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Research article

# Breast cancer screening among Arabic women living in the State of Qatar: Awareness, knowledge, and participation in screening activities

Tam Truong Donnelly[1,*], Al-Hareth Al Khater[2], Salha Bujassoum Al-Bader[2], Mohamed Ghaith Al Kuwari[3], Nabila Al-Meer[2], Mariam Malik[3], Rajvir Singh[2], Sofia Chaudhry[4], Roqaia Ahmad Dorri[4]

[1]Faculty of Medicine, The University of Calgary, P.O. Box 23133 Doha, Al Rayyan Campus, Al Forousiya Road, Qatar
[2]Hamad Medical Corporation
[3]Primary Health Care
[4]University of Calgary, Qatar
[*]Email: tdonnell@ucalgary.ca

## ABSTRACT

**Background:** Breast cancer is the most common cancer among women in the State of Qatar, and the incidence rate is rising. Previous findings indicate women in Qatar are often diagnosed with breast cancer at advanced stages and their participation rates in screening activities are low.

**Purpose:** To investigate within the State of Qatar Arabic women's knowledge regarding breast cancer and breast cancer screening (BCS) methods and their participation rates in BCS. This paper reports on the results of a cross-sectional survey.

**Methods:** A quantitative, cross-sectional interview survey was conducted with 1,063 Arabic women (Qatari citizens and non-Qatari Arabic-speaking residents), 35 years of age or older, from March 2011 to July 2011.

**Results:** Of the 1,063 women interviewed (87.5% response rate), 90.7% were aware of breast cancer; 7.6% were assessed with having basic knowledge of BCS, 28.9% were aware of breast self-examination (BSE), 41.8% were aware of clinical breast exams (CBE), and 26.9% were aware of mammograms. Of the women interviewed, 13.8% performed BSE monthly, 31.3% had a CBE once a year or once every two years, and 26.9% of women 40 years of age or older had a mammogram once a year or once every two years. Participation rates in BCS activities were significantly related to awareness and knowledge of BCS, education levels, and receiving information about breast cancer, self-examination or mammography from any of a variety of sources, particularly physicians.

**Conclusions:** Study results demonstrate that despite the existent breast cancer screening recommendations, less than one-third of Arabic women living in Qatar participate in BCS activities. Public health campaigns encouraging more proactive roles for health care professionals regarding awareness and knowledge of breast cancer, BCS, and the benefits of early detection of breast cancer will help increase screening rates and reduce mortality rates among Arabic women living in the State of Qatar.

*Keywords:* Qatar, breast cancer screening, breast cancer awareness and knowledge, Arabic women breast cancer screening, Qatar females, breast self-examination, clinical breast examination, mammogram

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## BACKGROUND

Worldwide, breast cancer is the most commonly diagnosed and one of the leading causes of cancer deaths [1,2]. In the Middle East region, the incidence of breast cancer has substantially increased in the last 24 years [3]. Women are not only being diagnosed with breast cancer in the later stages of the disease but also a higher proportion of younger women in their thirties and forties are clinically presenting with breast cancer [3–5]. According to the World Health Organization (WHO), Qatar experienced a 12.9/100,000 breast cancer mortality rate in 2008 [6]. This mortality rate is higher than other Arab peninsular countries, such as Saudi Arabia (10.4/100,000) and the United Arab Emirates (10.9/100,000), which also have lower incidence rates of breast cancer compared to the rest of the Middle East [6].

Qatar has experienced substantial development and lifestyle changes in the past few decades, which have been largely driven by oil and natural gas wealth [7]. Prevalence and patterns of cancer have been affected by rapid growth and subsequent environmental and social changes [3,7,8]. In 2007, 20% of cancer cases receiving treatment in one oncology hospital in Doha (Al Amal Hospital) were for breast cancer [9]. Data reviewed by Bener et al. from Qatar's 2006 National Cancer Disease Registry, and the WHO (2008) revealed that breast cancer is the leading cancer diagnosis, far greater than other most common cancers for Qatari women [6,7].

### A note on terminology

We refer throughout the paper to 'Arabic' women. This term defines our study group as Arabic speakers, despite the fact that they are not all ethnically Arab. We use the term Arabic as a shorthand for 'Arabic-speaking' in this paper. See 'Study population' in the Methods section for further details.

### Breast cancer incidence rates in the Middle East region

According to the International Agency for Cancer Research and GLOBOCAN 2008 estimates of age-standardized rates of breast cancer incidence and mortality, breast cancer incidence rates in the Arab Middle East are currently highest in Lebanon (55.4/100,000), followed by Bahrain (49.8/100,000) and Kuwait (47.7/100,000) [6]. In the Gulf Cooperation Council (GCC) countries,[1] breast cancer incidence rates are highest in Bahrain (49.8/100,000), followed by Kuwait (47.7/100,000) and Qatar (38.1/100,000). Compared to other Arab peninsular countries, such as Saudi Arabia (22.4/100,000) or Yemen (20.8/100,000), Qatar's incidence rate is high [6,10]. While breast cancer incidence rates in Western and European countries have stabilized or increased slightly in recent years [1,6,11], breast cancer incidence rates in Middle Eastern countries are increasing rapidly, and Qatar is no exception [7,8]. Bener et al. (2008) reviewed Qatar's National Cancer Disease Registry and found a 57.1% increase in total cancer cases in Qatar from 2002 to 2006 (360 cases compared to 170 cases between 1991 and 1996) [7].

### Breast cancer screening

Mortality rates have decreased by 25 to 30% with early detection, improved quality of screening activities, and enhanced treatment [11,12]. Breast cancer detected in the early stages has a higher chance of responding successfully to treatment [12,13]. Arabic women currently face a significant risk of high mortality rate from breast cancer due to frequent diagnosis in the advanced stages of the disease [7,8,14,15].

Early detection and screening activities of breast cancer include breast self examination (BSE), clinical breast examination (CBE), and mammography. Mammography can reduce mortality rates in women aged 40 to 74 by 25% [11,16]. The WHO (2011) reports mammography to be the most successful way of detecting breast cancer amongst women older than 50 [1].

Previously in Qatar, the breast cancer screening (BCS) recommendation was for a monthly BSE with a yearly CBE for women aged above 35 years and a mammogram every two years for women aged 40–69 years, unless otherwise advised by physicians [17,18]. However, BCS recommendations are currently being revised in Qatar to reflect Qatar's health care context and to meet the need of cancer care for younger women. The guidelines now recommend a monthly BSE starting at age 20, a yearly

[1] GCC countries include Saudi Arabia, the United Arab Emirates (UAE), Qatar, Bahrain, Oman and Kuwait.

CBE for women aged 35 and above, and an annual mammogram for women aged 40–69 years, unless otherwise advised by physicians.

Although data related to breast cancer research in the Middle East is scarce [7,19], previous studies in the region have found low BCS participation rates amongst women [8,13,20–22]. In a more recent study of 1,200 Qatari national women between the ages of 30–55 years, it was discovered that despite an adequate knowledge of breast cancer, participation rates in breast cancer screening activities were low; BSE 24.9%, CBE 23.3% and mammography 22.5% [13,20]. Of note, women taking part in these activities were mainly young and of higher socioeconomic status. These rates are very low when compared to women's breast cancer screening rates in countries such as Canada, Denmark, Finland, Sweden and the Netherlands, where 70% to 85% women aged 50–69 years have had a mammogram in the previous three years [23]. National screening programs vary; therefore, benchmarking remains a challenge. However, low breast cancer screening participation rates in Qatar should raise concern among health care providers and policy makers alike.

### Barriers to Arabic women's breast cancer screening

Factors that are associated with women's compliance or lack thereof in BCS activities must be investigated to create an effective intervention strategy. Studies have also shown that physician's recommendation acts as an enabler, while not receiving a recommendation can act as a barrier [8]. Previous studies have revealed that additional barriers to mammogram practice include fear of cancer, fear of finding out one has cancer, the notion that there is no cure, perceived benefit, time, cost, fear of gossip, fear that breast examination and mammogram could be painful, husband or other male family members objecting to breast examination, preference for a female health professional, accessibility of the health care system, perceived effectiveness and embarrassment [8,14,20–22,24,25].

In some conservative Arab areas, barriers to BCS can also include travel restrictions for women, some of whom may not drive or travel alone without a male due to laws or customs [20,22]. Coupled with male relatives who may not be supportive or who object to such examinations, women are vulnerable to the risk of discovering breast cancer at later stages if they are not comfortable raising issues of breast lumps and breast exams. Consequently, health promotion messages must also promote male encouragement of their female relatives' decision to seek a mammogram [19].

Studies have shown that knowledge, attitudes, beliefs and practices related to breast cancer screening practices are influenced by social and cultural frameworks [8,14,20–22,24,25]. Therefore, it is essential to examine knowledge, attitudes, beliefs, practices, barriers and enablers for specific populations before designing and implementing an intervention strategy [21,25–27]. Accordingly, contextual factors that influence breast cancer screening practices amongst Arabic women living in the State of Qatar must be investigated in order to design a socio-culturally appropriate intervention strategy that addresses the threat of breast cancer in Qatar.

### The multiple intervention framework

Because breast cancer screening is complex in nature and has many interrelated determinants, promoting breast cancer screening behaviors requires a comprehensive set of intervention strategies targeting individual behavior changes, collective capacity and action, and supportive environments. The Canadian Ottawa Charter for Health Promotion confirms that health is influenced by contextual factors including those that are social, economic, political, and cultural [28]. Thus, developing a successful health promotion program necessitates more complex, multi-sector interventions that facilitate individual behavioral changes and address those contextual factors that influence health [28,29]. See Fig. 1.

The design of multiple intervention programs for community health involves the deployment of multiple strategies via multiple channels to deal with the health problems. These strategies are aimed at individuals, groups, communities, organizations and policies. The goal of this research study is to develop, implement, and sustain an intervention program that raises awareness of breast cancer and increases women's participation in breast cancer screening activities. To achieve this goal, a multiple intervention conceptual framework was adopted for the design of our research program [29]. A **three-phase research program** was planned. The aim of Phase I was to seek understanding of breast health issues as experienced by Arabic women in Qatar. The aim of **Phase II** is to identify and

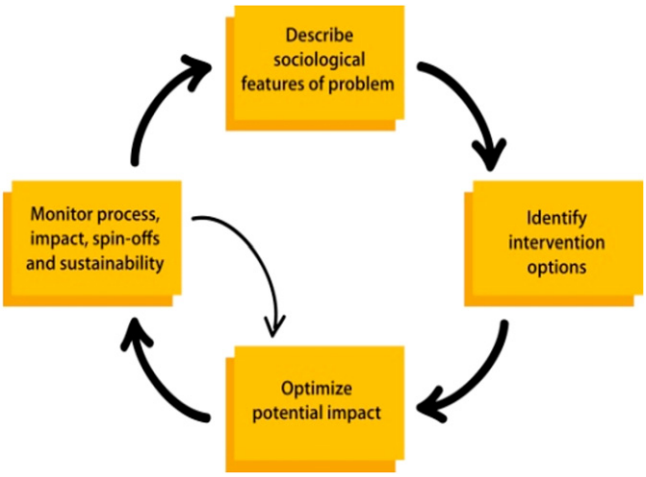



**Figure 1. Multiple intervention framework [29].**

implement strategies that would assist and encourage women to participate in breast cancer screening activities. The aim of **Phase III** is to evaluate the feasibility and sustainability of such strategies in order to increase participation in breast cancer screening activities over the long term [30–32].

Phase I currently consists of two studies: a quantitative cross-sectional interview survey and an exploratory, qualitative study using individual in-depth interviews conducted with Arabic women, Arabic men and health care providers in Qatar. Based on the results of the quantitative cross-sectional survey, the primary outcomes of interest measured for this paper include (a) awareness of and participation rates in breast cancer and BCS of Arabic women living in Qatar, and (b) the relationship between Arabic women's awareness, knowledge of breast cancer and its screening, select socio-demographic factors, and their participation in BCS (mammogram, clinical breast examination, breast self examination).

As part of phase I of our research program, a quantitative, descriptive cross-sectional community-based interview survey with Arabic women living in Qatar was conducted from March 2011 to July 2011 to investigate women's participation rates in breast cancer screening activities, their knowledge about breast cancer and its screening methods, barriers and facilitators to participation, and their view of the current breast cancer screening programs in the State of Qatar. Data was collected to answer the following *research questions*:

1. What are the participation rates of Arabic women in BSE, CBE, and mammogram?
2. To what extent are Arabic women's awareness and knowledge of breast cancer (BC) and its screening, as well as other selected factors, associated with BCS behaviors?

Ethics approval for this research study was obtained from the Hamad Medical Corporation Research Committee and the University of Calgary's Conjoint Health Research Ethics Board. Consent to participate in this study was obtained from each participant. Prior to conducting an interview, each participant was given an explanation of the study and her rights according to standard interview guidelines. Participants were assured that all information would remain confidential, and interview questionnaires were stripped of identifying information to preserve confidentiality.

## METHODS

### Study population

According to 2010 census data in Qatar [33], there are approximately 72,240 women who are 35 years of age and older living in Doha, Al Wakrah, and Al Khor/Al Thakhira, of which there are 60,937 women 35 years and older in Doha; 7,909 in Al Wakrah; and 3,394 in Al Khor/Al Thakira. Based on a 95% confidence level, the study's sample size was calculated using Cochran's formula for sample size [34]. See Fig. 2.

A convenience sample of 1,215 self-identified Arabic women (Qatari citizens and non-Qatari Arabic-speaking residents) who met the study's inclusion criteria was approached and invited to

| City | Population of women 35 years and over | Sample size using a margin of error of 3.5% | Sample size using a margin of error of 5% |
|---|---|---|---|
| Doha | 60,937 | 640 | 315 |
| Al Wakrah | 7,909 | 83 | 41 |
| Al Khor | 3,394 | 36 | 18 |
| Total | 72,240 | 759 | 374 |

**Figure 2. Study sample calculation based on Cochran's formula for sample size.**

participate in the survey, 1,063 of whom agreed to participate in a structured, face-to-face interview (87.5% response rate). Study participant inclusion criteria also included being aged 35 years or older, recruitment from one of seven different health care settings in Qatar, and having lived in Qatar for at least 10 years. Women who did not meet the mentioned inclusion criteria were excluded from the study. To ensure that information gathered reflected the experiences of women living in both urban and semi-urban/rural areas, participants were recruited from urban hospital settings and community health clinics in Doha, Al Wakrah (South of Qatar), and Al Khor (North of Qatar). Other main sites in Qatar are currently under Qatar Petroleum and Qatar Gas jurisdiction. Not only is accessibility to these sites difficult, but Qatar Petroleum and Qatar Gas are responsible for the provision of health care to its workers, with the majority of these workers being male.

## Questionnaire and data collection method

Face-to-face interviews using a structured, quantitative survey questionnaire were used for data collection. Interviews were conducted in Arabic by seven female interviewers and lasted an average of 30 minutes. These interviewers were nurses who were fluent in both Arabic and English, had experience working in the health care system in Qatar, and were trained by the lead principal investigator of the project (TD). Five of these research staff had a Bachelor of Science degree in Nursing and two were in their final year of obtaining the degree. To ensure diversity of participants and represent the general female Arabic population, study participants were interviewed during different days of the week and different times of the day.

Survey items had been developed specifically for this study and were further refined based on the responses and suggestions of experts in the field. The structured questions were based upon the literature and the results of previous studies [35–40]. With permission from researchers who conducted similar surveys with women of different ethno-cultural backgrounds—Dr. Stephen McPhee [41–43] and Dr. Juliane Cheek [44]—items from their surveys of breast cancer screening with Vietnamese women living in the U.S and Australia, respectively, were also incorporated. These items have been tested and proven valid and reliable. Back-translation of the survey questionnaire into Arabic and English was carried out to ensure lexical equivalence. The survey instrument was field tested with 30 Arabic women (35 years of age and older) at the various research sites by a female interviewer fluent in both Arabic and English prior to conducting the full-scale study; these results were not included in the full-scale study, and were meant to further clarify and refine questionnaire items, develop community connections and coalition, and assess the feasibility of the full-scale survey.

## Statistical analysis

Descriptive statistics in the form of mean, standard deviations for interval variables and frequency, with percentages for categorical variables, were performed. To see associations between dependent and categorical variables, chi-square tests were performed. Co-linearity for all covariates significant at univariate analysis was tested before using them in the multivariate logistic regression analysis.[2] Multivariate logistic regression was used to assess the effects of selected socio-demographic factors, awareness and knowledge of BCS, health care provider information, and sources of information about breast cancer and mammogram in predicting the binary dependent variables (e.g. clinical breast

[2] The CBE Awareness variable was kept in the multivariate analysis, despite its high colinearity with CBE practice.

examination, breast self examination, mammogram). A P value of 0.05 (two tailed) was considered as a statistically significant level. Data analysis was done using statistical program SPSS version 19.

## RESULTS

### Participants' profile: overall demographics

The 1,063 participants who completed the interview were between the ages of 35–82 ($M = 44.9$, $SD = 8.4$) years old; 78.9% were married, 98.2% were Muslims, 84.6% had children (49.2% had five or more children), 88.7% resided in urban areas, 33.3% attended university, 30.9% reported their husband attended university, 34.1% were employed and 58.8% were full-time homemakers.

According to 2010 Qatar Census results, Qatari citizens represent 24.4% of the population in Qatar; Qatari female citizens represent 36.7% of the female population living in Qatar [33]. Overall, 52.1% of the women interviewed in this study were Qatari citizens, 10.9% were citizens of other Arab peninsular/GCC countries (Saudi Arabia, UAE, Kuwait, Oman, Bahrain, Yemen), 16% were citizens of Levant countries (Syria, Lebanon, Palestine, Jordan), 10.1% were citizens of North African countries (Egypt, Libya, Tunisia, Algeria, Morocco), and 10.9% were citizens of other countries in the greater Middle East (Sudan, Iraq, Iran, Somalia, Mauritania, Pakistan). All participants completed the interview in Arabic and resided in Qatar for at least 10 years, with the majority living in Qatar between 30–49 years ($M = 34.8$, $SD = 14.6$).

Using the U.S. Bureau of Labor Statistics Standard Occupational Classification system to categorize participants' occupations, more than two-thirds of employed participants (69.1%) were categorized as working in the "Management, Business, Science or Arts" field [45]. Forty-three (4%) of the women interviewed reported that they had been diagnosed with breast cancer (Table 1).

### Awareness of breast cancer and breast cancer screening activities

In this study, the term "awareness" is used to indicate that a participant has a preliminary understanding of breast cancer and its screening, whereas the term "basic knowledge" indicates that a participant has a higher level of understanding and accurate knowledge of breast cancer and its screening. For example, a participant was assessed as having breast cancer awareness if she had heard of breast cancer and received some information about breast cancer from at least one source (Table 2). However, a participant was further assessed as having basic knowledge of breast cancer screening only if she knew how to examine her own breasts, and knew the most recent national screening recommendations for mammography, breast self-examination and clinical breast examination (Table 3). It is important to note that the current study's indicators for assessing participants' awareness and basic knowledge were different (as indicated in Tables 2 and 3) than in other studies conducted in the region [13,22].

To qualify as being aware, participants had to meet the criteria for each category listed in Table 2. The present study found that while 90.7% of participants had awareness of breast cancer, only 28.9% had awareness of BSE, 41.8% of CBE, and 26.4% of mammography.

### Basic knowledge of breast cancer screening activities

Upon assessing higher level knowledge of screening recommendations, only 7.6% of participants were assessed with having basic knowledge of breast cancer screening activities (Table 3).

### Breast cancer screening participation rates

For the current study, appropriate practice of breast cancer screening activities was defined according to the most recent national screening guidelines and local health center recommendations; breast self examination (BSE) must have been performed by the participant monthly, clinical breast examination (CBE) must have been performed by a health care professional (most often a doctor or a nurse) within the last 1–2 years, and participants 40 years of age or older must have had a mammogram within the last 1–2 years.

The current study found 13.9% of participants reported performing a monthly BSE, 31.3% had a CBE within the last 1 to 2 years, and 26.9% of participants 40 years of age or older had a mammogram within the last 1–2 years. Over 50% of the participants interviewed reported they had never participated in BCS activities (Table 4). Almost half of survey participants reported that they plan to have a CBE or mammogram in the next 12 months; 49.4% of the participants said they plan on having a breast exam by a health care professional, and 47.8% of the participants $\geq$40 years old

**Table 1. Selected socio-demographic data ($N = 1{,}063$)**

| Variable | *N* (%) |
|---|---|
| **Age** ($M = 44.9$, $SD = 8.4$) | |
| 35–39 years | 365 (34.4) |
| 40–49 years | 399 (37.6) |
| 50–59 years | 220 (20.7) |
| 60+years | 77 (7.2) |
| **Nationality** | |
| Qatari (Qatari citizen) | 554 (52.1%) [a] |
| Non-Qatari (Qatari resident) | 509 (47.9%) |
| **Religion** | |
| Muslim | 1044 (98.2%) |
| Christian | 19 (1.8%) |
| **Marital status** | |
| Single/never married | 83 (7.8%) |
| Married | 839 (78.9%) |
| Other (separated, divorced, widowed) | 141 (13.3%) |
| **Education level of participant** [b] | |
| Never went to school | 146 (13.7%) |
| Primary school | 213 (20%) |
| High school | 287 (27%) |
| Trade school | 62 (5.8%) |
| University | 354 (33.3%) |
| **Employment status of participant** [b] | |
| Employed | 362 (34.1%) |
| Management, Business, Science, Arts | 250 (69.1%) |
| Service Occupations | 34 (9.4%) |
| Sales and Office Occupations | 64 (17.5%) |
| Construction, Maintenance Occupations | 1 (0.3%) |
| Production, Transportation Occupations | 4 (1.1%) |
| Full time homemaker | 625 (58.8%) |
| Unemployed | 75 (7.1%) |
| **Education level of husband** | |
| Never went to school | 112 (10.5%) |
| Primary school | 164 (15.4%) |
| High school | 233 (21.9%) |
| Trade school | 59 (5.6%) |
| University | 328 (30.9%) |
| Not applicable/other | 167 (15.7%) |
| **Living area** | |
| Urban | 943 (88.7%) |
| Semi-urban | 120 (11.3%) |
| **Years in Qatar** ($M = 34.8$, $SD = 14.6$) | |
| 10–29 years | 332 (31.2) |
| 30–49 years | 551 (51.8) |
| 50+years | 180 (16.9) |
| **Has participant ever had breast cancer?** | |
| Yes | 43 (4%) |
| No | 1020 (96%) |

[a] According to 2010 Qatar Census results, Qatari citizens represent 24.4% of the entire population in Qatar. Qatari female citizens represent 36.7% of the entire female population in Qatar [33].

[b] 1 participant did not answer these questions.

said they plan on having a mammogram. Only 1.5% of women participants reported that their husbands or male family members are not supportive of them having breast examinations by a health care professional, and 1.0% reported their husbands or other family members' objection was the reason they were not planning on having a mammogram.

### Relationship between awareness, knowledge, educational levels and participation rates

Bivariate analyses using chi-square testing were also used to assess relationships between awareness, knowledge, educational levels and participation rates in BCS activities (Table 5). The current study found awareness and basic knowledge of BCS amongst participants were significantly related to participation rates in breast cancer screening activities. Participants who had appropriately practiced BSE were more likely to have breast cancer awareness, $\chi 2(1, N = 1062) = 8.74$, $p = 0.003$; BSE awareness, $\chi 2(1, N = 1063) = 199.53$, $p = 0.001$; CBE awareness,

**Table 2. Awareness of breast cancer and breast cancer screening ($N = 1063$).**

| **Awareness of Breast Cancer**<br>**Participant must have correctly answered both questions:** | **Correct**<br>**n (%)** | | **Incorrect**<br>**n (%)** |
|---|---|---|---|
| Have you ever heard of breast cancer? **[Yes]** | 993 (93.4%) | | 70 (6.6%) |
| Have you ever had any information about breast cancer from: [participant must say **"Yes"** to at least one]: | | | |
| Family member or friend | 713 (67.1%) | | 350 (32.9%) |
| Newspapers/magazines | 692 (65.2%) | | 371 (34.8%) |
| Television | 781 (73.5%) | | 282 (26.5%) |
| Pamphlet | 505 (47.6%) | | 558 (52.4%) |
| Doctor | 305 (28.7%) | | 758 (71.3%) |
| Nurse | 185 (17.4%) | | 878 (82.6%) |
| Health educator | 176 (16.6%) | | 887 (83.4%) |
| Number (%) of participants who correctly answered both questions | | 964 (90.7%) | |
| **Awareness of Breast Self Examination**<br>**Participant must have correctly answered both questions:** | **Correct**<br>**n (%)** | | **Incorrect**<br>**n (%)** |
| Have you ever heard of women performing breast self-examination at home? **[Yes]** | 436 (41.0%) | | 627 (59.0%) |
| Do you know how to examine your own breast? **[Yes]** | 469 (44.1%) | | 594 (55.9%) |
| Number (%) of participants who correctly answered both questions | | 307 (28.9%) | |
| **Awareness of Clinical Breast Examination**<br>**Participant must have correctly answered both questions:** | **Correct**<br>**n (%)** | | **Incorrect**<br>**n (%)** |
| Have you ever heard of an exam where a doctor or a nurse examines a woman's breast to feel for a small lump that could be an early sign of breast cancer? **[Yes]** | 753 (70.8%) | | 310 (29.2%) |
| Have you ever had such a breast examination by a doctor or a nurse? **[Yes]** | 451 (42.4%) | | 612 (57.6%) |
| Number (%) of participants who correctly answered both questions | | 444 (41.8%) | |
| **Awareness of Mammography**<br>**Participant must have correctly answered both questions:** | **Correct**<br>**n (%)** | | **Incorrect**<br>**n (%)** |
| At what age does the Qatar screening program suggest that women should start having mammograms? [40–50] | 387 (36.4%) | | 676 (63.6%) |
| How often does the screening program suggest that women should have a mammogram? **[once a year, once every two years]** | 509 (47.9%) | | 554 (52.1%) |
| Number (%) of participants who correctly answered both questions | | 281 (26.4%) | |

**Table 3. Basic knowledge of breast cancer screening ($N = 1,063$).**

| **Participant must have correctly answered all 6 questions:** | **Correct**<br>**n (%)** | | **Incorrect**<br>**n (%)** |
|---|---|---|---|
| At what age does the Qatar screening program suggest that women should start having mammograms? [40–50] | 387 (36.4%) | | 676 (63.6%) |
| How often does the screening program suggest that women should have a mammogram? **[once a year, once every two years]** | 509 (47.9%) | | 554 (52.1%) |
| Have you ever heard of an exam where a doctor or a nurse examines a woman's breast to feel for a small lump that could be an early sign of breast cancer? **[Yes]** | 753 (70.8%) | | 310 (29.2%) |
| Have you ever had such a breast examination by a doctor or a nurse? **[Yes]** | 451 (42.4%) | | 612 (57.6%) |
| Have you ever heard of women performing breast self-examination at home? **[Yes]** | 436 (41.0%) | | 627 (59.0%) |
| Do you know how to examine your own breast? **[Yes]** | 469 (44.1%) | | 594 (55.9%) |
| Number (%) of participants who correctly answered all 6 questions | | 81 (7.6%) | |

$\chi 2(1, N = 1063) = 91.28$, $p = 0.001$; mammogram awareness, $\chi 2(1, N = 1062) = 11.44$, $p = 0.001$; and basic knowledge of BCS, $\chi 2(1, N = 1063) = 79.63$, $p = 0.001$. Similar trends were found for appropriate practices of CBE and mammogram (with $p$ values $\leq 0.05$).

Higher education levels of participants were also significantly related with appropriate practice of BCS activities [BSE, $\chi 2(1, N = 1062) = 31.14$, $p = 0.001$; CBE, $\chi 2(1, N = 1062) = 16.16$, $p = 0.003$;

**Table 4. Breast cancer screening participation rates.**

| Participant practiced BCS activities | At appropriate time[a] | At some point | Never practiced |
|---|---|---|---|
| | | n (%) | n (%) |
| Breast Self Examination (BSE) ($N = 1063$) [b] | **148 (13.9%)** | 294 (27.7%) | 621 (58.4%) |
| Clinical Breast Examination (CBE) ($N = 1063$) | **333 (31.3%)** | 118 (11.1%) | 612 (57.6%) |
| Mammogram (only women aged ≥ 40) ($N = 696$) [c] | **187 (26.9%)** | 87 (12.5%) | 421 (60.6%) |

[a] Although breast cancer screening guidelines are being revised to reflect Qatar's health context and to meet the need of cancer care for women, appropriate times in this study indicate BSE Monthly; CBE for women aged ≥35 within the last 1–2 years; mammogram for women aged ≥40 within the last 1–2 years.

[b] 5 participants did not answer this question.

[c] 1 participant did not answer this question. Therefore, calculations related to mammogram practice are based on $n = 695$.

Mammogram, $\chi 2(1, N = 695) = 18.36, p = 0.001$]. This was also true for their husbands' education levels for participants who were ever married [BSE, $\chi 2(1, N = 896) = 38.65, p = 0.001$; CBE, $\chi 2(1, N = 896) = 17.15, p = 0.002$; Mammogram, $\chi 2(1, N = 604) = 15.34, p = 0.004$].

Demographic factors such as age, nationality, marital status, residential information, and employment status were also analyzed (Table 6). Marital status was significantly related to CBE practice, $\chi 2(2, N = 1063) = 20.51, p = 0.001$. Employed participants were significantly more likely to perform BSE monthly than unemployed participants, [$\chi 2(2, N = 1062) = 16.07, p = 0.001$]. While age did not significantly relate to appropriate mammogram practice, the 40–49 year old age group was significantly more likely to have performed a monthly BSE [ $\chi 2(3, N = 1061) = 17.57, p = 0.001$] or had a CBE within the last 1–2 years [ $\chi 2(3, N = 1061) = 24.92, p = 0.001$] than other age groups. Similarly, participants who had been living in Qatar for 50 years or more were significantly less likely to perform monthly BSE, [ $\chi 2(2, N = 1063) = 17.26, p = 0.001$]; however, length of residence did not affect CBE or mammogram practice. It is more likely that older Qatari women are less aware of or know how to perform breast self examination. Living area (urban versus semi-urban areas) was also not significantly related to participation in BCS (Table 6).

### Multivariate analysis of factors associated with practice of breast cancer screening

Table 7 represents the multivariate logistic regression analysis of selected independent factors that may be used as indicators to predict participation in breast cancer screening activities. Variables with a small number of cases were removed from the multivariate regression analysis.

Participants who were aware of BSE or CBE had between two to seven times the odds of performing a BSE appropriately than those without awareness (OR = 6.40; 95% CI = 3.97–10.33; $p < 0.001$ and OR = 2.78; 95% CI = 1.63–4.73; $p < 0.001$, respectively). Having awareness of CBE was the strongest predictor for appropriate CBE practice (OR = 185.56; 95% CI = 81.50–422.50; $p < 0.001$). Participants whose doctor talked to them about breast cancer had two to three times the odds of practicing BSE (OR = 2.08; 95% CI = 1.05–4.14; $p = 0.037$) or having CBE (OR = 3.52; 95% CI = 1.63–7.61; $p = 0.001$) than those whose doctors did not. Participants had increased odds of having a BSE or CBE if they received information about breast cancer from a nurse (CBE: OR = 2.72; 95% CI = 1.29–5.75; $p = 0.009$), newspaper/magazine (BSE: OR = 2.10; 95% CI = 1.05–4.18; $p = 0.035$), or received information about mammography from a doctor (CBE: OR = 1.74; 95% CI = 1.02–2.95; $p = 0.041$), or television/radio (CBE: OR = 2.03; 95% CI = 1.03–3.99; $p = 0.041$) than those who did not.

Although having mammogram awareness was not a predictor for having a mammogram, participants with CBE awareness were more likely to have had a mammogram at appropriate/recommended times (OR = 6.51; 95% CI = 3.65–11.63; $p < 0.001$). The strongest predictor for having a mammogram was receiving information about a mammogram from a doctor (OR = 10.10; 95% CI = 5.85–17.44; $p < 0.001$). Participants also had at least twice the odds of having a mammogram if their doctor talked to them about breast cancer (OR = 3.15; 95% CI = 1.35–7.40; $p = 0.008$), or if they received information about mammography from a pamphlet (OR = 2.26; 95% CI = 1.08–4.70; p = 0.030).

**Table 5. Awareness, knowledge, education and participation in breast cancer screening activities.**

| Variable | Appropriate practice of BSE | | Appropriate practice of CBE | | Participation in Mammogram | |
|---|---|---|---|---|---|---|
| | Yes (%) N=148 | No (%) N=915 | Yes (%) N=333 | No (%) N=730 | Yes (%) N=187 | No (%) N=508 |
| Awareness of breast cancer | 144 (97.3) | 820 (89.6) | 324 (97.3) | 640 (87.7) | 180 (96.3) | 441 (86.8) |
| | $\chi 2(1, N = 1062) = 8.74$, $p = 0.003$ | | $\chi 2(1, N = 1062) = 26.81$, $p = 0.001$ | | $\chi 2(1, N = 695) = 12.82$, $p = 0.001$ | |
| Awareness of BSE | 115 (77.7) | 192 (21.0) | 163 (48.9) | 144 (19.7) | 80 (42.8) | 116 (22.8) |
| | $\chi 2(1, N = 1063) = 199.53$, $p = 0.001$ | | $\chi 2(1, N = 1063) = 95.08$, $p = 0.001$ | | $\chi 2(1, N = 695) = 26.86$, $p = 0.001$ | |
| Awareness of CBE | 115 (77.7) | 329 (36.0) | 326 (97.9) | 118 (16.2) | 164 (87.7) | 164 (32.3) |
| | $\chi 2(1, N = 1063) = 91.28$, $p = 0.001$ | | $\chi 2(1, N = 1063) = 628.10$, $p = 0.001$ | | $\chi 2(1, N = 695) = 168.44$, $p = 0.001$ | |
| Awareness of mammogram | 56 (37.8) | 225 (24.6) | 129 (38.7) | 152 (20.8) | 82 (44.1) | 91 (17.9) |
| | $\chi 2(1, N = 1062) = 11.44$, $p = 0.001$ | | $\chi 2(1, N = 1062) = 38.14$, $p = 0.001$ | | $\chi 2(1, N = 694) = 49.84$, $p = 0.001$ | |
| Basic knowledge of BCS | 38 (25.7) | 43 (4.7) | 66 (19.8) | 15 (2.1) | 33 (17.6) | 25 (4.9) |
| | $\chi 2(1, N = 1063) = 79.63$, $p = 0.001$ | | $\chi 2(1, N = 1063) = 102.53$, $p = 0.001$ | | $\chi 2(1, N = 695) = 28.94$, $p = 0.001$ | |
| Education participant | | | | | | |
| Never went to school | 8 (5.4) | 138 (15.1) | 29 (8.7) | 117 (16.0) | 20 (10.7) | 112 (22.0) |
| Primary school | 16 (10.8) | 197 (21.6) | 60 (18.0) | 153 (21.0) | 40 (21.4) | 122 (24.0) |
| High School | 39 (26.4) | 248 (27.1) | 90 (27.0) | 197 (27.0) | 46 (24.6) | 127 (25.0) |
| Trade school | 11 (7.4) | 51 (5.6) | 23 (6.9) | 39 (5.3) | 15 (8.0) | 29 (5.7) |
| University | 74 (50.0) | 280 (30.6) | 131 (39.3) | 223 (30.6) | 66 (35.3) | 118 (23.2) |
| | $\chi 2(4, N = 1062) = 31.14$, $p = 0.001$ | | $\chi 2(4, N = 1062) = 16.16$, $p = 0.003$ | | $\chi 2(4, N = 695) = 18.36$, $p = 0.001$ | |
| Education husband | | | | | | |
| Never went to school | 3 (2.4) | 109 (14.1) | 23 (7.8) | 89 (14.8) | 16 (9.8) | 87 (19.8) |
| Primary school | 9 (7.2) | 155 (20.1) | 42 (14.2) | 122 (20.3) | 25 (15.2) | 89 (20.2) |
| High School | 31 (24.8) | 202 (26.2) | 85 (28.7) | 148 (24.7) | 43 (26.2) | 106 (24.1) |
| Trade school | 13 (10.4) | 46 (6.0) | 23 (7.8) | 36 (6.0) | 10 (6.1) | 29 (6.6) |
| University | 69 (55.2) | 259 (33.6) | 123 (41.6) | 205 (34.2) | 70 (42.7) | 129 (29.3) |
| | $\chi 2(4, N = 896) = 38.65$, $p = 0.001$ | | $\chi 2(4, N = 896) = 17.15$, $p = 0.002$ | | $\chi 2(4, N = 604) = 15.34$, $p = 0.004$ | |

## DISCUSSION AND RECOMMENDATIONS

The results of the current study demonstrates that the majority of Arabic women in Qatar are aware of breast cancer (90.7%), however, there are much lower levels of awareness and knowledge of breast cancer screening activities, and only 7.6% of the women interviewed were assessed with having basic knowledge of the most recent screening guidelines in Qatar for BSE, CBE and mammograms.

Previous studies conducted throughout the Middle East [5,8,13–15,20–22] have also found that BCS participation rates are low. Bener et al. (2009) in a study of 1,200 Qatari women (aged 30–55) found 24.9% of those interviewed practice BSE, 23.3% had CBE, and 22.5% had mammography [13]. The current study assessed participation rates in breast cancer screening activities according to the BCS recommended guidelines in Qatar. As expected, current findings

**Table 6.** Selected demographic factors and participation in breast cancer screening activities.

| Variable | Appropriate practice of BSE | | Appropriate practice of CBE | | Participation in Mammogram | |
|---|---|---|---|---|---|---|
| | Yes (%) N=148 | No (%) N=915 | Yes (%) N=333 | No (%) N=730 | Yes (%) N=187 | No (%) N=508 |
| Age Groups | | | | | | |
| 35–39 | 47 (32.2) | 318 (34.8) | 88 (26.5) | 277 (38.0) | - | - |
| 40–49 | 75 (51.4) | 324 (35.4) | 150 (45.2) | 249 (34.2) | 110 (58.8) | 289 (56.9) |
| 50–59 | 20 (13.7) | 200 (21.9) | 80 (24.1) | 140 (19.2) | 64 (34.2) | 155 (30.5) |
| 60+ | 4 (2.7) | 73 (8.0) | 14 (4.2) | 63 (8.6) | 13 (7.0) | 64 (12.6) |
| | $\chi 2(3, N = 1061) = 17.57$, $p = 0.001$ | | $\chi 2(3, N = 1061) = 24.92$, $p = 0.001$ | | $\chi 2(2, N = 695) = 4.62$, $p = 0.099$ | |
| Nationality | | | | | | |
| Qatari Citizens | 69 (46.6) | 485 (53.0) | 163 (48.9) | 391 (53.6) | 98 (52.4) | 280 (55.1) |
| Qatari Residents | 79 (53.4) | 430 (47.0) | 170 (51.1) | 339 (46.4) | 89 (47.6) | 228 (44.9) |
| | $\chi 2(1, N = 1063) = 2.08$, $p = 0.149$ | | $\chi 2(1, N = 1063) = 1.95$, $p = 0.163$ | | $\chi 2(1, N = 695) = 0.41$, $p = 0.524$ | |
| Marital status | | | | | | |
| Single | 14 (9.5) | 69 (7.5) | 11 (3.3) | 72 (9.9) | 4 (2.1) | 25 (4.9) |
| Married | 119 (80.4) | 720 (78.7) | 289 (86.8) | 550 (75.3) | 158 (84.5) | 392 (77.2) |
| Others | 15 (10.1) | 126 (13.8) | 33 (9.9) | 108 (14.8) | 25 (13.4) | 91 (17.9) |
| | $\chi 2(2, N = 1063) = 1.92$, $p = 0.383$ | | $\chi 2(2, N = 1063) = 20.51$, $p = 0.001$ | | $\chi 2(2, N = 695) = 5.15$, $p = 0.076$ | |
| Living area | | | | | | |
| Urban | 137 (92.6) | 806 (88.1) | 298 (89.5) | 645 (88.4) | 171 (91.4) | 440(86.6) |
| Semi-Urban | 11 (7.4) | 109 (11.9) | 35 (10.5) | 85 (11.6) | 16 (8.6) | 68 (13.4) |
| | $\chi 2(1, N = 1063) = 2.55$, $p = 0.110$ | | $\chi 2(1, N = 1063) = 0.29$, $p = 0.588$ | | $\chi 2(1, N = 695) = 3.00$, $p = 0.083$ | |
| Years in Qatar | | | | | | |
| 10–29 | 65 (43.9) | 267 (29.2) | 111 (33.3) | 221 (30.3) | 59 (31.6) | 134 (26.4) |
| 30–49 | 71 (48.0) | 480 (52.5) | 169 (50.8) | 382 (52.3) | 84 (44.9) | 238 (46.9) |
| 50+ | 12 (8.1) | 168 (18.4) | 53 (15.9) | 127 (17.4) | 44 (23.5) | 136 (26.8) |
| | $\chi 2(2, N = 1063) = 17.26$, $p = 0.001$ | | $\chi 2(2, N = 1063) = 1.09$, $p = 0.579$ | | $\chi 2(2, N = 695) = 1.98$, $p = 0.371$ | |
| Employment status | | | | | | |
| Employed | 71 (48.0) | 291 (31.8) | 124 (37.2) | 238 (32.6) | 57 (30.5) | 131(25.8) |
| Homemaker | 72 (48.6) | 553 (60.5) | 182 (54.7) | 443 (60.8) | 112 (59.9) | 333 (65.7) |
| Unemployed | 5 (3.4) | 70 (7.7) | 27 (8.1) | 48 (6.6) | 18 (9.6) | 43 (8.5) |
| | $\chi 2(2, N = 1062) = 16.07$, $p = 0.001$ | | $\chi 2(2, N = 1062) = 3.62$, $p = 0.164$ | | $\chi 2(2, N = 694) = 2.00$, $p = 0.367$ | |

indicate that participation rates in BCS activities among Arabic women living in Qatar were also low; only 13.9% of participants performed a monthly breast self examination (BSE), 31.3% had a clinical breast examination (CBE) within the last 1 to 2 years, and 26.9% of participants 40 years of age or older had a mammogram done within the last 1 to 2 years. Compared to European guidelines set to >70% acceptance levels of non-opportunistic breast cancer screening programs, participation rates in Qatar and other Gulf Cooperation Countries (GCC) are very low [10,46]. This study's results also show that there are some women who have, at some point, performed BSE (27.7%), had CBE (11.1%) and mammogram (12.5%). Together with findings that indicate almost half of participants said that they plan to have a CBE (49.4%) or mammogram (47.8%, >40 years old) within the next 12 months, these are encouraging findings. It may be that with encouragement and more awareness of national guidelines, more Qatari women may practice BCS according to the recommended guidelines.

**Table 7. Multivariate logistic regression analysis of selected factors associated with practice of breast cancer screening.**

| Variables | Category | OR | 95% CI | P value |
|---|---|---|---|---|
| **Appropriate practice of BSE** | | | | |
| BSE awareness | Yes | 6.40 | 3.97–10.33 | <0.001 |
| CBE awareness | Yes | 2.78 | 1.63–4.73 | <0.001 |
| Doctor talked to participant about breast cancer | Yes | 2.08 | 1.05–4.14 | 0.037 |
| Participant received information about breast cancer from a newspaper/magazine | Yes | 2.10 | 1.05–4.18 | 0.035 |
| **Appropriate practice of CBE** | | | | |
| CBE awareness | Yes | 185.56 | 81.50–422.50 | <0.001 |
| Doctor talked to participant about breast cancer | Yes | 3.52 | 1.63–7.61 | 0.001 |
| Participant received information about breast cancer from a nurse | Yes | 2.72 | 1.29–5.75 | 0.009 |
| Participant received information about mammography from a doctor | Yes | 1.74 | 1.02–2.95 | 0.041 |
| Participant received information about mammography from television/radio | Yes | 2.03 | 1.03–3.99 | 0.041 |
| **Appropriate practice of mammogram** | | | | |
| CBE awareness | Yes | 6.51 | 3.65–11.63 | <0.001 |
| Doctor talked to participant about breast cancer | Yes | 3.15 | 1.35–7.40 | 0.008 |
| Participant received information on mammogram from a doctor | Yes | 10.10 | 5.85–17.44 | <0.001 |
| Participant received information on mammogram from a pamphlet | Yes | 2.26 | 1.08–4.70 | 0.030 |

It is important to note that the authors of this paper are aware of the controversial issue regarding the effectiveness and usefulness of breast self-examination for women living in other societies [47]. Given that the population of interest is women who come from different ethno-cultural backgrounds throughout the Middle East and who live in an area with notably low participation rates in CBE and mammography, *not* recommending BSE to Arabic women warrants very careful consideration of such a decision's impact on early detection of breast cancer in Qatar.

Both bivariate analyses and multivariate regression analyses showed nationality was not a significant predictor for BCS practice. We suggest this result is due to the fact that the Qatari government provides subsidized or free health care services—including mammograms at recommended times—in modern facilities for all of its residents, which reduces the burden of cost as a barrier to having a mammogram. Qatar is a multi-national country (the current study's sample population represented over 20 different nationalities); it is encouraging that nationality does not affect participation rates in BCS activities. However, since fewer Qatari women citizens reported that their doctors talked to them about breast cancer (19.3%) than other Arabic women living in Qatar (29.9%), those behind public education campaigns and health care providers should find ways to talk to and encourage Qatari women about breast cancer awareness and recommended screening activities. Previous studies also indicate that physicians are less likely to share information or recommend mammography to women different than themselves in nationality, age, gender or social class [8,27,48].

Although living area (urban versus semi-urban) was not significantly related to participation in BCS activities, living in semi-urban areas might limit the ability of women age 40 and older to access mammography screening clinics in urban areas because they have to travel longer distances to a mammogram clinic. Thus, a mobile mammogram clinic that provides service closer to women living in semi-urban areas may increase women's mammogram participation rates [49].

Participants with higher levels of education were more likely to participate in BCS activities. A recent study in Saudi Arabia (2011) indicates similar results; women with at least university level education are more likely to participate in BSE and CBE than women with lower educational levels [50]. It is important to note that not only did participation in breast cancer screening activities increase with higher education levels of women participants, but they also increased with higher education levels of their husbands. To our knowledge, no other studies have examined the relationship between the husband's level of education and the wife's breast cancer screening

knowledge and activities in the Middle East. The current study found husbands' higher education levels are significantly related to women having knowledge of BCS and to higher participation rates in breast cancer screening activities. It may be that men who have higher education levels are more aware of breast cancer, its screening, and the benefits of early detection of breast cancer; thus they may give more support and encouragement to their wives to participate in BCS activities. As men play an important role in Arabic women's lives, their interest and participation in breast cancer screening could be an effective enabler [19,49]. Thus, Arabic men should be made aware of breast cancer and its screening, and their role in providing support and encouragement to their female family members in BCS activities. It is a very encouraging finding from our study that only between 1.0 and 1.5% of participants perceived that their husbands or other family members object to breast examinations.

The current study also indicates receiving information about breast cancer and BCS from any source significantly increased participation in screening activities. Multivariate regression analyses indicate receiving information from a doctor about breast cancer was a predictor for performing breast self-examination, having a clinical breast examination or a mammogram at recommended times. Despite this, doctors do not often talk about breast cancer or actively encourage their female patients to participate in breast cancer screening activities; only 24.4% of the women interviewed reported that their doctors had ever talked to them about breast cancer. Women whose doctors talked to them about mammography were more likely to have a mammogram according to recommended guidelines. Previous studies have also shown physician recommendations are important determinants of mammography [27,50–52]. This indicates the critical role doctors have in raising awareness in women about breast cancer and breast cancer screening services.

Policies related to screening guidelines and patient education should stress increased physician-patient time to discuss breast cancer, screening recommendations, the benefits of early detection, and the negative effects of not participating in appropriate BCS activities. As current findings suggest, women are more likely to participate in BCS activities if they received information from even one source about breast cancer or mammography, and one of the strongest predictors of participating in BCS was receiving information from their doctors. Primary care physicians often build a rapport with their patients, and are therefore in an ideal position to raise awareness among women during routine patient visits [50]. Physicians should be encouraged to incorporate breast cancer screening recommendations into their daily routine and practice with their female patients.

The current study demonstrates that not only doctors, but also other health care providers such as nurses and health educators play a significant role in breast health care in Qatar. Women who received information about breast cancer from a nurse had twice the odds of having a CBE at recommended times than women who did not receive information from a nurse (OR = 2.72; 95% CI = 1.29–5.75; $p = 0.009$). Yet, only 17.4% of the women interviewed in this study received information about breast cancer from a nurse, 16.6% from a health educator, and 11.9% and 9% received information about mammography from nurses or health educators, respectively. Health care providers were found to be important sources of knowledge about breast cancer screening for Arabic women in other studies [50–56]. Several studies have also found that nurses and health care workers do not have sufficient knowledge of breast cancer risk factors and screening methods [57–60], and their lack of knowledge limits encouragement of patients to engage in screening activities [60]. Allied health professionals should therefore be trained and empowered to play a bigger and more proactive part in breast cancer intervention strategies in Qatar and neighboring countries. A 2011 study conducted in Qatar found that even pharmacists are willing to be involved with educating their patients about breast cancer, despite their current low involvement [61].

A Train-the-Trainer (TTT) program that focused on teaching breast cancer screening and prevention to nurses from 20 different countries indicates health care providers such as nurses and allied health professionals can help address knowledge gaps [62]. A similar study in Turkey found knowledge and participation rates of Turkish women increased following a BSE educational intervention program [63]. Although promising, rates are still low and indicate having knowledge may not be enough. Previous studies have found that even among Arab women with sufficient knowledge, participation in breast cancer screening activities remained low [13,22,53,57,64,65]. More research on socio-cultural barriers is needed for development of culturally appropriate interventions.

Given these findings—that there are low levels of awareness and knowledge of breast cancer screening and that women who are aware of BCS recommendations are more likely to practice BCS activities according to recommended guidelines—it is imperative that public educational campaigns

be implemented in Qatar to promote breast health and early detection of breast cancer. Breast cancer awareness campaigns are effective educational tools; they have been shown to increase motivation in women and improve physician initiative for early detection [19]. Raising awareness about breast cancer and its screening among women in Qatar through a variety of sources is also important when considering an intervention program. This study found women who received information about breast cancer or mammograms from any of the sources asked (family/friend, newspaper/magazine, television/radio, pamphlets, doctor, nurse, health educator) were more likely to participate in BCS. Although only 1.1% of the women interviewed listed the internet as their source of information on breast cancer, it is also important to utilize the internet to raise awareness about breast cancer and its screening among younger women. Sending reminders in the form of a letter or SMS message might be effective in increasing attendance at Well-Women clinics for breast examination and mammogram uptake [14,15]; 58.7% of women interviewed in the current study said that they would have a mammogram if they received a letter reminding them from a doctor or other health care provider.

## CONCLUSION

While breast cancer incidence rates are rising among women in the Middle East [3,7,8], current findings on the strongest predictors for participation in breast cancer screening activities among Arabic women in Qatar are encouraging. An overwhelming majority (94%) of the women interviewed reported that they would make an appointment for a mammogram if their doctor recommended it, and a doctor recommendation is one of the strongest predictors of screening practices. It is therefore critical to raise awareness among physicians and other health care professionals such as nurses, health educators, or pharmacists of the effectiveness of their explanations and demonstrations to patients about breast cancer and its screening. It is also important to raise awareness of breast cancer and early detection amongst women through various forms of media to increase participation in early screening programs and reduce breast cancer morbidity and mortality for Arab women living in Qatar.

Due to convenience sampling, the current study has limited ability to generalize survey results and potential bias. To avoid bias to some extent, randomly-selected times were chosen for the face-to-face interviews, and attempts were made to approach all potential respondents in an interview location. This method has been used successfully in other studies to recruit respondents in hard-to-reach communities [66,67]. In addition, data was collected from self-reports, and may be subject to inaccuracy or social-desirability response bias.

Despite these limitations, the benefits of this study's findings are potentially far-reaching and include: raising awareness levels of breast cancer and its screening activities; developing a culturally appropriate, socially-acceptable, and effective intervention program; and ultimately, decreasing both morbidity and mortality from breast cancer in Qatar. Linking research findings to policy making, service delivery and practice is an important element of this study. As several investigators of this study are key health care providers and health care policy-makers who are committed to providing services that meet the health care needs of women in Qatar, we anticipate that the results of this research will impact health care policy as well as health care provision to women in Qatar. Findings may also be applicable to other female populations in the Middle East and benefit women of similar ethnic and cultural backgrounds worldwide.

## COMPETING INTERESTS

The authors declare they have no competing interests.

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## AUTHORS' CONTRIBUTIONS

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(i) DT: Contributed to the conception and design of the study and the acquisition, analysis and interpretation of the data, drafted the manuscript and gave final approval of the manuscript version submitted for publication.

(ii) AKA: Contributed to the conception and design of the study and the acquisition of the data, revised the manuscript and gave final approval of the manuscript version submitted for publication.

(iii) AKM: Contributed to the conception and design of the study and the acquisition of the data, review the manuscript critically for content and gave final approval of the manuscript version submitted for publication.

(iv) SR: Contributed to the conception and design of the study and the acquisition, analysis and interpretation of the data, revised the manuscript and gave final approval of the manuscript version submitted for publication.

(v) BAS: Contributed to the conception and design of the study and the acquisition of the data, revised the manuscript and gave final approval of the manuscript version submitted for publication.

(vi) AMN: Contributed to the conception and design of the study and the acquisition of the data, revised the manuscript and gave final approval of the manuscript version submitted for publication.

(vii) MM: Contributed to the conception and design of the study and the acquisition of the data, review the manuscript critically for content and gave final approval of the manuscript version submitted for publication.

(viii) CS: Contributed to the analysis and interpretation of the data, drafted the manuscript and gave final approval of the manuscript version submitted for publication.

(ix) DR: Contributed actively to the acquisition of data, organized workshop training for interviewers, liaison with each data collection site, translated material from English to Arabic.

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