



The Association between Cardiovascular Disease Knowledge and Risk Factors among African American Breast Cancer Survivors in the Deep South

Journal of Health Disparities Research and Practice

Volume 13 | Issue 4

Article 7

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2020

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### Abstract:

**Purpose:** African American breast cancer survivors in the Deep South have a disproportionately high burden of cardiovascular disease (CVD) mortality. Multiple potentially modifiable CVD risk factors are highly prevalent in this population, such as high blood pressure, obesity, and poor dietary habits. The purpose of this study was to assess the association between CVD health metrics and heart disease knowledge among the target population.

**Methods:** The Heart Disease Knowledge Questionnaire was used to assess the participants' knowledge of heart disease and heart disease risk factors. Questions from My Life Check were used to assess the participants cardiovascular health metrics. Multivariate regression analyses were performed to determine which cardiovascular health metrics and demographic characteristics could predict the participants' heart disease knowledge score.

**Results:** Seventy African American breast cancer survivors living in the Deep South enrolled in the study. The participants' mean age was 56.76 years ( $\pm 10.36$ ) and 42.9% had a college degree or higher level of education. A multivariate regression analysis showed that the number of healthy diet score components was the only cardiovascular health metric that was statistically significantly associated with heart disease knowledge score ( $p = .01$ ). Education level was the only demographic characteristic that was statistically significantly associated with heart disease knowledge score ( $p = .004$ ).

**Conclusion:** Our results indicate that participants with more knowledge of heart disease and

higher levels of education are more likely to have better cardiovascular health metrics. Our findings underscore the need to implement CVD risk reduction interventions targeted towards African American breast cancer survivors in the Deep South.

**Keywords:**

Breast Cancer Survivor, African American Women, Cardiovascular Disease, Health Disparities, Deep South

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### Recommended Citation

Williams, Michelle S. and Anyimukwu, Chizoba (2020) "The Association between Cardiovascular Disease Knowledge and Risk Factors among African American Breast Cancer Survivors in the Deep South," *Journal of Health Disparities Research and Practice*: Vol. 13 : Iss. 4 , Article 7.  
Available at: <https://digitalscholarship.unlv.edu/jhdrp/vol13/iss4/7>

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### Cover Page Footnote

This research was funded by grant from the Mississippi Center for Clinical and Translational Research, grant number U54 GM115428. The authors have no relevant financial or non-financial interests to disclose. Written informed consent was obtained from all participants. Ethical approval to conduct this study was obtained from the Institutional Review Board at the University of Mississippi Medical Center



**Journal of Health Disparities Research and Practice**  
**Volume 13, Issue 4, Winter 2020, pp. 78-91**

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School of Public Health  
University of Nevada, Las Vegas

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### **ABSTRACT**

**Purpose:** African American breast cancer survivors in the Deep South have a disproportionately high burden of cardiovascular disease (CVD) mortality. Multiple potentially modifiable CVD risk factors are highly prevalent in this population, such as high blood pressure, obesity, and poor dietary habits. The purpose of this study was to assess the association between CVD health metrics and heart disease knowledge among the target population.

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**Results:** Seventy African American breast cancer survivors living in the Deep South enrolled in the study. The participants' mean age was 56.76 years ( $\pm 10.36$ ) and 42.9% had a college degree or higher level of education. A multivariate regression analysis showed that the number of healthy diet score components was the only cardiovascular health metric that was statistically significantly associated with heart disease knowledge score ( $p = .01$ ). Education level was the only demographic characteristic that was statistically significantly associated with heart disease knowledge score ( $p = .004$ ).

**Conclusion:** Our results indicate that participants with more knowledge of heart disease and higher levels of education are more likely to have better cardiovascular health metrics. Our findings underscore the need to implement CVD risk reduction interventions targeted towards African American breast cancer survivors in the Deep South.

**Keywords:** Breast Cancer Survivor, African American Women, Cardiovascular Disease, Health Disparities, Deep South

## INTRODUCTION

Historically in the US, the incidence of breast cancer has been higher among white women than African American women (DeSantis, Ma, et al., 2019; DeSantis, Miller, et al., 2019; Siegel et al., 2020). However, data from the Surveillance, Epidemiology, and End Results (SEER) Program show that the incidence of breast cancer among African American women is currently higher than that of their white counterparts in some states in the Deep South region of the US (DeSantis, Ma, et al., 2019; DeSantis et al., 2017; DeSantis, Miller, et al., 2019; Siegel et al., 2020). The increased incidence of breast cancer among African American women in the Deep South is especially alarming, because African American breast cancer survivors are four times more likely to die than survivors of all other races and ethnicities (DeSantis et al., 2016; DeSantis, Ma, et al., 2019). The elevated prevalence of preventable cardiometabolic comorbidities, such as cardiovascular disease (CVD) and type 2 diabetes, among African American breast cancer survivors contributes to their significantly poorer health outcomes (DeSantis et al., 2017; DeSantis, Miller, et al., 2019; Siegel et al., 2020; Williams et al., 2020).

Evidence shows that CVD is a major, yet often overlooked, comorbidity among African American breast cancer survivors in the Deep South (Coughlin et al., 2020; Gernaat et al., 2017; Mehta et al., 2018). Although this population is significantly more likely to die prematurely from CVD than from breast cancer, their awareness of an elevated CVD risk is low (Gallicchio et al., 2017; Yedjou et al., 2017). Breast cancer treatments may contribute to CVD risk in breast cancer survivors (Coughlin et al., 2020; Simões et al., 2020). The cardiotoxic effects of chemotherapy and radiation can also exacerbate CVD risk in survivors with modifiable CVD risk factors, such as poor eating habits, physical inactivity, overweight/obesity and smoking (Coughlin et al., 2020; Gernaat et al., 2017; Mehta et al., 2018).

Due to the expected rise in the number of breast cancer survivors with CVD, experts at the American Heart Association (AHA) issued a call for the investigation of the effects of risk factor modification on CVD outcomes in breast cancer survivors (Mehta et al., 2018). Evidence-based lifestyle behavior interventions that promote healthy eating patterns, adequate physical activity, and smoking cessation have been proven to be effective at improving CVD risk factors (Drozek et al., 2014; Morton et al., 2016). However, the reach of such interventions are often limited to non-minority populations in urban communities (Melvin et al., 2013). For example, the Complete Health Improvement Program (CHIP) has been proven to be effective at producing clinically significant improvements in CVD risk factors among participants (Drozek et al., 2014; Kent et al., 2013; Morton et al., 2017). However, the CHIP has not been successfully implemented in predominately African American communities or in rural or medically underserved areas in the Deep South. This is due, in part, to the lack of tailoring of the intervention materials for the target population. The unique realities of African American breast cancer survivors in the Deep South affect their options for food and exercise modalities, and their access to clinic-based lifestyle behavior interventions (Melvin et al., 2013; Parham & Scarinci, 2007; Smith et al., 2018; Tucker et al., 2005; Yan et al., 2019). Therefore, there is a need to systematically adapt existing efficacious, evidence-based lifestyle behavior interventions, such as the CHIP, in order to expand their reach to high risk populations (Morton et al., 2016).

We used the Intervention Mapping (IM)-Adapt framework to conduct a multi-phase mixed methods study aimed at adapting the CHIP for African American breast cancer survivors in the Deep South (Bartholomew, 2006). The results reported in this manuscript reflect Step 1 of IM-

Adapt, which is to conduct a needs assessment. We conducted a cross-sectional survey to determine the prevalence of CVD risk factors and the level of knowledge about CVD and CVD risk factors among the African American breast cancer survivors in the Deep South.

## **METHODS**

### Study Design

A multiphase mixed methods study was conducted between October 2019 and June 2020. IM-Adapt served as the program planning framework for the study. For the needs assessment phase, we conducted a cross-sectional survey of the African American breast cancer survivors in the Deep South in order to gather data regarding their breast cancer diagnosis and treatment history, overall health history, cardiovascular health metrics, CVD knowledge, and perceived nutrition environments. The results reported in this manuscript are focused on the association between the participants' cardiovascular health metrics and their CVD knowledge.

### Participant Selection

Participants were recruited through community-based breast cancer events (i.e. 5K charity races), community-based breast cancer organizations, social media, respondent driven sampling, and the Mississippi Cancer Registry. A brief screening questionnaire was used to assess women's eligibility to participate in the study. Women were eligible to participate if they were age 18 years and older, identified as African American or Black, had been diagnosed with breast cancer, had completed primary breast cancer treatment at least 1 year prior to enrollment in the study, and currently lived in Mississippi, Alabama, Tennessee, Louisiana, or Georgia. The questionnaires were administered over the phone by a member of the research team. The research team member asked each question verbatim and recorded the participants' responses in an online database.

### CVD Knowledge Assessment

The Heart Disease Knowledge Questionnaire was used to assess the participants' knowledge of CVD and CVD risk factors. It is a validated tool for assessing the heart disease knowledge of adults (Bergman et al., 2011). The 30-item questionnaire is sub-divided into five knowledge domains that evidence suggest are relevant to CVD: dietary knowledge, epidemiology, medical information, risk factors, and heart attack symptoms (Bergman et al., 2011). We added one additional question to the Heart Disease Knowledge Questionnaire to assess participants' awareness of the risk of CVD among breast cancer survivors. The response options for all of the questions were "yes," "no," and "don't know."

### Cardiovascular Health Metrics

Questions from *My Life Check* were used to assess the participants' cardiovascular health metrics (Lloyd-Jones et al., 2010; *My Life Check - Life's Simple 7*, 2020). As defined by the AHA guidelines, the cardiovascular health metrics encompass four health behaviors and three health factors that have been shown to be associated with CVD and stroke (Lloyd-Jones et al., 2010). The metrics assessed by *My Life Check* are BMI, blood glucose level, blood pressure, total cholesterol level, physical activity level, dietary habits and smoking status (*My Life Check - Life's Simple 7*, 2020). The AHA's measures for poor, intermediate, and ideal cardiovascular health metrics were used to categorize the participants' metrics (Lloyd-Jones et al., 2010).

*Body Mass Index* A research team member used the participant's self-reported height and weight to compute BMI.

*Physical Activity Level* To assess the participants' level of physical activity, they were asked how many minutes of moderate-intensity physical activity they participated in weekly.

*Smoking Status* The question, "What is your smoking status?" was used to assess the participants' smoking status. The response options were: "I currently smoke," "I quit in the last 12 months," "I quit more than 12 months ago," and "I've never been a smoker."

*Healthy Diet Score* Participants were asked a series of open-ended questions to determine their average intake of fruits, vegetables, whole grains, sugar sweetened beverages, and fish. To assess their consumption of sodium, participants were asked to report their preferences for adding salt to their food, for consuming pre-packaged, and for consuming processed food. The measures were used to compute a healthy diet score for each participant which ranged from 0 - 5.

*Health Conditions* The assessment of blood glucose level, blood pressure, and total cholesterol were modified for this study since *My Life Check* was administered over the phone and participants were not required to have these measures recently assessed by a healthcare provider. These metrics were assessed using dichotomous questions ("Yes" or "No") to determine whether the participant had ever been diagnosed by a healthcare provider as having high blood pressure, high blood sugar, or high cholesterol.

#### Ethical Approval

Each participant received a monetary honorarium for participating in the survey. Ethical approval to conduct this study was obtained from the Institutional Review Board at the University of Mississippi Medical Center. All participants provided signed informed consent to participate in the study.

#### Analytic Methods

Descriptive statistics were computed to assess the participants' demographic characteristics. We conducted a one-way between-groups ANOVA to determine if there was an association between the participants' characteristics, cardiovascular health metrics and their CVD knowledge. Statistical significance for all of the analyses performed was set at  $\alpha = .05$ . All statistical analyses were performed using SPSS for Mac (version 25).

## **Results**

### Participant Recruitment and Characteristics

The demographic characteristics of the participants are displayed in Table 1. The participants ranged in age from 32 to 80 years old with a mean age  $56.76 \pm 10.36$  years. The majority (58.9%) of the participants were not married and employed at least part time (51.4%). Only 2.8% of the participants had less than a high school education, and 42.9% had a college or graduate degree. Nearly all (94.3%) of the participants had health insurance. The majority of the participants resided in metro counties (81.4%) in Mississippi, Alabama, Georgia and Tennessee.

### Breast Cancer Diagnosis and Treatment History

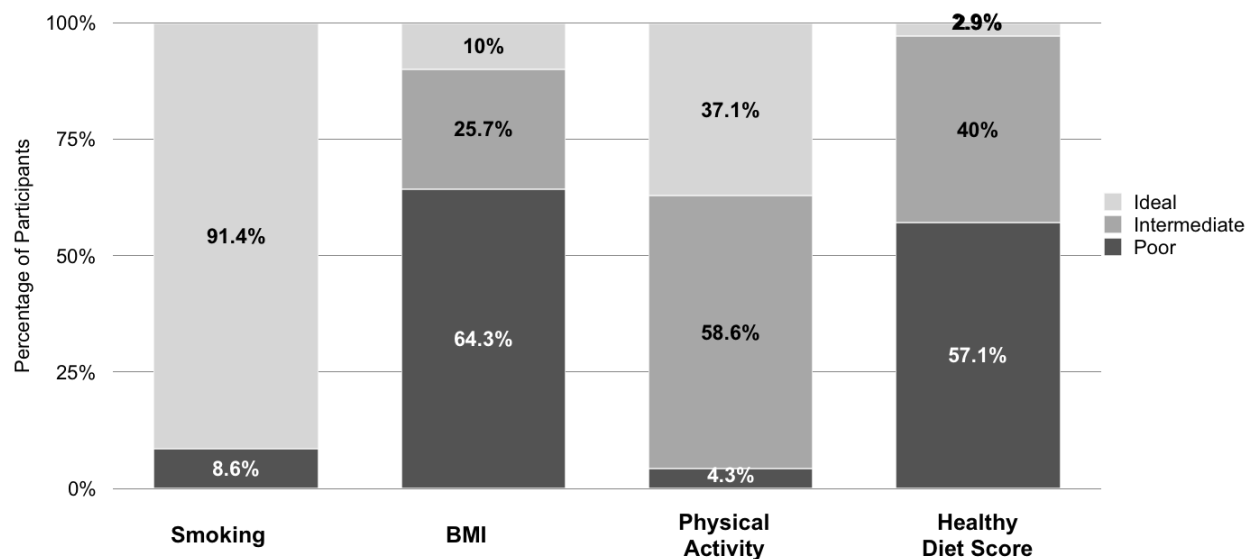
Approximately 44.3% of the participants were diagnosed with breast cancer before they entered menopause. Ten participants (14.3%) had been diagnosed with breast cancer more than once. Surgery (97.1%) was the most commonly reported type of breast cancer treatment, followed by chemotherapy (78.6%) and radiation (54.3%).

### Cardiovascular Health Metrics

Figure 1 shows the ratings of the four health behavior cardiovascular health metrics that were assessed. Very few (8%) participants reported being current smokers. However, obesity was

prevalent among the participants, with 64.3% having a BMI of 30 or higher. The majority of the participants (58.6%) engaged in 1 – 149 minutes of moderate intensity physical activity each week. However only 37.1% met or exceeded the recommend minimum 150 minutes of moderate-intensity physical activity every week. Overall, diet was the most poorly rated cardiovascular health metric. None of the participants met all 5 components of the healthy diet score. Only 2.9% of the participants met 4 of the 5 components of the healthy diet score, giving their diet a rating of ideal. Over half (57.1%) of the participants' healthy diet scores were rated as poor because they met 1 or none of the healthy diet score components. The high percentage of poor health diet scores was mainly due to a low intake of fruits and vegetables, a high intake of sodium, and a low intake of whole grains.

Figure 1. Participants' cardiovascular health metrics



Of the three health condition cardiovascular metrics that were assessed (Table 1), the most commonly reported was being diagnosed with high blood pressure (65.7%), followed by high blood cholesterol (41.1%), and high blood sugar (22.9%).



Table 1. Demographic characteristics of the participants (N=70)

Participant Characteristic	N (%)
Age, mean SD	56.8±10.36
Highest Level of Education	
Less than high school	2 (2.8)
High school graduate/GED or equivalent	12 (17.1)
Some college or AA degree	26 (37.1)
College graduate or above	30 (42.9)
Rurality	
Metro County	57 (81.4)
Non-Metro County	13 (18.6)
Body Mass Index	
Normal Weight	7 (10.0)
Overweight	18 (25.7)
Obese	45 (64.3)
Diagnosed with High Blood Sugar	
Yes	16 (22.9)
No	54 (77.1)
Diagnosed with High Blood Cholesterol	
Yes	29 (41.1)
No	41 (58.6)
Diagnosed with High Blood Pressure	
Yes	46 (65.7)
No	24 (34.3)
Smoking Status	
Current Smoker	6 (8.6)
Former Smoker	10 (14.3)
Never Smoked	54 (77.1)
Menopausal Status when Diagnosed with Breast Cancer	
Premenopausal or Perimenopausal	31 (44.3)
Postmenopausal	39 (55.7)
Number of Times Diagnosed with Breast Cancer	
1	60 (85.7)
2 or more	10 (14.3)
Breast Cancer Treatment	
Chemotherapy	55 (78.6)
Radiation	38 (54.3)
Surgery	68 (97.1)

Note. N = 70. All of the participants identified as African American or Black females.

### Heart Disease Knowledge

Journal of Health Disparities Research and Practice Volume 13, Issue 4, Winter 2020

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The percentage of correct responses to each item on the Heart Disease Knowledge Questionnaire are displayed in Table 2. The participants' responses indicated that they were most knowledgeable about heart disease risk factors. Over 75% of participants correctly responded to 5 of the 9 questions in the risk factors domain. However, only 61% were aware that some women who have had breast cancer may have an increased risk for heart disease. The participants had the least knowledge about heart attack symptoms and medical information. There was only one of the 4 questions about heart attack symptoms for which more than 75% of the participants responded correctly. That is of particular concern given the importance of obtaining treatment early when a person experiences the symptoms of a heart attack. The participants' responses to the questions in the medical knowledge domain indicate that there is a significant lack of knowledge of important factors regarding understanding of medical information that can be used to assess one's risk of heart disease.

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Table 2 The percentage of correct responses to items on the Heart Disease Knowledge Questionnaire

Item	% Correct
<b>Dietary Knowledge Domain</b>	
Margarine with liquid safflower oil is healthier than margarine with hydrogenated soy oil.	37.5%
Polyunsaturated fats are healthier for the heart than saturated fats.	48.4%
Trans-fats are healthier for the heart than most other kinds of fats.	68.8%
Most of the cholesterol in an egg is in the white part of the egg.	68.8%
Dietary fiber lowers blood cholesterol.	68.8%
Eating a high fiber diet increases the risk of getting heart disease.	85.9%
Many vegetables are high in cholesterol.	93.8%
<b>Epidemiology Domain</b>	
Most women are more likely to die from breast cancer than heart disease.	62.5%
Women are less likely to get heart disease after menopause than before.	64.1%
Heart disease is the leading cause of death in the United States.	75.0%
Heart disease is better defined as a short-term illness than a chronic, long-term illness.	76.6%
<b>Medical Information Domain</b>	
Atrial defibrillation is a procedure where hardened arteries are opened to increase blood flow.	34.4%
“High” blood pressure is defined as 110/80 (systolic/diastolic) or higher.	40.7%
The healthiest exercise for the heart involves rapid breathing for a sustained period of time.	59.4%
HDL refers to “good” cholesterol, and LDL refers to “bad” cholesterol.	60.9%
Cardiopulmonary resuscitation (CPR) helps to clear clogged blood vessels.	65.6%
Most people can tell whether or not they have high blood pressure.	73.4%
A healthy person's pulse should return to normal within 15 minutes after exercise.	78.1%
<b>Risk Factors Domain</b>	
The most important cause of heart attacks is stress.	18.8%
Smokers are more likely to die of lung cancer than heart disease.	50.0%
Some women who have had breast cancer may have an increased risk for heart disease.*	60.9%
Taking an aspirin each day decreases the risk of getting heart disease.	70.3%
Taller people are more at risk for getting heart disease.	75.0%
Eating a lot of red meat increases heart disease risk.	81.3%
People who have diabetes are at higher risk of getting heart disease.	85.9%
Having had chicken pox increases the risk of getting heart disease.	87.5%
Walking and gardening are considered types of exercise that can lower heart disease risk.	95.3%
<b>Heart Attack Symptoms Domain</b>	
Turning pale or gray is a symptom of having a heart attack.	31.3%
Men and women experience many of the same symptoms of a heart attack.	51.6%
Feeling weak, lightheaded, or faint is a common symptom of having a heart attack.	60.9%
Sudden trouble seeing in one eye is a common symptom of having a heart attack.	82.8%

\* Item added by the research team to assess participants' awareness of breast cancer survivors' increased risk of heart disease.

The Association of Heart Disease Knowledge Score with Participants' Characteristics and Cardiovascular Health Metrics

Multiple variate regression analyses were preformed to investigate the relationship between heart disease knowledge score and the participants' demographic characteristics and cardiovascular health metrics. The results of the analysis for three of the participants' characteristics showed that highest level of education was positively and statistically significantly correlated with heart disease knowledge score. This result indicated that participants with higher heart disease knowledge scores tended to have completed higher levels of education. Age and years since breast cancer diagnoses did not contribute to the model. The multiple regression model with all three demographic characteristic predictor variables produced  $R^2 = .154$ ,  $F(3, 66) = 3.99$ ,  $p = .011$ .

The results of the analysis for the 7 cardiovascular health metrics are displayed in Table 3. Healthy diet score components was positively and statistically significantly correlated with heart disease knowledge score, indicating that participants who consumed diets that met a higher number of the healthy diet score components tended to have higher heart disease knowledge scores. BMI, being diagnosed with high cholesterol, high blood sugar or high blood pressure, the number of minutes of weekly physical activity, and current smoking status did not contribute to the model. The multiple regression model with all seven cardiovascular health metric predictor variables produced  $R^2 = .121$ ,  $F(7, 62) = 1.222$ ,  $p = .304$ .

Table 3 Results from the regression analysis of participants' cardiovascular health metrics and heart disease knowledge score

Variable	Unstandardized Coefficients		Standardized Coefficients	t	p
	B	SE	Beta( $\beta$ )		
Body Mass Index	.161	.242	.088	.667	.507
Diagnosed with high blood pressure	-.180	3.586	-.007	-.050	.960
Diagnosed with high cholesterol	1.060	3.192	.041	.332	.741
Diagnosed with high blood sugar	.153	3.465	.005	.044	.965
Physical Activity: Minutes	.008	.016	.060	.483	.631
Current Smoking Status	1.303	5.848	.029	.223	.824
Healthy Diet Components	4.187	1.587	.327	2.638	.011*

\*  $p < .05$

## DISCUSSION

Knowledge is a central construct in several health behavior theories. For the example, the Informational Motivational Behavioral Skill Model posits that a high degree of relevant knowledge about a health behavior is necessary for people to carry out the behavior (Fisher & Fisher, 1992). Therefore, we hypothesized that participants with higher heart disease knowledge scores would be more likely to engage in the health behaviors associated with the AHA's ideal cardiovascular health metrics. The results of our analysis showed that healthy diet score was the only cardiovascular health metric that was significantly and positively associated with heart disease knowledge score. We also found that education level was significantly and positively associated with heart disease knowledge score.

Our participants had the least knowledge about heart attack symptoms and medical knowledge related to heart disease. Our results are similar to those found by other investigators (Jones et al., 2006; Lutfiyya, Cumba, et al., 2008; Lutfiyya, Lipsky, et al., 2008; Winham & Jones, 2011). Lutfiyya and his colleagues (2008) found that heart attack and stroke symptom knowledge was low among African American males who participated in the 2003-2005 Behavioral Risk Factor Surveillance Survey. Similar to our participants, the African American women in Winham and Jones' (2011) study also had low awareness about the difference between the heart attack symptoms experienced by women and men. And were not highly likely to be aware that women's risk for heart disease increases after menopause (Winham & Jones, 2011).

Unlike other investigators, we found that education, but not age was significantly associated with higher heart disease related knowledge (Jones et al., 2006; Lutfiyya, Cumba, et al., 2008). Education was the most significant predictor of heart disease knowledge among African American participants in several studies (Lutfiyya, Cumba, et al., 2008; Lutfiyya, Lipsky, et al., 2008; Winham & Jones, 2011). The mean heart disease knowledge score of our participants was higher than the mean score of the adult sample who participated in a study conducted by Bergman et al. (2011) aimed at validating the Heart Disease Knowledge Survey. This difference would be expected since, overall, our participants had higher levels of education than the participants in the study conducted by Bergman et al. (2011). These findings underscore the importance of tailoring health education interventions to meet the needs of individuals with varying levels of education (Hawkins et al., 2008; Noar et al., 2011; Schmid et al., 2008).

Very little research has been done to examine the correlation between context specific knowledge and health behaviors associated with cardiovascular risk. We found that the only CVD risk behavior that was significantly correlated to heart disease knowledge was healthy diet components. Contextual knowledge and procedural knowledge are essential for the performance of health behaviors (Bandura, 1986). Therefore, further research focused on understanding the contextual and procedural knowledge that is necessary for African American breast cancer survivors in the Deep South to engage in healthy lifestyle behavior is warranted.

### Implications

There is a need to increase African American breast cancer survivor's awareness of the increased risk of heart disease. A breast cancer diagnosis can be an opportunity for a teachable moment. Healthcare providers should seize the opportunity to inform African American breast cancer survivors about the modifiable risk factors that can impact their risk of developing CVD. Evidence suggests that lifestyle behavior interventions can have a significant return on investments for African American women (Michaud et al., 2017). Therefore, there is a need to increase the

dissemination and implementation of theory- and evidence-based interventions that are culturally appropriate and accessible to high-risk populations such as African American breast cancer survivors in the Deep South.

#### Limitations

One of the significant limitations of this study was the reliance on self-reported data for the participants' breast cancer diagnosis and breast cancer treatment history. The majority of the participants had difficulty recalling details about their breast cancer diagnosis and treatment. For example, participants could easily recall the general type of treatment that they had (i.e. chemotherapy, radiation), but most were not able to recall the specific kind of chemotherapy drug or the type of radiation therapy they received. Also, most of the participants were diagnosed before the American Joint Committee on Cancer updated their breast cancer staging guidelines in 2018. Consequently, only a few participants were able to report their breast cancer stage subcategory or hormone receptor status. Another limitation was the use of self-reported data to estimate the participants' cardiovascular health metrics. For example, the AHA *My Life Check* requires an individual to report their dietary intake for key diet components, which can be impacted by recall bias and/or social desirability bias. In addition, there are some limitations with the *My Life Check* tool due to the generic diet assessment. For example, the Healthy Diet Score includes the weekly consumption of fish but does not offer alternative measures for individuals who do not consume meat, such as vegans or vegetarians. In addition, we were not able to conduct clinical assessments of the participants' blood pressure, cholesterol and blood sugar, therefore, we used a proxy measure to assess those cardiovascular health metrics. Our sample size of 70 was another limitation of the study. We used a variety of recruitment strategies including sending recruitment materials to eligible women in the Mississippi Cancer Registry. However, that only yielded a 7% response rate. We found that respondent driven sampling was the most effective means of recruitment. Therefore, we will use respondent driven sampling as a primary recruitment strategy for future studies.

#### **CONCLUSION**

African American breast cancer survivors continue to experience significantly poorer health outcomes than women of all other race and ethnicities. The prevalence of modifiable cardiometabolic comorbidities, including CVD, contribute to this disparity. Further research is needed to disseminate and implement sustainable, evidence-based CVD risk reduction interventions that are adapted for this high-risk population.

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