

Insights into the Refusal of Free Screening Mammograms: Exploring Contributing Factors

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Background: Despite the availability of free screening mammograms (SMG) through the Breast Cancer Early Detection (BCED) Program in the Qassim region of Saudi Arabia, a notable gap exists between program implementation and the actual uptake of SMG. This study aims to assess the refusal rate, identify barriers to participation, and shed light on the factors influencing women's decisions regarding SMG.

Methods: A cross-sectional study was conducted among consecutive women aged 40–69 participating anonymously in the BCED program in September 2023. The participants were administered a validated Arabic language survey encompassing breast cancer screening backgrounds and knowledge, reasons for refusal, and factors influencing SMG reconsideration. Logistic regression was employed to identify factors linked with SMG refusal using SPSS version 28.

Results: Of the 2446 eligible women in the study, 576 (23.6%) declined to undergo SMG. The median age of participants was 49 years, primarily married (91.5%) and residing in central cities (60.3%). Previous mammogram history was reported by 21.4%, with only 12.9% performing regular SMGs every 1–2 years. Married women had a 31% lower refusal likelihood to SMG compared to widowed/divorced women (Adjusted Odds Ratio [aOR] = 0.69, $p = 0.02$). Women residing in peripheral areas showed approximately 1.45 times higher odds of refusal compared to those in central cities (aOR = 1.45, $p < 0.001$), and women without prior history of SMG had 2.13 times higher odds of refusal (aOR = 2.14, $p < 0.001$).

Conclusion: The refusal rate for SMG in the Qassim region aligns closely with rates observed in developed countries. Despite this progress, significant barriers to SMG uptake persist, and tailored interventions targeting specific demographic groups and addressing these barriers are essential to improving screening participation, promoting a culture of proactive screening behavior, and ensuring equitable access to screening services for all eligible women.

Keywords: screening mammograms, breast cancer, Qassim, Saudi Arabia

Introduction

Breast cancer (BC) stands as the most prevalent cancer among females worldwide and in Saudi Arabia (SA).^{1,2} In 2020, BC accounted for 35% of new cases and 8.4% of cancer-related deaths among females in SA.² Although the age-standardized incidence rate (ASR) of BC among females in SA and the Qassim region is lower than the global rate at 28.4 and 28.1 vs 54.1 per 100,000 women.^{1,3} However, there has been a notable increase in the annual percentage change (APC) from 2002 to 2016, with rates of 4.8% and 7%, respectively.⁴ Screening mammograms (SMG) is vital in early BC detection and mortality reduction.⁵ However, the rate of screen-detected BC in SA is low at 11.2%,⁶ indicating limited uptake of SMG and emphasizing the need for enhanced efforts to promote BC screening. The National Breast Cancer Early Detection (BCED) Program in Saudi Arabia received approval in May 2011 and was officially established in March 2012,⁷ with Qassim region initiating the regional SMG initiative as early as 2007.⁸ The program is designed to provide free screening mammograms to women aged between 40 and 69 years without genetic predisposition, having a

history of chest radiotherapy for Hodgkin's lymphoma between the ages of 10 to 30 years, prior history of breast or ovarian cancer, family history of breast or ovarian cancer, or BC symptoms such as breast pain, lumps, or discharge.⁷ Women can enter the program through self-referral or referral by a healthcare practitioner. The recommended frequency for screening is every two years. The program in the Qassim region follows the same guidelines and procedures as the rest of Saudi Arabia. Notably, the practitioners involved in the program are predominantly female, aligning with practices in many international programs. The utilization rate of SMG among eligible women in SA varies between 6%-47%,⁹⁻¹⁸ in contrast to the higher rates of 58%-89% reported in Western countries.¹⁹⁻²² Commonly cited obstacles to undergoing SMG include lack of time, fear of discovering cancer or undergoing cancer treatment, apprehensions related to hospitals and healthcare facilities, discomfort or embarrassment during the procedure, concerns of pain, perception of not needing it without breast lumps, a belief of being too young and reservation about radiation exposure as documented in numerous studies.^{9,10,16,23-28}

Qassim, located centrally within SA, is one of the nation's 13 administrative regions. It spans an area of 73,000 square kilometers, representing approximately 3.2% of the country's land area. It hosts a population of 1.45 million and an annual growth rate of 2.36%.^{29,30} In efforts to combat BC, the BCED program in Qassim employs various strategies, including conducting awareness campaigns, organizing educational workshops, and deploying mobile SMG units. The program provides free SMG and operates through 149 primary healthcare centers connected to 7 mammogram centers.³¹ Suspected cases detected during screenings undergo further evaluation by specialized health practitioners, and confirmed cases are referred to the oncology center. Despite these efforts, there remains a notable gap between program implementation and the actual uptake of SMG among eligible women. Therefore, this research aims to assess the SMG refusal rate, identify barriers to participation, and shed light on the factors influencing women's decisions regarding SMG. The insights gained from this study are intended to inform evidence-based aimed at improving BC screening efforts and ultimately enhancing health outcomes in the Qassim region.

Patients and Methods

A cross-sectional study was conducted among consecutive women aged 40 to 69 years who visited primary health care centers between September 3 and October 2, 2023. These women were eligible for the screening mammography (SMG) program, which targets all eligible visitors to the centers, regardless of the reason for their visit. While the SMG program is part of the routine care for eligible women, the research study sought additional participation and data collection. The study was approved by the Regional Research Ethics Committee of Health and Curative Programs Department, Public Health and Community Health Administration, Qassim Cluster, Qassim Province (number 607/45/1567). Informed consent was obtained from all participants in adherence to ethical guidelines. All methods were conducted in compliance with the Declaration of Helsinki and the relevant guidelines and regulations. Eligibility for the study was determined based on criteria identical to those of the BCED program for screening mammography.⁷ Only those who expressed willingness to participate, had not been referred for SMG within the past two years and confirmed their capability to complete the survey were included. The sample size was determined using the OpenEpi program, considering an expected refusal rate of 49% based on the previous local data of the BCED program in June 2023. With a confidence level of 95% and a precision of 2%, the required sample size was calculated to be 2395 women. With an expected response rate of 50%, the targeted screened women for the study were set at 4800 women.

Survey Structure and Data Management

The survey questions were adopted from the revised Champion's barriers scale for SMG³² and reported barriers from previous studies.^{9,10,16,23-28} The survey was pilot-tested on 30 women and underwent meticulous translation into Arabic and validation by healthcare professionals specializing in biolinguistics to ensure clarity, appropriateness, and precision in content and translation. A thorough back-translation process ensured accuracy, considering Arabic was the participants' native language. The survey consisted of three sections. The first part involved assessing eligibility through five binary questions. The second part focused on gathering background information from participants, including demographic details such as age, residence, marital status, education level, height, weight, previous history of mammogram (MGM), and attitude towards regular SMG, comprising a total of 13 binary/multiple-choice/open-ended questions.

Lastly, the third part comprised four multiple-choice questions to gauge knowledge about SMG, one binary question concerning SMG uptake response, and 20 questions (binary/open-ended) exploring reasons for refusal and the potential impact of specific suggestions to reconsider SMG; see [Appendix 1](#) for details. Prospective participants were informed about the study by their healthcare providers during primary healthcare visits. Informed consent was obtained from all participants, including those who were illiterate through oral explanations provided by trained research assistants. The questionnaire was administered face-to-face to all participants. Research assistants read the questions aloud and recorded the responses directly into the online survey system. This method ensured that all participants, regardless of literacy level, could accurately contribute to the study. De-identified data were entered into an encrypted Microsoft Excel database and stored on a password-protected computer. Participant IDs were assigned for confidentiality. Data access was restricted to delegated research team members via secure email accounts.

Statistical Analysis

Descriptive and inferential statistics were employed using SPSS version 28. Frequencies, proportions, means, and standard deviations summarized the data. The age was stratified into three groups (40–49), (50–59), and 60 to 69). The Body Mass Index (BMI) is distributed into normal weight (<25), overweight (25 to <30), and obese (≥ 30). The residency in Qassim was classified into two groups: central for living in the main cities and peripheral for towns and villages. The correct answer for each of the four knowledge questions scored 2; the incorrect answer is 0, and the unknown is 1, giving a total of 8. The participants were classified based on knowledge as good (7–8), intermediate (5–6), and poor (≤ 4). Chi-square and t-tests assessed differences in refusal based on socio-demographic characteristics. Logistic regression analysis, with crude and adjusted odds ratios (OR) and 95% confidence intervals (CI), identified factors associated with BC screening refusal ($p < 0.05$).

Results

Participants' Characteristics, Backgrounds, and Knowledge About SMG

A total of 2446 participants were included in the study, and the details of eligibility screening are illustrated in the flow diagram ([Figure 1](#)). The median age of participants was 49 years (IQR: 44–56), and 51% were between the 40–49 age group. The majority were currently married individuals (91.5%), and 7.9% were widowed or divorced. Educational level diversity was evident, and 21.3% were illiterate. The employment status indicated that 18.9% of participants were employed, while 81.1% were not. Residency patterns showed that 60.3% resided in central cities and 39.7% in peripheral areas. The median weight was 73 (IQR:66–80) Kg, the median height was 157 (IQR:154–160) cm, and the median BMI was 29.2 (IQR: 26.8–32.9) Kg/m². The distribution is as follows: normal weight 316 women (12.9%), while the majority either overweight 1011 (41.3%) or obese 1024 (42.0%). Notably, 523 (21.4%) of participants had a history of previous mammograms (range 1–6). Among those with a history of mammograms, the median age at first mammogram was 45 (IQR:42–51) years, and only 315 (12.9%) performed SMG regularly every 1–2 years.

Regarding awareness regarding SMG, the majority, 89.2% (2183 women), acknowledged that SMG is considered the standard for early detection of BC. Concerning the availability of free mammogram screening programs in the region, a significant proportion, 92% (2251 women), were aware of the programs. Participants were also asked about the recommended age for women to commence mammograms. The majority, 84.1% (2060 women), correctly identified that it should be done for women 40 years and above. As for the frequency of SMG, the data revealed that 69.4% (1698 women) were familiar with the guideline recommendation for SMG every 1–2 years. Overall, 71.9% (1759 women) exhibited a good knowledge score, and only 9.7% (238 women) were categorized as having poor knowledge of SMG in Qassim.

Out of 2446, the majority of participants accepted SMG 1870 (76.5%), and 576 women (23.5%) refused the SMG. There was a statistically significant difference based on responses to SMG uptake with marital status ($p=0.003$), education level ($p=0.01$), residence ($p<0.001$), previous history of performing SMG ($p<0.001$), and following SMG regularly ($p<0.001$). There was a higher refusal rate in women ≥ 60 years (27.1%) compared to younger women (22.8%), but that was not statistically significant ($p=0.2$). There were no differences based on employment status ($p=0.2$), knowledge score ($p=0.5$), or BMI ($p=0.77$). The details of participants' characteristics stratified by response to SMG uptake are presented in [Table 1](#).

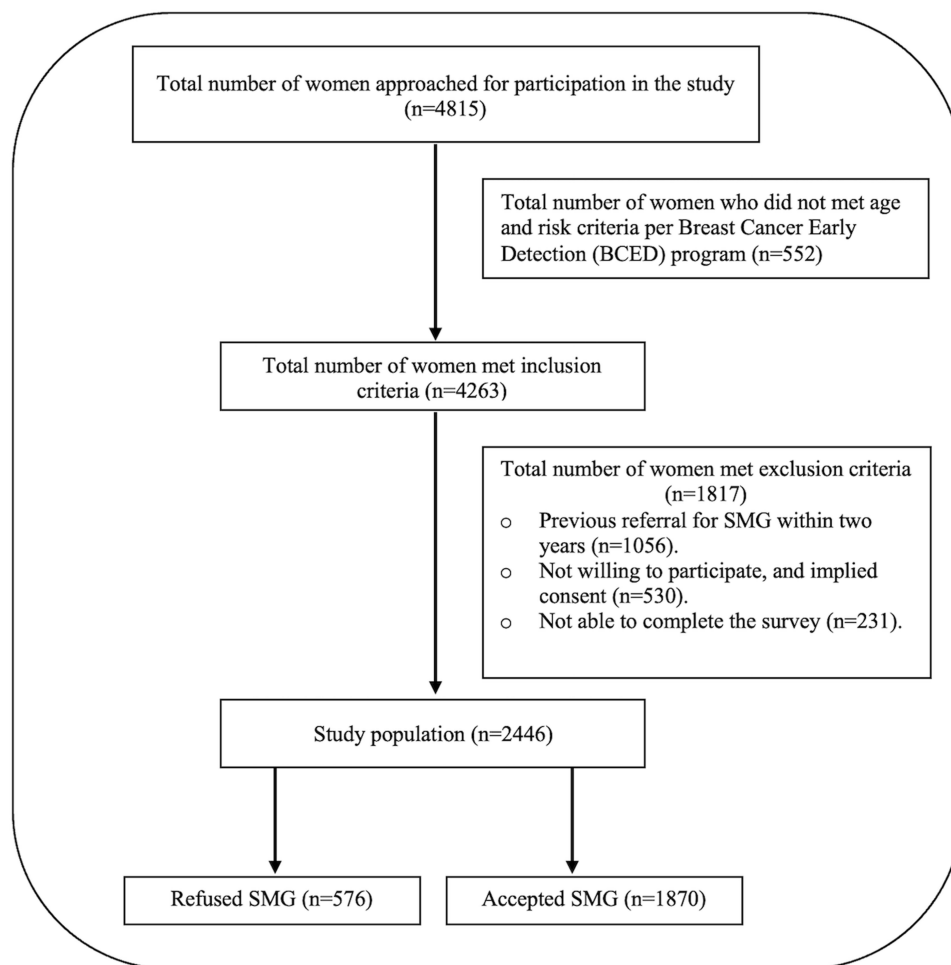


Figure 1 Flow chart for the study population.

Reasons and Factors Associated with Refusing SMG

Among the 23.5% (576 women) who refused SMG services, the primary reasons cited were a perceived lack of necessity due to the absence of a lump (74.0%). Following this, concerns regarding difficulty accessing mammogram sites (63.9%) and fear of receiving unfavorable news (55.7%). Additional significant factors included time constraints (53.3%), apprehension about radiation exposure (48.6%), and fear of mammogram-associated pain (48.4%). Furthermore, some

Table 1 Participants' Characteristics Stratified by Response to Screening Mammogram Uptake (n=2446)

Variable	Overall n (%) (n=2446)	Accepted n (%) (n=1870)	Refused n (%) (n=576)	P-value
Age (years)				
40–49	1247 (51)	961 (77.1)	286 (22.9)	0.2
50–59	834 (34.2)	644 (77.2)	190 (22.8)	
60–69	361 (14.8)	263 (72.9)	98 (27.1)	
Marital Status				
Single	13 (0.5)	6 (46.2)	7 (53.8)	0.003
Married	2240 (91.6)	1729 (77.2)	511 (22.8)	
Widowed/Divorced	139 (7.9)	135 (69.9)	(48) (30.1)	

(Continued)

Table I (Continued).

Variable	Overall n (%) (n=2446)	Accepted n (%) (n=1870)	Refused n (%) (n=576)	P-value
Education				
Illiterate	520 (21.3)	370 (71.2)	150 (28.8)	0.01
Primary/ Intermediate	891 (36.4)	700 (78.6)	191 (21.4)	
Secondary	542 (22.2)	415 (76.6)	127 (23.4)	
University or higher	493 (20.2)	385 (78.1)	108 (21.9)	
Employment Status				
Working	462 (18.9)	363 (78.6)	99 (21.4)	0.2
Not Working	1984 (81.1)	1507 (76.0)	477 (24.0)	
Residence				
Main Cities	1475 (60.3)	1174 (79.6)	301 (20.4)	<0.001
Peripheral Areas	971 (39.7)	696 (71.7)	275 (28.3)	
BMI				
Normal Weight	316 (12.9)	244 (77.2)	72 (22.8)	0.77
Overweight	1011 (41.3)	765 (75.7)	246 (24.3)	
Obese	1028 (42)	788 (76.7)	240 (23.3)	
Knowledge Score				
Good	1759 (71.9)	1329 (75.6)	430 (24.4)	0.09
Intermediate	449 (18.4)	361 (80.4)	88 (19.6)	
Poor	238 (9.7)	180 (75.6)	58 (24.4)	
Previous history of Mammogram				
Yes	523 (21.4)	453 (86.6)	70 (13.4)	<0.001
No	1634 (66.8)	1208 (73.9)	426 (26.1)	
Not sure	289 (11.8)	212 (72.6)	80 (27.4)	
Follow REGULAR MAMMOGRAM SCREENING (n=523)				
Yes	315 (60.2)	281 (89.2)	34 (10.8)	<0.001
No	173 (33.1)	143 (82.7)	30 (17.3)	
I Do Not Know	35 (6.7)	29 (82.9)	6 (17.1)	

participants expressed embarrassment (35.1%) about breast exposure, while others cited feeling too young for screening (27.8%) or religious constraints (25.0%). A smaller proportion reported concerns about hospital facilities (29.9%) or past negative experiences with mammogram screenings (19.8%). A minority also provided miscellaneous reasons in response to the open-ended question, including an inability to leave the house (2), fear of impacting pregnancy or lactation (3), feeling too old for screening (2), other meanings for fear of BC discovery (8), or geographical distance from mammogram centers (6).

Further details on these reasons are provided in [Table 2](#).

Multivariate analysis identified marital status, residential location, and mammogram history as independent predictors of mammogram rejection in our participants. Widowed/Divorced women had a 1.55-fold increase in the likelihood of refusing SMG compared to married women (Adjusted Odds Ratio [OR] = 1.55, $p = 0.01$). Women residing in peripheral areas showed approximately 1.45 times higher odds of refusal than those in central cities (Adjusted OR = 1.45, $p < 0.001$). Furthermore, women without prior mammograms had 2.13 times higher odds of refusal (Adjusted OR = 2.13, $p < 0.001$), as shown in [Table 3](#).

Participants who declined SMG were surveyed regarding their willingness to reconsider in various scenarios. When offered a female healthcare examiner, 58.9% expressed agreement. Positive perceptions were observed regarding the availability of free transportation to the mammogram center, with 65.5% agreeing. Consideration of scheduling convenience revealed that 58.9% agreed with the idea of having appointments during non-working hours. Similarly,

Table 2 The Participant's Reasons for Refusal of Screening Mammogram (n=576)

Reasons	No. (%)
Not Need it Because of No Lump.	426 (74.0)
Not Need it Because I am Young.	160 (27.8)
Previously Undergone Mammogram	152 (26.4)
Fear Receiving Bad News.	321 (55.7)
Fear of Radiation Exposure.	280 (48.6)
Fear of Pain During a Mammogram.	279 (48.4)
Embarrassed about Breast Exposure.	202 (35.1)
Difficulty Reaching the Mammogram Site.	368 (63.9)
Religious Restrictions on Exposure.	144 (25.0)
Lack of Time Due to Busy Schedule.	307 (53.3)
Fear of Hospital Facilities.	172 (29.9)
Previous Negative Experience with Mammogram Screening.	114 (19.8)
Other reasons	13 (1.0)

Table 3 Predictors of Mammogram Rejection Among Women in Qassim, Saudi Arabia

Variable	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age, Continuous Variable (Years)	1.01 (0.99–1.02)	0.1	1.01 (0.99–1.02)	0.2
Marital Status				
Married	1		1	0.01
Widowed/Divorced	1.45 (1.05–2.01)	0.02	1.55 (1.10–2.19)	
Education				
Illiterate	1		1	0.2
Primary/ Intermediate	0.67 (0.52–0.86)		0.79 (0.60–1.04)	
Secondary	0.75 (0.57–0.99)	0.01	0.98 (0.70–1.36)	
University or Higher	0.69 (0.52–0.92)		0.94 (0.66–1.33)	
Employment				
Working	1	0.2	–	
Not-Working	1.16 (0.91–1.48)			
Residence				
Main Cities	1	<0.001	1	<0.001
Peripheral Areas	1.54 (1.27–1.86)		1.45 (1.18–1.79)	
BMI				
Normal Weight	1		–	
Overweight	(0.81–1.47)	0.77		
Obese	1.0 (0.76–1.39)			
Mammogram in Past				
Yes	1		1	<0.001
No	2.28 (1.73–3.00)	<0.001	2.13 (1.61–2.83)	
Not Sure	2.45 (1.72–3.55)		2.39 (1.66–3.45)	

Table 4 Factors Influencing Reconsideration of SMG Among Refusers (n=576)

Variable	n (%)
Female Healthcare Examiner	
Agree	339 (58.9)
Somewhat Agree.	110 (19.1)
Disagree	127 (22.0)
Free Transportation to the Mammogram Center	
Agree	377 (65.5)
Somewhat Agree.	121 (21.0)
Disagree	78 (13.5)
Appointment Available During Non-Working Hours	
Agree	340 (59.0)
Somewhat Agree.	139 (24.1)
Disagree	97 (16.8)
Sick Leave for a Mammogram During Working Hours	
Agree	302 (52.4)
Somewhat Agree.	157 (27.3)
Disagree	117 (20.3)
A counseling Session with a Healthcare Provider	
Agree	305 (53.0)
Somewhat Agree.	154 (26.7)
Disagree	117 (20.3)

52.4% expressed agreement with the provision of sick leave for a mammogram during working hours. Including a counseling session with a healthcare provider received favorable responses, with 53% in agreement, as shown in Table 4.

Discussion

The insight gained from this study sheds light on the SMG refusal rate among Saudi women in the Qassim region and emphasizes factors influencing SMG uptake and developing targeted interventions. Our analysis revealed that 23.5% of eligible women declined the service. These findings highlight the necessity for targeted interventions and tailored educational campaigns to address specific barriers faced by different demographic groups. Participants' decisions to decline SMG were primarily influenced by the absence of a lump, difficulty in accessing mammogram sites, fear of receiving bad news, time constraints, apprehensions regarding radiation exposure, and concerns about mammogram-associated pain, embarrassment, or religious constraints. Marital status, residence, and previous history of performing mammograms emerged as independent predictors of mammogram rejection among participants. Despite these challenges, the study identifies potential facilitators that could positively influence women's willingness to reconsider screening mammography. These include the presence of a female healthcare examiner, free transportation to the mammogram center, convenient scheduling, provision of sick leave during working hours, and the inclusion of counseling sessions with healthcare providers. These results underscore the potential influence of specific facilitators on individuals' willingness to reconsider and actively participate in screening mammography.

The demographic composition of our study sample mirrors that of our population, with a younger age group and a higher-than-average BMI, categorized as overweight or obese. Additionally, the majority were married, resided in central cities, and educated.^{6,9,10,16,24,27,33,34} Our study's age representation, particularly with a significant proportion of women aged 40–49 years, supports the generalizability of our findings to similar demographic groups within the eligible screening age range. In Saudi Arabia, the median age at breast cancer diagnosis is 45.7 years, which aligns with data

from other Arab countries, Asia, and the Caribbean.^{6,35} Research across our region, encompassing areas like Saudi Arabia, the United Arab Emirates, and Egypt, consistently reveals suboptimal utilization of screening mammography. Studies indicate that 40% to 92% of women have never undergone mammography.^{16,17,33,36} This underutilization contributes to a lower rate of screen-detected tumors. For example, among 2212 consecutive women diagnosed with localized disease, only 11.2% had tumors detected through screening.⁶ In contrast, Western countries typically report higher rates, ranging from 22% to 48%.^{37,38} These disparities in screening rates have significant implications for the timing of diagnosis and subsequent management strategies.

In the last decade, the Ministry of Health has implemented significant efforts through various measures such as awareness campaigns, screening programs, and the introduction of mobile clinics to enhance screening uptake. Our findings, with 23.6% of eligible women declining the service, indicate the effectiveness of national and regional, aligning with observed improvement in other countries over time.^{38,39} Significantly, our results suggest a comparable refusal rate to developed countries like Canada (28%) and Scotland (25%) and approaching the levels observed in Denmark (16.9%) and Australia (17%).^{19,39,40} This progress indicates an improvement in the acceptance and participation in SMG, which is essential for enhancing early detection and the management of BC within our regions. However, despite the majority (76.4%) accepting SMG in our study, questions remain regarding their adherence to the screening pathway, warranting further examination. Previous reports showed that among women exhibiting a positive attitude toward screening mammograms, only 30–50% underwent the procedure.^{9,41}

A notable finding from our study is the primary reason for refusing SMG, which is the “perceived lack of necessity due to the absence of a lump” (74%). This highlights a significant misunderstanding among participants about the purpose of breast cancer screening, which is intended for asymptomatic women to detect cancer at an early stage. This finding underscores a critical gap in knowledge about breast cancer screening programs. Despite generally high knowledge scores reported in our study, the misconception that screening is unnecessary without symptoms suggests that the tool used to measure knowledge might not have captured this aspect adequately. Therefore, future research should address these issues while assessing knowledge of and attitudes toward SMG. Nonetheless, educational interventions are required to address this misunderstanding among women. Our findings indicate that educational campaigns should emphasize that breast cancer screening is crucial in the absence of symptoms, aiming to correct this prevalent misconception and improve screening uptake. Future research should incorporate comprehensive tools that better assess understanding of the asymptomatic nature of screening.

Additionally, special attention should be given to improving participation among illiterate women. Tailored educational interventions, such as visual aids, community-based programs, and verbal communication strategies, could be highly effective. Collaborating with community leaders and healthcare providers to deliver culturally appropriate and accessible information can also help bridge this gap and enhance participation rates in this vulnerable group.

However, in our study, a significant portion of participants, representing one-fourth of the sample, cited religious constraints as a primary reason for declining screening, emphasizing its substantial impact. This finding shed light on religious beliefs toward SMG. Previous research has indicated that religious beliefs, particularly among Muslim women, may influence socio-ethical, cultural, and religious perspectives on health practices related to BC screening.^{42–44} To address these challenges, our study advocates implementing educational initiatives to overcome these barriers.

Multivariate analysis showed that marital status, residence, and previous history of performing mammograms were independent factors in accepting mammograms, which agrees with previous studies.^{16,38} There was a notable trend among women from peripheral areas to decline SMG, which aligns with previous studies. Systematic reviews of 28 and 21 studies highlighted that rural populations were less inclined to undergo SMG and an increased likelihood of diagnosis at advanced stages of BC.^{45,46} Conversely, no difference in SMG uptake was observed based on residential locations in Scotland and Australia.¹⁹

No significant link was found between knowledge scores and refusal rates. This lack of association may stem from the fact that most participants displayed high knowledge scores, with just a small fraction (9.7%) having low scores. However, a clear correlation emerged between knowledge scores and education level. Those with higher education had significantly lower rates of poor knowledge scores compared to the illiterate group ($p < 0.001$), consistent with previous research.^{16,27} Regarding refusal rates among women 60 years and older, it was higher at 27.1%, although not

statistically significant ($p=0.2$). While education showed a higher refusal rate in univariate analysis, this association did not reach statistical significance in multivariate analysis.

With SMG accessible in all Saudi regions and provided free of charge, urgent measures are needed to enhance compliance with BC screening through intensive educational campaigns. Emphasizing the importance of screening for individuals within specific age groups and locations, irrespective of symptoms, is crucial. Additionally, addressing religious beliefs through community involvement, particularly with religious figures, is indispensable. Comprehensive strategies that target identified barriers and capitalize on potential facilitators are essential to improving SMG in the Qassim region. Collaborative efforts involving healthcare providers, community leaders, and policymakers are essential to implementing culturally sensitive and context-specific interventions. Significant strides can be made in early detection and effective management by addressing these challenges and advocating for a proactive approach to BC screening. Ultimately, this can help alleviate the burden of BC on women in the Qassim region of Saudi Arabia.

The findings of this study offer valuable insights into enhancing breast screening programs and addressing potential barriers, ultimately improving the effectiveness of BC detection and prevention efforts. However, it's important to acknowledge a potential limitation, namely the possible lack of generalizability of the findings to the entire population. We observed that despite higher knowledge levels, there were misconceptions about breast cancer screening criteria. This could be due to the potential limitation of the tool to capture the knowledge related to prevailing misconceptions. However, the knowledge tool showed acceptable internal consistency as judged by Cronbach's alpha (0.703). Additionally, a limitation of the study was that the sample was powered solely for the rejection rate, with no a priori sample size calculations done for factors associated with rejection. However, post-hoc calculations based on observed exposure distribution among the two groups indicated that our sample had a minimum of 95% power for observed odds ratios in the regression model. Moreover, social desirability bias is possible, where women might have responded positively despite not intending to undergo SMG. However, this would minimally impact the validity of our results, as the data collected was completely anonymized for privacy, and participants were consecutive and assured of standard care in the facility regardless of their survey responses. Despite these limitations, the study's findings will contribute to improving breast screening initiatives and fostering more effective BC detection and prevention strategies.

Conclusion

The refusal rate for SMG among Saudi women in the Qassim region, at 23.5%, aligns closely with rates observed in developed countries. Despite this progress, significant barriers to SMG uptake persist, including logistical challenges, fear of unfavorable health news, and cultural and religious considerations. Tailored interventions targeting specific demographic groups and addressing these barriers are essential to promote a culture of proactive screening behavior and ensure equitable access to screening services for all eligible women.

Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

The study was approved by the Regional Research Ethics Committee of Health and Curative Programs Department, Public Health and Community Health Administration, Qassim Cluster, Qassim Province (number 607/45/1567). Participants were required to provide informed consent before participating in the study, demonstrating their understanding of the study's objectives and expressing their voluntary agreement to participate. All methods were performed following relevant guidelines and regulations.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the *Breast Cancer: Targets and Therapy* to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that the research was conducted without commercial or financial relationships that could be construed as potential conflicts of interest.

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