The Association between Hypertension and Race/Ethnicity among Breast Cancer Survivors

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Abstract

Purpose—Hypertension is a significant, modifiable risk factor for cardiovascular disease (CVD). African American women who are diagnosed with early stage breast cancer have a significantly higher risk of premature death due to CVD. The purpose of this study was to examine the association between hypertension and race/ethnicity among breast cancer survivors using data from the National Health and Nutrition Examination Surveys 1999 – 2014.

Methods—Non-Hispanic African American and non-Hispanic White women who were diagnosed with breast cancer were identified. Hypertension was defined as taking medication to treat hypertension, having a systolic blood pressure 140, or a diastolic blood pressure 90. Modified Poisson regression was performed to estimate the prevalence ratios (PR) and corresponding 95% confidence intervals (CI) for race/ethnicity as it relates to hypertension controlling for potential confounders.

Results—Of the 524 breast cancer survivors included in our study, 107 (20.4%) were African American and 417 (80.0%) were White. After adjusting for age, marital status, education, annual household income, health insurance, smoking and drinking status, physical inactivity, obesity, and

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diabetes, African American breast cancer survivors had a 30% higher prevalence of hypertension (PR=1.30 [95% CI: 1.11–1.52]) than White breast cancer survivors.

Conclusions—These results indicate that African American breast cancer survivors have a significantly higher risk of CVD due to hypertension even after controlling for other comorbid conditions such as diabetes and obesity.

Keywords

Breast cancer survivor; health disparities; hypertension

Introduction

African American women who are diagnosed with breast cancer are 42% more likely to die than their non-Hispanic White counterparts due in part to the greater number of comorbid chronic conditions among African American breast cancer survivors [1, 2] [3, 4, 1, 5–7]. African American women who are diagnosed with ductal carcinoma in situ (DCIS) are significantly more likely to die at earlier ages from CVD than from breast cancer [8, 3, 9, 10]. Data from the Surveillance, Epidemiology, and End Results Program of the National Cancer Institute show that the risk of death from cardiovascular disease (CVD) among African American breast cancer survivors is excessively higher than that of their White counter parts (Hazard Ratio 6.43, CI: 3.61–11.45) [3]. The American Heart Association (AHA) has published a scientific statement regarding CVD mortality among breast cancer survivors which highlights the elevated risk of CVD morbidity and mortality among African American breast cancer survivors [11].

The short-term and long-term cardiotoxic effects of chemotherapy and radiation may contribute to the excess CVD mortality among breast cancer survivors [12, 13]. However, hypertension and other modifiable CVD risk factors may moderate the cardiotoxic effects of cancer therapy [14, 11]. Identifying modifiable risks for CVD may enable oncologists to predict cardiotoxicity in breast cancer survivors before they prescribe treatments [12, 13, 11, 14].

However, there is a lack of studies aimed at investigating modifiable factors that contribute to the excess CVD mortality among African American breast cancer survivors. Hypertension is the leading modifiable risk factor for CVDs, including, ischemic heart disease, heart failure, atrial fibrillation, stroke, and hypertensive disease [15, 16]. Breast cancer and hypertension have common risk factors including overweight and obesity, physical inactivity, smoking, excess alcohol consumption, and poor dietary habits [17]. Therefore, determining the prevalence of hypertension among breast cancer survivors is an important step towards identifying population-specific risk factors that contribute to excess avoid CVD deaths among breast cancer survivors.

The purpose of this study was to examine the association between hypertension and race/ethnicity among breast cancer survivors using the data from the 1999 – 2014 National Health and Nutrition Examination Surveys (NHANES) to determine if disparities in the prevalence of hypertension exist between African American and White breast cancer

survivors. We hypothesized that African American breast cancer survivors would have a higher prevalence of hypertension than White breast cancer survivors.

Methods

Design, setting and participant selection

The NHANES is an annual assessment of the health, functional, and nutritional status of a probability sample of non-institutionalized individuals living in the US [18]. Some subgroups of the US population, such as racial and ethnic minorities, and low income Whites, are oversampled to ensure the statistics are reliable [18]. Demographic, socioeconomic, diet, and health-related data was collected during in-home interviews [18]. Medical, dental, and physiological assessments were conducted in mobile examination centers [18]. Data from eight 2-year cycles of the NHANES (1999 – 2014) were used in this study. The NHANES protocol was reviewed and approved by the National Center for Health Statistics Research Ethics Review Board [18]. All NHANES participants provided signed informed consent. Non-Hispanic African American and non-Hispanic White women between the ages of 18 to 85 who reported having been diagnosed with breast cancer were selected for inclusion in this study.

Hypertension

Hypertension was defined according to the guidelines from the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure that were used between 1999 – 2014 [19, 20]. The mean systolic and diastolic blood pressures were calculated for each participant. Participants were categorized as having hypertension if they were taking medication to control their blood pressure, their mean systolic blood pressure was 140, or their mean diastolic blood pressure was 90.

Race/Ethnicity

Race/Ethnicity was our main independent variable. For the NHANES, race/ethnicity was coded as Mexican American, Other Hispanic, non-Hispanic White, non-Hispanic Black, or other non-Hispanic race including non-Hispanic multiracial. For this study we selected women who self-identified as non-Hispanic Black and non-Hispanic White due to the fact that these groups have the highest breast cancer incidence rates in the US.

Health related variables

Health insurance was operationalized as a dichotomous variable, participants who reported having any form of health insurance were categorized affirmatively. Participants who reported that they had not smoked at least 100 cigarettes in their lifetime were categorized as "never smoker." Participants who reported that at the time of the survey they smoked every day or some days were categorized as "current smoker." Participants who smoked at least 100 cigarettes in their lifetime, but were not current smokers were categorized as "former smokers." Participants were categorized as a "non-drinker" if they had not consumed at least 12 alcoholic beverages in their lifetime. Participants were categorized as "current drinker" if they had reported having drank at least 1 alcoholic beverage in the last 12 months. Participants were categorized as "former drinkers" if they reported the consumption of at

least 12 alcoholic beverages in their lifetime, but had not drank any alcoholic beverages within the last 12 months. Physically inactive is a dichotomous variable. The questions used to assess physical activity were changed between the 2006 and 2007 NHANES cycles. Therefore, participants in the 1999 – 2006 NHANES were categorized as physically inactive if they reported not engaging in moderate or vigorous sports, fitness, or recreational activities for at least 10 minutes continuously in the past 30 days. Participants in the 2007 – 2014 NHANES were classified as physically inactive if they reported not engaging in vigorous or moderate sports, fitness, or recreational activities for 10 minutes continuously in a typical week. Obesity is a dichotomous variable. Participants were classified as having obesity if their BMI was 30. Participants were classified as having diabetes if they reported taking medication to control their blood sugar or they reported that they had been diagnosed with diabetes.

Demographic variables

A cancer survivor is defined as someone who has been diagnosed with cancer without regard to the time since diagnosis [21]. Participants were categorized as breast cancer survivors if they self-reported that they had been diagnosed with breast cancer. Marital status is a dichotomous variable, with participants being categorized as "married" or "not married." Education level was categorized according to the highest grade or level of school completed, or the highest degree the participant earned. Categories for educational level were "less than high school graduate," "high school graduate/GED," and "more than high school graduate." Annual household income was categorized as "$34,999 or less," $35,000 to $74,999," or "$75,000 and over."

Analytic Methods

The distribution of demographic and health-related characteristics of African-American and White breast cancer survivors aged 18 and older in NHANES 1999–2014 was calculated using the adjusted Wald test for continuous variables and Pearson Chi-square with a Rao-Scott correction for categorical variables, respectively. The prevalence of hypertension in the sample was greater than 10%. Therefore, we conducted a modified Poisson regression with robust standard errors to estimate prevalence ratios (PR) and corresponding 95% confidence intervals for the relationship between hypertension and race among breast cancer survivors [22, 23]. Three progressively more complex models were specified. Model 1 adjusted for age; model 2 adjusted for variables in model 1 plus marital status, education, and income; and model 3 included the variables in model 2 plus health insurance, smoking status, drinking status, physical inactivity, obesity, diabetes and hypertension. For all analyses, p-values less than or equal to 0.05 were considered statistically significant. All statistical tests were two-sided. All statistical analyses were completed using STATA statistical software, Version 14.

Results

The distribution of the demographic and health-related characteristics of breast cancer survivors for the total sample and by race is displayed in Table 1. Of the 524 breast cancer survivors, 20.4% were African American. The mean age of the total sample was 65.9±0.8

years. The majority of the breast cancer survivors reported: being married, being more than a high school graduate, having insurance, being a current drinker, being physically inactive, and having hypertension. Less than half of the participants reported having an annual household income less than $34,999, being a current smoker, having obesity, or having diabetes. When examining the factors by race, there were no significant differences between African American and White breast cancer survivors as it relates to education, health insurance, or smoking status. However, African American breast cancer survivors were less likely to be married, a current drinker, and physically inactive compared to White breast cancer survivors. African American breast cancer survivors also were more likely to have an annual household income of less than $35,000, and have obesity, diabetes or hypertension than White breast cancer survivors.

Adjusted prevalence ratios for the relationship between race and hypertension among African American and White breast cancer survivors are shown in Table 2. In model 1, which was adjusted for age, African American breast cancer survivors had a 52% (PR=1.52 [95% CI: 1.32–1.75]) higher prevalence of hypertension than White breast cancer survivors. When accounting for demographic variables in model 2, African American breast cancer survivors had a 42% (PR=1.42 [95% CI: 1.22–1.66]) higher prevalence of hypertension relative to White breast cancer survivors. In model 3, which a for age, demographics, and health related characteristics, the fully-adjusted prevalence of hypertension was 30% (PR=1.30 [95% CI: 1.11–1.52]) higher among African American breast cancer survivors compared to White breast cancer survivors.

Discussion

The purpose of our study was to examine the association between hypertension, a significant CVD risk factor, and race/ethnicity among breast cancer survivors. We found that the prevalence of hypertension among breast cancer survivors in NHANES 1999 – 2014 was 30% higher for African American women than White women after adjusting for demographic and health-related factors. Although the percentage of African American breast cancer survivors who were physically inactive or current smokers, was lower than White breast cancer survivors, a significantly higher percentage of African American breast cancer survivors had obesity and/or diabetes. African American breast cancer survivors with obesity or with both obesity and diabetes had the highest prevalence of hypertension, 25% and 37%, respectively, yet it is noteworthy that they had lower rates of physical inactivity and current smoking rates than their White counterparts. This suggests that focusing on changing activity levels and promoting smoking cessation may not be the primary intervention targets to reduce African American breast cancer survivors' rates of hypertension. There is a need to evaluate modifiable CVD risk factors among African American breast cancer survivors in order to identify those which have the greatest effect on CVD risk.

The incidence of breast cancer has increased by 0.04% per year among African American women over the last 10 years of available data [24, 14, 5]. Because studies have consistently found that CVD death rates are significantly higher than breast-cancer specific death rates for postmenopausal African American women who are diagnosed with early-stage, estrogen-receptor positive breast cancer, there is a critical need to reduce gaps in the care of African

American breast cancer survivors who have or who are at high-risk of developing CVD [10, 3, 12, 11]. Identifying modifiable risk factors that contribute to excess CVD mortality among African American breast cancer survivors is extremely important, especially among women who have undergone cardiotoxic cancer treatments [25, 26]. The incorporation of CVD risk evaluation, and subsequently, population-specific CVD prevention interventions into the survivorship care plans for African American breast cancer survivors is needed to reduce CVD mortality in this population [11, 27, 28, 14].

Currently, there is very little published research that is focused on hypertension and CVD among African American breast cancer survivors. Therefore, our study will make a significant contribution to the growing body of literature regarding the intersection of CVD and cancer survivorship. A strength of our study is the inclusion of several demographic and health-related CVD risk factors in our analysis. However, because we used cross-sectional data from the NHANES our study is not without limitations. We were limited to the data collected during the NHANES interviews and assessments. This resulted in a small sample size for African American breast cancers survivors. In addition, we were unable to identify additional factors that may be associated the participants' risk of hypertension, such as the stage of cancer diagnosis, and the estrogen receptor, progesterone receptor, and human epidermal growth factor receptor 2 status of their tumors. Recall bias and social desirability bias may have affected the responses of some participants. In addition, our sample of African American breast cancer survivors was smaller than that of their White counterparts.

Conclusion

We examined the association between hypertension, and race/ethnicity among breast cancer survivors, due to the elevated CVD mortality rate among breast cancer survivors. In our study using data from NHANES 1999–2014, we showed that the prevalence of hypertension is significantly higher among African American breast cancer survivors than White breast cancer survivors. The higher prevalence of hypertension may contribute to the difference in CVD outcomes between African American and White breast cancer survivors. Given the steady increase in the incidence of breast cancer among African American women, greater attention should be focused understanding the underlying modifiable risk factors that drive breast cancer mortality disparities [29, 5]. Factoring modifiable CVD risk factors into the treatment and survivorship care plans of African American breast cancer survivors may help to reduce premature CVD morality in this population.

Acknowledgments

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Table 1.

Distribution of Demographic and Health-Related Characteristics of Breast Cancer Survivors by Race in the NHANES 1999 – 2014

Characteristic	Total (N = 524)	African American (N =107)	white (N = 417)	*p* Value
Demographic				
Age, mean±SD	65.9±0.8	66.3±0.8	61.8±1.9	.024
Married, %	55.9	33.4	58.0	<.001
Education, %				.052
Less than high school graduate	16.0	26.8	14.9	
High school graduate/GED	26.7	22.28	27.2	
More than high school graduate	57.27	50.96	57.88	
Annual Household Income, %				.002
Less than $34,999	41.2	54.9	39.9	
$35,000 - $74,999	25.89	29.90	25.49	
$75,000 and over	5.98	6.71	5.91	
Health-Related				
Health Insurance, %	97.4	96.4	97.5	.639
Smoking, %				.372
Never smoker	54.5	62.4	53.7	
Former smoker	32.2	27.6	32.7	
Current smoker	13.3	10.0	13.7	
Alcohol, %				.009
Non-drinker	18.7	24.9	18.1	
Former drinker	31.1	41.2	30.2	
Current drinker	50.2	33.7	51.8	
Physically Inactive, %	56.1	45.8	57.1	.043
Obesity, %	36.5	58.4	34.4	<.001
Diabetes, %	15.3	32.2	13.7	<.001
Hypertension, %	57.8	74.8	56.1	.006
Systolic blood pressure (mmHG)	130.1±1.2	130.1±1.3	129.7±2.7	.876
Diastolic blood pressure (mmHG)	68.9±0.6	68.8±0.7	70.8±1.3	.181

*NHANES = National Health and Nutrition Examination Survey; GED = General Education Development

Table 2

Prevalence Ratios and 95 Percent Confidence Intervals for the Association between Race and Hypertension among Breast Cancer Survivors in the NHANES 1999 – 2014

Independent Variable	Model 1[a]	p-value	Model 2[b]	p-value	Model 3[c]	p-value
Race	1.52 (1.32 – 1.75)	<0.001	1.42 (1.22 – 1.66)	<0.001	1.30 (1.11 – 1.52)	0.001
Age	1.03 (1.02 – 1.04)	<0.001	1.03 (1.02 – 1.04)	<0.001	1.03 (1.02 – 1.04)	<0.001
Married			1.02 (0.89 – 1.18)	0.743	1.06 (0.92 – 1.22)	0.415
Education Level						
Less than high school graduate			1.00		1.00	
High school graduate/GED			0.88 (0.72 – 1.07)	0.198	0.87 (0.71 – 1.07)	0.188
More than high school graduate			0.80 (0.66 – 0.97)	0.024	0.83 (0.67 – 1.02)	0.076
Annual Household Income						
Less than $34,999			1.00		1.00	
$35,000 - $74,999			1.09 (0.93 – 1.28)	0.270	1.07 (0.90 – 1.28)	0.455
$75,000 and over			0.78 (0.58 – 1.05)	0.104	0.82 (0.61 – 1.09)	0.173
Missing			0.80 (0.53 – 1.22)	0.303	0.78 (0.46 – 1.32)	0.354
Health Insurance					1.73 (0.67 – 4.47)	0.253
Smoking						
Never smoker					1.00	
Former smoker					1.09 (0.90 – 1.32)	0.369
Current smoker					0.97 (0.65 – 1.45)	0.867
Alcohol						
Non-drinker					1.00	
Former drinker					0.89 (0.72 – 1.10)	0.268
Current drinker					0.84 (0.66 – 1.07)	0.162
Physically Inactive					0.93 (0.79 – 1.10)	0.392
Comorbidities						
Neither diabetes nor obesity					1.00	
Diabetes and obesity					1.37 (1.06 – 1.77)	0.015
Diabetes only					1.01 (0.76 – 1.34)	0.950
Obesity only					1.25 (1.03– 1.52)	0.026

[a]Model 1 (unadjusted)

[b]Model 2 (Adjusted for demographic characteristics): Martial Status, Education Level, and Income

[c]Model 3 (Adjusted for risk factors for high blood pressure): Health Insurance, Smoking, Drinking Alcohol, Physical Inactivity, Obesity and Diabetes

[*]NHANES = National Health and Nutrition Examination Survey; GED = General Education Development