemographic characteristics, only *NSES* was negatively associated with being a consistent heavy drinker over time (aOR: 0.85, 95% CI: 0.73–0.99 per 1 SD higher NSES, Table 5).

Among those who were smokers or drinkers at baseline, we observed within-person increases in number of cigarettes or alcohol consumed per day. For example, after a 5-year period, cigarettes increased 1.5 per day and servings of alcohol increased 0.14 per day (among those who smoked at visit 1 and 3 or reported >0 servings of alcohol at visit 1 or 3, respectively). However, there was no strong evidence that neighborhood social environment impacted within-person changes in cigarettes per day or daily servings of alcohol over time (Supplement Table 1 and Supplement Table 2).

DISCUSSION

This study examined the associations of neighborhood social environment with prevalent and changes in smoking and alcohol use in a large sample of African American adults. Lower NSES, lower neighborhood social cohesion, and higher neighborhood violence and disorder were positively associated with current smoking at baseline and consistent smoking over approximately eight years of follow-up in median. Long-term heavy alcohol use was associated with lower NSES but there was no evidence of associations with other social environment variables.

Our findings support prior studies that reported cross-sectional associations between prevalence of current smoking and less socially cohesive neighborhoods [11, 25], lower neighborhood safety [11, 23] and higher neighborhood disorder [22]. Our findings on negative associations between NSES and smoking prevalence was supported by prior work [39] but others have reported heterogeneity in NSES effects between socioeconomic subgroups (only among Whites but not Blacks [15] or finding associations only with particular components of neighborhood exposure (percentage of adults in a college education and percentage of owner-occupied households) [13]).

Our current work is one of the few studies that have examined and confirmed associations between social environment and persistent smoking over eight years of follow-up. A few studies investigating NSES found that smokers living a deprived area were less likely to quit [19, 20, 40]. However, little longitudinal work has been done on regarding other dimensions of the social environment and results have been mixed. A clinical trial found that neighborhood social cohesion appeared to contribute to smoking cessation among African American smokers [41] yet one cohort study found no association [42]. One recent paper found neighbourhood safety cross-sectionally associated with smoking but not with changes in smoking during 8 years of follow-up [42]. The strength of the prevalence association in our current study may indicate that health-damaging stressors that potentially lead to damaging health behaviors may come from many sources (neighborhood residential environment, job, and/or institutional environments) and many time periods (old, new, and/or on-going exposures). It is challenging to isolate the impacts of neighborhood social environment during a few time periods to current and persistent smoking and alcohol behaviors. More longitudinal studies are needed to confirm our null findings.

Our finding that NSES was associated with long-term heavy alcohol use was consistent with most other studies [18, 21]; however, other studies only found associations between NSES among Whites [14] or among males [43]. However, contrary to our hypothesis, we found no evidence that neighborhood violence or disorder contribute to alcohol use.

Our study is one of the largest longitudinal studies to examine the associations between neighborhood social conditions and cigarette and alcohol use among African American adults over a long follow-up period. Nevertheless, more studies are needed to determine whether our results are generalizable to African Americans outside of a southern metropolitan area. Bias may have been introduced due to loss-to-follow-up being over-represented by higher income participants. Although the neighborhood social environments

scales we used were validated and had satisfactory reliability, self-perceptions of environments can potential bias analyses of how environments can affect behavior, what has been termed ‘same source bias’ [32]. We aggregated the neighborhood social environment survey data for multiple survey participants in order to improve the measurement/robustness of the survey-derived exposures while avoiding this type of bias. In addition, survey data were only collected during the middle of the follow-up period (2004–2008) and did not represent a time-varying measure except for 14% of participants who moved their residence during follow-up. This study was unable to include availability of tobacco and alcohol which may be associated with related behaviors and differ by residential location [21] thus resulting in residual confounding. Also, JHS only collected general alcohol consumption on drinks per day and thus we could not assess associations with episodic or binge drinking. In addition, as would be expected in an older population [44], our study population had a fairly low baseline smoking rate, and relatively few individuals quit over follow-up, thus results should be interpreted with caution.

CONCLUSION

Our study adds support to the growing body of empirical evidence that implicates the neighborhood social environment as a potential risk factor for smoking and highlights the challenges that smoking cessation efforts may face in this context, in particular among African Americans. It provides important evidence on one of the behavioral mediators commonly thought to link neighborhood environments and cardiovascular disease outcomes and provides some understanding of how specific unhealthy behaviors are amplified as a consequence of negative environmental exposures among African Americans.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding

This work was supported by Center for Integrative Approaches to Health Disparities [P60 MD002249] funded by the National Institute on Minority Health and Health Disparities, by EPA and NIMHD: Environment Supplement [P60 MD002249 05S1] and by the MESA Neighborhood Study [R01 HL071759] funded by the National Institutes of Health, National Heart, Lung, and Blood Institute. The Jackson Heart Study is supported by contracts [HHSN268201300046C] through [HSN268201300050C] from the National Heart, Lung, and Blood Institute and the National Institute on Minority Health and Health Disparities. The views expressed in this manuscript are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute; the National Institutes of Health; or the U.S. Department of Health and Human Services.

References

1. Jamal A, Homa DM, O'Connor E, et al. Current cigarette smoking Among Adults - United States, 2005–2014. *Mmwr-Morbidity and Mortality Weekly Report*. 2015; 64:1233–40.
2. NIDA. Trends & Statistics. National Institute on Drug Abuse; 2015. Retrieved from <http://www.drugabuse.gov/related-topics/trends-statistics> on July 31, 2015
3. Dawson DA, Goldstein RB, Saha TD, et al. Changes in alcohol consumption: United States, 2001–2002 to 2012–2013. *Drug and alcohol dependence*. 2015; 148:56–61. [PubMed: 25620731]

4. Schoenborn CA, Adams PF, Peregoy JA. Health behaviors of adults: United States, 2008–2010. Vital and health statistics Series 10, Data from the National Health Survey. 2013;1–184.
5. Kerr WC, Karriker-Jaffe KJ, Ye Y. Examining alcohol's contribution to the US African-American/White cirrhosis mortality differential from 1950 to 2002. *Alcohol and alcoholism*. 2013; 48:605–12. [PubMed: 23558110]
6. Witbrodt J, Mulia N, Zemore SE, et al. Racial/ethnic disparities in alcohol-related problems: differences by gender and level of heavy drinking. *Alcoholism, clinical and experimental research*. 2014; 38:1662–70.
7. Williams DR, Collins C. Racial residential segregation: a fundamental cause of racial disparities in health. *Public health reports*. 2001; 116:404–16. [PubMed: 12042604]
8. Sampson RJ, Raudenbush SW, Earls F. Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science*. 1997; 277:918–24. [PubMed: 9252316]
9. Mezuk B, Abdou CM, Hudson D, et al. “White Box” Epidemiology and the Social Neuroscience of Health Behaviors: The Environmental Affordances Model. *Society and mental health*. 2013;3.
10. Kawachi I, Berkman L. Social cohesion, social capital, and health. *Social epidemiology*. 2000:174–90.
11. Patterson JM, Eberly LE, Ding YM, et al. Associations of smoking prevalence with individual and area level social cohesion. *J Epidemiol Commun H*. 2004; 58:692–7.
12. Lin EY, Witten K, Casswell S, et al. Neighbourhood matters: Perceptions of neighbourhood cohesiveness and associations with alcohol, cannabis and tobacco use. *Drug Alcohol Rev*. 2012; 31:402–12. [PubMed: 22142140]
13. Cohen SS, Sonderman JS, Mumma MT, et al. Individual and neighborhood-level socioeconomic characteristics in relation to smoking prevalence among black and white adults in the Southeastern United States: a cross-sectional study. *Bmc Public Health*. 2011;11. [PubMed: 21208451]
14. Karriker-Jaffe KJ, Zemore SE, Mulia N, et al. Neighborhood disadvantage and adult alcohol outcomes: differential risk by race and gender. *Journal of studies on alcohol and drugs*. 2012; 73:865–73. [PubMed: 23036203]
15. Author 2003 [details removed for peer review]
16. Rachele JN, Wood L, Nathan A, et al. Neighbourhood disadvantage and smoking: Examining the role of neighbourhood-level psychosocial characteristics. *Health & place*. 2016; 40:98–105. [PubMed: 27228312]
17. Author 2010 [details removed for peer review]
18. Fone DL, Farewell DM, White J, et al. Socioeconomic patterning of excess alcohol consumption and binge drinking: a cross-sectional study of multilevel associations with neighbourhood deprivation. *BMJ open*. 2013;3.
19. Giskes K, van Lenthe FJ, Turrell G, et al. Smokers living in deprived areas are less likely to quit: a longitudinal follow-up. *Tobacco control*. 2006; 15:485–8. [PubMed: 17130379]
20. Turrell G, Hewitt BA, Miller SA. The influence of neighbourhood disadvantage on smoking cessation and its contribution to inequalities in smoking status. *Drug Alcohol Rev*. 2012; 31:645–52. [PubMed: 22507105]
21. Author 2015 [details removed for peer review]
22. Miles R. Neighborhood disorder and smoking: Findings of a European urban survey. *Soc Sci Med*. 2006; 63:2464–75. [PubMed: 16904800]
23. Shareck M, Ellaway A. Neighbourhood crime and smoking: the role of objective and perceived crime measures. *Bmc Public Health*. 2011;11. [PubMed: 21208451]
24. Jitnarin N, Heinrich KM, Haddock CK, et al. Neighborhood Environment Perceptions and the Likelihood of Smoking and Alcohol Use. *Int J Env Res Pub He*. 2015; 12:784–99.
25. Author 2008 [details removed for peer review]
26. Bryden A, Roberts B, McKee M, et al. A systematic review of the influence on alcohol use of community level availability and marketing of alcohol. *Health & place*. 2012; 18:349–57. [PubMed: 22154843]

27. Fuqua SR, Wyatt SB, Andrew ME, et al. Recruiting African-American Research Participation in the Jackson Heart Study: Methods, Response Rates, and Sample Description. *Ethnicity & Disease*. 2005; 15:S6–18–S6–29.
28. Taylor HA, Wilson JG, Jones DW, et al. Toward resolution of cardiovascular health disparities in African Americans: Design and methods of the Jackson Heart Study. *Ethnicity & Disease*. 2005; 15:S4–S17.
29. Hickson DA, Waller LA, Gebreab SY, et al. Geographic Representation of the Jackson Heart Study Cohort to the African-American Population in Jackson, Mississippi. *Am J Epidemiol*. 2011; 173:110–7. [PubMed: 21076050]
30. Robinson JC, Wyatt SB, Hickson D, et al. Methods for Retrospective Geocoding in Population Studies: The Jackson Heart Study. *J Urban Health*. 2010; 87:136–50. [PubMed: 20187277]
31. Author 2007 [details removed for peer review]
32. Macleod J, Davey Smith G, Heslop P, et al. Psychological stress and cardiovascular disease: empirical demonstration of bias in a prospective observational study of Scottish men. *Bmj*. 2002; 324:1247–51. [PubMed: 12028978]
33. Author 2008 [details removed for peer review]
34. Savitz NV, Raudenbush SW. Exploiting spatial dependence to improve measurement of neighborhood social processes. *Sociological Methodology*. 2009; 39:151–83.
35. Author 2001 [details removed for peer review]
36. Howard G, Manolio TA, Burke GL, et al. Does the association of risk factors and atherosclerosis change with age? An analysis of the combined ARIC and CHS cohorts. The Atherosclerosis Risk in Communities (ARIC) and Cardiovascular Health Study (CHS) investigators. *Stroke; a journal of cerebral circulation*. 1997; 28:1693–701.
37. HHS. Dietary Guidelines for Americans. Vol. 2010. Washington, DC: US Government Printing Office; U.S. Department of Agriculture and U.S. Department of Health and Human Services; 2010.
38. Author 2011 [details removed for peer review]
39. Fleischer NL, Thrasher JF, Juarez BSD, et al. Neighbourhood deprivation and smoking and quit behaviour among smokers in Mexico: findings from the ITC Mexico Survey. *Tobacco control*. 2015; 24:56–63.
40. Kendzor DE, Reitzel LR, Mazas CA, et al. Individual- and area-level unemployment influence smoking cessation among African Americans participating in a randomized clinical trial. *Soc Sci Med*. 2012; 74:1394–401. [PubMed: 22405506]
41. Reitzel LR, Kendzor DE, Castro Y, et al. The Relation between Social Cohesion and Smoking Cessation among Black Smokers, and the Potential Role of Psychosocial Mediators. *Ann Behav Med*. 2013; 45:249–57. [PubMed: 23135831]
42. Author 2017 [details removed for peer review]
43. McKinney CM, Chartier KG, Caetano R, et al. Alcohol Availability and Neighborhood Poverty and Their Relationship to Binge Drinking and Related Problems Among Drinkers in Committed Relationships. *J Interpers Violence*. 2012; 27:2703–27. [PubMed: 22890980]
44. Weinberger AH, Pilver CE, Mazure CM, et al. Stability of smoking status in the US population: a longitudinal investigation. *Addiction*. 2014; 109:1541–53. [PubMed: 24916157]

Highlights

- This study investigated longitudinal associations between health behaviors and multiple neighborhood social environment domains using a large cohort of African American population over approximately eight years of follow-up.
- Lower neighborhood socioeconomic status, lower neighborhood social cohesion, and higher neighborhood violence and disorder were positively associated with current smoking at baseline and consistent smoking over the follow-up period.
- Long-term heavy alcohol use was associated with lower neighborhood socioeconomic status but there was no evidence of associations with other social environment variables.

Table 1**Social Environment Neighborhood Survey Scales, Jackson Heart Study**

Scales^a	Items
Social Cohesion	
	This is a close knit neighborhood
	People around here are willing to help their neighbors
	People in this neighborhood generally don't get along
	People in this neighborhood can be trusted
	People in this neighborhood don't share the same values
Neighborhood Violence	
	How often was there a fight in this neighborhood in which a weapon was used?
	How often was there a violent argument between neighbors?
	How often were there gang fights?
	How often was there a sexual assault or rape?
	How often was there a robbery or mugging?
Neighborhood Disorder	
	Excessive noise
	Heavy traffic or speeding cars
	Trash and Litter

^aResponse options for social cohesion were on a 4-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (4). Items 3 and 5 were reverse coded. Response options for neighborhood violence were on a 4-point Likert scale ranging from Never (1) to Often (4). Response options for neighborhood disorder were on a 4-point Likert scale ranging from Not really a problem (1) to Very serious problem (4). All the three neighborhood social environment scales had satisfactory internal consistency: Cronbach's alpha for social cohesion: 0.72; violence: 0.75; disorder: 0.68 and ICCs consistent with the literature: social cohesion, 0.09; violence, 0.12; disorder, 0.20.

Table 2

Sample characteristics at baseline and by change in smoking status over follow up

Variable	Cigarette Smoking Status at Visit 1 ^a				Cigarette Smoking Behavior Change Status from Visit 1 to Visit 3 ^b			
	Overall	Never	Former	Current	Never -> None	Former -> None	Current -> None	Never/Former ->Current
N	3166	2218 (70%)	584 (18%)	364 (11%)	2200 (69%)	560 (18%)	119 (4%)	42 (1%)
Age at Visit 1, Mean (SD)	54.43 (12)	53.49 (12.41)	59.28 (10.19)	52.39 (9.98)	53.53 (12.4)	59.52 (9.96)	55.53 (10.4)	51.71 (13.6)
Gross Family Annual Income (\$) at Visit 1, Mean (SD)	4.65 (3.16)	4.84 (3.17)	4.47 (3.13)	3.84 (2.95)	4.85 (3.18)	4.52 (3.14)	4.16 (3.15)	3.15 (2.28)
Sex, N (%)								
Female	2032 (64.18)	1548 (76.18)	300 (14.76)	184 (9.06)	1535 (75.54)	285 (14.03)	64 (3.15)	28 (1.38)
Male	1134 (35.82)	670 (59.08)	284 (25.04)	180 (15.87)	665 (58.64)	275 (24.25)	55 (4.85)	14 (1.23)
Education, N (%)								
Less than high school	489 (15.45)	294 (60.12)	123 (25.15)	72 (14.72)	287 (58.69)	117 (23.93)	24 (4.91)	13 (2.66)
High school graduate/GED	545 (17.21)	355 (65.14)	120 (22.02)	70 (12.84)	352 (64.59)	110 (20.18)	22 (4.04)	13 (2.39)
Vocational school/trade school/college	2132 (67.34)	1569 (73.59)	341 (15.99)	222 (10.41)	1561 (73.22)	333 (15.62)	73 (3.42)	16 (0.75)
Employment, N (%)								
Management	1295 (40.9)	988 (76.29)	212 (16.37)	95 (7.34)	984 (75.98)	206 (15.91)	37 (2.86)	10 (0.77)
Production	592 (18.7)	324 (54.73)	148 (25)	120 (20.27)	321 (54.22)	139 (23.48)	33 (5.57)	12 (2.03)
Service	1279 (40.4)	906 (70.84)	224 (17.51)	149 (11.65)	895 (69.98)	215 (16.81)	49 (3.83)	20 (1.56)
Married^c, N (%)								
Married	1809 (57.14)	1278 (70.65)	348 (19.24)	183 (10.12)	1273 (70.37)	340 (18.79)	67 (3.7)	13 (0.72)
Not Married	1357 (42.86)	940 (69.27)	236 (17.39)	181 (13.34)	927 (68.31)	220 (16.21)	52 (3.83)	29 (2.14)
Neighborhood Social Environment								
SES (higher score higher SES) at Visit 1, Mean (SD)	-2.52 (3.77)	-2.3 (3.82)	-2.93 (3.71)	-3.21 (3.45)	-2.29 (3.82)	-2.93 (3.72)	-2.67 (3.61)	-3.36 (3.15)
Social Cohesion at Visit 1, Mean (SD)	3.01 (0.12)	3.02 (0.12)	3.01 (0.12)	2.99 (0.13)	3.02 (0.12)	3.01 (0.12)	3.01 (0.12)	2.98 (0.13)
Neighborhood Violence at Visit 1, Mean (SD)	1.26 (0.12)	1.25 (0.12)	1.27 (0.12)	1.28 (0.13)	1.25 (0.12)	1.27 (0.12)	1.26 (0.12)	1.29 (0.12)
Neighborhood Disorder at Visit 1, Mean (SD)	1.67 (0.24)	1.66 (0.24)	1.7 (0.24)	1.71 (0.23)	1.66 (0.24)	1.7 (0.24)	1.68 (0.23)	1.77 (0.24)

^a ANOVA test and Chi-square test separately for continuous variables and column categorical variables testing whether the distribution of the variable was similar across different groups of smoking behaviors. All *p*-values <0.05.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Married status: Yes: married; No: divorce/never married/separately/widowed.

Neighborhood SES are derived from the Census and constitute a sum of z-scores. Neighborhood disorder, social cohesion, violence are derived from questionnaire and have a potential range from 1–4. Neighborhood social environment variables were moderately to highly correlated: Spearman rank correlations 0.5 to 0.9.

Adjusted multinomial regression: prevalence and changes in smoking status with neighborhood social environment exposures (N=3166) ^a

Table 3

		Model 1 ^c		Model 2 ^c	
		OR	95% CI	OR	95% CI
Prevalence of smoking at Visit 1					
Exposures	Outcomes: Smoking Status				
Neighborhood SES	Never (reference)	--	--	--	--
	Former	0.90	(0.81,0.99)	0.94	(0.84,1.05)
	Current	0.72	(0.64,0.82)	0.87	(0.76,0.99)
Social Cohesion	Never (reference)	--	--	--	--
	Former	0.86	(0.78,0.96)	0.89	(0.80,0.99)
	Current	0.78	(0.69,0.87)	0.87	(0.78,0.98)
Neighborhood Violence	Never (reference)	--	--	--	--
	Former	1.14	(1.04,1.24)	1.11	(1.00,1.22)
	Current	1.33	(1.21,1.46)	1.17	(1.06,1.28)
Neighborhood Disorder	Never (reference)	--	--	--	--
	Former	1.14	(1.03,1.27)	1.11	(0.98,1.25)
	Current	1.33	(1.18,1.50)	1.14	(1.00,1.29)
Change in smoking status from Visit 1 to Visit 3 ^b					
Exposures	Outcomes: Smoking Status Change				
Neighborhood SES	Never → None (reference)	--	--	--	--
	Former → None	0.88	(0.79,0.97)	0.90	(0.81,1.01)
	Current → None	0.90	(0.73,1.10)	1.05	(0.86,1.28)
	Never/Former → Current	0.73	(0.54,0.99)	1.04	(0.70,1.55)
	Current → Current	0.64	(0.54,0.75)	0.79	(0.67,0.95)
Social Cohesion	Never → None (reference)	--	--	--	--
	Former → None	0.86	(0.77,0.95)	0.88	(0.79,0.98)
	Current → None	0.85	(0.74,0.97)	0.92	(0.80,1.06)
	Never/Former → Current	0.69	(0.53,0.90)	0.84	(0.60,1.18)
	Current → Current	0.73	(0.64,0.83)	0.84	(0.74,0.95)

		Model 1 ^c		Model 2 ^c	
		OR	95% CI	OR	95% CI
Neighborhood Violence	Never -> None (reference)	--	--	--	--
	Former -> None	1.13	(1.04,1.23)	1.11	(1.02,1.22)
	Current -> None	1.14	(0.97,1.34)	1.02	(0.87,1.21)
	Never/Former -> Current	1.36	(1.05,1.77)	1.07	(0.75,1.54)
Neighborhood Disorder	Current -> Current	1.50	(1.34,1.67)	1.30	(1.16,1.46)
	Never -> None (reference)	--	--	--	--
	Former -> None	1.14	(1.02,1.26)	1.11	(0.99,1.24)
	Current -> None	1.12	(0.95,1.33)	0.98	(0.83,1.16)
	Never/Former -> Current	1.56	(1.18,2.07)	1.23	(0.83,1.82)
	Current -> Current	1.49	(1.29,1.73)	1.26	(1.08,1.47)

^aNeighborhood social environment scores were standardized in unit of SD; therefore, the results can be interpreted as odds ratio by 1 SD increase in neighborhood social environment variable.

^bCumulative neighborhood social environment scores were used for analysis in health behavior change.

^cModel 1: Age at Visit 1, Sex; Model 2: Age at Visit 1, Sex, Education (< HS, HS/GED, BA+), Income(\$), Married (1/0), Occupation (production/service/management/professional)

^dBold font indicates that confidence intervals do not include the null; that is, the point estimate is statistically significant at p-value <0.05.

Table 4

Sample characteristics at baseline and by change in alcohol use over follow up.

Variable	Alcohol Drinking at Visit 1				Alcohol Drinking Behavior Change from Visit 1 to Visit 3 ^d			
	Overall	None	Moderate	Heavy	Moderate/None - > Moderate/ None	Heavy -> Moderate/None	Moderate/None - > Heavy	Heavy -> Heavy
N	3166	1642 (52%)	981 (31%)	543 (17%)	2450 (77%)	299 (9%)	173 (5%)	244 (8%)
Age at Visit 1, Mean (SD)	54.43 (12)	57.12 (11.77)	52.42 (11.41)	49.94 (11.66)	55.9 (11.71)	51.52 (11.58)	47.77 (11.37)	48 (11.49)
Gross Family Annual Income (\$at Visit 1, Mean (SD))	4.65 (3.16)	4.12 (2.96)	5.58 (3.26)	4.59 (3.17)	4.66 (3.16)	4.75 (3.24)	4.75 (3.12)	4.39 (3.07)
Sex, N (%)								
Female	2032 (64.18)	1199 (59.01)	538 (26.48)	295 (14.52)	1617 (79.58)	169 (8.32)	120 (5.91)	126 (6.2)
Male	1134 (35.82)	443 (39.07)	443 (39.07)	248 (21.87)	833 (73.46)	130 (11.46)	53 (4.67)	118 (10.41)
Education, N (%)								
Less than high school	489 (15.45)	331 (67.69)	87 (17.79)	71 (14.52)	402 (82.21)	39 (7.98)	16 (3.27)	32 (6.54)
High school graduate/GED	545 (17.21)	314 (57.61)	148 (27.16)	83 (15.23)	436 (80)	39 (7.16)	26 (4.77)	44 (8.07)
Attended voc. school, trade school, or college	2132 (67.34)	997 (46.76)	746 (34.99)	389 (18.25)	1612 (75.61)	221 (10.37)	131 (6.14)	168 (7.88)
Employment, N (%)								
Management	1295 (40.9)	619 (47.8)	471 (36.37)	205 (15.83)	1009 (77.92)	126 (9.73)	81 (6.25)	79 (6.1)
Production	592 (18.7)	295 (49.83)	158 (26.69)	139 (23.48)	430 (72.64)	70 (11.82)	23 (3.89)	69 (11.66)
Service	1279 (40.4)	728 (56.92)	352 (27.52)	199 (15.56)	1011 (79.05)	103 (8.05)	69 (5.39)	96 (7.51)
Married^c, N (%)								
Married	1809 (57.14)	937 (51.8)	610 (33.72)	262 (14.48)	1464 (80.93)	152 (8.4)	83 (4.59)	110 (6.08)
Not Married	1357 (42.86)	705 (51.95)	371 (27.34)	281 (20.71)	986 (72.66)	147 (10.83)	90 (6.63)	134 (9.87)
Neighborhood Social Environment, Visit 1, mean (SD)								
SES (higher score higher SES) at Visit 1, Mean (SD)	-2.52 (3.77)	-2.95 (3.6)	-1.86 (3.91)	-2.43 (3.84)	-2.57 (3.77)	-1.95 (4.08)	-2.12 (3.6)	-3.01 (3.45)
Social Cohesion at Visit 1, Mean (SD)	3.01 (0.12)	3.01 (0.12)	3.02 (0.11)	3.01 (0.13)	3.02 (0.12)	3.01 (0.13)	3.02 (0.12)	3 (0.13)
Neighborhood Violence at Visit 1, Mean (SD)	1.26 (0.12)	1.27 (0.12)	1.24 (0.12)	1.26 (0.13)	1.26 (0.12)	1.25 (0.13)	1.24 (0.12)	1.27 (0.13)
Neighborhood Disorder at Visit 1, Mean (SD)	1.67 (0.24)	1.69 (0.23)	1.64 (0.23)	1.67 (0.25)	1.68 (0.23)	1.65 (0.25)	1.64 (0.24)	1.7 (0.25)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

^a ANOVA test and Chi-square test separately for continuous variables and column categorical variables testing whether the distribution of the variable was similar across different groups of smoking behaviors. All p-values <0.05 except for the distribution of gross family annual income, social cohesion, Neighborhood violence by alcohol drinking behavior change from Visit 1 to Visit 3.

^b Married status: Yes: married; No: divorce/never married/separately/widowed.

^c Neighborhood SES are derived from the Census and constitute a sum of z-scores. Neighborhood disorder, social cohesion, violence are derived from questionnaire and have a potential range from 1–4.

Adjusted multinomial regression: prevalence and changes in alcohol use with Neighborhood social environment exposures (N=3166) ^a

Table 5

		Model 1 ^c		Model 2 ^c	
Prevalence of alcohol use at Visit 1		OR	95% CI	OR	95% CI
Exposures	Outcomes: Alcohol use				
Neighborhood SES	Moderate (reference)	--	--	--	--
	Never	0.82	(0.76,0.89)	0.96	(0.88,1.05)
	Heavy	0.83	(0.75,0.93)	0.97	(0.87,1.09)
Social Cohesion	Moderate (reference)				
	Never	0.93	(0.84,1.03)	1.03	(0.95,1.12)
	Heavy	0.87	(0.79,0.97)	0.97	(0.86,1.09)
Neighborhood Violence	Moderate (reference)				
	Never	1.15	(1.04,1.27)	1.02	(0.93,1.11)
	Heavy	1.21	(1.09,1.35)	1.07	(0.95,1.21)
Neighborhood Disorder	Moderate (reference)				
	Never	1.14	(1.04,1.26)	0.99	(0.91,1.08)
	Heavy	1.20	(1.06,1.35)	1.04	(0.91,1.19)
Change in alcohol behavior from Visit 1 to Visit 3 ^b					
Exposures	Outcomes: Alcohol Use Change				
Neighborhood SES	Moderate/None -> Moderate/None	--	--	--	--
	Heavy -> Moderate/None	1.05	(0.92,1.21)	1.11	(0.97,1.27)
	Moderate/None -> Heavy	1.01	(0.88,1.16)	1.01	(0.86,1.19)
	Heavy -> Heavy	0.78	(0.68,0.89)	0.85	(0.73,0.99)
Social Cohesion	Moderate/None -> Moderate/None				
	Heavy -> Moderate/None	0.98	(0.85,1.12)	1.00	(0.88,1.13)
	Moderate/None -> Heavy	0.99	(0.88,1.11)	1.00	(0.88,1.13)
	Heavy -> Heavy	0.85	(0.74,0.96)	0.91	(0.79,1.04)
Neighborhood Violence	Moderate/None -> Moderate/None				
	Heavy -> Moderate/None	1.02	(0.89,1.17)	0.98	(0.85,1.14)

		Model 1 ^c		Model 2 ^c	
		OR	95% CI	OR	95% CI
Neighborhood Disorder	Moderate/None -> Heavy	0.96	(0.81,1.12)	0.95	(0.79,1.13)
	Heavy -> Heavy	1.20	(1.05,1.37)	1.10	(0.94,1.29)
	Moderate/None -> Moderate/None				
	Heavy -> Moderate/None	0.98	(0.84,1.14)	0.94	(0.80,1.09)
	Moderate/None -> Heavy	0.98	(0.83,1.16)	0.98	(0.81,1.19)
	Heavy -> Heavy	1.22	(1.05,1.43)	1.13	(0.94,1.34)

^aNeighborhood social environment scores were standardized in unit of SD; therefore, the results can be interpreted as odds ratio by 1 SD increase in Neighborhood social environment variable.

^bCumulative Neighborhood social environment scores were used for analysis in health behavior change.

^cModel 1: Age at Visit 1, Sex; Model 2: Age at Visit 1, Sex, Education (< HS, HS/GED, BA+), Income(\$), Married (1/0), Occupation (production/service/management/professional)

^dBold font indicates that confidence intervals do not include the null; that is, the point estimate is statistically significant at *p*-value <0.05.