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Do neighborhood characteristics contribute beyond individual demographics to cancer control behaviors among African American adults?

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Abstract

Background: Recent years have seen increased interest in the role of neighborhood factors in chronic diseases such as cancers. Less is known about the role of neighborhood factors beyond individual demographics such as age or education. It is particularly important to examine neighborhood effects on health among African American men and women, considering the

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disproportionate impact of cancer on this group. This study evaluated the unique contribution of neighborhood characteristics (e.g., racial/ethnic diversity, income) beyond individual demographics, to cancer control behaviors in African American men and women.

Methods: Individual-level data were drawn from a national survey (N=2,222). Participants' home addresses were geocoded and merged with neighborhood data from the American Community Survey. Multi-level regressions examined the unique contribution of neighborhood characteristics beyond individual demographics, to a variety of cancer risk, prevention, and screening behaviors.

Results: Neighborhood racial/ethnic diversity, median income, and percentage of home ownership made modest significant contributions beyond individual factors, in particular to smoking status where these factors were associated with lower likelihood of smoking ($ps < .05$). Men living in neighborhoods with older residents, and greater income and home ownership were significantly more likely to report prostate specific antigen testing ($ps < .05$). Regional analyses suggested different neighborhood factors were associated with smoking status depending on the region.

Conclusion: Findings provide a more nuanced understanding of the interplay of social determinants of health and neighborhood social environment among African American men and women, with implications for cancer control interventions to eliminate cancer disparities.

Keywords

Neighborhood; Cancer; African American; Disparities; Multilevel; Health Behaviors

1. Introduction

A fundamental principle of health geography is that where a person lives or their neighborhood, affects individual health. There is considerable literature on the impact of neighborhood factors and a wide range of cancer-related outcomes from prevention and early detection^[1–3] to survivorship^[4,5]. Studies have more recently begun to examine multilevel models of the role of individual and neighborhood factors in cancer-related outcomes^[5,6,7]. However additional research is needed to clarify whether neighborhood factors are simply a context to the lives of people or whether they significantly contribute to health and wellbeing, above and beyond the individual-level factors such as a person's age or education. This is particularly the case when considering cancer control in diverse populations in the context of cancer disparities.

Recent writings further exemplify the importance of neighborhood factors, analyzed using geospatial techniques, in cancer control and population science research^[8–10]. Krieger noted that there is “*profound and startling lack of empirical research on the impact of residential segregation*” on the cancer continuum from both a racial and economic perspective^[9]. Because of historic and contemporary forces that perpetuate racial residential segregation, African American men and women in particular are more likely to live in disadvantaged neighborhoods with concentrated poverty^[11,12]. The confluence of neighborhood poverty and racial segregation gives rise to distinctive physical and social neighborhood factors that are associated with poor health outcomes^[13]. Several authors argued that to fully evaluate neighborhood effects on health, the complex and multilevel associations among individual

socioeconomic status, neighborhood socioeconomic status, neighborhood social capital, segregation, and discrimination^[13–17] must be investigated.

Although previous research suggests that neighborhoods can play a role in outcomes along the cancer continuum¹⁸, more investigation is required to understand the role of neighborhood characteristics in cancer control behaviors, a primary driver of cancer disparities^{19,20}, as well as the relative contribution of neighborhood in relation to demographics such as age or education. The current study tests a multilevel model examining the extent to which indicators of neighborhood social environment (age, racial/ethnic diversity, income) contribute above and beyond key individual-level demographics, to a variety of cancer risk, prevention, and screening behaviors among African American men and women.

We hypothesize that neighborhood characteristics will make significant additional contributions to cancer control behaviors beyond the statistical contributions of individual demographics, such that African American men and women living in neighborhoods where the median age of residents is older, with greater racial/ethnic diversity and median income, and greater rates of home ownership will report more cancer control behaviors. Secondary analyses examined the neighborhood models for smoking status, the outcome most consistently associated with neighborhood factors, comparing/contrasting three US geographic regions. Study findings will enhance our understanding of cancer etiology and can inform multilevel cancer prevention and control interventions aiming to reduce persistent cancer disparities impacting this group.

2. Material and methods

2.1 Data sources

2.1.1 Neighborhood-level data—We used U.S. Census tracts as the neighborhood unit of analysis. Typically encompassing between 2,500 to 8,000 people, a census tract is smaller than a city but larger than a block group or census block^[21]. The census tract is roughly equivalent to a neighborhood established by the Bureau of Census for analyzing stable population characteristics and is typically integrated with large national surveys at the individual level^[22–25]. While we had considered using census block groups as the neighborhood level of analysis, the distribution of study participants per block group was highly skewed with a number of block groups with zero participants. Therefore, census tract rather than block group was chosen as the neighborhood unit of analysis.

We used the following neighborhood characteristics from the U.S. 2010 American Community Survey (ACS) at the tract level. *Median Age* reports the median age, in years, of residents (21 years and above) living in a census tract. *Racial/Ethnic Diversity* is a tract-level racial/ethnic diversity index that represents the likelihood that two persons, chosen at random from the same census tract, belong to different racial/ethnic groups. The index ranges from 0 to 100 with higher scores indicating greater diversity. *Median Income* reports the median household income in dollars for the past 12-months in a given census tract. *Home Ownership* reports the percentage of owner-occupied housing units out of the total

housing units in a census tract, further adding to the nuance of neighborhood socioeconomic status.

2.1.2 Cancer control behavioral data—Data from the National Cancer Institute-funded *Religion and Health in African Americans* (RHIAA) study^[26] are utilized because the study focused on a national probability sample of African American men and women and collected detailed survey data on a variety of cancer control behaviors. The study included 2,370 African American participants who completed a telephone interview. Sampling and recruitment methods are detailed elsewhere^[27,28]. Eligibility criteria included speaking English, self-identifying as African American, age 21 years or older and no history of cancer due to survey items on cancer prevention and screening behaviors. Professional interviewers read participants an informed consent script and obtained verbal assent. Interviews were roughly one hour and included cancer risk (e.g., heavy alcohol use, smoking), prevention (e.g., fruit/vegetable consumption, physical activity) and screening (e.g., breast, prostate, colorectal) behaviors. A demographic module provided data on individual-level demographics described in 2.1.3. The University of Maryland Institutional Review Board approved the RHIAA study as well as the current work.

Behavioral Risk Factor Surveillance System (BRFSS) items were used to assess alcohol and tobacco use^[29]. The alcohol consumption item asked whether participants had any alcohol use in the previous 30 days. For those answering yes, a subsequent item assessed heavy alcohol use as the number of times in the previous 30 days with 4 (for men) or 5 (for women) or more drinks on one occasion. The tobacco use item asked if participants had smoked cigarettes 100 or more cigarettes in their lifetime. The items had adequate test-retest reliability in a previous sample of African American men and women^[30].

An adapted National Cancer Institute's 5-A-Day Survey was used to evaluate average daily fruit and vegetable consumption^[31,32], with seven items assessing fruit consumption and 5 items targeting vegetables. The brief version of the International Physical Activity Questionnaire^[33] was used to measure physical activity, where items evaluate number of minutes in the previous week participants engaged in vigorous and moderate activity and walking.

Participants reported on select age- and sex-appropriate cancer screening behaviors consistent with screening recommendations at the time of data collection and using items based on the BRFSS. Women age 40 and older were asked whether they had completed a mammogram within the previous year. Men were asked whether they had completed a prostate specific antigen test in the past year.

2.1.3 Individual-level data—Individual age, sex, and education were identified as individual-level factors of focus based on their ubiquity in social epidemiological research on demographic characteristics associated with health-related outcomes. These indicators were self-reported by RHIAA study participants. Income was not utilized due to extent of missing data.

2.2 Geocoding and study area

Geocoding is the process of converting addresses into geographic coordinates used to place markers on a map. Of the 2,370 participants, addresses of 45 (1.9%) people could not be geocoded due to incorrect or incomplete addresses. After geocoding, we merged datasets from the two data sources: individual demographics and cancer control behaviors from the RHIAA survey and neighborhood level data from the 2010 ACS. For presentation and visualization purposes, we used the 9 established U.S. Census divisions to characterize the data: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific^[21]. Due to small sample size and the possibility of unstable results, three divisions (New England, Pacific, and Mountain) were not included in study analyses, resulting in a final analytic sample of N=2,222 in the study area of 6 census divisions.

2.3 Statistical methods

First, descriptive analyses (e.g., means/standard deviations, percentages) were conducted on the neighborhood characteristics and cancer control behavior variables to contextualize the multilevel model findings (see Table 1). Second, we conducted parametric (for continuous variables) and non-parametric (for binary variables) correlations to estimate bivariate associations between neighborhood-level factors and cancer control behaviors (see Table 2). Finally, we used hierarchical logistic (for binary dependent variables) and linear (for continuous dependent variables) regression, entering individual-level demographics (e.g., participant age, sex, education) in step one followed by each of the neighborhood-level variables separately in step 2 (see Tables 3–4). This hierarchical, multi-level approach was used to identify the unique role of each neighborhood factor in the outcome variable above and beyond individual-level demographics. Due to the small increment of measurement, the neighborhood income variable was recoded into 5 levels for the regression models. A secondary exploratory analysis used US Census Divisions to create a Northeast, Midwest, and Southeast region and the models for smoking status were examined within these three regions.

3. Results

3.1 Descriptive analysis

3.1.1 Analytic sample—The analytic sample (N=2,222) was on average 53.8 years old (SD = 14.77), over half were female (62.3%), with a median household income of \$30,001–40,000/year, and at least some college education (54.1%). The study sample is comparable to national averages for African American men and women with regard to income, with the 2015 median income of African American households reported as \$36,544^[34]. The current sample was similar to the U.S. population in proportion of men (current=37.7%, U.S.=47.7%) and educational attainment (current=25.2% attended 4+ years of college, U.S.=20.3%), however our participants were older than the U.S. African American population where the median age is 33.7 years.

3.1.2 Spatial distribution of sample—Figure 1 shows the distribution of study participants across the census divisions. Most were from the eastern half of the U.S. with

higher proportions in the West South Central, South Atlantic, and East South-Central divisions. The spatial distribution of percentage of participants in the 6 U.S. Census divisions included in the analysis are as follows: 34.0% South Atlantic, 19.9% East North Central, 17.3% Middle Atlantic, 13.4% West South Central, 12.0% East South Central, 3.4% West North Central.

3.1.3 Cancer control behaviors—Descriptive data on cancer control behaviors is shown in Table 1. Just over 40% of the sample had consumed alcohol in the previous 30 days, and few engaged in heavy alcohol use (16.6%). Almost half had smoked 100 or more cigarettes in their lifetime. Mean daily fruit and vegetable servings combined was 4.59. For the three levels of physical activity, the mean varied from 40.15 to 48.40 minutes per week. With regard to cancer screening behaviors, roughly three-fourths of women reported having a mammogram in the past year and among men, almost seventy percent reported a prostate specific antigen test the past year.

3.1.4 Neighborhood characteristics—Descriptive data on participants' neighborhood factors indicate that generally, the neighborhoods had a median resident age in the middle 30's and the neighborhoods showed modest scores (33.60 out of 100) on the racial/ethnic diversity index. Neighborhood median household income was on average was just over \$32,000 and fewer than 50% of housing units were owner-occupied.

3.2 Bivariate associations between neighborhood factors and cancer control behaviors

Table 2 shows correlations between the neighborhood characteristics and cancer control behaviors. For cancer risk behaviors, alcohol use showed a handful of associations with neighborhood factors, but cigarette smoking was consistently and significantly associated with less racially/ethnically diverse neighborhoods and those low in indicators of socioeconomic status. For cancer prevention behaviors, while there were no significant neighborhood associations with fruit consumption and only one for physical activity, vegetable consumption was significantly associated with greater neighborhood age and median income. Cancer screening utilization had significant associations with several neighborhood factors.

3.3 Multilevel models including individual and neighborhood factors

3.3.1 Neighborhood resident median age—Tables 3 and 4 show multi-level logistic and linear regressions, respectively, from multilevel models where individual demographics were entered in step 1 and then neighborhood factors in step 2, to evaluate whether they contributed uniquely to the outcomes. The logistic regression models indicate that average age of neighborhood residents made marginal additional contributions to alcohol use in the past 30 days and smoking history ($p < .10$), in which as average resident median age increases, likelihood of these behaviors decreases. Average age of neighborhood residents did not contribute significantly beyond individual factors for heavy drinking, fruit or vegetable consumption, or physical activity. While average age of neighborhood residents did not significantly contribute to mammography, it did contribute beyond individual factors to men's greater likelihood ($OR = 1.04$) of having a PSA exam in the previous year ($p < .05$).

3.3.2 Neighborhood racial/ethnic diversity—Tables 3 and 4 show multi-level logistic and linear regressions, respectively, for the neighborhood diversity models. Neighborhood racial/ethnic diversity made a significant additional contribution, beyond individual factors, to smoking history ($p < .05$), in which as racial/ethnic diversity in a neighborhood increases, likelihood of smoking decreases. Neighborhood racial/ethnic diversity contributed marginally to heavy drinking again where greater diversity was associated with lower heavy drinking ($p < .10$). Neighborhood racial/ethnic diversity did not make a significant contribution beyond individual factors for any other of the behaviors.

3.3.3 Neighborhood median income—Tables 3 and 4 show multi-level logistic and linear regressions, respectively, for the neighborhood median income models. Median income contributed uniquely to smoking history where participants living in neighborhoods with higher income were less likely ($OR = 0.93$) to report smoking ($p < .05$). For cancer screening, neighborhood median income contributed marginally to mammography ($p < .10$) and significantly to prostate specific antigen testing ($p < .01$; $OR = 1.25$), such that those living in neighborhoods higher in income were more likely to report screening. Median neighborhood income contributed uniquely to heavy drinking, where those living in neighborhoods with greater income were less likely to report heavy drinking ($p < .01$). Neighborhood median income did not make a significant contribution beyond individual factors for any other of the behaviors.

3.3.4 Neighborhood home ownership—Tables 3 and 4 show multi-level logistic and linear regressions, respectively, for the neighborhood home ownership models. Home ownership contributed uniquely to smoking history and marginally to heavy drinking in which participants living in neighborhoods where more people own their homes were less likely to smoke or engage in binge drinking ($p < .01$, $p < .10$, respectively). Home ownership made a significant contribution to men's reporting prostate specific antigen testing whereby those living in neighborhoods where more people owned their homes were more likely to report screening ($p < .01$). Neighborhood home ownership did not make a significant contribution beyond individual factors for any other of the behaviors.

3.3.5 Regional analyses—Only in the Midwest region was neighborhood's average resident age negatively associated with odds of smoking, beyond the demographic variables ($p < .05$) (see Supplemental Table 1). Only in the Southeast region was neighborhood racial/ethnic diversity negatively associated with odds of smoking, beyond the demographic variables ($p < .05$) (see Supplemental Table 2). Only in the Northeast region was neighborhood median income negatively associated with odds of smoking, beyond the demographic variables ($p < .05$, $OR = 0.89$) (see Supplemental Table 3). Home ownership in the Midwest was marginally negatively associated with odds of smoking, beyond the demographic variables ($p < .10$) while in the other two regions home ownership was non-significant (see Supplemental Table 4).

4. Discussion

This study makes an important contribution to understanding the role of neighborhood social environment in cancer through examination of the unique contribution of neighborhood

factors historically rooted in structural racism and discrimination, above and beyond key individual demographics, to a variety of cancer control behaviors. The study's focus on African American men and women is notable given the disproportionate burden of cancer impacting this group, and the study's findings have implications for cancer control interventions aiming to close the disparity. Examining cancer risk, prevention, and screening behaviors provides an opportunity to determine whether neighborhood factors contribute similarly or differently to lifestyle behaviors from smoking and physical activity, to cancer screening.

The current findings suggest that the neighborhood social environment contributes statistically, yet modestly in magnitude, beyond key individual demographic factors, to smoking status in African American men and women and to men's prostate cancer screening. Our participants living in neighborhoods with greater racial/ethnic diversity, median income, and home ownership were less likely to report smoking. It is possible that the social environments in this type of neighborhood may facilitate anti-tobacco norms, however there may be unmeasured factors such as lower stress that help explain these effects. For African American men, neighborhood income and home ownership were also associated with prostate cancer screening, yet neighborhood resident age was also a factor, again suggesting a normative context or information sharing between residents that may foster screening. Our findings are consistent with others who reported that neighborhood makes a unique contribution health indicators such as soda consumption and weight^[35] and prostate cancer survival^[5], or may interact with individual factors, such as the interaction of individual race/ethnicity and neighborhood racial composition in women's development of high-grade cervical lesions^[6]. However, there were also a number of null findings, such as for diet and physical activity. This highlights the importance of considering the applied implications of neighborhood social environment for different types of cancer control outcomes. Behaviors like diet or physical activity may be more rooted in the neighborhood built environment rather than the social environment.

In bivariate models, though alcohol use showed sporadic and modest associations with neighborhood factors, cigarette smoking was consistently and significantly associated with less racially/ethnically diverse neighborhoods and those low in socioeconomic indicators. Though these associations were small, they could be due to patterns of tobacco advertising in predominately African American neighborhoods and the availability of tobacco, including individual cigarette sales^[36]. Alternatively, findings suggest that greater neighborhood racial/ethnic diversity may be a protective factor against smoking as people from different races/ethnicities bring different social/cultural norms and acceptance of smoking. The finding around neighborhood diversity and smoking is consistent with the body of literature suggesting that residential segregation has a predominately negative impact on health-related outcomes.

It is noteworthy that neighborhood characteristics contributed more consistently to cancer risk and screening behaviors than to cancer prevention behaviors such as diet and physical activity. Results suggest that individual factors may be more important for maintaining positive lifestyle behaviors while one's neighborhood environment is more likely to play a role in unhealthy behaviors, yet other neighborhood factors may be supportive of cancer

screening. It is possible that people living in neighborhoods with older residents get exposed to positive social influences and role modeling by others getting screened, or that providers strategically locate in neighborhoods with more people age-eligible for cancer screening.

The regional analysis suggested that different neighborhood factors appeared to play a role in smoking status, whereby in the Northeast, neighborhood income played a small role, in the Midwest, neighborhood resident age played a small role, and in the Southeast, neighborhood racial/ethnic diversity came into play. These results indicate the need for future research to determine why these patterns exist as well as conduct regional analyses for additional cancer control behaviors. The findings have implications for regionally targeted cancer interventions for African American men and women.

The current findings are to be taken in light of some limitations. Though the study took advantage of data from a national probability sample, there were too few African American households contacted in several census divisions, particularly those in the Western U.S., for data analysis. Findings are not to be taken as representing all African American men and women due to response biases in the sample such as older age. Second, there are additional individual- and interpersonal-level factors that also impact cancer control behaviors but were beyond the scope of the analysis. Researchers should consider examining more complex models of multiple influences on cancer-relevant outcomes, particularly among populations impacted by health disparities, including models that assess potential moderation or mediation effects. Third, though some studies examine neighborhood factors in health using an index comprised of multiple related indicators, we intended to evaluate the role of individual indicators neighborhood social environment. Use of an index can result in masking the role of individual indicators and makes the development of recommendations for targeted interventions imprecise. Finally, the effect sizes were modest for the neighborhood-level factors, however this may be due to small units of measurement. These findings call for further research to explicate the relative contributions of multi-level factors in cancer control behaviors in this and other populations.

5. Conclusions

The current analyses provide insights as to the modest yet unique contributions of neighborhood characteristics to cancer control behaviors in a group of people historically plagued by cancer disparities. Findings contribute to a more nuanced understanding of the interplay of multilevel social determinants of health among African American men and women. The findings have implications for the development of more effective cancer control interventions to eliminate the historically rooted cancer disparities impacting this group. This includes smoking cessation interventions that aim to minimize the negative impact of segregation or interventions that foster supportive relationships between mature African American men to encourage informed decision making for prostate cancer screening.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1:
Spatial distribution of African American study participants and study area

Table 1.

Descriptive analysis of neighborhood characteristics and cancer control behaviors among African American study participants, 2008–2010

	Value	N
Neighborhood characteristics		
Median resident age (years)	36.10	2221
Racial/ethnic diversity index; Mean (SD)	33.60 (21.92)	2222
Median resident income	\$32,417.00	2221
Percent home ownership; Mean (SD)	45.94 (19.54)	2222
Cancer risk behaviors		
	Mean (SD) or % yes	N
Used alcohol in past 30 days	41.1%	2,218
Had 4/5+ alcoholic beverages/day in past 30 days ^a	16.6%	2,169
Smoked > 100 cigarettes in lifetime	44.1%	2,217
Cancer prevention behaviors		
Fruit servings / day	2.43 (1.36)	2,222
Vegetable servings / day	2.16 (0.96)	2,222
Walking minutes / week	48.40 (53.45)	2,123
Moderate physical activity minutes / week	40.15 (53.47)	2,134
Vigorous physical activity minutes / week	46.72 (57.45)	2,141
Cancer screening behaviors		
Mammogram in the past year ^b	76.2%	1,068
Prostate specific antigen test in the past year ^c	68.1%	429

Note. Sample sizes vary due to sub-sample and skip patterns.

^a heavy drinking defined as 4+/day for women, 5+/day for men

^b Among women age 40 and older

^c Among men age 45 and older

Table 2.

Pearson's correlations of neighborhood factors and cancer control behaviors among African American study participants, 2008–2010

	Median Resident Age	Racial/Ethnic Diversity	Median Resident Income	Home Ownership
Cancer risk behaviors				
Alcohol Use in past 30 days	-.04 *	-.02	.04	-.02
# days with 4/5+ alcoholic beverages/day in past 30 days ^a	-.02	-.04	.04	-.04 *
Smoked >= 100 cigarettes	-.04	-.06 *	-.07 **	-.08 **
Cancer prevention behaviors				
Fruit servings per day	.04	-.01	.03	.02
Vegetable servings per day	.05 *	-.03	.05 *	.03
Walking minutes / week	-.01	.02	.01	.02
Moderate physical activity minutes / week	-.01	-.01	-.01	-.02
Vigorous physical activity minutes / week	.01	-.01	-.01	.01
Cancer screening behaviors				
Mammogram in past year	.07 *	.05	.06 *	.03
PSA test in past year	.11 *	.07	.10 *	.12 *

** = $p < .01$;

* = $p < .05$

^a heavy drinking defined as 4+/day for women, 5+/day for men

PSA = prostate specific antigen

Logistic regressions for role of individual and neighborhood factors in cancer control behaviors among African American study participants, 2008–2010

Table 3.

Average Neighborhood Resident Age							
Alcohol use in past 30 days	Independent variable	OR	95% CI	Smoked >= 100 cigarettes	Independent variable	OR	95% CI
Step 1 ***	Age ***	0.98	0.97–0.98	Step 1 ***	Age ***	1.02	1.01–1.03
	Sex ***	1.78	1.48–2.12		Sex ***	1.75	1.46–2.09
	Education ***	1.16	1.07–1.26		Education ***	0.79	0.73–0.86
	Age ***	0.98	0.97–0.98		Age ***	1.02	1.01–1.03
Step 2 ^	Sex ***	1.78	1.49–2.13	Step 2 ^	Sex ***	1.76	1.47–2.10
	Education ***	1.17	1.08–1.28		Education ***	0.80	0.73–0.87
	Neighborhood age ^	0.99	0.97–1.00		Neighborhood age ^	0.98	0.97–1.00
	N=2,206						
Mammogram in past year							
Independent variable	OR	95% CI	PSA test in last year				
Step 1	Age	1.01	0.99–1.02	Step 1 ^	Age *	1.03	1.00–1.05
	Sex	--	--		Sex	--	--
	Education	1.08	0.94–1.24		Education	0.99	0.81–1.20
Step 2	Age	1.01	0.99–1.02	Step 2 *	Age *	1.03	1.00–1.05
	Sex	--	--		Sex	--	--
	Education	1.06	0.92–1.21		Education	0.97	0.80–1.18
N=1,061	Neighborhood age	1.03	1.00–1.05	N=425	Neighborhood age *	1.04	1.00–1.08
Neighborhood Racial/Ethnic Diversity							
Alcohol use in past 30 days	Independent variable	OR	95% CI	Smoked >= 100 cigarettes	Independent variable	OR	95% CI
Step 1 ***	Age ***	0.98	0.97–0.98	Step 1 ***	Age ***	1.02	1.01–1.03
	Sex ***	1.77	1.48–2.11		Sex ***	1.75	1.46–2.08
	Education ***	1.16	1.06–1.26		Education ***	0.79	0.72–0.86
	Age ***	0.98	0.97–0.98		Age ***	1.02	1.01–1.02
Step 2	Sex ***	1.76	1.47–2.10	Step 2 *	Sex ***	1.74	1.45–2.07
	Education ***	1.16	1.06–1.26		Education ***	0.79	0.72–0.86
	Neighborhood diversity	1.00	0.99–1.00		Neighborhood diversity *	1.00	0.99–1.00
N=2,207							

Mammogram in past year	Independent variable	OR	95% CI	PSA test in last year	Independent variable	OR	95% CI
Step 1	Age	1.01	0.99–1.02	Step 1 [^]	Age [*]	1.03	1.00–1.05
	Sex	--	--		Sex	--	--
	Education	1.08	0.94–1.23		Education	0.99	0.81–1.20
Step 2	Age	1.01	0.99–1.02	Step 2	Age [*]	1.03	1.01–1.05
	Sex	--	--		Sex	--	--
	Education	1.08	0.94–1.23		Education	0.98	0.81–1.20
N=1,062	Neighborhood diversity	1.01	1.00–1.01	N=425	Neighborhood diversity	1.01	1.00–1.02
Neighborhood Income							
Alcohol use in past 30 days	Independent variable	OR	95% CI	Smoked >= 100 cigarettes	Independent variable	OR	95% CI
Step 1 ^{***}	Age ^{***}	0.98	0.97–0.98	Step 1 ^{***}	Age ^{***}	1.02	1.01–1.03
	Sex ^{***}	1.77	1.48–2.11		Sex ^{***}	1.75	1.46–2.08
	Education ^{***}	1.16	1.06–1.26		Education ^{***}	0.79	0.72–0.86
Step 2	Age ^{***}	0.98	0.97–0.98	Step 2 [*]	Age ^{***}	1.02	1.01–1.03
	Sex ^{***}	1.77	1.48–2.11		Sex ^{***}	1.75	1.47–2.10
	Education ^{**}	1.15	1.06–1.26		Education ^{***}	0.81	0.74–0.88
N=2,207	Neighborhood income	1.01	0.95–1.08	N=2,206	Neighborhood income [*]	0.93	0.88–0.99
Mammogram in past year	Independent variable	OR	95% CI	PSA test in last year	Independent variable	OR	95% CI
Step 1	Age	1.01	0.99–1.02	Step 1 [^]	Age [*]	1.03	1.00–1.05
	Sex	--	--		Sex	--	--
	Education	1.08	0.94–1.23		Education	0.99	0.81–1.20
Step 2 [^]	Age	1.01	0.99–1.02	Step 2 ^{**}	Age	1.03	1.01–1.06
	Sex	--	--		Sex	--	--
	Education	1.05	0.91–1.20		Education	0.93	0.76–1.13
N=1,062	Neighborhood income [^]	1.09	0.99–1.22	N=425	Neighborhood income ^{**}	1.25	1.08–1.45
Neighborhood Home Ownership							
Alcohol use in past 30 days	Independent variable	OR	95% CI	Smoked >= 100 cigarettes	Independent variable	OR	95% CI
Step 1 ^{***}	Age ^{***}	0.98	0.97–0.98	Step 1 ^{***}	Age ^{***}	1.02	1.01–1.03
	Sex ^{***}	1.77	1.48–2.11		Sex ^{***}	1.75	1.46–2.08

Step 2	Education ***	1.16	1.06–1.26			0.79	0.72–0.86	
	Age ***	0.98	0.97–0.98	Step 2 **		1.02	1.01–1.03	
	Sex ***	1.77	1.48–2.11			1.75	1.46–2.09	
	Education ***	1.17	1.07–1.27			0.80	0.74–0.88	
	Home ownership	1.00	0.99–1.00	N=2,206		0.99	0.99–0.99	
N=2,207								
Mammogram in past year								
Step 1	Independent variable	OR	95% CI	PSA test in last year		Independent variable	OR	95% CI
	Age	1.01	0.99–1.02	Step 1 ^		Age *	1.04	1.00–1.05
	Sex	--	--			Sex	--	--
	Education	1.08	0.94–1.23			Education	0.81	0.81–1.20
Step 2	Age	1.01	0.99–1.02	Step 2 **		Age *	1.03	1.01–1.05
	Sex	--	--			Sex	--	--
	Education	1.06	0.93–1.22			Education	0.95	0.78–1.16
N=1,062	Home ownership	1.00	1.00–1.01	N=425		Home ownership **	1.02	1.00–1.03

Note:

^

= p < .10;

* = p < .05;

** = p < .01;

*** = p < .001

OR = odds ratio; 95% CI = confidence interval

Table 4.

Linear regressions for role of individual and neighborhood factors in cancer control behaviors among African American study participants, 2008–2010

# days with 4/5+ alcoholic beverages/day in past 30 days	Independent variable	β	95% CI	Fruit servings/day	Independent variable	β	95% CI
Step 1 ***	Age **	-.06	-.02 – -.00	Step 1 ***	Age ***	.14	.01 – .02
	Sex ***	-.08	-.65 – -.18		Sex **	.05	.04 – .27
	Education ^	-.04	-.21 – .01		Education ***	.10	.08 – .19
	Age **	-.01	-.02 – -.00		Age ***	.14	.01 – .02
	Sex ***	-.42	-.65 – -.18		Sex **	.06	.04 – .27
Step 2	Education ^	-.10	-.21 – .01	Step 2	Education ***	.10	.08 – .19
	Neighborhood age	-.01	-.03 – .02		Neighborhood age	.02	-.01 – .01
	N=2,154				N=2,206		
Vegetable servings/day							
Step 1 ***	Age ***	.14	.01 – .01	Step 1 ***	Age ***	-.12	-.60 – -.29
	Sex *	.05	.01 – .17		Sex *	-.04	-.940 – -.02
	Education ***	.17	.11 – .19		Education	.01	-2.05 – 2.29
	Age ***	.14	.01 – .01		Age ***	-.12	-.60 – -.29
	Sex *	.05	.01 – .17		Sex ^	-.04	-.938 – .01
Step 2	Education ***	.16	.11 – .19	Step 2	Education	.01	-2.01 – 2.27
	Neighborhood age	.03	-.01 – .01		Neighborhood age	.01	-.36 – .49
	N=2,206				N=2,108		
Moderate activity minutes/week							
Step 1 ***	Age ***	-.08	-.42 – -.12	Step 1 ***	Age ***	-.13	-.65 – -.33
	Sex ***	-.15	-.20.66 – -.11.35		Sex ***	-.19	-27.66 – -17.82
	Education	-.02	-3.12 – 1.19		Education	-.02	-3.24 – 1.31
	Age ***	-.08	-.42 – -.12		Age ***	-.13	-.65 – -.33
	Sex ***	-.15	-20.69 – -11.36		Sex ***	-.19	-27.64 – -17.79
Step 2	Education	-.02	-3.11 – 1.24	Step 2	Education	-.02	-3.31 – 1.28
	Neighborhood age	-.01	-.47 – .37		Neighborhood age	.01	-.37 – .52
	N=2,119				N=2,125		

# days with 4/5+ alcoholic beverages/day in past 30 days	Independent variable	β	95% CI	Fruit servings/day	Independent variable	β	95% CI
Step 1 ***	Age **	-.06	-.02 – -.01	Step 1 ***	Age ***	.14	.01 – .02
	Sex ***	-.07	-.64 – -.17		Sex ***	.05	.04 – .27
	Education *	-.04	-.22 – -.01		Education ***	.10	.08 – .19
Step 2 ^	Age **	-.07	-.02 – -.01	Step 2	Age ***	.14	.01 – .02
	Sex ***	-.07	-.63 – -.16		Sex ***	.05	.04 – .27
	Education *	-.04	-.22 – -.01		Education ***	.10	.08 – .19
N=2,158	Neighborhood diversity ^	-.04	-.01 – .01	N=2,210	Neighborhood diversity	-.01	-.01 – .00
Vegetable servings/day	Independent variable	β	95% CI	Walking minutes / week	Independent variable	β	95% CI
Step 1 ***	Age ***	.14	.01 – .01	Step 1 ***	Age ***	-.12	-.60 – -.29
	Sex *	.05	.01 – .17		Sex ^	-.04	-.9.35 – .04
	Education ***	.17	.12 – .19		Education	.01	-.2.10 – 2.24
Step 2	Age ***	.14	.01 – .01	Step 2	Age ***	-.12	-.60 – -.28
	Sex *	.05	.01 – .17		Sex ^	-.04	-.9.39 – .01
	Education ***	.17	.12 – .19		Education	.01	-.2.11 – 2.23
N=2,210	Neighborhood diversity	-.02	-.01 – .01	N=2,112	Neighborhood diversity	.01	-.07 – .14
Moderate activity minutes/week	Independent variable	β	95% CI	Vigorous activity minutes/week	Independent variable	β	95% CI
Step 1 ***	Age ***	-.08	-.42 – -.12	Step 1 ***	Age ***	-.13	-.66 – -.33
	Sex ***	-.15	-.20.69 – -.11.38		Sex ***	-.19	-.27.57 – -.17.72
	Education	-.02	-.3.09 – 1.22		Education	-.02	-.3.35 – 1.21
Step 2	Age ***	-.08	-.43 – -.12	Step 2	Age ***	-.13	-.66 – -.33
	Sex ***	-.15	-.20.68 – -.11.36		Sex ***	-.19	-.27.56 – -.17.71
	Education	-.02	-.3.09 – 1.22		Education	-.02	-.3.35 – 1.22
N=2,122	Neighborhood diversity	-.01	-.12 – .09	N=2,129	Neighborhood diversity	-.01	-.12 – .10
# days with 4/5+ alcoholic beverages/day in past 30 days	Independent variable	β	95% CI	Fruit servings/day	Independent variable	β	95% CI
Step 1 ***	Age **	-.06	-.02 – -.01	Step 1 ***	Age ***	.14	.01 – .02

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Step 2** N=2,158	Sex***	-.07	-.64 – -.17			.05	.04 – .27
	Education^	-.04	-.22 – -.01			.10	.08 – .19
	Age**	-.06	-.02 – -.01	Step 2		.14	.01 – .02
	Sex***	-.07	-.64 – -.17			.05	.04 – .27
	Education	-.03	-.19 – -.04			.10	.07 – .19
Vegetable servings/day Step 1*** N=2,210	Neighborhood income*	-.06	-.19 – -.02	N=2,210		.02	-.03 – .06
	Independent variable	β	95% CI	Walking minutes / week	Independent variable	β	95% CI
	Age***	.14	.01 – .01	Step 1***	Age***	-.12	-.60 – -.29
	Sex*	.05	.01 – .17		Sex^	-.04	-.935 – .04
	Education***	.17	.12 – .19		Education	.01	-.210 – 2.24
Step 2 N=2,210	Age***	.14	.01 – .01	Step 2	Age***	-.12	-.60 – -.29
	Sex*	.05	.01 – .17		Sex^	-.04	-.935 – .04
	Education***	.16	.11 – .19		Education	-.01	-.233 – 2.16
	Neighborhood income	.02	-.02 – .04	N=2,112	Neighborhood income	.01	-.120 – 2.13
	Independent variable	β	95% CI	Vigorous activity minutes/week	Independent variable	β	95% CI
Moderate activity minutes/week Step 1*** N=2,122	Age***	-.08	-.42 – -.12	Step 1***	Age***	-.13	-.66 – -.33
	Sex***	-.15	-.20.69 – -.11.38		Sex***	-.19	-.27.57 – -.17.72
	Education	-.02	-.3.09 – 1.22		Education	-.02	-.3.35 – 1.21
	Age***	-.08	-.42 – -.12	Step 2	Age***	-.13	-.66 – -.33
	Sex***	-.15	-.20.69 – -.11.38		Sex***	-.19	-.27.56 – -.17.71
# days with 4/5+ alcoholic beverages/day in past 30 days Step 1*** N=2,122	Education	-.02	-.3.06 – 1.38		Education	-.02	-.3.56 – 1.14
	Neighborhood income	-.01	-.1.95 – 1.35	N=2,129	Neighborhood income	-.01	-.1.30 – 2.19
	Independent variable	β	95% CI	Fruit servings/day	Independent variable	β	95% CI
	Age**	-.06	-.02 – -.01	Step 1***	Age***	.14	.01 – .02
	Sex***	-.07	-.64 – -.17		Sex***	.05	.04 – .27
Step 2^	Education*	-.04	-.22 – -.01		Education***	.10	.08 – .19
	Age**	-.06	-.02 – -.01	Step 2	Age***	.14	.01 – .02

N=2,158	Sex ^{**}	-.07	-.64 – -.16			Sex ^{***}	.05	.04 – .27
	Education [^]	-.04	-.21 – .02			Education ^{***}	.10	.08 – .19
	Home ownership [^]	-.04	-.01 – .01		N=2,210	Home ownership	-.01	-.01 – .01
Vegetable servings/day	Independent variable	β	95% CI	Walking minutes / week		Independent variable	β	95% CI
Step 1^{***}	Age ^{***}	.14	.01 – .01	Step 1^{***}		Age ^{***}	-.12	-.60 – -.29
	Sex [*]	.05	.01 – .17			Sex [^]	-.04	-.935 – .04
	Education	.17	.12 – .19			Education	.01	-.210 – 2.24
Step 2	Age ^{***}	.14	.01 – .01	Step 2		Age ^{***}	-.12	-.60 – -.29
	Sex [*]	.05	.01 – .17			Sex [^]	-.04	-.937 – .02
	Education ^{***}	.17	.12 – .19			Education	-.01	-.234 – 2.06
N=2,210	Home ownership	-.01	-.01 – .01	N=2,112		Home ownership	.02	
Moderate activity minutes/week	Independent variable	β	95% CI	Vigorous activity minutes/week		Independent variable	β	95% CI
Step 1^{***}	Age ^{***}	-.08	-.42 – -.12	Step 1^{***}		Age ^{***}	-.13	-.66 – -.33
	Sex ^{***}	-.15	-.20.69 – -.11.38			Sex ^{***}	-.19	-.27.57 – -.17.72
	Education	-.02	-.3.09 – 1.22			Education	-.02	-.3.35 – 1.21
Step 2	Age ^{***}	-.08	-.42 – -.12	Step 2		Age ^{***}	-.13	-.66 – -.33
	Sex ^{***}	-.15	-.20.68 – -.11.37			Sex ^{***}	-.19	-.27.57 – -.17.71
	Education	-.02	-.2.99 – 1.38			Education	-.02	-.3.46 – 1.17
N=2,122	Home ownership	-.02	-.16 – .08	N=2,129		Home ownership	.01	-.10 – .15

Note:

[^]
= p < .10;^{*}
= p < .05;^{**}
= p < .01;^{***}
= p < .001;

significance at Block 2 indicates a significant F change

95% CI = confidence interval