Title

The Effects of Multilevel Social Stressors on Cancer-Related Health Behaviors

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Publication Date

2024

Peer reviewed|Thesis/dissertation

The Effects of Multilevel Social Stressors on Cancer-Related Health Behaviors

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DISSERTATION
Submitted in partial satisfaction of the requirements for degree of
DOCTOR OF PHILOSOPHY

in

Epidemiology and Translational Science

in the

GRADUATE DIVISION
of the
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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Dedication

This dissertation is dedicated to my mother, Nasri Ali Hassan, who taught me the importance of education.

Acknowledgments

This work would not have been possible without a small group of people at UCSF and beyond who provided the support and encouragement I needed to get through this process.

First, I would like to thank my advisor, Scarlett Lin Gomez who was patient, kind, and encouraging even when I found myself unmotivated or uninspired to keep going. She taught me that hard work, dedication, and resilience are important in academia. But beyond that, she taught me that kindness goes a long way.

I am incredibly grateful for my dissertation committee members, Drs. Elaine Allen, Amani Nuru-Jeter, and Yvette Cozier who provided not only feedback but also a listening ear. They didn't let me fall through the cracks and for that, I am forever indebted to them.

I would also like to thank faculty and others in the department including Dr. Maria Glymour who over the years provided a lot of encouragement. Maria, you're not only an accomplished researcher but you're a great mentor. I would also like to thank Catie Oldenburg and Eva Wong-Moy. Thank you Catie and Eva for rallying around me. A special thank you to Meghan Morris who championed me every step of this dissertation and beyond. Meghan, I not only found a mentor in you but I also found a lifelong friend.

I am indebted to the Black Women's Health Study and the RESPOND study. Without their generous use of their data, this work would not have been possible.

Finally, I would like to thank Erica Breslau and Stephen Taplin. Thank you both for encouraging me when I decided to apply for my PhD. You've been incredible mentors over the years.

The Effects of Multilevel Social Stressors on Cancer-Related Health Behaviors

Ekland Abdiwahab

Abstract

Cancer is a leading cause of morbidity and mortality among Black men and women with a substantial burden due to alcohol use, smoking, obesity, and physical activity. Despite growing evidence of the importance of early life adverse experiences on long-term health, little is known about the independent and joint effects of adverse experiences and neighborhood racial segregation on cancer-related risk factors among Black men and women. Black Americans are particularly vulnerable to a higher burden of adverse experiences. In addition, due to high levels of racial residential segregation in the United States, Black Americans are also more likely than other races to live in poor, segregated neighborhoods irrespective of individual education and income. There is some evidence suggesting that modifying the neighborhood may attenuate the effects of adverse experiences. Understanding the potential joint effects of adverse experiences and neighborhood context may provide insights into potential pathways and effective intervention strategies to reduce the cancer burden in this population.

For this dissertation I employ two data sets, the Black Women's Health Study and RESPOND, to answer three questions. In the first chapter, I assessed the association between patterns of lifetime abuse, physical and sexual, and smoking, drinking, and obesity as measured by BMI and waist-to-hip ratio. We found that although exposure in specific life periods is important, chronic exposure to physical and sexual abuse across the life course also matters for cancer-related health factors. In the second chapter, I examined if the association of lifetime abuse with adult alcohol use, smoking, and body size (BMI, waist-to-hip ratio) was modified by neighborhood racial segregation and neighborhood socioeconomic status. We found the association between lifetime abuse and cancer-related factors was modified by neighborhood

SES and neighborhood racial segregation. In the final chapter, I examined 1) the association between adverse childhood experiences and health behavior in adult life, including alcohol use, smoking, BMI, and physical activity in Black men with prostate cancer, and 2) determined if the association of adverse childhood experiences with health behaviors in adult life among Black men with prostate cancer was modified by coping style, neighborhood racial segregation as measured using neighborhood typology, and neighborhood socioeconomic status. We that adverse childhood experiences influence smoking in adulthood and that both neighborhood SES and coping style modify the relationship between adverse experiences and physical activity.

These findings provide evidence for the joint effects of experiencing adverse experiences and living in racially segregated neighborhoods.

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List of abbreviations

ACEs: adverse childhood experiences

AOR: adjusted odds ratios

BMI: body mass index

BWHS: Black Women's Health Study

CDC: Center for Disease Control

NIAAA: National Institutes of Alcohol Abuse and Alcoholism

SAMHSA: Substance Abuse and Mental Health Services Administration

SES: socioeconomic status

WHR: waist-to-hip ratio

Chapter 1 Abstract

Background: Cancer is the second leading cause of death among non-Hispanic Black women in the United States. Adverse experiences in childhood including physical abuse and sexual abuse have been found to have effects on cancer-related health behaviors. Examining patterns of adverse experiences may provide insights into the potential pathway between adverse experiences and adult health behaviors. This is important for identifying points for effective intervention

Methods: Using data from 36,274 participants in the Black Women's Health Study (BWHS), a longitudinal cohort of Black women in the United States between 21-69 years of age, we conducted multivariable logistic regression to assess the association between lifetime abuse (in childhood, adolescence, and adulthood) and ever-smoking, drinking, and obesity as measured by BMI and waist-to-hip ratio.

Results: Lifetime abuse was found to be associated with increased odds of BMI ≥30. Compared with women who did not experience any abuse across the lifespan, abuse was significantly associated with BMI≥30 at every life stage except for adulthood only and adolescence and adulthood, AOR=1.08 (95% CI: 0.95-1.23) and 1.21(0.89-1.65), respectively. Ever smoking is significantly associated with abuse at every life stage and is highest among women who experienced abuse in adolescence and adulthood, AOR=2.36 (1.72-3.25).

Conclusion: We found that adverse experiences across the life course matter for cancer-related factors. Future studies should explore mechanisms through which chronic experiences of adverse experience across the lifespan influence cancer-related health behaviors.

Chapter 1 Main Body

INTRODUCTION

Cancer is the second leading cause of death among non-Hispanic Black women in the United States. There were an estimated 112,090 new cases of cancer and 37,250 cancer deaths among Black women in 2022[1]. Relative to women of other race/ethnic groups, Black women have a higher prevalence of modifiable risk factors that are important drivers of cancer incidence, survivorship, and mortality including higher obesity rates, higher binge or problem drinking, and lower smoking quit rates than their White counterparts[2-8]. It is estimated that more than 75% of lung cancer, 50% of alcohol-related cancers, and 50% of obesity-related cancers can be averted if just these three risk factors are eliminated[9-10]. Thus, identifying the predictors of these cancer-related health behaviors can have a substantial collective impact on reducing cancer incidence and mortality among Black women.

Obesity is an important predictor of cancer incidence, responsible for 40% of all cancers diagnosed in the United States each year[11]. It is associated with a higher incidence of aggressive, hard-to-treat cancer; higher cancer progression post-diagnosis; and higher cancer mortality[12-14]. The prevalence of obesity is the highest for Non-Hispanic Black women (56.9%) compared to Hispanic women (45.7%), Non-Hispanic White women (39.8%), and Non-Hispanic Asian women (17.2%)[3]. Black women are also more likely to be morbidly obese (BMI≥40) in every age group compared to White women[15].

The relationship between smoking and cancer incidence and mortality is well established. Smoking is associated with 20% of all cancer incidence and 30% of all cancer deaths in the United States[16,17]. It is associated with the leading cancers in Black women, specifically breast, lung, and colorectal cancers, which account for 52% of new cancers in Black women[1]. Smoking prevalence among Black women in early life is lower than their White counterparts, however,

rates cross over in adulthood[18,,19]. In addition, despite smoking fewer cigarettes per day, and having more quit attempts, Black women are more likely to become lifelong smokers than White and Hispanic women[8,20].

Alcohol use is associated with an increased incidence of cancer. Both moderate drinking defined as ≤7 drinks/week and heavy drinking defined as more than 7 drinks/week for women have been found to increase the risk for breast, colorectal, and liver cancer[21,22]. Even among moderate drinkers, the incidence of breast, colorectal, and liver cancer are 1.23, 1.2, and 2 times higher than non-drinkers, respectively[21, 22]. Although Black women have a lower prevalence of alcohol consumption than White women, Black women are more likely to become heavy drinkers[5]. The prevalence of 12-month alcohol use, high-risk drinking, and alcohol use disorders (from DSM-IV) have increased markedly among Black women from the period 2001-2002 to 2012-2013 compared to other racial/ethnic groups[5].

Adverse experiences in childhood including physical abuse and sexual abuse have been found to have effects on cancer-related health behaviors[23]. Importantly there is empirical evidence of a graded relationship between the number of self-reported adverse experiences in childhood and poor health behaviors and outcomes. Individuals who report ≥4 adverse experiences in early life (birth to 17) have greater odds of self-reported smoking, being severely obese (BMI≥35), and developing alcohol use disorders[23].

There are persistent racial/ethnic disparities in the exposure to adverse experiences. Black girls are more likely than their White counterparts to witness domestic violence, report higher rates of harsh punishment, and report physical neglect[24-31]. Black women are more likely to experience intimate partner violence, psychological violence, and sexual violence[32.33]. Higher rates of adverse experiences are in large part a consequence of economic disadvantage; a consistent

positive relationship has been found between lower socioeconomic position and a greater risk for adverse experiences[34-36].

While most studies of adverse experiences have focused exclusively on early life or adulthood, there is some evidence that both the timing and continuity of these exposures matter for health. In addition, as most studies have used largely White samples, the relationship between adverse experiences and cancer-related health behaviors among Black women remains undetermined. Examining patterns of adverse experiences may provide insights into the potential pathway between adverse experiences and adult health behaviors. This is important for identifying points for effective interventions[37,38].

Aims

This study aimed to examine the association between patterns of adverse experiences across the life course and associations with adult alcohol use, smoking, and obesity as measured by body mass index (BMI) and waist-to-hip ratio (WHR) in Black women. We hypothesized that Black women with exposure to adverse experiences over the life course will have a higher prevalence of alcohol use, smoking, and obesity as measured by BMI and WHR as adults.

METHODS

Data

The Black Women's Health Study (BWHS) is a longitudinal cohort of 59,000 women who were aged 21-69 at baseline enrollment in 1995. Respondents were recruited through the Essence magazine subscriber list, professional organizations rosters, and friends and relatives of early respondents. The cohort is national, spanning all parts of the United States with the majority of respondents residing in California, New York, New Jersey, Illinois, Michigan, and Georgia[39,40]. Follow-up questionnaires are administered biennially via U.S. mail. The response rate since

baseline has been over 80% in each cycle of follow-up[41,42]. The Black Women's Health Study has been widely used to address several research questions including the drivers of breast cancer, hypertension, preterm birth, and type-2 diabetes[43-46]. The BWHS study protocol is approved by the Boston University Medical Campus Institutional Review Board.

Inclusion criteria

For the current study, analyses were restricted to women who completed the 2005 questionnaire, as it asked about physical and sexual abuse. Only women who provided information for the primary exposure, physical and sexual abuse in childhood, adolescence, and adulthood were included (n=36,274).

Measures

Lifetime abuse

A 9-item instrument that was adapted from two previous scales was included in the 2005 follow-up questionnaire to assess abuse in childhood (up to age 11), adolescence (age 12-18), and adulthood (age 19-present (in 2005))[47,48]. Participants were asked if they had ever experienced any of the following forms of physical abuse during the specific life periods: someone "pushed, grabbed, or shoved me", "threw something at me that could hurt me", "kicked, bit, or punched me", "hit me with something including hand or fist", "choked or burned me", "physically attacked me in some other way". Sexual abuse was measured as any report of someone having "exposed their genitals against my will" or "was sexual with me against my will". Response options to both physical and sexual abuse questions were never, 1-3 times, and 4 or more times. Adapting a coding scheme that had been used in previous publications from the BWHS, each form of physical abuse was scored as 1 if participants reported experiencing it 4 or more times and 0 otherwise[47,48]. If participants reported being "choked or burned", they received a score of 1 if it occurred 1-3 times and 2 if it occurred 4 or more times. Otherwise, they received

a score of 0. Similarly, any experiences of sexual abuse were scored as 2 if it occurred ≥4 times and 1 if it occurred 1-3 times, otherwise, they received a score of 0. Responses were then summed within each lifestage. It's been established empirically that ≥4 adverse experiences are associated with a higher risk of poor health outcomes[23], therefore using this threshold, 4 or more experiences within each lifestage were coded as 1 and 0 otherwise. These scores were then summed across the life course stages. Cumulative scores of experiences of abuse were generated and categorized as 1) no abuse across the life course, which are individuals who have an abuse score of 0 at each lifestage (childhood, adolescence, and adulthood); 2) childhood only; 3) adolescence only; 4) adulthood only; 5) childhood and adolescence; 6) child and adulthood; 7) adolescence and adulthood; and 8) childhood, adolescence, and adulthood. Sensitivity analyses were undertaken to determine if the results differed by the type of abuse (physical vs. sexual).

Smoking

Data on smoking history was ascertained from the 2005 follow-up questionnaire. Participants reported whether or not they smoked one or more cigarettes every day for at least a year. Response options were current, past, and never. Current and past smokers were collapsed into one category and smoking was recorded as ever smoker and never smoker.

Alcohol use

Data on drinking history was ascertained from the 2005 follow-up questionnaire. Participants reported whether or not they drank alcoholic beverages (beer, wine, wine cooler, or liquor) at least once a week for at least one year. Response options were current, past, and never. Current and past alcohol use were collapsed into one category and lifetime alcohol use was recoded as ever/never.

Body size

Self-reported height was obtained from the 1995 baseline questionnaire and weight was obtained from the 2005 follow-up survey to construct BMI (weight in kilograms divided by squared height in meters). Standard cut-points were used to categorize individuals as obese (≥30 kg/m^2) and not obese (<30 kg/m^2) in the final models. Participants reported waist circumference (inches) at the level of umbilicus and hip circumference (inches) on the 2005 questionnaire. The World Health Organization's definition of abdominal obesity was used to determine a WHR cut-point of >0.85 inches as obese.

Covariates

Covariates include age (years), education (less than high school, high school graduate, some college, college graduate, and graduate degree); occupation (professional or manager, sales/clerical, service/craft/operative/farmer, and other); geographic region (Northeast, South, Midwest, and West); marital status (married/living together, separated/divorced, single, and widowed); and childhood socioeconomic status (SES) as measured through parental education (less than high school, high school graduate, some college, and college graduate or more). Covariates were selected *a priori* based on theory and variables that predicted both exposure and outcomes were retained in the final analysis.

Analysis

Groups defined by lifestage abuse scores were compared according to demographic factors using the chi-squared test and one-way ANOVA for continuous variables. Separate logistic regression models were used to estimate unadjusted (crude) and adjusted odds ratios (OR) and 95% confidence intervals (95% CI) for the association between lifestage abuse scores and categories of alcohol use (ever versus never), smoking status (ever versus never), BMI (≥30

versus <30 kg/m^2), and WHR (>0.85 versus ≤0.85 inches). All analyses were conducted in Stata15 (College Station, TX)[49].

RESULTS

Table 1.1 presents the demographic characteristics of the whole sample as well as the demographic differences between women in different categories of lifestage abuse scores. The mean age of participants in the 2005 sample was 49.0 (10.6). The highest proportion of participants reported obtaining a graduate degree (34.7%), living in the South (35.4%), being married or living with a partner (44.9%), and working as a professional or manager (60.6%). Approximately two-thirds of participants reported never smoking and 60.6% reported a history of alcohol use. About 40% of women were classified as obese based on their BMI (43.4%) and WHR (38.5%). There were statistically significant differences in demographic and cancer-related risk factors based on lifestage abuse. Compared to women who reported no abuse across the life course, women who reported abuse at all three life stages were younger, had lower SES based on education and occupation, had lower parental education, were likely to be divorced or separated, more likely to report smoking and drinking, and were more likely to be obese based on both BMI and WHR (**Table 1.1**).

Abuse (sexual and physical) is associated with increased odds of BMI ≥30. Compared with women who did not experience any abuse across the lifespan, abuse at every lifestage was significantly associated with BMI≥30 except for abuse in adulthood only and adolescence and adulthood (**Figure 1.1**). Unlike, BMI, obesity measured as WHR was significantly associated with abuse in adolescence and adulthood only. Relative to women with no experience of abuse, the odds of WHR >0.85 was, AOR=1.69 (95% CI: 1.20-2.39), among women who reported abuse in adolescence and adulthood only (**Figure 1.1**). Ever smoking is significantly associated with abuse at every life stage and is highest among women who experienced abuse in

adolescence and adulthood, AOR=2.36 (1.72-3.25) (**Figure 1.1**). Similarly, ever drinking was associated with abuse at every life stage excluding abuse in childhood only (**Figure 1.1**).

Sensitivity analyses were carried out to determine if assessing each type of abuse (physical vs sexual abuse) exclusively would yield results that diverged from the main findings. Unlike sexual abuse alone (**Figure 1.3**), physical abuse at every life stage was found to be significantly associated with increased odds of ever smoking (**Figure 1.2**). Similarly, physical abuse at every life stage, except childhood only and childhood and adulthood, is associated with being an ever-drinker (**Figure 1.2**). Sexual abuse on its own appears to have less of an influence on cancer-health behaviors (**Figure 1.3 and Figure 1.4**).

DISCUSSION

In this large population-based study using the largest national cohort of Black women to date, we found that although exposure in specific life periods is important, chronic exposure to physical and sexual abuse across the life course also matters for cancer-related health factors. For example, the adjusted odds of obesity as defined as BMI≥30 kg/m^2 jumps from 1.19 in those who reported abuse in childhood alone to 1.50 in those who reported abuse in both childhood and adulthood. Similar patterns emerge in smoking and drinking behaviors when adulthood abuse is included in abuse measures. In contrast, WHR does not appear to be impacted as strongly by abuse.

While most studies continue to limit measures of abuse or adverse experiences more broadly to early life (birth to 18 years of age), there is some evidence that assessment of abuse should extend from childhood into adulthood and efforts are being made to capture and incorporate measures of adult adverse experiences[50-52]. The mechanisms that link the type and timing of

abuse to cancer-related health behaviors are unclear, however, it appears that abuse in general matters for cancer-related behaviors.

Various mechanisms have been hypothesized to explain how experiences of abuse get under the skin[53-55]. Experiences of abuse may alter the regulation of stress signaling pathways and immune system function in particular the hypothalamic-pituitary-adrenal (HPA) axis and cortisol production[53-55]. Overstimulation of the HPA axis through repeated experiences of stressful events in early life without mental or emotional support to counter this stress may predispose individuals to unhealthy coping behaviors. Foods that are high in fats and carbohydrates, alcohol, and nicotine are believed to help regulate feedback to the HPA axis thus resulting in increased release of dopamine and Beta-endorphins and subsequently resulting in feelings of relaxation and reducing anxiety[56-63]. By disrupting the normal function of stress signaling pathways, adverse experiences may prime individuals to develop or maintain poor health behaviors.

Strengths and limitations

There are several limitations to this study. First, this was a cross-sectional analysis where we cannot make any assumptions of causality between abuse and cancer-related health behaviors. Second, there is also potential for underreporting of abuse. Individuals may be likely to suppress particularly violent abuse experiences including sexual abuse, as a result, this exposure may be underreported[64]. Underreporting would result in misclassification and if this is the case then the estimates produced are likely to be underestimates of the true associations. Third, the scale that was included limited adverse experiences to two categories of abuse, physical and sexual. Other domains of abuse including emotional abuse, neglect, and household dysfunction are often correlated, and excluding them limits our understanding of how these factors are related and where potential interventions should be focused. Fourth, there may be social desirability

bias as smoking, drinking history, and height and weight were self-reported. Participants may be more inclined to underreport drinking and smoking therefore biasing the associations towards the null. In addition, BMI is an imprecise measure of obesity; it does not distinguish between fat, muscle, or bone mass and current cutoffs may misclassify Black women as obese[65, 66]. Finally, the data analyzed are older, from 2005[67,68]. There are several strengths to this study including the fact that the data come from the largest ongoing study of Black Women in the United States, it is nationally representative, and information on abuse across the lifespan (childhood, adolescence, and adulthood) was collected.

Conclusions

The findings of this study suggest that adverse experiences across the life course matter for obesity, drinking, and smoking in adulthood among US Black women. Previous studies have limited adverse experiences to early life but these findings suggest that exposure to abuse in adulthood also matters for these behaviors. Future studies should explore mechanisms through which chronic experiences of adverse experience across the lifespan influence cancer-related health behaviors.

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Table 1.1: Demographic characteristics by type and timing of abuse: Black Women's Health Study Participants (N=36,274), 2005

	Full Sample	No Abuse across the life course	Childhood (Up to age 11) Abuse	Adolescence (age 12-18) Abuse	Adulthood (age 19 to present) Abuse	Childhood and Adolescence Abuse	Childhood and Adulthood Abuse	Adolescence and Adulthood Abuse	All three life periods	P-Value
Number of women	36,274	28,069 (81.0%)	2,568 (7.41%)	517 (1.49%)	1360 (3.93%)	1092 (3.15%)	295 (0.85%)	232 (0.67%)	514 (1.48%)	
Age in years, mean (SD)	49(10.6)	49.3(10.7)	46.1(9.3)	46.7(9.4)	50.3(9.9)	46.7(8.8)	49.1(9.2)	49.6(9.5)	48.2(8.8)	<.01
Education										
Less than high school	1.4	1.2	0.3	1.2	1.9	1.7	2.2	6.1	3.1	<.01
High school grad	11.6	11.2	8.0	11.3	15.5	9.5	13.8	18.7	13.5	
Some college	25.8	24.9	26.8	29.4	32.0	29.5	32.4	31.8	33.8	
College degree	26.4	26.9	27.6	26.5	23.8	25.1	24.7	21.5	22.6	
Graduate degree	34.7	35.8	27.3	31.6	26.8	34.3	26.9	22.0	27.0	
Occupation										
Professional/manager	60.6	61.5	61.7	59.4	56.6	57.2	54.5	47.4	52.0	<.01
Sales/Clerical	24.2	24.0	23.5	25.0	25.2	25.6	26.6	28.7	27.1	
Services/Craft/Operative/Farmer	9.8	9.3	7.9	9.6	13.0	11.1	12.8	18.7	14.3	
Other	5.4	5.2	6.8	6.1	5.2	6.1	6.2	5.2	6.6	
Parental education										
Less than high school	24.7	24.1	22.0	20.8	29.0	21.9	28.8	26.2	32.7	<.01
High school grad	28.7	29.1	27.2	28.7	26.9	28.4	27.7	26.7	26.9	
Some college	24.2	24.3	25.5	26.0	23.9	24.8	23.1	22.5	23.6	
College grad and more	22.4	22.6	25.4	24.4	20.2	25.0	20.5	24.6	16.8	
Marital status										
Married/Living together	44.9	46.2	45.3	43.4	34.2	41.2	32.7	37.8	31.2	<.01
Separated/Divorced	26.4	24.8	25.4	28.5	46.2	29.6	45.6	41.4	41.2	
Widowed	22.1	22.6	26.4	22.6	13.3	23.9	15.7	13.1	20.0	
Single	6.5	6.5	2.9	5.5	6.3	5.3	6.1	7.7	6.6	
Region										
South	35.4	36.0	32.9	32.4	36.0	29.2	30.3	31.5	31.3	<.01
Northeast	24.5	24.3	26.4	25.2	21.0	26.5	25.9	21.6	21.6	
Midwest	22.3	22.1	21.7	21.9	25.9	22.8	24.2	26.7	26.3	
West	17.8	17.6	19.0	20.4	17.1	21.5	19.7	20.3	20.8	
Lifetime smoking history										
Ever	35.6	33.9	36.3	43.1	45.5	42.4	46.8	56.5	50.8	<.01
Lifetime drinking history										
Ever	60.6	59.4	61.0	66.4	67.8	65.0	69.7	74.9	70.9	<.01
BMI (units)										
≥30 (obese)	43.4	42.3	47.5	48.7	45.4	50.4	52.0	47.2	53.1	<.01
Waist to hip ratio (units)										
>.85 (obese)	38.5	37.9	38.0	40.6	42.5	40.8	38.3	51.1	41.8	<.01

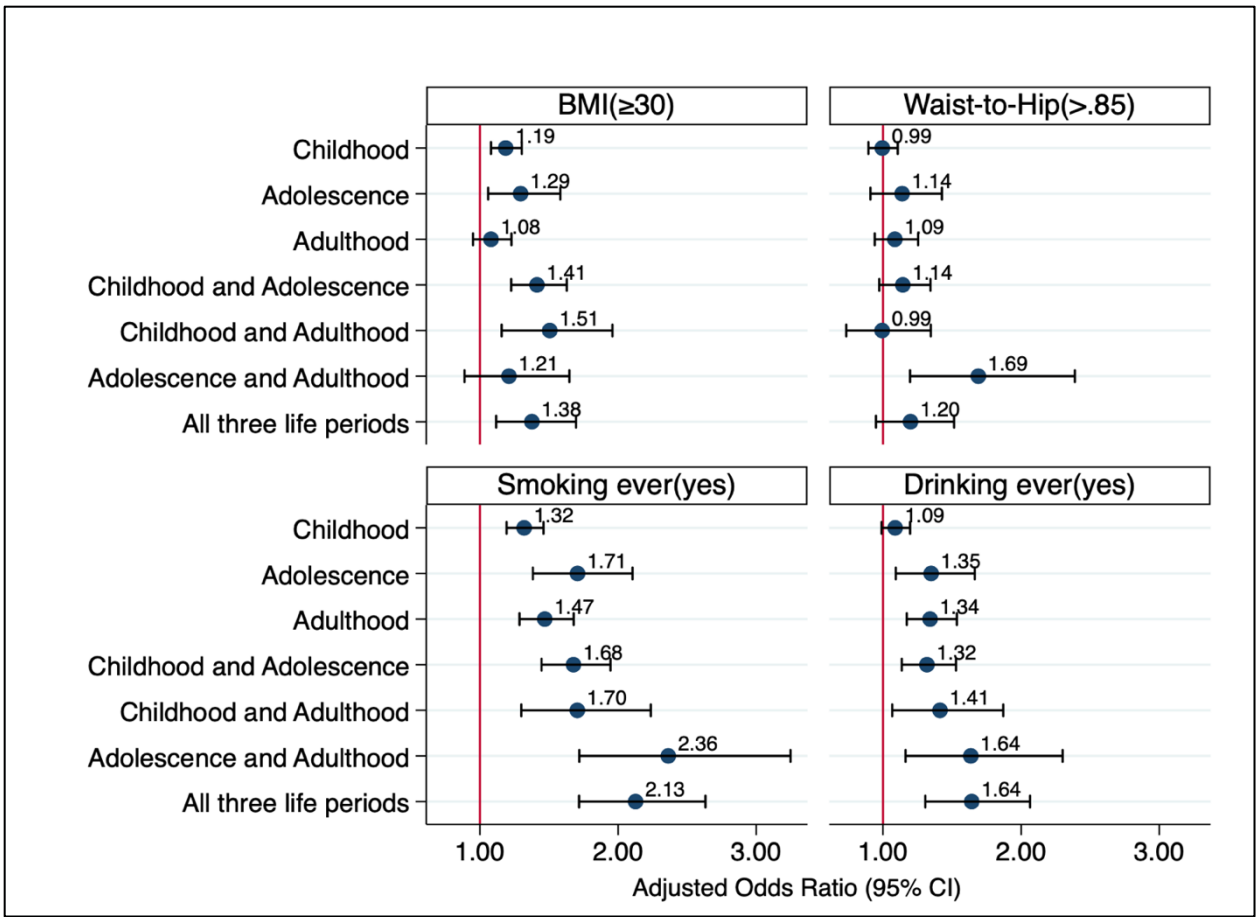

Figure 1.1: Lifetime Physical and Sexual Abuse and Odds of Poor Health Factors, Black Women's Health Study (2005)

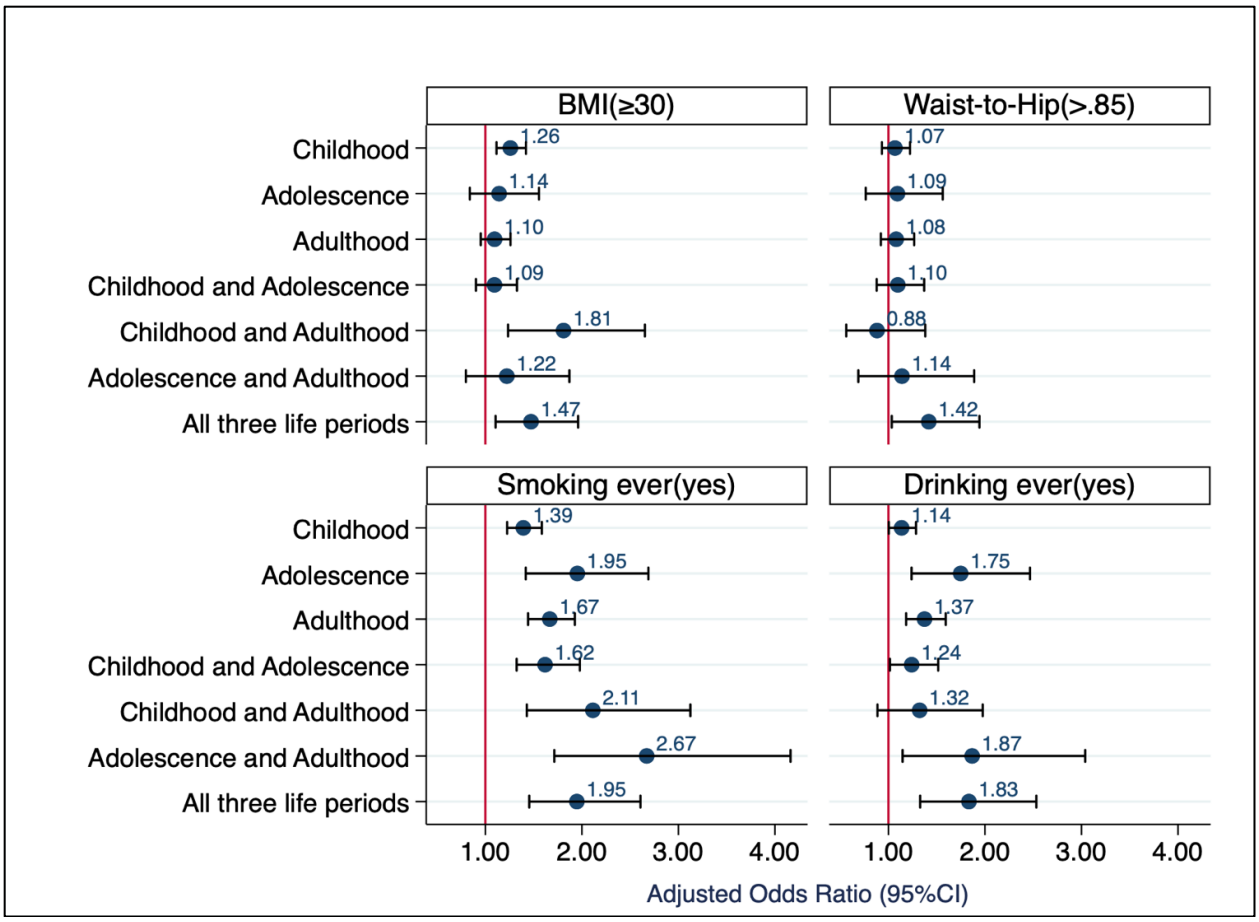

Figure 1.2: Lifetime Physical Abuse and Odds of Poor Health Factors, Black Women's Health Study (2005)

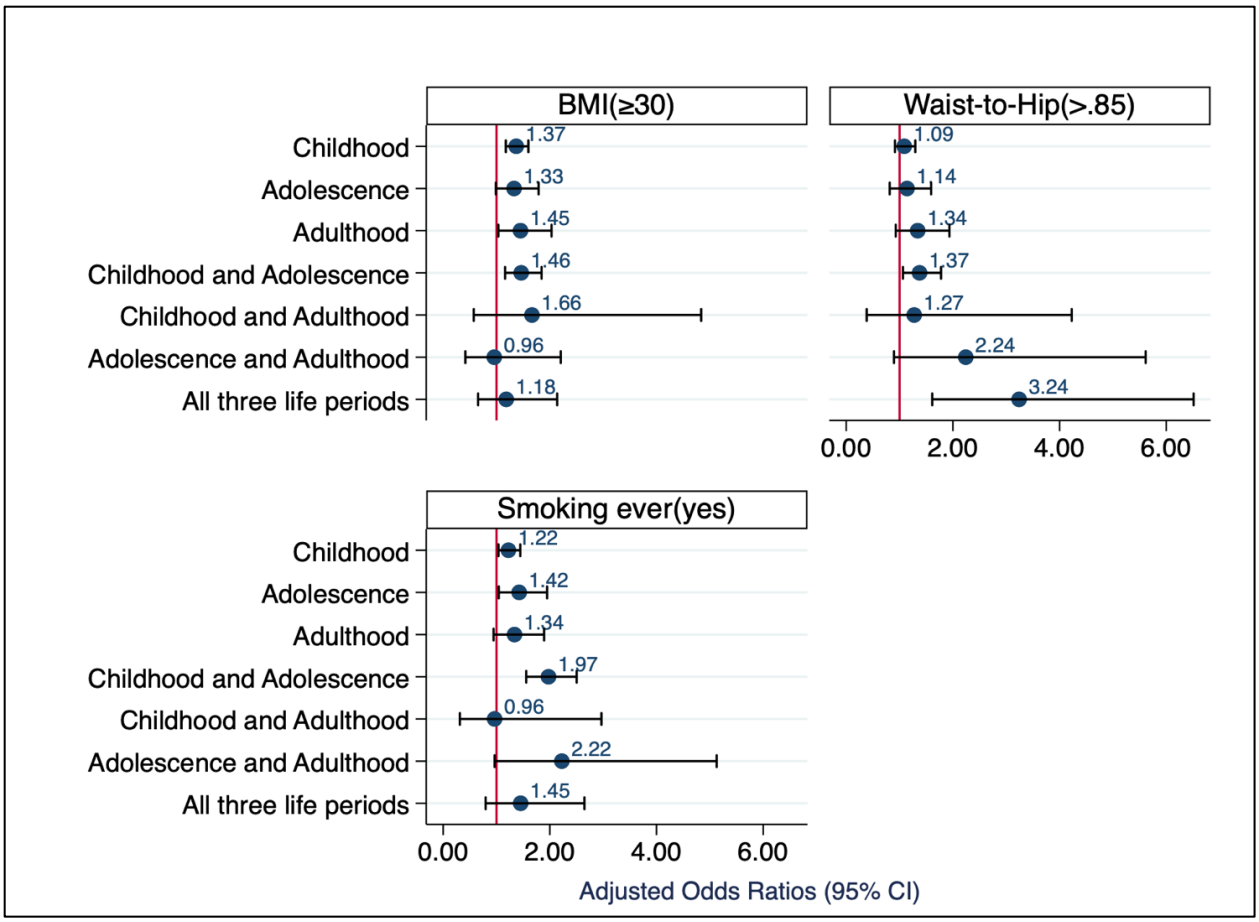

Figure 1.3: Lifetime Sexual Abuse and Odds of Obesity and Smoking, Black Women's Health Study (2005)

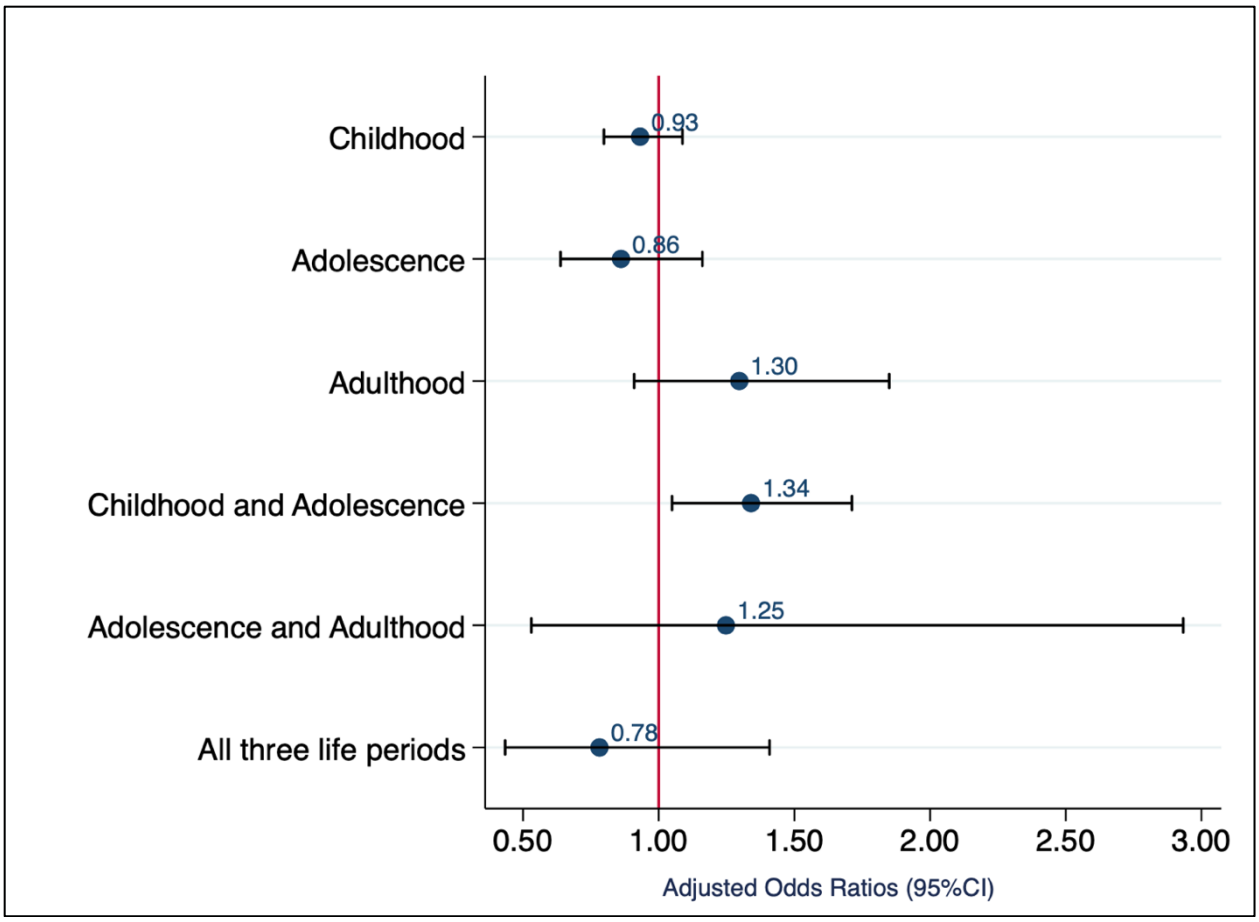

Figure 1.4: Lifetime Sexual Abuse and Odds of Drinking, Black Women's Health Study (2005)

Chapter 2 Abstract

Background: Neighborhood segregation is a fundamental cause of racial health disparities and plays a role in modifying health behaviors and subsequently impacting cancer outcomes independent of individual characteristics. Most studies do not examine the interaction between the neighborhood environment and lifetime abuse, as the neighborhood environment may modify the effects of lifetime abuse on cancer-related health behaviors. This study aims to assess the joint effects of neighborhood segregation, neighborhood SES, and adverse experiences across the life course.

Methods: Using the Black Women's Health Study, logistic regression models were used to estimate adjusted ORs and 95% confidence intervals for the association between lifetime abuse scores and categories of alcohol use, smoking status, waist-to-hip ratio, and BMI. Effect modification by neighborhood SES and neighborhood segregation as measured by the dissimilarity and interaction indexes were tested using interaction terms.

Results: Women who scored high on the abuse scale (≥4 experiences of abuse) at all three life periods and who live in low SES neighborhoods had increased odds of obesity (AOR=2.08, 95% CI: 1.16-3.73) and ever smoking (AOR=1.49, 95% CI: 1.09-2.04) compared to women who had no experiences of abuse and who lived in high SES neighborhoods. There was no evidence of an interaction between lifetime abuse and segregation using the dissimilarity index and exposure.

Conclusion: The findings of this study provide some evidence of the joint effects of lifetime abuse and neighborhood SES on cancer-related factors among Black women.

Chapter 2 Main Body

INTRODUCTION

Neighborhood segregation, a consequence of historic policies including redlining, is a fundamental cause of racial health disparities and plays a role in modifying health behaviors and subsequently impacting cancer outcomes independent of individual characteristics[1-3]. Neighborhood segregation often represents the enduring effects of racial, social, and economic inequalities in the United States. Although Black neighborhood poverty has declined, Black neighborhood segregation has not[5,6]. The majority of low-income Black Americans (80%) live in low-income neighborhoods compared to less than 50% of low-income White Americans[5]. Not only are Black Americans more likely to be born and raised in high-poverty, racially segregated neighborhoods, but they are also more likely to remain in those neighborhoods after a generation[7]. Furthermore, unlike their White counterparts, on average Black Americans regardless of individual factors such as education and income are less likely to experience residential mobility out of poor neighborhoods[7]. It is well-documented that neighborhoods impact health through various pathways. Socially, neighborhoods create connections such as religious participation, civic engagement, social cohesion, collective efficacy, and social support. Physically, neighborhoods influence the quality of housing, pollution levels, business investment, the concentration of food, tobacco, and alcohol outlets, and green spaces. Neighborhoods are also tied to the quality of schools, access to jobs, crime rates, and access to healthcare[8-12].

The inverse relationship between residential segregation, neighborhood SES, and health behaviors is well demonstrated empirically[2,12]. Low SES, predominantly Black neighborhoods impact health and health behaviors by making readily available cheap and often culturally marketed fast food, tobacco, and alcohol outlets[4,8,9,13-15]. These neighborhoods are less likely to have green spaces, but more likely to have higher environmental pollutants and higher violence

rates which destroy social cohesion[10]. These social and environmental factors contribute to higher stress levels and consequently harmful stress-coping behaviors including binge eating; consumption of high sugar, high salt, and low nutrient-dense foods; alcohol use; and smoking[16-24]. Black Americans living in high-income, predominantly White neighborhoods have access to healthier foods, green spaces, and educational opportunities. However, these neighborhoods also expose Black residents to traumatic, race-related stressful experiences that are deleterious to both mental and physical health and may not return the same protective effects for Black residents as they do White residents[25]. In addition, very little is known about the protective health effects of living in high SES, highly segregated Black neighborhoods although there is evidence that ethnic density may be protective for older Black Americans[26]. Deleterious cancer-related health behaviors are often clustered in highly deprived neighborhoods; neighborhood-level interventions that address upstream health determinants such as neighborhood SES and neighborhood segregation may be more effective at simultaneously addressing multiple health behaviors than more common intervention strategies that target individual health behaviors in isolation[27].

Adverse childhood experiences (ACEs) including physical and sexual abuse have been found to have lasting effects on cancer-related health behaviors[28]. ACEs are traumatic experiences and a form of toxic stress that occurs in childhood (birth to 17). While ACEs shape health behavior in adulthood, very little has been done to understand the cumulative effects of these experiences across the life course. Individuals who experience adverse experiences in childhood are more likely to have similar experiences in adulthood[29]. One in four Black girls will be sexually abused before adulthood[30]. Black girls are also more likely to witness domestic abuse and to be physically victimized than their White counterparts[31]. Similarly, Black women have high rates of abuse in adulthood compared to other groups of women[30]. More than 40% of Black women experience intimate partner violence in their lifetime and more than 1 in 5 Black women

experience sexual assault in their lifetime[30]. Most studies do not examine the interaction between the neighborhood environment and lifetime abuse, as the neighborhood environment may modify the effects of lifetime abuse on cancer-related health behaviors[32]. To assess the joint effects of neighborhood segregation, neighborhood SES, and adverse experiences across the life course, I am employing the environmental affordances model as a framework to guide my analysis. The environmental affordances model attempts to explain the interplay of individual stress, structural factors, and health behaviors among Black Americans[33]. Using this framework, I hypothesize that: 1) chronic experiences of abuse across the life course increase the propensity to engage in poor health behaviors and 2) low SES, highly segregated neighborhoods are a source of stress but also provide opportunities to alleviate stress through the overabundance of alcohol, tobacco, and fast food outlets. Therefore, women who have experienced abuse in their lifetime and who also live in these neighborhoods will have higher odds of smoking, drinking, and obesity in adulthood than women who live in higher SES and less racially segregated neighborhoods.

In this study I employ two dimensions of segregation: evenness and exposure, to assess the joint effects of neighborhood segregation, neighborhood SES, and adverse childhood experiences on cancer-related health behaviors. Although Massey and Denton classified racial segregation into five key dimensions: evenness, exposure, centralization, concentration, and clustering, I limited this analysis to exposure and evenness based on the available data and because these measures have been found to reflect two distinct dimensions of segregation – distribution, and likelihood of contact - and may be particularly important for measuring neighborhood segregation in cancer studies[34-36] .

Evenness refers to the unequal or differential distribution of social groups across areal units in a city[34]. In this study, it is the degree to which each census tract has the same distribution of

Blacks to Whites as the larger metropolitan area overall. Evenness is commonly measured using the index of dissimilarity. The index of similarity varies from 0 to 1 and is calculated as:

$$D = \frac{1}{2}\sum_{i=1}^{n}\left|\frac{w_i}{W_T} - \frac{b_i}{B_T}\right|$$

Where:

n = number of tracts or spatial units
w_i = number of Whites in tract i
W_T = total number of Whites in the city
b_i = number of Blacks in tract i
B_T = total number of Blacks in the city

D tells us the proportion of either Black (or White) residents that would have to move to achieve even racial distribution. The second measure, exposure, is the likelihood of contact between social groups within geographic areas of a city[34]. Exposure is assessed using the interaction index and ranges from 0 to 100.

$$B_{bw} = \sum\left(n_{ib}/N_b\right)\left(n_{iw}/n_i\right)$$

Where:

n_{ib} = number of Blacks in the tract
n_{iw} = number of Whites in the tract
N_b = number of Blacks in the city
n_i = total population of the tract

In this study, B tells us the probability of a Black participant interacting with or meeting a White person in their neighborhood, at the census tract level.

Black women experience higher rates of obesity compared to their White counterparts and although Black women both smoke and drink at lower rates than their White counterparts, they are more likely to become heavy drinkers and lifelong smokers [37-43]. These risk factors in addition to social stressors are likely to make Black women particularly vulnerable to developing cancer. A large body of literature links both neighborhood exposures and adverse childhood

experiences (ACEs) to cancer-related health behaviors, however, most of these studies examined these exposures in isolation, without considering neighborhood context, thereby limiting the ability to identify potential pathways and effective intervention strategies. Understanding the potential joint effects of ACEs that prime individuals to adopt poor health behaviors to cope with their trauma, and neighborhood SES and segregation which are associated with access to alcohol, cigarette, and fast-food outlets, may provide insights.

Aims

This study aims to determine whether the association between lifetime abuse with adult alcohol use, smoking, and body size (BMI, waist-to-hip ratio) is modified by neighborhood racial segregation and neighborhood socioeconomic status. I hypothesize that living in less racially segregated and higher SES neighborhoods will attenuate the relationship between adverse experiences and adult alcohol use, tobacco use, waist-to-hip ratio, and BMI.

METHODS

Data

The Black Women's Health Study (BWHS) is an ongoing longitudinal cohort of 59,000 women who were 21-69 years of age at baseline enrollment in 1995. Respondents were recruited through the Essence magazine subscriber list, professional organizations rosters, and friends and relatives of early respondents. The cohort is national, spanning all regions of the United States with most respondents reside in California, New York, New Jersey, Illinois, Michigan, and Georgia Follow-up postal and web-based questionnaires are administered biennially through 2021 with triennial follow-up thereafter[44,45]. The response rate since baseline has been over 80% in each cycle of follow-up.

Measures

Adverse experiences

A 9-item instrument that was adapted from two previous scales was included in the 2005 follow-up questionnaire to assess abuse in childhood (up to age 11), adolescence (age 12-18), and adulthood (age 19-present (in 2005))[46,47]. Participants were asked if they had ever experienced any of the following forms of physical abuse during the specific life periods: someone "pushed, grabbed, or shoved me", "threw something at me that could hurt me", "kicked, bit, or punched me", "hit me with something including hand or fist", "choked or burned me", "physically attacked me in some other way". Sexual abuse was measured as any report of someone having "exposed their genitals against my will" or "was sexual with me against my will". Response options were never, 1-3 times, and 4 or more times. Adapting a coding scheme that had been used in previous publications from the BWHS, each form of physical abuse was scored as 1 if participants reported experiencing it 4 or more times and 0 otherwise. If participants reported being "choked or burned", they received a score of 1 if it occurred 1-3 times and 2 if it occurred 4 or more times. Otherwise, they received a score of 0. Similarly, any experiences of sexual abuse were scored as 2 if it occurred ≥4 times and 1 if it occurred 1-3 times, otherwise, they received a score of 0. Responses were then summed within each life course stage. It has been established empirically that ≥4 adverse experiences are associated with a higher risk of poor health outcomes, therefore using this threshold, if a participant reported 4 or more experiences within each life course stage they were coded as 1 and 0 otherwise. These scores were then summed across the life course stages. Cumulative scores of adverse experiences were generated and categorized as 1) no adverse experience across the life course, which are individuals who have adverse experiences score of 0 at each life stage (childhood, adolescence, and adulthood); 2) childhood only; 3) adolescence only; 4) adulthood only; 5) childhood and adolescence which is the traditional life stage operationalized in studies of ACEs[28]; and 6) childhood, adolescence, and adulthood.

Neighborhood SES and Segregation

Neighborhood SES was determined by linking participants' geocoded addresses at each questionnaire cycle (2005 cycle onward) to year 2010 US Census data via the Federal Information Processing Standards (FIPS) code at the block group level. Factor analysis was performed to create a neighborhood SES score based on six variables (median household income; median housing value; percentage of households receiving interest, dividend or net rental income; percentage of adults aged ≥ 25 years who have completed college; percentage of employed persons aged ≥ 16 years who are in occupations classified as managerial, executive or professional; and percentage of families with children that are not headed by a single female), with higher values indicating higher SES. Neighborhood SES in 2005 was obtained and measured in quintiles; ranging from the lowest neighborhood SES quintile (Q1) to the highest neighborhood SES quintile (Q5)[48,49].

Measures of racial segregation were obtained from the American Communities Project, Brown University (https://www.brown.edu/academics/spatial-structures-in-social-sciences/american-communities-project). The American Communities Project obtained population data on all ages for the major racial/ethnic groups (non-Hispanic white, non-Hispanic Black, Hispanic, and Asian) in (2005-2009). The BWHS FIPS codes at the block group level were converted to the metropolitan statistical area (MSA) using the Geographic Correspondence Engine from Missouri Census Data Center (http://mcdc.missouri.edu/applications/geocorr.html). Subsequently, the MSAs for participants were linked with the MSA segregation measures obtained from the ACS project. We used the following cut-off points for the dissimilarity index that have been used in previous sociological and health studies[34, 50,51]: extreme segregation (70-100), high segregation (40-69), moderate segregation (30-39), and low segregation (0-29). We used the following cut-off for the interaction index: very low (≤0.3), low (>0.3 and ≤0.4), moderate (>0.4 and ≤0.6), and

high (>0.6). The dissimilarity index, interaction index, and neighborhood SES were all recoded in the final analysis. Dissimilarity index/evenness was recategorized as low segregation if <40 and high segregation if ≥40; interaction index/exposure was recategorized as low exposure if ≤.40 and moderate/high exposure if >.40; the top two highest quintiles of neighborhood SES were collapsed and recategorized as high neighborhood SES and the bottom three quintiles were collapsed and recategorized as low neighborhood SES.

Smoking and Alcohol Use

Data on smoking history was ascertained from the baseline survey and the 2005 follow-up questionnaire. Participants were asked if they ever smoked one or more cigarettes every day for at least a year. Smoking was coded as current, past, and never. Current and past smokers were collapsed into one category and smoking was recorded as ever smoker and never smoker. Data on drinking history was also ascertained from the baseline survey and the 2005 follow-up questionnaire. Participants were asked if they had ever drunk alcoholic beverages (beer, wine, wine cooler, or liquor) at least once a week for at least one year. Alcohol use was initially coded as current, past, and never. Current and past alcohol use were collapsed into one category and lifetime alcohol use was recoded as ever/never.

Body size

Height was obtained from the 1995 baseline questionnaire and weight was obtained from the 2005 follow-up survey to construct body mass index (BMI) (weight in kilograms divided by squared height in meters). Standard cut-points were used to categorize respondents as obese (≥30) and not obese (<30) in the final models. Participants reported waist circumference (inches) at the level of the umbilicus and hip circumference (inches) on the 2005 follow-up questionnaire. The waist circumference measure was divided by the hip circumference measure

to compute the waist-to-hip ratio (WHR). The World Health Organization's definition of abdominal obesity was used to determine the WHR cut-point for obesity (> 0.85).

Covariates

Covariates in the models include age reported in 2005; education (less than high school, high school graduate, some college, college graduate, and graduate degree) reported in 1995 and 2003; occupation (professional or manager, sales/clerical, service/craft/operative/farmer, and other) reported in 1995; geographic region (Northeast, South, Midwest, and West) and marital status (married/living together, separated/divorced, single, and widowed) reported in 2005; and childhood socioeconomic status (SES) as measured through parental education (less than high school, high school graduate, some college, and college graduate or more) reported in 2009. There was high missingness in income therefore this variable was excluded. Covariates were selected *a priori* based on theory and variables that predicted the exposure and outcomes were included in the final analysis.

Inclusion criteria

For this study, primary analysis was restricted to women who completed the 2005 questionnaire and who completed the childhood, adolescence, and adulthood abuse questions that were included on that questionnaire. The analytic sample was further restricted to individuals for whom we could ascertain neighborhood SES and segregation information (n=27,236).

Analysis

Separate logistic regression models were used to estimate unadjusted and adjusted ORs and 95% confidence intervals for the association between lifetime abuse scores and categories of alcohol use, smoking status, waist-to-hip ratio, and BMI. Effect modification by neighborhood SES and neighborhood racial segregation as measured by the dissimilarity and interaction

indexes were tested using interaction terms. All analyses were conducted in Stata15 (College Station, TX)[52].

RESULTS

Table 2.1 presents the demographic, behavioral, and neighborhood characteristics of the analytic sample. The mean age of participants in the 2005 sample was 49.2 (10.5). Most participants did not experience ≥4 adverse experiences at any life stage (82.8%). Roughly 7% experienced ≥4 experiences of abuse only in childhood, 1.4% in adolescence only, 3.9% in adulthood only, and 1.4% in all three life periods. Most respondents live in highly segregated yet high SES neighborhoods. Roughly 62.5% of respondents live in highly segregated neighborhoods based on the dissimilarity index, meaning respondents live in a neighborhood where 40% to 69% of residents would need to move to achieve equal racial distribution. An additional 34.6% live in extremely racially segregated neighborhoods where 70% or more residents would need to move to achieve racial distribution; 65.7% of respondents live in neighborhoods that have very low exposure to White individuals at the census tract level(**Table 2.1**). The highest proportion of participants reported obtaining a graduate degree (36.0%), working as a professional or manager (62.4%), being married or living with a partner (46.4%), and living in the South (33.1%). Approximately two-thirds of participants reported never smoking (64.7%) and 39.5% reported never drinking. Based on BMI, approximately 43% of women were classified as obese (≥ 30 kg/m^2) while 38% were classified as obese based on WHR (> 0.85).

Figure 2.1 shows there is evidence of an interaction between lifetime abuse and neighborhood SES. Compared with women who have no experiences of physical or sexual abuse and who live in high SES neighborhoods, women who scored high on the abuse scale (≥4 experiences of abuse) at all three life periods and who live in low SES neighborhoods have increased odds of obesity defined by a waist-to-hip (WHR) ratio >.85 (AOR=2.08, 95% CI: 1.16-3.73). Similarly,

women who scored high on the abuse scale (≥4 experiences of abuse) in childhood only and who lived in low SES neighborhoods had higher odds of ever smoking (AOR=1.49, 95% CI: 1.09-2.04) compared to women who had no experiences of abuse and who lived in high SES neighborhoods. Finally, there was evidence of interaction between abuse in childhood only and adulthood only and neighborhood SES. The odds of ever drinking among women who experienced abuse in childhood only and who lived in low SES neighborhoods in adulthood was (AOR=1.31, 95% CI: 1.06-1.62). The odds of ever drinking among women who experienced abuse in childhood only and who lived in low SES neighborhoods in adulthood was (AOR=1.39, 95% CI: 1.01-1.91). There was evidence of an interaction between lifetime abuse and neighborhood SES with regard to BMI (**Figure 2.1**). There was no evidence of an interaction between lifetime abuse and segregation using the dissimilarity index (**Figure 2.2**). Women who reported abuse in all three life stages and who lived in neighborhoods with low exposure to White individuals had lower odds of obesity as measured by BMI; there was no interaction between abuse during the other life periods and exposure with regard to WHR, ever smoking, and ever drinking (**Figure 2.3**).

DISCUSSION

In this population-based study of Black women across the United States, the association between lifetime abuse and cancer-related factors was modified by neighborhood SES and neighborhood racial segregation. The association between lifetime abuse and cancer-related factors was amplified among individuals who resided in low SES and low-exposure neighborhoods. These findings are consistent with literature that shows that neighborhood conditions are important for adopting poor behaviors [1-3]. Although experiences of abuse are important for developing poor coping behaviors, there is some indication that neighborhood conditions are also important in this relationship.

Strengths and limitations

There are several limitations to this study. First, this was a cross-sectional analysis therefore we cannot determine causation. Second, do not have information on early life neighborhood conditions therefore we cannot determine temporality between neighborhood conditions and abuse. However, we did adjust for parental education which may be a reasonable proxy for childhood SES[53]. Data indicate that children who live in low SES neighborhoods are at higher risk for abuse[31]. Third, there is potential for underreporting of abuse. Thus, our findings may represent an underestimation of the true associations between lifetime abuse and cancer-related factors. Fourth, although we adjusted for important confounding factors, the adjustment is not exhaustive and there may be unmeasured confounding. For example, we could not adjust for income because of the high missingness in this variable. Fifth, although useful in guiding my analysis, both the dissimilarity index and interaction index have limitations[34]. Finally, since the outcomes are self-reported there is potential for measurement error and social desirability bias[54,55].

There are several strengths to this study including the fact that it is a nationally representative sample of Black women in the United States. There was information on abuse across the lifespan (childhood, adolescence, and adulthood) therefore I could compare abuse at various life stages. Finally, there were multiple dimensions of the neighborhood that I could assess; both socioeconomic and racial segregation.

Conclusions

The findings of this study provide some evidence of the joint effects of lifetime abuse and neighborhood SES and neighborhood segregation on cancer-related factors among Black women. Interactive effects are not consistent and vary by exposure and outcomes. Future

studies should explore the pathway between experiences of abuse and neighborhood SES, neighborhood segregation, and cancer-related factors.

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Table 2.1: Demographic, behavioral, and neighborhood characteristics: Black Women's Health Study participants (N=27,236), 2005

	Full Sample (%)
Age in years, mean (SD)	49.2(10.5)
Adverse childhood experiences (ACEs)	
No abuse	82.8
Childhood only	7.4
Adolescence only	1.4
Adulthood only	3.9
Childhood and adolescence	3.1
All three life periods	1.4
Dissimilarity Index	
Low segregation	0.7
Moderate segregation	2.2
High segregation	62.5
Extreme segregation	34.6
Interaction index	
Very low exposure	65.7
Low exposure	14.3
Moderate exposure	17.1
High exposure	2.9
Neighborhood SES	
Quintile 1 (lowest)	17.3
Quintile 2	18.5
Quintile 3	19.3
Quintile 4	22.6
Quintile 5 (highest)	22.4
Education	
Less than high school	1.0
High school grad	10.6
Some college	25.5
College degree	26.8
Graduate degree	36.0
Occupation	
Professional/manager	62.4
Sales/Clerical	24.1
Services/Craft/Operative/Farmer	8.8
Other	4.8
Parental education	
Less than high school	23.7
High school grad	28.8
Some college	24.6
College grad and more	22.9
Marital status	
Married/Living together	46.4
Separated/Divorced	25.6
Widowed	21.9
Single	6.1

	Full Sample (%)
Region	
South	33.1
Northeast	24.1
Midwest	24.2
West	18.6
Smoking history	
Current	11.0
Never	64.7
Past	24.3
Drinking history	
Current	24.2
Never	39.5
Past	36.3
Body Mass Index (BMI)	
<30 (not obese)	57.2
≥30 (obese)	42.8
Waist-to-hip ratio (WHR)	
≤.85 (not obese)	62.1
>.85 (obese)	37.9

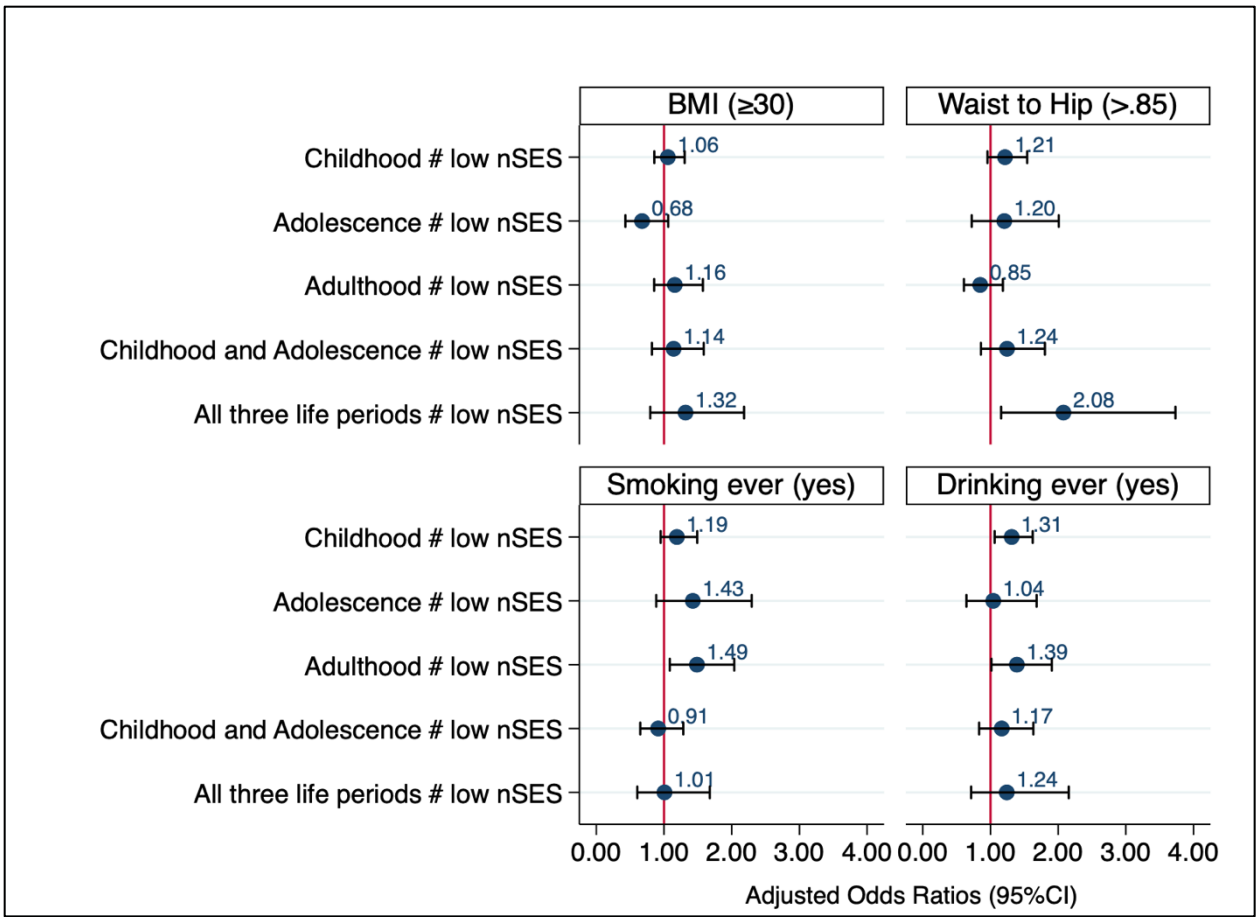

Figure 2.1: Effect modification of the relationship between lifetime physical and sexual abuse and cancer-related health factors by neighborhood SES among participants in the Black Women's Health Study, 2005, N=27,236

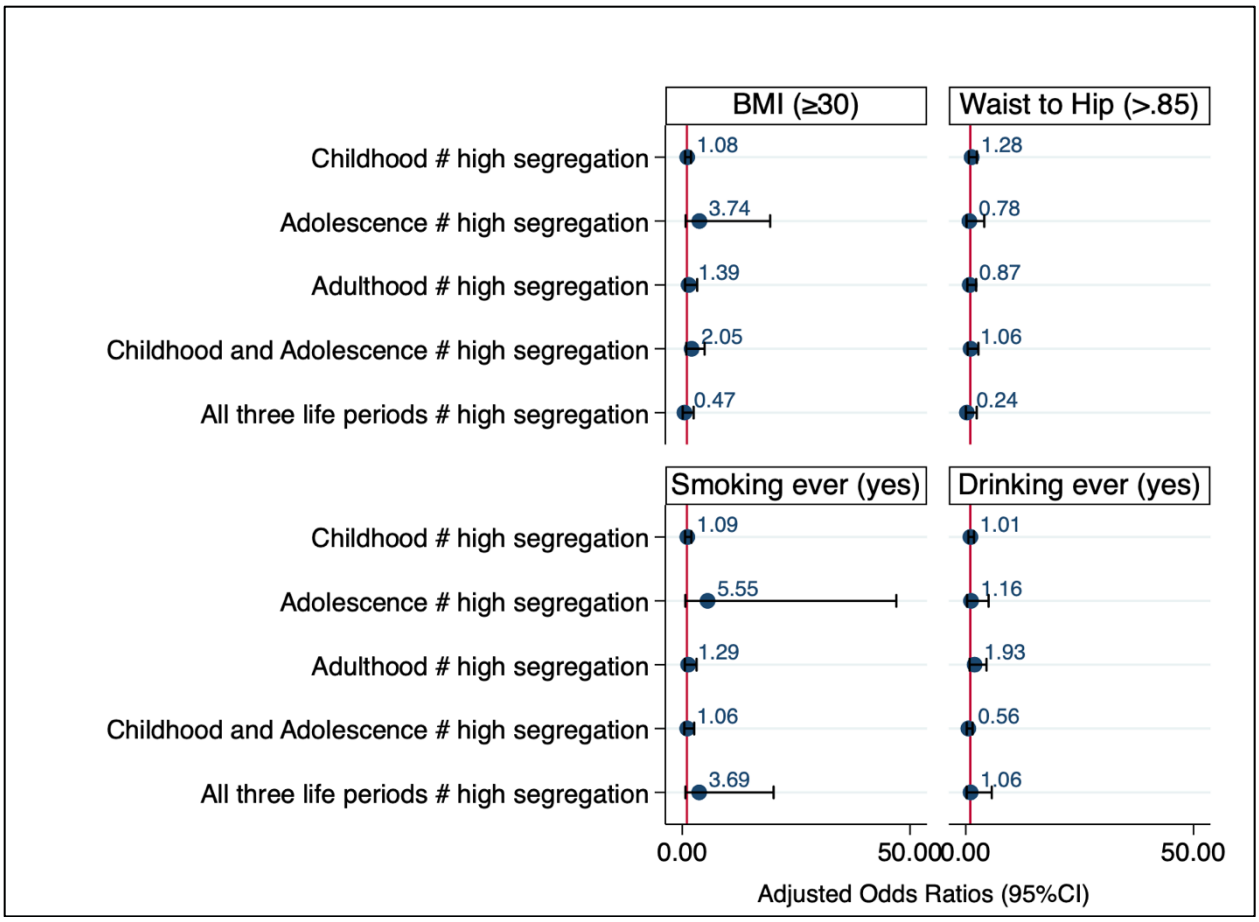

Figure 2.2: Effect modification of the relationship between lifetime physical and sexual abuse and cancer-related health factors by Dissimilarity Index among participants in the Black Women's Health Study, 2005, N=27,236

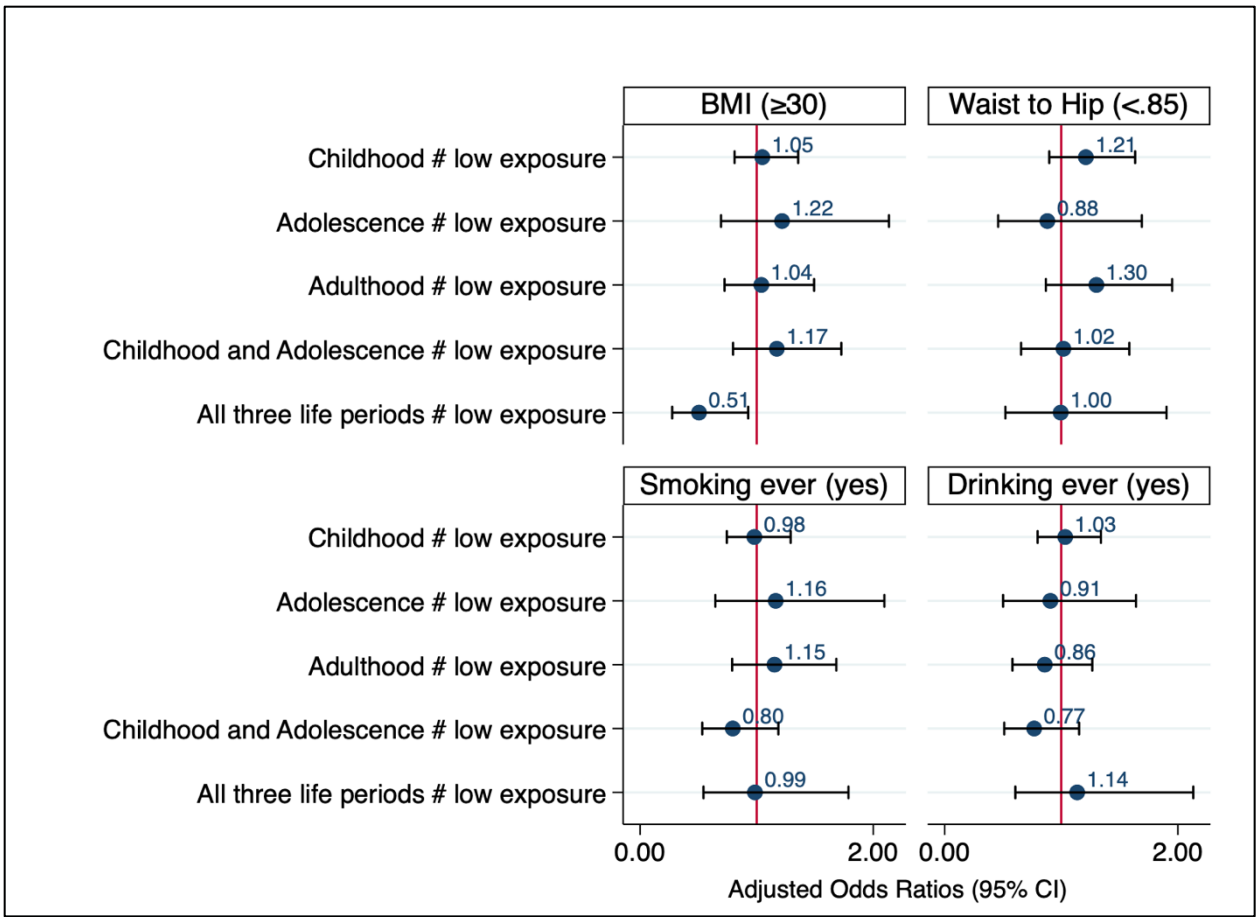

Figure 2.3: Effect modification of the relationship between lifetime physical and sexual abuse and cancer-related health factors by Interaction Index among participants in the Black Women's Health Study, 2005, N=27,236

Chapter 3 Abstract

Background: Black men are more likely to develop prostate cancer, more likely to develop aggressive forms of prostate cancer, and have 2 times higher mortality rates from prostate cancer compared to White men. The relationship between adverse experiences in childhood and poor health behaviors in adulthood has been established empirically. Interventions that aim to address individual experiences of ACEs without also addressing the larger neighborhood context may be ineffective.

Methods: Using data from RESPOND, a population-based national study of Black men with prostate cancer, I conducted separate logistic regression models to estimate ORs and 95% confidence intervals for the association between ACE scores and categories of alcohol use, smoking status, BMI, and physical activity. Effect modification by coping style, neighborhood SES, and neighborhood typology were tested using interaction terms.

Results: Compared to men who reported 0 ACES, the odds of ever smoking were 1.36 (95%CI: 1.07-1.73) and 1.75 (95%CI: 1.25-2.46), among men who reported 1-3 ACEs and 4+ ACES, respectively. ACEs were not associated with smoking type, obesity, alcohol use, or physical activity. There is evidence of an interaction between ACEs and coping style and neighborhood SES.

Conclusion: Findings from this study suggest that adverse childhood experiences influence smoking in adulthood and that both neighborhood SES and coping style modify the relationship between ACEs and physical activity.

Chapter 3 Main Body

INTRODUCTION

In the United States, Black men are more likely to develop prostate cancer, more likely to develop aggressive forms of prostate cancer, and have 2 times higher mortality rates from prostate cancer compared to White men[1,2]. Growing evidence suggests that lifestyle factors are important for cancer survivorship and survival. Specifically, physical activity, body mass index (BMI), smoking, and alcohol use impact post-treatment quality of life, prostate cancer progression and recurrence, and prostate cancer mortality[3-5].

Smoking, obesity, and physical activity impact prostate cancer survival[6-8]. Several studies have also found that these factors are associated with disease progression, disease recurrence, and prostate cancer-specific mortality. For example, prostate cancer patients who are current smokers have a mortality rate that is nearly twice as high as former smokers; current smokers are also 1.5 times more likely to present with metastatic disease, and 1.4 times more likely for PSA to rise after surgery compared to former smokers [7]. Furthermore, there is evidence of a dose-response relationship between smoking and prostate cancer mortality[8]. Several meta-analyses have found that a 5 kg/m2 increase in pre-diagnosis BMI is associated with a 15%-20% higher risk of prostate cancer-specific mortality, and a 21% higher risk of biochemical recurrence [9,10]. In addition, weight gain after diagnosis appears to be just as important for disease progression and mortality[11], While studies on the effects of physical activity post-diagnosis have found that type of exercise and length of exercise matter. One study found that ≥3 hours/week of vigorous activity (e.g., jogging, biking, and swimming) reduces prostate cancer-specific mortality (HR:0.39, 95% CI: 0.18-0.84) compared to <1 hour of vigorous activity per week[12]. Another study found that men who walk or bike ≥20 min/day vs. <20 min/day have lower prostate cancer-specific mortality (HR:0.61, 95%CI: 0.43-0.87) and men who exercise ≥1 hour/week have lower prostate cancer mortality than men who exercise <1 hour/week (HR:

0.68, 95%CI: 0.48-0.94)[13]. Yet another study found that walking briskly (≥3 mph) for 3 or more hours per week was associated with decreased prostate cancer progression (HR:.43, 95%CI: 0.21-0.91) compared to walking at an easy pace (<2 mph) for less than 3 hours per week[14].

The relationship between alcohol intake and prostate cancer survival is not well established, yet there is growing evidence that alcohol intake negatively impacts prostate cancer survival. A small population-based cohort study of 829 men with prostate cancer found that post-diagnosis alcohol consumption (≥2 drinks/day) was associated with nearly a twofold increase in prostate cancer-specific mortality (HR: 1.82, 95% CI:1.07-3.10)[15]. A meta-analysis of 27 studies found a positive dose-response relation between the quantity of alcohol and prostate cancer morbidity and mortality[16]. Thus, an increase in physical activity and reduction in BMI, smoking, and drinking, before and after diagnosis, may help reduce the higher mortality rates of prostate cancer among Black men.

Understanding upstream factors that promote these poor health behaviors in Black men both before and after prostate cancer diagnosis will have important implications for improving prostate cancer survival, and ultimately addressing the high mortality rate, in this group. The relationship between adverse experiences in childhood (ACEs) and poor health behaviors in adulthood has been established empirically[17, 18]. The odds of self-reported smoking, being severely obese (BMI≥35), and being an alcoholic are 2.2, 1.6, and 7.8, respectively, among individuals who report ≥4 categories of adverse experiences in childhood compared to those who report no adverse experiences[17]. ACEs are a form of toxic stress in childhood, and when prolonged over time and in the absence of parental or adult support, may become biologically and behaviorally embedded. ACEs are thought to reprogram stress pathways[19]. Foods that are high in fats and carbohydrates and alcohol increase the release of dopamine and Beta-

endorphins and nicotine reduces stress-related anxiety by mediating the mesolimbic dopamine system thus giving rise to feelings of relaxation and reducing anxiety[20--27].

Health behaviors associated with ACEs do not occur in a vacuum. Most studies of ACEs do not take into consideration their interactions with the neighborhood environment, as the neighborhood environment may modify the effects of ACEs[28]. Black men are more likely to live in highly racially and economically segregated and highly deprived neighborhoods than White men. Neighborhoods create opportunities to develop poor health behaviors. Racial residential segregation, a form of structural racism and a fundamental cause of racial health disparities plays a role in modifying health behaviors[29,30]. Low-income predominantly Black neighborhoods are associated with a higher prevalence of cheap, in some cases, culturally marketed fast food, tobacco, and alcohol outlets[31-34]. They are also associated with higher rates of violence which disrupt social cohesion and create social norms promoting the acceptability of smoking and drinking[35]. Living in highly segregated and economically deprived neighborhoods are associated with higher rates of late-stage prostate cancer and higher rates of prostate cancer-specific mortality[36-38]. Affluent neighborhoods may help mitigate the deleterious effects of early life trauma while poor neighborhoods may exacerbate their effects. Consequently, interventions that aim to address individual experiences of ACEs without also addressing the larger neighborhood context may be ineffective.

To better understand the potential joint effects of ACEs and neighborhood segregation, I am using the environmental affordances model to guide my analysis. This model attempts to explain the interplay of individual stress, structural factors, and health behaviors to elucidate drivers of poor health outcomes among Black Americans[39]. The environmental affordance model posits that: 1) environmental context is a source of stress; 2) coping behaviors are shaped by larger social and cultural norms, and by contextual factors; and 3) when organisms experience

immediate stress, they try to minimize the effects of that stressful experience[40]. Mezuk et al argue that individuals who are socially disadvantaged experience stress from the social environment and that these same environments provide health-related coping strategies (e.g., tobacco use, alcohol intake, fast food intake). These coping efforts are effective in protecting mental health in the immediate term, but in the long term, this may result in poor physical health outcomes such as obesity and chronic illness in middle and late life[39].

Black men bear a persistently high burden of prostate cancer mortality and are two times more likely to die from prostate cancer than White men. Therefore, the survivorship period is critical for improving mortality outcomes in this population. Health behaviors after a prostate cancer diagnosis are also associated with survival[3-7]. The environmental affordances model may offer a useful framework for understanding how the joint outcomes of early life adversity and environmental context may shape later life behaviors among Black men. Racial residential segregation may also be an important modifier of the association between ACEs and later-life health behaviors as highly segregated low-income neighborhoods have fewer opportunities for purchasing healthy foods and fewer green spaces for physical activity and more opportunities for purchasing alcohol and tobacco products.

Aims

This study therefore, aims to 1) examine the association between adverse childhood experiences and health behavior in adult life, including alcohol use, cigarette smoking, BMI, and physical activity in Black men with prostate cancer; and 2) to determine whether the association of adverse childhood experiences with health behaviors in adult life among Black men with prostate cancer is modified by coping style, neighborhood racial segregation as measured using neighborhood typology, and neighborhood socioeconomic status. I hypothesize that a) Black men with ≥4 adverse experiences in childhood will have higher odds of problem drinking,

cigarette smoking and obesity, and will not meet physical activity recommendations; and b) coping style as measured by the environmental affordances model and the John Henryism scale ; and (c) living in less racially segregated neighborhoods, and higher SES neighborhoods will attenuate the relationship between adverse childhood experiences and adult alcohol use, tobacco use, BMI, and physical activity.

METHODS

Data

RESPOND is a population-based national study of Black men with prostate cancer, recruited primarily from population-based cancer registries (e.g., state registries of California, Louisiana, Georgia, Texas, New York, and the Detroit, Michigan registry), but also through community and outreach efforts. Eligible participants were men aged 21 years and older, diagnosed with first primary histologically confirmed prostate cancer between 2015-2020, and self-identified as Black. Participation in the RESPOND Study provided information on a variety of exposures including lifestyle factors, social stressors, and access to healthcare via a self-administered survey by mail, internet, or phone. Recruitment began in 2018 and recently concluded; this analysis used an interim sample of participants diagnosed 2015-2018.

Measures

ACEs

The ACEs scale based on the Centers for Disease Control and Prevention (CDC) was adapted slightly based on focus groups of Black prostate cancer survivors. The scale included six categories of family dysfunction and three categories of abuse before the age of 18. Participants were asked: “Did you live with anyone who was depressed?”; “Did you live with anyone who was a problem drinker or alcoholic?”; “Did you live with anyone who used illegal street drugs or who abused prescription medications?”; “Did you live with anyone who served time or was

sentenced to serve time in a prison, jail, or other correctional facility?"; "Were your parents separated or divorced?"; "How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?"; "How often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking."; "How often did a parent or adult in your home ever swear at you, insult you, or put you down?"; How often did anyone at least 5 years older than you or an adult, ever touch you sexually?"; "How often did anyone at least 5 years older than you or an adult, try to make you touch them sexually?"; and "How often did anyone at least 5 years older than you or an adult, force you to have sex?" Response options for the family dysfunction categories were no, yes, don't know/not sure, and prefer not to answer. Response options for the abuse questions included frequency of adverse experience (i.e., never, once, more than once). The three questions that measured facets of sexual abuse were collapsed into one category. In this analysis, responses were scored 1 if participants answered affirmatively regardless of frequency and 0 if they responded no or never. Responses of don't know/not sure and prefer not to answer were excluded from the analysis. Responses were then summed across all categories with a minimum score of 0 and a maximum score of 9. ACEs were then further categorized as 0, 1-3, and ≥4 experiences.

Smoking

Data on smoking history was ascertained from the survey. Participants were asked, "Have you ever smoked at least 100 cigarettes in your lifetime?" Response options were: yes or no, and those responding yes were further asked, "How many cigarettes do you (or did you) usually smoke per day?" Response options were: 1-5, 6-10, 11-20, 21-30, and 31+. Participants were categorized as ever vs. never smokers. Among smokers, participants were further categorized by smoking type, light smokers (≤10 cigarettes per day) vs. moderate/heavy smokers (>10 cigarettes per day). Although there are no safe levels of smoking and there is no consensus on

the definition of light smoking, these cut-points are based on commonly used cut-points in the smoking literature[40].

Alcohol use

Participants were asked, “In the past month, about how often do you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage, or liquor?” One drink is equivalent to a 12 oz beer, a 5 oz glass of wine, or a drink with one shot of liquor. Response options were: every day (7 days per week), 5-6 times per week, 3-4 times per week, 1-2 times per week, fewer than once per week, and did not drink (non-drinker). Participants were also asked, “When you drank during the past month, how many drinks do you have on a typical occasion?” Response options were 3 or more drinks, 1-2 drinks, and did not drink. It is generally recommended that men limit their alcohol use to no more than 2 drinks per day[41]. There is some evidence that excess alcohol use is associated with increased prostate cancer and progression to metastatic prostate cancer, so in addition to alcohol quantity and frequency, I constructed a variable for excess alcohol use. The Centers for Disease Control (CDC) and the Substance Abuse and Mental Health Services Administration (SAMHSA) define binge drinking as 5 or more drinks for a man on the same occasion on at least 1 day in the past 30 days. The National Institutes of Alcohol Abuse and Alcoholism (NIAAA) defines excess drinking as 4 or more drinks on any given day. Using these definitions and based on the survey response options, I defined excess alcohol use as drinking 3 or more drinks on a typical occasion in the past 30 days.

Body size

Height and weight were obtained from the survey to construct BMI (weight in kilograms divided by squared height in meters). Standard cut-points were used to categorize participants as obese (≥30) and not obese (<30) and morbidly obese (≥40) and not morbidly obese (<40) in the final models.

Physical activity

Participants were asked, “How many days per week do you typically get moderate or strenuous exercise (such as heavy lifting, shop work, construction or farm work, home repair, gardening, bowling, golf, jogging, basketball, riding a bike, etc.)?” Response options were 5-7 times per week, 3-4 times per week, 1-2 times per week, and less than once per week/do not exercise. Participants were further asked, “On those days that you do moderate or strenuous exercise, how many minutes did you typically exercise at this level?” Response options were less than 30 minutes, 30 minutes – 1 hour, more than 1 hour, and do not exercise. Responses were recategorized based on the CDC physical activity recommendation of at least 150 minutes of moderate-intensity aerobic physical activity. Using this definition and based on survey response options, respondents were categorized as met physical activity recommendation (yes) if they reported exercising 30 minutes or more, 3 or more times per week, and categorized (no) if they did not.

Covariates

Potential covariates include age modeled as a continuous variable; completed education categorized as less than high school, high school graduate or GED, vocational/some college, and college graduate or more. Participants were recruited from cancer registries in California, Louisiana, Georgia, Texas, New York, and Detroit, Michigan. For this analysis, states were restricted to include only Georgia, California, Michigan, and Louisiana. Marital status was categorized as married/partnered, separated/divorced, widowed, and never married. Total family income was categorized as less than $15,000, $15,000-$35,999, $36,000-$45,999, $46,000-$65,999, $66,000 to $99,999, and $100,000 or more. Employment status was categorized as retired, full-time employed, part-time employed, and other. To capture financial hardship in early life including up to age 30, participants were asked, “How worried were you or your family about

being able to pay your normal monthly bills, including rent, mortgage, and/or other costs?", with response options of: not at all worried, a little worried, somewhat worried, and very worried. Childhood socioeconomic status was measured as father's and mother's highest level of completed education and was categorized as less than high school, high school grad/GED, vocational training/some college, and college grad or more.

Effect modifiers

The John Henryism coping scale assesses a person's perceived ability to control their environment through high-effort active coping and is associated with hypertension, self-reported physical health, and allostatic load among Black men[42]. In the RESPOND survey, participants were instructed, "These statements are about how you currently see yourself. Indicate your level of agreement or disagreement with each statement": 1) You've always felt that you could make of your life pretty much what you wanted to make of it; 2) Once you make up your mind to do something, you stay with it until the job is completely done; 3) You like doing things that other people thought could not be done; 4) When things don't go the way you want them to, that just makes you work even harder; 5) Sometimes, you feel that if anything is going to be done right, you have to do it yourself; 6) It's not always easy, but you manage to find a way to do the things you really need to get done; 7) Very seldom have you been disappointed by the results of your hard work; 8) You feel you are the kind of individual who stands up for what he believes in, regardless of the consequences; 9) In the past, even when things got really tough, you never lost sight of your goals; 10) It's important for you to be able to do things the way you want to do them rather than the way other people want you to do them; 11) You don't let your personal feelings get in the way of doing a job; 12) Hard work has really helped you to get ahead in life. Response options for all statements were strongly disagreed, somewhat disagree, somewhat agree, and strongly agree. Response options were reverse-coded and summed across all statements. Responses ranged from a minimum score of 12 and a maximum score of 48. A

median split was used to generate a binary variable for John Henryism (high vs. low). Cronbach's alpha was used to assess internal consistency[43].

Neighborhood SES was generated using methods created by both Yost et al and Yang et al[44]. The neighborhood SES index is composed of census tract level measures of socioeconomic status including % in poverty, education, median household income, median rent, median house value, % employed, and % blue collar employees[44]. Neighborhood SES was categorized in quintiles with quintile 1 representing the lowest SES and quintile 5 representing the highest SES. Most studies of racial segregation that assess Black health have focused largely on Black individuals living in largely Black neighborhoods. Very little is known of the effects of living in majority White or mixed-race neighborhoods on the health behaviors or health outcomes of Black individuals living in these types of neighborhoods. For this analysis, I am employing neighborhood typologies created by Joseph Gibbons to assess the joint effects of adverse childhood experiences and neighborhood racial segregation[45]. Gibbon's typology neighborhood types include predominantly White, predominantly Black, predominantly other, and mixed community. Predominantly White neighborhoods are defined as those with at least 60% White residents and minority groups represent no more than 20% of the neighborhood. Predominantly Black neighborhoods are defined as those with at least 50% Black residents and other races represent no more than 20% of the neighborhood. Predominantly other neighborhoods are those with at least 50% other races and Black residents do not make up more than 20% of the neighborhood. Mixed communities are those with no more than 50% white, Black, or other races[45].

Analysis

For this study, the primary analysis was restricted to Black men who completed the RESPOND questionnaire between 2018 and 2021, who were non-missing for all 12 statements that made

up the ACEs scale, and for whom neighborhood contextual factors (neighborhood SES and Gibbon's typologies) were available (N=3,104).

Separate logistic regression models were used to estimate ORs and 95% confidence intervals for the association between ACE scores and categories of alcohol use, smoking status, BMI, and physical activity. Independent models were conducted for each outcome. Covariates in the final model were selected *a priori* based on theory. Effect modification by active coping, neighborhood SES, and neighborhood typology were tested using interaction terms. All analyses were conducted in Stata15 (College Station, TX)[46].

RESULTS

Table 3.1 displays the demographic characteristics and cancer-related health behaviors of the total study sample and according to different categories of ACEs. Among the total study sample (n= 3,104), Black men diagnosed with prostate cancer had an average age of 67.3 (SD:6.8). The highest proportion of participants were from Georgia (50.7%), married or partnered (65.2%), retired (51.2%), had vocational training or some college education (34.8%), and approximately 20% reported a total household income of $100,000 or more. Respondents reported low levels of parental education and nearly half of respondents reported not being worried about their family being able to pay their normal monthly bills, including, rent, mortgage, and/or other costs from childhood up through age 30. Regarding cancer-related health factors, 39.4% of respondents were obese (BMI ≥30) and 4.3% were morbidly obese (BMI≥40). Nearly half of respondents (46.4%) reported ever smoking, of which 24.2% reported smoking 1-20 cigarettes per day, and 33.4% met the definition of moderate/heavy smokers (>10 cigarettes per day). Two-thirds of respondents reported either not drinking in the past month or drinking less than once per week. Among respondents who reported drinking in the past month, 42.8% reported drinking less than 2 drinks per drinking session.

Only 8.6% of respondents met the definition of problem drinking. A quarter of respondents reported not exercising or exercising less than once per week, 45.7% reported moderate or strenuous exercise 3-4 times per week, and 40.7% reported 30 minutes to 1 hour of moderate or strenuous exercise. Only 38.9% met the physical activity recommendations (**Table 3.1**).

Approximately 35.5% of respondents reported experiencing zero (0) ACES, while 24.7% reported one, 15.4% reported two, 11.0% reported three, and 13.3% reported four or more ACEs. Compared to respondents who reported no ACEs, respondents who reported 4+ ACEs were younger, had more personal and parental education, and had higher income, (**Table 3.1**). A higher proportion of respondents who reported 4+ ACES report being ever smokers, drinking more frequently, having more drinks per session, and meeting the definition of problem drinking than respondents with 0 ACEs (**Table 3.1**).

Table 3.1 also displays the distribution of coping style, neighborhood socioeconomic status, and neighborhood typology in the full sample as well as the differences in coping style, neighborhood socioeconomic status, and neighborhood typology between men in different categories of ACEs. The Cronbach's alpha for the John Henryism scale was 0.80. Nearly half (49.1%) of respondents scored in the high range of the scale. A larger percentage of men in the 0 ACEs group scored high on the John Henryism scale (54.1%) compared to men in the 4+ ACEs group (41.3%). Respondents were more likely to live in a mixed White and Black neighborhood (35.1%) followed by a predominately Black neighborhood (27.6%). Men in the 4+ ACEs group were more likely to live in high SES and mixed other neighborhoods compared to men in the 0 ACEs group.

The adjusted odds ratios (AOR) for the relationship between ACEs and cancer-related factors are represented in **Table 3.2**. Adjusting for age, education, parental education, marital status, employment, total household income, and state of residence, ACEs were associated with increased odds of ever smoking only. Compared to men who reported 0 ACES, the odds of ever smoking were 1.36 (95%CI: 1.07-1.73) and 1.75 (95%CI: 1.25-2.46), among men who reported 1-3 ACEs and 4+ ACES, respectively. ACEs were not associated with smoking type, obesity, alcohol use, or physical activity (**Table 3.2**).

Table 3.3 shows the results of interactions between ACEs, coping style, and neighborhood SES. Compared to men with 0 ACEs, low John Henryism, and who live in low nSES neighborhoods, men with no ACEs who scored score high on the John Henryism scale and live in low SES neighborhoods have increased odds of meeting the physical activity recommendation (AOR=2.79, 95% CI: 1.64-4.73). Men who have 0 ACEs, scored high on John Henryism, and live in high SES neighborhoods also have increased odds of meeting the physical activity recommendation (AOR=1.90, 95% CI: 1.07-3.38). Similarly, men who have 1-3 adverse childhood experiences and scored high on John Henryism have increased odds of meeting the physical activity recommendation (AOR=1.90, 95% CI: 1.36-2.65). Higher odds of meeting the physical activity recommendation are seen among men who reported 1-3 ACEs irrespective of coping style or neighborhood SES (**Table 3.3**). There were no interactions between ACEs and neighborhood typology (**Table 3.4**).

DISCUSSION

In this national sample of Black men diagnosed with prostate cancer, adverse experiences in childhood had the greatest influence on smoking. Individuals are more likely to adopt risky health behaviors such as smoking to deal with the stress associated with ACES. Although smoking provides an immediate sensation of relaxation nicotine is addictive and may lead to lifelong use. Another finding is that neighborhood SES appears to modify the relationship between ACEs and physical activity. It is known that the neighborhood environment is important for adopting healthy behaviors. Finally, men with high John Henryism - a form of active coping - had higher odds of meeting the physical activity recommendations regardless of adverse experiences and neighborhood SES indicating that coping style is important for adopting cancer-related health behaviors.

Black men are more vulnerable than White men to developing health behaviors that put them at higher risk for prostate cancer morbidity and mortality. Despite smoking fewer cigarettes per day, Black men have more quit attempts and are more likely to become lifelong smokers than White men[47]. Smoking status alone accounts for a larger fraction of all-cause mortality among Black men over 50 compared to White men[48]. Black men are more likely to be obese (BMI≥30) and morbidly obese (BMI ≥40) than their White counterparts, and obesity may differentially affect Black men[49]. For example, a prospective cohort study found that higher BMI was strongly associated with increased incidence of prostate cancer among Black men but not among White men[50].

Despite initiating drinking at a later age and having lower overall drinking rates, compared to White men, Black men are more likely to “telescope”, that is go from regular alcohol use to alcohol dependence[51], and to report alcohol dependence[51]. They are also less likely to experience the health benefits associated with moderate drinking (e.g. antioxidants associated

with red wine drinking), and are less likely to get help for alcoholism than their White counterparts[52-55].

Overall, Black Americans have the second highest prevalence of physical inactivity in the U.S.; 23 states have a physical inactivity prevalence of 30% or more among Black adults[56]. A study that assessed physical activity among Black Americans using four national surveys found that 45% to 52% of Black men met physical activity guideline recommendations. Furthermore, there was a significant decline in physical activity as Black men aged; 66% of men 25-44 reported physical activity compared to 22% of men ≥65. Physical activity is socioeconomically patterned with men of higher education reporting a higher percentage of physical activity[57].

There are racial/ethnic disparities in exposure to ACEs. Nationally, 61% of Black non-Hispanic children experience at least one ACE compared to 51% of Hispanic children, 40% of White non-Hispanic children, and 23% of Asian non-Hispanic children[58]. Compared to their white counterparts, Black boys are more likely to have a parent or guardian who is separated or divorced; to have a parent or guardian who has died; to have a parent or guardian who is currently or formerly incarcerated; to witness domestic violence; and to be victimized and placed in child protective services[59]. Higher rates of adverse experiences are linked to higher economic disadvantage and historic racism among Black Americans[60-62] Black men who initiate and continue smoking, drinking, and unhealthy eating as a coping mechanism to early life trauma may be less able to regulate these behaviors either before or after a prostate cancer diagnosis.

Limitations

There are several limitations to this study; 1) this is a cross-sectional study therefore we cannot determine causality between ACEs and health behaviors. 2) Men self-reported height which may be overreport in this sample; men are more likely to report being taller than they are and

this measure was not validated in the RESPOND study. 3) The sample may not be representative. Although respondents were sampled from multiple states and across four regions, the RESPOND sample consists of men who are highly advantaged socioeconomically compared to the larger Black male population in the United States. 4) All variables were collected contemporaneously including neighborhood factors; temporality may be an issue. 5) Reporting of ACEs may have been impacted by cancer diagnosis. Men in this study may attribute their cancer diagnosis and subsequently their cancer behaviors to ACEs. If so, there may be non-differential misclassification of the exposure and overestimation of the true association between ACEs and cancer-related behaviors. However, it is unlikely that participants were aware of the study hypothesis and any studies linking cancer outcomes to ACEs.

Conclusions

The findings of this study suggest that adverse childhood experiences influence smoking in adulthood and that both neighborhood SES and coping style modify the relationship between ACEs and physical activity. Previous studies have exclusively assessed the impacts of ACEs and neighborhood SES and/or neighborhood segregation independently limiting our understanding of their joint impact. Future studies should explore mechanisms through which the joint effects of adverse childhood experiences and neighborhood SES and/or neighborhood racial segregation influence cancer-related health behaviors.

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Table 3.1: Demographic characteristics, cancer-related health factors, and neighborhood characteristics by number of adverse childhood experiences (ACEs) among Black men diagnosed with prostate cancer, RESPOND study, 2018-2021, N=3,104

	Full sample (n=3,104)	No ACEs (n=1,101)	1-3 ACEs (n=1,586)	4+ ACEs (n=417)	p-value
Age in years, mean (SD)	67.3(6.8)	68.2(6.8)	67.4(6.8)	64.9(6.3)	P<.001
Age in years, %					
Less than 60	13.0	10.8	12.7	19.8	P<.001
60-69	45.7	42.8	45.1	55.2	
70 or older	41.4	46.5	42.3	25.0	
Education, %					
Less than high school	11.5	13.4	9.7	13.3	P<.05
High school graduate or GED	26.2	31.0	25.8	15.7	
Vocational/Some college	34.8	29.2	36.9	41.5	
College graduate or more	27.4	26.3	27.6	29.5	
Father's education, %					
Less than high school	55.0	58.7	52.5	55.0	P<.05
High school graduate or GED	27.0	25.0	29.2	23.9	
Vocational/Some college	10.3	8.1	10.7	14.5	
College graduate or more	7.7	8.2	7.7	6.6	
Mother's education, %					
Less than high school	42.1	46.4	40.1	39.9	P<.05
High school graduate or GED	34.5	32.1	36.1	34.1	
Vocational/Some college	13.3	11.4	14.2	14.5	
College graduate or more	10.0	10.2	9.6	11.5	
Total household income, %					
Less than $15,000	15.4	18.5	13.7	14.5	P<.05
$15,000 to $35,999	19.9	21.2	19.5	18.3	
$36,000 to $45,999	11.2	10.1	12.0	10.9	
$46,000 to $65,999	16.1	16.8	15.9	14.7	
$66,000 to $99,999	16.8	15.4	18.1	15.0	
$100,000 or more	20.6	18.1	20.7	26.7	
How worried were you or your family about being able to pay your normal monthly bills? During young adult life (up to age 30):					
Not at all worried	47.2	52.9	46.2	36.7	P<.001
A little worried	26.5	25.0	27.5	26.8	
Somewhat worried	17.9	15.5	18.2	22.4	
Very worried	8.4	6.6	8.2	14.1	

	Full sample (n=3,104)	No ACEs (n=1,101)	1-3 ACEs (n=1,586)	4+ ACEs (n=417)	p-value
State, %					
Georgia	50.7	54.6	51.0	39.8	P<.001
California	26.1	21.0	26.8	37.2	
Louisiana	15.4	18.9	13.7	12.5	
Michigan	7.8	5.5	8.6	10.6	
Marital Status, %					
Married/partnered	65.2	67.0	64.8	62.2	P=.50
Separated/divorced	19.2	18.2	19.6	20.0	
Widowed	6.3	6.9	6.3	5.1	
Never married	9.3	8.0	9.4	12.7	
Employment Status, %					
Retired	51.2	53.8	52.5	39.6	P<.01
Full-time employed	25.3	22.9	25.4	31.2	
Part-time employed	5.5	5.3	5.3	6.9	
Unemployed	1.6	1.9	1.4	1.8	
Other	16.4	16.2	15.5	20.5	
Obese (body mass index ≥30)					
Yes	39.4	40.2	38.7	59.8	P=.75
No	60.6	59.8	61.3	40.2	
Morbidly obese (body mass index ≥40)					
Yes	4.3	3.9	4.7	4.2	P=.81
No	95.7	96.1	95.4	95.8	
Have you ever smoked at least 100 cigarettes in your lifetime?					
Yes	46.5	42.1	47.8	53.0	P<.001
No	53.5	57.9	52.2	47.0	
How many cigarettes do you (or did you) usually smoke per day?					
1-5	36.3	42.6	34.2	30.4	P<.01
6-10	31.1	27.2	32.5	34.1	
11-20	24.2	22.5	24.1	28.0	
21-30	6.1	6.3	5.9	6.5	
31+	2.3	1.3	3.3	0.9	
Smoking type					
Light smoker	66.6	68.7	66.1	64.0	P=.47
Moderate/heavy smoker	33.4	31.3	33.9	36.0	

	Full sample (n=3,104)	No ACEs (n=1,101)	1-3 ACEs (n=1,586)	4+ ACEs (n=417)	p-value
In the past month, about how often do you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage, or liquor? One drink is equivalent to a 12 oz beer, a 5 oz glass of wine, or a drink with one shot of liquor.					
Did not drink	46.4	50.2	45.1	41.5	
Fewer than once per week	18.6	18.9	18.9	16.8	P<.01
1-2 times per week	14.7	13.3	15.3	16.3	
3-4 times per week	11.5	10.4	11.7	13.4	
5-6 times per	4.0	2.7	4.3	6.6	
Everyday	4.7	4.4	4.7	5.4	
When you drank during the past month, how many drinks do you have on a typical occasion?					
Did not drink	47.7	51.6	46.1	43.7	P<.01
<2 drinks per session	42.8	39.5	44.7	44.2	
3 or more drinks per session	9.5	8.9	9.2	12.2	
Excess drinking					
Yes	8.6	8.2	8.0	11.9	P<.04
No	91.4	91.8	92.0	88.1	
How many days per week do you typically get moderate or strenuous exercise (such as heavy lifting, shop work, construction or farm work, home repair, gardening, bowling, golf, jogging, basketball, riding a bike, etc.)?					
No exercise/<once per week	25.2	27.1	25.5	19.6	
1-2 times per week	29.1	29.2	27.8	34.1	P=.06
3-4 times per week	29.2	27.4	30.2	30.0	
5-7 times per week	16.4	16.4	16.5	16.3	
On those days that you do moderate or strenuous exercise, how many minutes did you typically exercise at this level?					
Do not exercise	18.6	21.7	17.6	14.4	
Less than 30 minutes	18.3	17.6	18.5	19.2	P<.01
30 min-1 hour	40.7	41.0	39.9	43.1	
More than 1 hour	22.4	19.7	24.1	23.3	
Met physical activity recommendation					
Yes	38.9	36.5	40.6	38.3	P=.13
No	61.2	63.5	59.4	61.7	

	Full sample (n=3,104)	No ACEs (n=1,101)	1-3 ACEs (n=1,586)	4+ ACEs (n=417)	p-value
John Henryism, %					
Low John Henryism	50.9	45.9	52.3	58.8	P<.001
High John Henryism	49.1	54.1	47.7	41.3	
Neighborhood Socioeconomic Status, %					
Q1 (low SES)	22.4	24.4	21.1	22.1	
Q2	20.4	21.9	21.1	13.9	P<.01
Q3	19.9	19.6	19.3	23.0	
Q4	23.6	20.4	25.0	26.4	
Q5 (high SES)	13.7	13.6	13.5	14.6	
Neighborhood typology, %					
Mixed White and Black	35.1	40.1	33.5	28.1	
Predominantly Black	27.6	26.3	28.7	26.4	P<.001
Mixed other	22.7	18.9	23.5	30.0	
Predominantly White	8.7	8.9	8.4	9.4	
Mixed Hispanic and Black	5.9	5.8	5.9	6.2	

Table 3.2: Multivariate logistic regression for the relationship between the number of adverse childhood experiences and cancer-related health behaviors among Black men diagnosed with prostate cancer, 2018-2021, RESPOND, N=3,104

Health behaviors	ACE count (reference category: 0 ACEs)	
	1-3 ACEs AOR (95%CI)	4+ ACEs AOR (95%CI)
Obese (BMI≥30)	0.82(0.64-1.05)	0.85(0.60-1.22)
Morbidly obese (BMI≥40)	0.76(0.44-1.40)	0.67(0.29-1.54)
Ever smoker	**1.36(1.07-1.73)***	**1.75(1.25-2.46)***
Moderate/heavy smoker	1.13(0.87-1.47)	1.23(0.86-1.76)
Current drinking	1.21(0.96-1.52)	1.18(0.85-1.63)
Excess drinking	1.00(0.66-1.51)	1.05(0.60-1.84)
Met physical activity recommendation	1.22(0.96-1.56)	1.06(0.75-1.49)

Table 3.3: Effect modification of the relationship between the number of adverse childhood experiences and cancer-related health behaviors by John Henryism coping style, and neighborhood SES among Black men diagnosed with prostate cancer, 2018-2021, RESPOND, N=3,104

	Obese (BMI≥30)	Morbidly obese (BMI≥40)	Ever smoker	Moderate/heavy smoker	Current drinking	Excess drinking	Met physical activity recommendation
	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)
ACE x John Henryism X nSES							
0 x low JH x low nSES(ref.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0 x low JH x high nSES	0.87(0.47-1.61)	0.49(0.12-1.95)	0.85(0.46-1.57)	1.00(0.38-2.64)	0.68(0.39-1.20)	0.60(0.20-1.79)	1.32(0.70-2.50)
0 x high JH x low nSES	0.73(0.44-1.22)	0.37(0.12-1.15)	0.67(0.41-1.09)	0.63(0.29-1.37)	0.73(0.46-1.17)	0.42(0.19-0.96)	2.79(1.64-4.73)**
0 x high JH x high nSES	0.76(0.43-1.34)	0.25(0.05-1.24)	0.79(0.46-1.36)	0.43(0.17-1.08)	1.15(0.68-1.95)	0.64(0.26-1.58)	1.90(1.07-3.38)*
1-3 x low JH x low nSES	0.74(0.46-1.18)	0.27(0.09-0.79)	1.45(0.92-2.31)	0.84(0.42-1.65)	0.89(0.57-1.38)	0.67(0.33-1.34)	1.38(0.83-2.32)
1-3 x low JH x high nSES	0.59(0.36-0.97)	0.53(0.20-1.44)	0.84(0.52-1.34)	0.85(0.40-1.81)	1.23(0.77-1.97)	0.63(0.29-1.37)	1.88(1.12-3.15)*
1-3 x high JH x low nSES	0.74(0.46-1.18)	0.73(0.31-1.76)	1.12(0.71-1.76)	0.80(0.41-1.57)	0.85(0.55-1.31)	0.66(0.33-1.33)	2.69(1.64-4.42)**
1-3 x high JH x high nSES	0.64(0.39-1.07)	0.13(0.03-0.62)	0.98(0.60-1.61)	0.59(0.27-1.30)	1.17(0.72-1.91)	0.51(0.22-1.17)	2.66(1.56-4.52)**
4 x low JH x low nSES	0.83(0.44-1.59)	0.26(0.05-1.35)	1.68(0.92-3.08)	1.56(0.66-3.66)	0.99(0.55-1.77)	0.75(0.31-1.82)	1.23(0.63-2.40)
4 x low JH x high nSES	0.77(0.39-1.50)	0.51(0.12-2.10)	1.64(0.84-3.20)	0.83(0.31-2.24)	0.96(0.50-1.84)	0.27(0.06-1.25)	1.72(0.85-3.47)
4 x high JH x low nSES	0.59(0.27-1.27)	0.46(0.11-1.96)	1.39(0.67-2.90)	1.06(0.34-3.25)	0.88(0.43-1.80)	1.12(0.41-3.10)	2.36(1.10-5.08)*
4 x high JH x high nSES	0.68(0.32-1.42)	0.20(0.02-1.74)	1.23(0.61-2.49)	0.67(0.20-2.19)	1.33(0.66-2.70)	0.67(0.21-2.18)	1.90(0.92-3.93)

Table 3.4: Effect modification of the relationship between the number of adverse childhood experiences and cancer-related health behaviors by neighborhood typology among Black men diagnosed with prostate cancer, 2018-2021, RESPOND, N=3,104

	Obese (BMI≥30)	Morbidly obese (BMI≥40)	Ever smoker	Moderate/heavy smoker	Current drinking	Excess drinking	Met physical activity recommendation
	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)
ACE x neighborhood typology							
0 x predominantly White (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0 x predominantly Black	0.68(0.34-1.39)	3.44(0.39-30.1)	0.78(0.39-1.57)	0.88(0.29-2.64)	0.84(0.43-1.64)	0.57(0.13-2.47)	0.63(0.30-1.30)
0 x mixed Black and White	0.75(0.38-1.48)	1.75(0.19-15.7)	0.63(0.33-1.23)	0.78(0.27-2.29)	0.66(0.35-1.25)	0.89(0.24-3.33)	1.12(0.57-2.19)
0 x mixed other	0.62(0.30-1.29)	2.60(0.28-24.3)	0.83(0.41-1.67)	0.84(0.27-2.61)	1.27(0.64-2.50)	2.18(0.57-8.36)	1.27(0.63-2.57)
1-3 x predominantly Black	0.61(0.32-1.19)	2.18(0.26-18.3)	0.86(0.45-1.64)	0.96(0.34-2.69)	0.81(0.43-1.50)	0.75(0.20-2.81)	1.25(0.65-2.40)
1-3 x predominantly White	0.52(0.24-1.15)	0.59(0.03-10.2)	0.91(0.42-1.97)	2.11(0.63-7.03)	0.91(0.44-1.91)	1.24(0.27-5.63)	1.72(0.80-3.73)
1-3 x mixed Black and White	0.62(0.33-1.19)	2.12(0.26-17.4)	1.17(0.62-2.20)	0.93(0.35-2.50)	1.05(0.57-1.93)	1.45(0.41-5.10)	1.02(0.53-1.93)
1-3 x mixed other	0.54(0.28-1.07)	1.44(0.16-13.2)	1.06(0.54-2.07)	0.62(0.21-1.82)	1.29(0.67-2.45)	0.94(0.25-3.61)	1.31(0.67-2.56)
4 x predominantly Black	0.50(0.20-1.21)	3.20(0.29-34.8)	1.26(0.55-2.87)	1.05(0.30-3.71)	0.95(0.42-2.11)	1.49(0.33-6.65)	1.21(0.53-2.78)
4 x predominantly White	0.69(0.24-1.98)	1.46(0.08-26.7)	0.84(0.29-2.38)	0.47(0.07-3.21)	1.54(0.55-4.32)	0.88(0.13-6.02)	0.75(0.27-2.11)
4 x mixed Black and White	0.57(0.25-1.29)	1.52(0.14-16.4)	1.50(0.68-3.31)	1.22(0.37-3.97)	0.93(0.43-1.99)	0.72(0.15-3.49)	0.72(0.31-1.67)
4 x mixed other	0.73(0.34-1.57)	0.77(0.06-9.89)	1.68(0.78-3.61)	1.52(0.46-5.02)	1.16(0.56-2.42)	1.50(0.36-6.22)	1.24(0.58-2.67)

Appendix Table 1.1: Lifetime physical and sexual abuse and odds of BMI ≥30 in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.23(1.14-1.34)	**1.19(1.08-1.30)**
Adolescence only	1.30(1.09-1.55)	**1.29(1.06-1.58)**
Adulthood only	1.14(1.02-1.27)	1.08(0.95-1.23)
Childhood and adolescence	1.39(1.23-1.56)	**1.41(1.23-1.63)**
Childhood and adulthood	1.48(1.18-1.87)	**1.51(1.16-1.96)**
Adolescence and adulthood	1.22(0.94-1.58)	1.21(0.89-1.65)
All 3 life stages	1.55(1.30-1.84)	**1.38(1.12-1.70)**

Appendix Table 1.2: Lifetime physical and sexual abuse and odds of WHR ≥.85 in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.00(0.91-1.10)	0.99(0.89-1.11)
Adolescence only	1.12(0.92-1.37)	1.14(0.91-1.43)
Adulthood only	1.21(1.07-1.37)	1.09(0.94-1.25)
Childhood and adolescence	1.13(0.98-1.30)	1.14(0.97-1.34)
Childhood and adulthood	1.02(0.77-1.33)	0.99(0.73-1.35)
Adolescence and adulthood	1.71(1.27-2.30)	**1.69(1.20-2.39)**
All 3 life stages	1.17(0.96-1.43)	1.20(0.95-1.51)

Appendix Table 1.3: Lifetime physical and sexual abuse and odds of being an ever smoker in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.11(1.03-1.21)	**1.32(1.19-1.46)**
Adolescence only	1.48(1.24-1.77)	**1.71(1.38-2.10)**
Adulthood only	1.63(1.46-1.82)	**1.47(1.29-1.68)**
Childhood and adolescence	1.44(1.27-1.63)	**1.68(1.45-1.94)**
Childhood and adulthood	1.72(1.36-2.16)	**1.70(1.30-2.24)**
Adolescence and adulthood	2.53(1.95-3.29)	**2.36(1.72-3.25)**
All 3 life stages	2.02(1.69-2.40)	**2.13(1.72-2.63)**

Appendix Table 1.4: Lifetime physical and sexual abuse and odds of being an ever drinker in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.07(0.98-1.16)	1.09(0.99-1.20)
Adolescence only	1.35(1.12-1.62)	**1.35(1.09-1.66)**
Adulthood only	1.44(1.28-1.62)	**1.34(1.17-1.53)**
Childhood and adolescence	1.27(1.12-1.44)	**1.32(1.14-1.53)**
Childhood and adulthood	1.57(1.23-2.02)	**1.41(1.07-1.87)**
Adolescence and adulthood	2.04(1.51-2.75)	**1.64(1.16-2.30)**
All 3 life stages	1.66(1.37-2.02)	**1.64(1.31-2.06)**

Appendix Table 1.5: Lifetime physical abuse and odds of BMI ≥30 in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.31(1.18-1.46)	**1.26(1.12-1.42)**
Adolescence only	1.12(0.86-1.45)	1.14(0.84-1.56)
Adulthood only	1.15(1.02-1.30)	1.10(0.95-1.26)
Childhood and adolescence	1.05(0.89-1.24)	1.09(0.90-1.33)
Childhood and adulthood	1.78(1.28-2.46)	**1.81(1.23-2.65)**
Adolescence and adulthood	1.25(0.88-1.79)	1.22(0.80-1.87)
All 3 life stages	1.54(1.21-1.97)	**1.47(1.11-1.96)**

Appendix Table 1.6: Lifetime physical abuse and odds of WHR ≥.85 in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.09(0.96-1.22)	1.07(0.93-1.22)
Adolescence only	1.05(0.77-1.44)	1.09(0.76-1.56)
Adulthood only	1.20(1.05-1.38)	1.08(0.92-1.27)
Childhood and adolescence	1.13(0.93-1.36)	1.10(0.88-1.37)
Childhood and adulthood	0.91(0.62-1.34)	0.88(0.56-1.38)
Adolescence and adulthood	1.30(0.85-1.98)	1.14(0.69-1.89)
All 3 life stages	1.27(0.97-1.66)	**1.42(1.03-1.94)**

Appendix Table 1.7: Lifetime physical abuse and odds of being an ever smoker in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.19(1.07-1.32)	**1.39(1.22-1.58)**
Adolescence only	1.52(1.16-1.98)	**1.95(1.42-2.69)**
Adulthood only	1.81(1.61-2.05)	**1.67(1.44-1.93)**
Childhood and adolescence	1.39(1.18-1.64)	**1.62(1.32-1.98)**
Childhood and adulthood	1.86(1.35-2.57)	**2.11(1.43-3.12)**
Adolescence and adulthood	2.80(1.95-4.01)	**2.67(1.71-4.16)**
All 3 life stages	1.87(1.47-2.38)	**1.95(1.45-2.61)**

Appendix Table 1.8: Lifetime physical abuse and odds of being an ever drinker in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.11(1.00-1.24)	1.14(1.00-1.29)
Adolescence only	1.69(1.26-2.26)	**1.75(1.24-2.47)**
Adulthood only	1.44(1.27-1.64)	**1.37(1.18-1.59)**
Childhood and adolescence	1.18(1.00-1.40)	**1.24(1.01-1.52)**
Childhood and adulthood	1.43(1.01-2.02)	1.32(0.89-1.98)
Adolescence and adulthood	2.39(1.56-3.67)	**1.87(1.15-3.04)**
All 3 life stages	1.89(1.44-2.49)	**1.83(1.32-2.53)**

Appendix Table 1.9: Lifetime sexual abuse and odds of BMI ≥30 in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.38(1.21-1.58)	**1.37(1.17-1.60)**
Adolescence only	1.36(1.04-1.76)	1.33(0.99-1.79)
Adulthood only	1.50(1.12-2.00)	**1.45(1.03-2.03)**
Childhood and adolescence	1.57(1.29-1.91)	**1.46(1.16-1.84)**
Childhood and adulthood	1.50(0.58-3.89)	1.66(0.57-4.84)
Adolescence and adulthood	1.40(0.76-2.58)	0.96(0.42-2.20)
All 3 life stages	1.66(1.01-2.70)	1.18(0.65-2.14)

Appendix Table 1.10: Lifetime sexual abuse and odds of WHR ≥.85 in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.10(0.94-1.28)	1.09(0.92-1.30)
Adolescence only	1.04(0.77-1.41)	1.14(0.82-1.59)
Adulthood only	1.50(1.09-2.07)	1.34(0.93-1.93)
Childhood and adolescence	1.33(1.06-1.67)	**1.37(1.06-1.78)**
Childhood and adulthood	1.39(0.47-4.15)	1.27(0.38-4.23)
Adolescence and adulthood	1.73(0.87-3.42)	2.24(0.89-5.61)
All 3 life stages	2.03(1.19-3.48)	**3.24(1.61-6.51)**

Appendix Table 1.11: Lifetime sexual abuse and odds of being an ever smoker in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	1.08(0.94-1.24)	**1.22(1.04-1.45)**
Adolescence only	1.38(1.06-1.79)	**1.42(1.04-1.95)**
Adulthood only	1.53(1.15-2.03)	1.34(0.94-1.89)
Childhood and adolescence	1.64(1.35-1.99)	**1.97(1.56-2.50)**
Childhood and adulthood	1.30(0.49-3.43)	0.96(0.31-2.97)
Adolescence and adulthood	2.74(1.48-5.07)	2.22(0.96-5.13)
All 3 life stages	1.55(0.96-2.52)	1.45(0.80-2.65)

Appendix Table 1.12: Lifetime sexual abuse and odds of being an ever drinker in adulthood, Black Women's Health Study (2005)

Variable	Unadjusted Odds Ratios	Adjusted Odds Ratios[a]
No abuse across the life span	1.00(reference)	1.00(reference)
Childhood only	0.98(0.85-1.12)	0.93(0.80-1.09)
Adolescence only	0.98(0.75-1.28)	0.86(0.64-1.16)
Adulthood only	1.52(1.11-2.08)	**1.30(0.91-1.85)**
Childhood and adolescence	1.36(1.11-1.68)	**1.34(1.04-1.71)**
Childhood and adulthood	4.6(1.05-20.2)	7.34(0.95-56.6)
Adolescence and adulthood	1.85(0.93-3.69)	1.25(0.53-2.93)
All 3 life stages	0.74(0.46-1.20)	0.78(0.43-1.41)

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