RESEARCH ARTICLE

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Determinants of Female Cancer Screening Awareness in Alabama's Black Belt Region

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Abstract

Background: Breast and cervical cancers represent significant health challenges in Alabama's Black Belt region, where they are leading causes of mortality among women. This study aims to investigate the factors influencing awareness levels of three critical female cancer screening methods: mammograms, clinical breast exams, and Pap tests. **Methods:** A cross-sectional survey was conducted with 257 participants in Alabama's Black Belt region, utilizing self-administered questionnaires to gather data on awareness of female cancer screening methods. To identify significant predictors of awareness for each screening method, logistic regression analysis was employed. **Results:** The study revealed high levels of awareness regarding mammograms, clinical breast exams, and Pap tests among participants. Women demonstrated significantly greater awareness of mammograms and Pap tests compared to men. Employment status and family history of cancer were identified as key predictors of awareness. Specifically, participants with a family history of cancer and those who were employed were more likely to be aware about mammograms, clinical breast exams, and Pap tests. Furthermore, self-reported health status was positively associated with awareness of clinical breast exams and Pap tests. Notably, the perception of racial impact on healthcare quality significantly influenced awareness of mammograms. **Conclusion:** Although this study highlights relatively high levels of female cancer screening awareness among women in Alabama's Black Belt region, there is a pressing need for concerted efforts to further enhance this awareness. Implementing comprehensive educational initiatives and improving healthcare resource provision are critical steps toward augmenting knowledge and achieving optimal cancer screening rates in this underserved community. Such measures are essential to mitigate cancer risks and improve health outcomes for women in this region.

Keywords: Breast cancer- cervical cancer- Pap test- mammogram- clinical breast exams- Black Belt region

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Introduction

Cancer poses significant challenges to society, public health, and the economy in the 21st century [1]. Globally, cancer is the second leading cause of death, accounting for 9.6 million deaths annually, which represents one in every six deaths (16.8%) and one-fourth (22.8%) of deaths from noncommunicable diseases worldwide [1, 2]. In the United States (U.S.), cancer is overall considered to be the second-leading cause of death among individuals younger than 85 years old [1]. Women are particularly at a higher risk of developing female-related cancers [3-6]. The most commonly diagnosed malignancies in women are breast and cervical cancers, which often lead to significant mortality rates [7-14]. In the U.S., every female has an estimated one in eight (12.4%) lifetime risk of developing breast cancer and being diagnosed with cervical cancer [15]. Given the lengthy process of malignant transformation of cancer [8], performing appropriate female cancer screenings through mammograms, clinical breast exams, and Pap tests would allow for early detection of premalignant lesions. This can be a positive preventive measure to reduce female mortality without altering disease incidence [10, 11, 16, 17], slowing disease progression, enabling early curative treatment whenever possible, and increasing awareness [8].

In Alabama's Black Belt region which runs across the southwestern part of the state and includes some of the eighteen poorest counties in the U.S. [18-22] health disparities remain a major public health concern that has not been adequately addressed. Female breast and cervical cancers are characterized the highest mortality rates, which are well-documented as significant health disparities in the Black Belt region [23-25]. In 2023, Alabama reported around 4,500 new cases of female breast cancer and about 720 related deaths. The state's incidence rate of 121.8 per 100,000 women is below the national average of 126.8. Black women had a higher incidence rate of 126.8

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compared to 119 for white women [26]. Additionally, Alabama saw approximately 240 new cases of cervical cancer, with an incidence rate of 9.2, higher than the national rate of 7.4. Black women had a higher cervical cancer incidence rate of 9.8 compared to 9.1 for white women. The state's cervical cancer mortality rate was 3.3, also higher than the national rate of 2.2, with Black women experiencing a mortality rate of 4.8 compared to 2.9 for white women [27].

Notably, breast cancer is the most common type of cancer, with the highest fatality rates among women [28]. Although early female cancer screening awareness campaigns are prevalent in urban areas [29], robust preventive efforts are limited in rural areas, where access to information is often restricted for the majority of women residing in the countryside [20, 30]. This is particularly concerning for women in Alabama's Black Belt region, a predominantly rural area characterized by higher rates of poverty, poor physical health, and a lack of health insurance coverage [20, 31]. These prevailing social problems create significant barriers to accessing healthcare for cancer screening and diagnosis at the earliest convenience necessary for raising cancer awareness and prevention strategies.

Prior studies that focused on rural regions found that a large proportion of women did not believe in the efficacy of mammograms, clinical breast exams, and Pap tests [32-38]. Another study conducted in rural Washington state on 512 Hispanic women found that a substantial proportion of women perceived Pap tests and mammograms as unnecessary diagnostic procedures rather than preventive health measures. Of those women 40 years or older, 78% had never heard of Pap test, and only 15% had ever received a Pap test; 38% had never heard of a mammogram, and only 30% had received a mammogram. Furthermore, 73% of the women had been taught about breast exams, but only 62% performed breast self-examinations [39]. Several studies have revealed that mammograms and Pap tests are not optional but should be mandatory routine screenings needed for the early diagnosis of precancerous lesions to detect abnormal alterations in cervical and breast cells [5, 6, 8, 17, 40-42].

Several factors are often associated with higher rates of mammograms, clinical breast exams, and Pap tests. These factors include higher educational attainment, a family history of cancer, employment, access to health insurance, social support, socioeconomic status, and race and ethnicity [15, 17, 21, 43, 44]. Women in rural areas, by large margins, exhibit lower awareness of female breast cancer (including mammograms and clinical breast exams) due to marginalization, poverty, and high illiteracy rates compared to women living in urban areas [23, 32, 35, 45, 46].

Additionally, rural women have limited access to breast cancer education, contributing to a lack of awareness and late screening [30, 32, 47]. In another study, 53.5% of the women were aware of breast self-exams as a form of breast cancer screening, although only 7.5% practiced it [33]. Regarding Pap test awareness, researchers have reported inconsistent findings [5, 12, 38, 39, 48]. In one study, the majority of women in rural areas demonstrated poor awareness of Pap test (55%) and their screening (75%), with both rural and urban areas showing deficiencies in knowledge of symptoms and risk factors [49]. In contrast, other researchers concluded that Pap test awareness was much higher among rural women with at least a high school education, health insurance, a personal health care provider, a recent clinical breast exam, and family influence to get a Pap test [5, 12, 37, 38, 50]. More than 95% of women in rural areas exhibit a higher level of Pap test awareness, with 84.6% believing in getting an annual Pap test, and 71.8% understanding the role of the Pap test, and women with low socioeconomic status often refuse to have the test done [5, 12, 46, 51].

Although Pap test is the primary screening method for cervical cancer, women in rural areas do not receive such clinical services [52, 53]. Lack of awareness of screening methods, low income, fear of embarrassment, pain from gynecological consultations, and misconceptions about cervical cancer symptoms are among the most frequently cited reasons that hinder women from getting a Pap test [12, 46, 49, 54].

On the other hand, there are very few existing studies that have explored men's awareness of female cancer screening and knowledge. The current studies have primarily focused on gender-specific female cancer screening awareness. There have not been many studies that address the understanding of awareness levels among men regarding cancers that exclusively affect women [55]. For this reason, it is vitally important to provide extensive training to improve awareness and knowledge of mammograms and Pap tests, regardless of gender. Engaging men in female cancer screening awareness is crucial because they often play key roles in influencing healthcare decisions within families. They can support and encourage female family members to participate in screening programs, thus potentially increasing screening rates and early detection of cancers. Additionally, men's understanding and support can alleviate the stigma and fear often associated with cancer screenings, leading to better health outcomes.

Examining the factors associated with female cancer screening awareness is also imperative approach in resource-limited settings such as the Black Belt, where the majority of women have limited access to healthcare services [27]. Although the existing literature on female cancer screenings is well-documented, studies focusing on female cancer screening awareness in rural communities are still limited. There remains a paucity of research on the in-depth understanding of female screening awareness regarding mammograms, Pap tests, and clinical breast exams in the Black Belt region. Therefore, this study collectively endeavors to (1) identify levels of female cancer screening awareness and disparities among both men and women, and (2) identify factors associated with the three female cancer screenings among rural women and men in the Black Belt region in Alabama.

Materials and Methods

Research Design and Data Collection

The current study employed a cross-sectional survey

research design. Under the Institutional Review Board (IRB) approval, a survey on cancer screening and health behavior was administered in the Black Belt area of Alabama. Participants completed self-administered surveys at a Health Disparity Event, Health Education Sessions, and Health Fairs in rural Alabama. For participants who have trouble reading, surveys were read to participants, and researchers recorded responses. Due to limited technology literacy among participants, a pencil and pen paper survey was applied, and then the responses were entered to Qualtrics. Participants received $15 for completing the survey as an appreciation for their time. The final sample of the survey was 257.

Dependent Variables

Three types of female cancer screening awareness were included: mammogram, clinical breast exam, and Pap test. Participants were asked three yes-or-no questions in the survey: "*Have you heard of mammogram?*" "*Have you heard of clinical breast exam?*" and "*Have you heard of Pap test?*" (0=no, yes=1).

Independent Variables

Based on comprehensive literature, independent variables were selected including socio-demographics, healthcare resources, participation in socializing groups, and health-related factors.

Socio-demographics. Gender (0=male, 1=female), marital status (0=single, separated, widowed, or divorced, 1=married or partnered), educational attainment (0=below bachelor's degree, 1=bachelor's degree or above), and employment status (0=unemployed, 1=employed) were analyzed as dichotomous variables. Participants reported their annual household income range through selecting from the following options: 1= $0-$9,999, 2=$10,000-$14,999, 3=$15,000-$19,999, 4=$20,000-$34,999, 5=$35,000-$49,999, 6=$50,000-$74,999, 7=more than $75,000. Annual household income of participants was analyzed as a continuous variable, ranging from 1 to 7.

Healthcare resources. Participants were asked in the survey, "*Do you think your race affects the quality of healthcare that you receive?*" (0=no, 1=yes). The usual place for healthcare, primary physician, and health insurance coverage were also analyzed dichotomously (0=no, 1=yes).

Participation in socializing groups. Participants were asked, "*do you attend any socializing group such as social club or religious group?*" (0=no, 1=yes).

Health-related factors. Self-reported health status, family cancer history, and number of medical conditions were included in health-related factors. Participants rated their current health with a single item that asked, "How would you rate your health at the present time?" Responses were "*very poor,*" "*poor,*" "*fair,*" "*good,*" "excellent or very good." The final variable was obtained by dichotomizing the original variable: 0=very poor/poor/fair, 1=good/excellent, or very good. For family cancer history, participants were asked, "*Have any of your family (parents, grandparents, siblings, or close relatives) ever had cancer of any kind?*" (0=no, 1=yes). Participants were asked in the survey, "*What types of disease do you suffer from: high blood pressure/diabetes/cardia disorder/stroke/arthritis/asthma and lung disease/gastrointestinal disorders?"*. The number of the disease that participants reported was treated as the number of medical conditions and analyzed as a continuous variable, ranging from 0 to 7.

Data Analysis

Univariate analysis was conducted to obtain the description of independent variables and rates of three types of female cancer screening awareness using frequencies for categorical variables and means (standard deviations) for continuous variables. Bivariate analysis was employed to examine the unadjusted association between each independent variable and three types of female cancer screening, respectively. Lastly, three sets of binary logistic regression were conducted to explore the associated factors with female cancer screening awareness. The significance level was determined at the p value of 0.05. SPSS was used to analyze the data.

Results

Description Characteristics of Participants

According to Table 1, three-quarters of participants were female (75.4%), and nearly forty percent were married or partnered (38.5%). Only one-quarter of respondents had a bachelor's degree or above (25.8%), and less than forty percent were employed (36.9%). Participants tended to have moderate household income (Mean=3.24, SD=2.08, range=1-7). Around forty percent of respondents reported that their race affected the quality of healthcare that they received (42.6%). The majority of participants had a usual place for healthcare (82.2%), primary physician (87.5%), and health insurance coverage (88.6%). More than half of respondents participated in a socializing group (59.2%). Almost seventy percent of participants (69.2%) reported that their family members had cancer, and around one-third of participants (65.2%) reported that their health status was good/very good/excellent. The average number of medical conditions among participants was 1.49 out of 7.

Female Cancer Screening Awareness Results

In Table 2, participants reported high rates of awareness of mammograms, administered breast exams, and Pap tests. Gender (being female), the usual place for healthcare, primary physician, health insurance coverage, family cancer history, and self-reported health status were significantly associated with three types of female cancer screening awareness ($p<0.05$). Additionally, employment was significantly associated with the awareness of administered breast exams, and participating in socializing groups was significantly associated with the awareness of Pap test ($p<0.05$).

Associated Factors with Female Cancer Screening Awareness Results

Table 3 showed associated factors with three types of female cancer screening awareness, respectively. Employment and family cancer history were significantly associated with all three types of female cancer screening

Table 1. Description of Independent Variables (N=257[a])

Charecterestic		n (%)[b]
Gender	Male	63 (24.6)
	Female	193 (75.4)
Marital status	Single, separated, widowed, or divorced	152 (61.5)
	Married or partnered	95 (38.5)
Education	Under bachelor's degree	173 (74.2)
	Bachelor's degree or above	60 (25.8)
Employment	Unemployed	154 (63.1)
	Employed	90 (36.9)
Perceiving race affecting healthcare quality	No	143 (57.4)
	Yes	106 (42.6)
Usual place for healthcare	No	45 (17.8)
	Yes	208 (82.2)
Primary physician	No	32 (12.5)
	Yes	223 (87.5)
Health insurance coverage	No	29 (11.4)
	Yes	225 (88.6)
Participation in socializing group	No	98 (40.8)
	Yes	142 (59.2)
Family cancer history	No	78 (30.8)
	Yes	175 (69.2)
Self-reported health status	Very poor/poor/fair)	88 (34.8)
	Good/very good/excellent	165 (65.2)
		Mean (S.D.)[b]
Household income (range 1-7)		3.24 (2.08)
Number of medical conditions (range 0-7)		1.49 (1.31)

[a], The total sample size of the study may not be the same as the total sample size of the survey due to missing values; [b], Means (S.D.) for continuous variables and n (%) for categorical variables.

awareness. Participants who were employed were more likely to have heard of mammograms (OR=16.29, CI=1.26-210.72, p<0.05), administered breast exam (OR=5.07, CI=1.35-19.04, p<0.05), and Pap test (OR=17.62, CI=1.65-188.13, p<0.05). Moreover, participants who reported family cancer history were more likely to be aware of mammograms (OR=16.12, CI=2.19-118.60, p<0.01), clinical breast exam (OR=5.74, CI=1.97-16.67, p<0.001), and Pap test (OR=6.78, CI=1.34-34.34, p<0.05).

In addition, females were more likely to have heard of mammograms (OR=53.04, CI=5.42-519.08, p<0.001) and Pap test (OR=16.46, CI=2.64-102.55, p<0.01). Self-reported health status was positively associated with awareness of clinical breast exams (OR=4.88, CI=1.53-15.56, p<0.01) and Pap test awareness (OR=17.78, CI=2.31-136.93, p<0.01). Marital status was only significantly associated with Pap test awareness (OR=0.17, CI=0.03-0.93, p<0.05), while perceiving race affects healthcare quality was only significantly associated with mammogram awareness (OR=6.40, CI=1.03-39.80, p<0.01)

Discussion

This study examined factors associated with three levels of female cancer awareness: mammogram, clinical breast exam, and Pap test in Alabama's Black Belt region. First, this study showed that more females reported high rates of awareness of mammograms, clinical breast exams, and Pap tests compared to males in the Black Belt region. These findings are inconsistent with prior studies that found women to have a lower prevalence of female cancer awareness [17, 23, 32, 35, 39, 45, 56, 57]. However, our findings indicating higher female cancer awareness in all three domains are not surprising, given that breast and cervical malignancies significantly affect American women in rural communities on a large scale due to limited resources to access healthcare [15, 27, 58], including in the Black Belt region where poverty is recorded at higher levels compared to other regions in the U.S. [59].

Although female cancer awareness has undoubtedly increased among women being screened in the Black Belt region, disparities persist. Not all women are aware about mammograms, clinical breast exams, and Pap tests [5, 12, 16, 32, 36-38, 60-62], due to factors such as lack of a usual place for healthcare, economic instability, or lack of insurance, which affect access to and compliance with female cancer screening. To reduce cancer mortality among women in the Black Belt region, it is crucial to not only provide comprehensive knowledge of routine mammograms, clinical breast exams, and Pap tests for early detection of gynecologic conditions but also to

Table 2. Bivariate Analysis on Female Cancer Screening Awareness (N=257[a])

		Heard of Mammogram		Heard of Administered Breast Exam		Heard of Pap test	
		n (%)[b]	p-value[c]	n (%)	p-value	n (%)	p-value
Total		220 (85.6)		185 (72.0)		198 (77.0)	
Gender	Male	38 (66.7)	0.000***	32 (58.2)	0.000***	30 (56.6)	0.000***
	Female	182 (95.3)		153 (85.5)		168 (92.8)	
Marital status	Single, separated, widowed, or divorced	132 (88.0)	0.313	112 (80.0)	0.634	124 (86.7)	0.621
	Married or partnered	82 (92.1)		71 (82.6)		70 (84.3)	
Education	<= bachelor's degree	148 (87.1)	0.109	122 (77.2)	0.16	133 (84.2)	0.202
	>=bachelor's degree	54 (94.7)		49 (86.0)		51 (91.1)	
Employment	No	131 (86.8)	0.131	104 (74.3)	0.022*	115 (82.1)	0.14
	Yes	81 (93.1)		74 (87.1)		76 (89.4)	
Race affecting healthcare quality	No	120 (87.0)	0.191	99 (77.3)	0.308	106 (82.8)	0.289
	Yes	95 (92.2)		82 (82.8)		87 (87.9)	
Usual place for healthcare	No	33 (73.3)	0.000***	24 (55.8)	0.000***	27 (64.3)	0.000***
	Yes	183 (92.0)		158 (84.0)		167 (88.8)	
Primary physician	No	23 (74.2)	0.007**	14 (48.3)	0.000***	16 (57.1)	0.000***
	Yes	195 (90.7)		169 (83.3)		180 (88.2)	
Health insurance	No	22 (78.6)	0.077	17 (65.4)	0.076	21 (80.8)	0.586
	Yes	195 (89.9)		165 (80.5)		174 (84.9)	
Participation in socializing group	No	82 (85.4)	0.165	68 (73.9)	0.147	70 (77.8)	0.012*
	Yes	125 (91.2)		105 (82.0)		118 (90.1)	
Family cancer history	No	59 (80.8)	0.014*	44 (63.8)	0.000***	51 (75.0)	0.011*
	Yes	157 (91.8)		137 (85.1)		143 (88.3)	
Self-reported health status	Very poor/poor/fair)	70 (83.3)	0.041*	54 (70.1)	.015*	60 (75.0)	0.002**
	Good/very good/excellent	148 (91.9)		130 (83.9)		136 (90.1)	
		Mean (SD)[b]	p-value	Mean (SD)	p-value	Mean (SD)	p-value
Household income (range 1-7, Mean=3.24)		3.33 (2.07)	0.08	3.45 (2.05)	-2.22	3.44 (2.07)	-2.22
Number of medical conditions (range 0-7, Mean=1.49)		1.48 (1.32)	0.998	1.51 (1.33)	-0.96	1.49 (1.32)	-2.45

[a], The total sample size of the study may not be the same as the total sample size of the survey due to missing values; [b], Means (SD) for continuous variables and n (%) for categorical variables; [c], T-test for continuous variables and χ for categorical variables; [d], *p<.05; **p<.01; ***p<.001.

increase support for accessing quality healthcare in this impoverished community. While men are not directly affected by female-related cancers, their lack of awareness is concerning, as they may be potential caregivers for family members or spouses at risk of cancer. If men are knowledgeable about female-related cancers, they can better encourage their spouses or family members to undergo clinical breast cancer and Pap test screenings, thereby preventing further risks [46]. To enhance cancer awareness among men, there is a need for health education that emphasizes the importance of understanding the potential risks associated with female cancers, particularly for men in the Black Belt region. Increased knowledge about cancer can serve as an effective intervention, especially in areas like the Black Belt, where people have limited access to healthcare resources [46].

The second important finding indicated that participants who were currently employed had significantly higher levels of awareness on mammograms, Pap tests, and clinical breast exams, supporting previous findings related to cervical cancer screening, particularly Pap tests [5, 6, 51, 63]. However, regarding breast cancer, our results are inconsistent with a prior study that found no significant association between employment and breast cancer awareness [64]. Our study suggests that having a job may be a crucial factor in enhancing female cancer screening awareness among women in the Black Belt region due to higher chance of healthcare accessibility. Moreover, with more than 63.1% of the unemployed population in the Black Belt region, increasing access to job opportunities could significantly improve access to employment-based health insurance. This can empower women to maintain routine female cancer screening awareness. However, women in the Black Belt region face limited job opportunities, which affects their access to and compliance with cancer screenings. Unemployed women may encounter numerous obstacles to routine female cancer screening, leading to higher mortality rates and limited knowledge compared to those with job opportunities. In resource-limited settings like the Black Belt region, access to employment opportunities could help reduce the risk of cancer and increase female cancer screening awareness and knowledge. Employment provides income and health insurance benefits, enabling women to seek

Table 3. Binary Logistic Regression on Predictors of Breast Cancer Screening and Pap Test Awareness

	Odds Ratio		
	Mammogram	Administered Breast Exam	Pap test
Gender (ref=male)	53.04***	2.57	16.46**
Female	(5.42, 519.08)	(0.81, 8.13)	(2.64, 102.55)
Education (ref=under bachelor's degree)	5.88	1.25	0.94
Bachelor's degree or above	(.29, 117.95)	(0.34, 4.54)	(0.10, 8.74)
Marital status (ref=single, separated, widowed, or divorced)	1.5	0.43	.17*
Married or partnered	(.21, 10.72)	(0.14, 1.29)	(0.03, .93)
Perception of race affecting healthcare quality (ref=no)	6.40*	1.02	3.1
Yes	(1.03, 39.80)	(0.40, 2.64)	(0.65, 14.70)
Employment (ref=no)	16.29*	5.07*	17.62*
Yes	(1.26, 210.72)	(1.35, 19.04)	(1.65, 188.13)
Household income	0.98	1.04	1.52
	(0.58, 1.65)	(0.77, 1.39)	(0.94, 2.47)
Usual place for healthcare (ref=no)	3.58	1.28	2.89
Yes	(0.48, 26.88)	(0.33, 4.98)	(0.43, 19.30)
Primary physician (ref=no)	1.92	3.71	5.55
Yes	(0.14, 26.18)	(0.73, 18.72)	(0.36, 84.71)
Health insurance coverage (ref=no)	1.39	1.79	0.33
Yes	(0.12, 15.57)	(0.43, 7.47)	(0.03, 3.79)
Participation in socializing group (ref=no)	2.37	1.29	4.71
Yes	(0.41, 13.60)	(0.47, 3.55)	(0.94, 23.49)
Family cancer history (ref=no)	16.12**	5.74***	6.78*
Yes	(2.19, 118.60)	(1.97, 16.67)	(1.34, 34.34)
Self-reported health status (ref=very poor/poor/fair)	5.95	4.88**	17.78**
Good/very good/excellent	(0.77, 45.92)	(1.53, 15.56)	(2.31, 136.93)
Number of medical conditions	1.41	1.34	1.55
	(0.69, 2.91)	(0.85, 2.10)	(0.78, 2.99)
Number of observation	177	169	168
Nagelkerke R Square	0.552	0.308	0.527
Hosmer and Lemeshow Test	0.998	0.39	0.983

*p<0.05; **p<0.01; ***p<0.001.

timely evaluations of cancer symptoms and increase their survival chances through regular screenings. According to the American Cancer Society [15], widespread adherence to screening for all levels of female cancers could decrease the incidence of female cancers by 20% and improve the lives of women in rural communities if they have access to employment opportunities.

Third, we found that participants who reported at least one of their family members to have had a history of cancer were more likely to be aware of mammogram, clinical breast exam, and Pap test. This finding is in line with previous studies that have cited family cancer history as a significant factor associated with the three levels of female cancer awareness [15, 21, 33, 43, 44, 63]. Given that women with a family cancer history are at an increased risk of developing breast cancer [44], participants with family cancer history may create fear that consciously heightens women's awareness of the consequences, prompting them to engage more actively in earning new knowledge and engaging in early screening at the initial stage compared to women without a family history of cancer.

More so, Geiger et al. [43] found that women in rural communities with a family history of breast cancer were five times more likely to have a mammogram and undergo clinical breast exams than those without such a history. Most women in rural clinics reported that at least one person in their lives, generally a close female relative, encouraged them to get a mammogram and follow through [54]. These findings from both present and previous studies strongly indicate that exposure to family cancer is a significant factor that can positively influence elevated levels of female cancer awareness and screening.

In the current study, the self-reported health status was positively associated with higher levels of awareness of clinical breast exams and Pap test awareness. This implies that individuals who perceive their health status positively may be more likely to be aware of preventive health measures, such as clinical breast exams and Pap test [65]. This association may be due to these individuals' proactive attitudes toward maintaining their health, which includes

being informed about and participating in regular health screenings in their communities. As such, these findings underscore the importance of promoting positive health perceptions and proactive health behaviors as a means to enhance awareness and utilization of preventive health services in the Black Belt region.

Finally, the perception that race affects healthcare quality was only significantly associated with higher levels of mammogram awareness. This awareness could be driven by increased levels of vigilance and a need to ensure they receive appropriate education about breast cancer screening despite potential disparities in healthcare quality in the Black Belt region. The significant association between this perception and mammogram awareness points to the broader issue of healthcare disparities and the need for targeted interventions to address and mitigate these concerns. Ensuring equitable access to quality healthcare and addressing racial disparities in healthcare perceptions are crucial for improving overall health outcomes and screening participation among diverse populations, particularly in the rural areas, such as Black Belt region.

Implications for Public Health Practice and Policy

One potential strategy for raising female cancer awareness across all three domains (mammograms, clinical breast exams, and Pap tests) is to promote health education programs that emphasize early screening messages. This approach is crucial for decreasing morbidity and mortality rates while increasing knowledge among women with low socioeconomic status [12, 63]. Although this study reveals an increase in female cancer awareness, there is insufficient evidence to suggest that women in the Black Belt region are adequately educated or knowledgeable about mammograms, clinical breast exams, and Pap tests due to limited resources. Launching an extensive health education campaign, particularly targeting the males and the unemployed, would encourage early screening, diagnosis, and understanding of cancer risk factors, symptoms, and preventive measures in the Black Belt region. Regular and emphathic encouragement of early participation in cancer screening promotion is likely to benefit women significantly. Further studies are needed to evaluate effective strategies for educating women and men about female cancers, encouraging family members to recommend screening, and empowering women to be more proactive in their efforts to combat cancer in the Black Belt region.

Evidence indicates inadequate healthcare resources in the Black Belt region [20, 21]. Addressing the unmet needs of successful female cancer screening awareness requires a more rigorous emphasis on the limited healthcare providers available, who play a crucial role in modifying health behaviors related to the complexities of female cancers. Jain et al. [13] have emphasized that issues surrounding female cancers are "preventable, but not yet prevented." Healthcare professionals should be encouraged to disseminate information on standard care procedures to identify women at highest risk for developing breast and cervical cancer, moving from basic awareness to a pragmatic approach focused on future prevention. It has been suggested that "increasing female screening in community clinics should include ensuring that clinicians discuss mammography" [54], as well as clinical breast exam and Pap test to patients in the Black Belt region. This strategy is essential for significantly enhancing female cancer awareness and ultimately improving perceptions of this deadly malignancy. Finally, these implications should prove beneficial to policymakers and program planners. Based on our findings, there is a pressing need for public policymakers to comprehend the urgency and importance of providing comprehensive support to meet the healthcare needs of women at risk of cancer mortality if early screening, awareness, and knowledge are not fully implemented in the Black Belt region.

Limitations of the study

There are several limitations to this study worth highlighting. First, the study used self-reported measures when assessing female cancer awareness (mammogram, clinical breast exam, and Pap test) that could have been either underreported or overreported. Second, this study's findings cannot be generalized related to female cancer screening awareness in other rural communities because participants formed a convenience sample recruited exclusively from the Black Belt region in Alabama. Despite the limitations, this study has contributed to building a foundation to understand female cancer awareness levels among rural women living in isolation with inadequate resources in the Black Belt region, where poverty negatively impacts their health outcomes.

In conclusion, this study underscores critical disparities and opportunities in female cancer awareness within Alabama's Black Belt region, revealing both progress and persistent challenges. While awareness levels of mammograms, clinical breast exams, and Pap tests among women appear relatively high compared to men in the region, significant gaps remain, particularly among the unemployed and those lacking access to healthcare resources. These findings highlight the need for targeted interventions to improve access to and compliance with cancer screenings, particularly in economically disadvantaged communities. Comprehensive health education programs focusing on early screening messages are essential to enhance public health outcomes. These programs should prioritize reaching vulnerable populations, including the unemployed, to increase awareness and understanding of cancer risks and preventive measures. Furthermore, leveraging family dynamics where a family history of cancer significantly boosts awareness can be pivotal in encouraging proactive screening behaviors. Addressing the broader systemic issues, such as healthcare resource shortages in rural areas like the Black Belt, is paramount. Policy efforts should prioritize expanding healthcare access and bolstering support for community clinics to ensure consistent delivery of cancer screening education and services. Empowering healthcare providers with the tools and resources to engage in proactive screening discussions is crucial for improving female cancer outcomes in these underserved regions. By integrating these strategies into public health policies and practices, policymakers can

ultimately mitigate disparities in female cancer awareness and improve health outcomes for women in Alabama's Black Belt region. These efforts are pivotal in advancing equitable healthcare access and reducing cancer morbidity and mortality rates among vulnerable populations.

Author Contribution Statement

All authors contributed equally in this study.

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