# Patterns, knowledge, and barriers of mammography use among women in Saudi Arabia

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## ABSTRACT

الأهداف : تقييم استخدام التصوير الشعاعي للثدي (الماموجرام) ، ومعرفة وتحديد الحواجز المرتبطة باستخدامه بين النساء في المملكة العربية السعودية.

الطريقة : أجرينا مسحا مستعرضا لخمس مناطق رئيسية في المملكة من فبراير 2015م إلى مايو 2015م . وشملت العينة النساء البالغ أعمارهن 40 عام . تم اختبار الارتباطات بين التنبؤات الإجتماعية والديموغرافية واستخدام التصوير الشعاعي للثدي وبين المعرفة الفعلية والمعرفة المتصورة باستخدام اختبار chi-square . استخدمنا أنوفا في اتجاه واحد لاختبار الارتباطات بين المتنبئين الإجتماعية والديغرافية ودرجات المعرفة الفعلية .

النتائج : تم المسح على 3245 امرأة ، نسبة الإبلاغ عن القيام بتصوير الثدي بالأشعة هي 40% . العوامل التي ارتبطت بشكل كبير مع انخفاض استخدام تصويرالثدي هي العمر (أكثر من أو يساوي 60 عاما) ، المرأة العازباء ، ومن لديها أقل من طفلين ، ومن لم تكمل المرحلة الثانوية ، ومن لها تاريخ عائلي لسرطان الثدي .

الخاتمة : استخدام الماموجرام والمعرفة منخفضة في المملكة العربية السعودية . يجب التأكيد على زيادة الوعي بفحص سرطان الثدي عن طريق برامج التثقيفية للمجتمع ، مما يمكنه مساعدة المرأة على التغلب على الحواجز والمفاهيم الخاطئة القائمة .

**Objectives:** To assess mammography utilization and knowledge, and to determine barriers associated with mammography utilization among Saudi women.

**Methods:** We conducted a cross-sectional survey in 5 main geographic regions of Saudi Arabia from February 2015 to May 2015. The sample comprised women aged ≥40 years. Associations between socio-demographic factors and mammography use were tested using chi-square test. Predictors of mammography use were assessed by logistic regression.

**Results:** A total of 3,245 women were surveyed, with 40% reporting ever having a mammogram. As indicated by the univariable analyses, older age (≥60 years), being single or divorced, having <2 children, not completing high school, and having a family history (hx) of breast cancer were significantly associated with never having a mammogram. Participants of older age (odds ratio [OR] 51-60 versus 41-50 = 0.6, 95% CI: 0.5-0.7 and OR >60 versus 41-50 = 0.5, 95% CI: 0.3-0.8), and divorced (OR divorced versus married = 0.6, 95% CI: 0.5-0.8] were less likely to have had a mammogram, while participants with no family hx of breast cancer (OR no family hx versus family hx = 1.5, 95%CI: 1.3-1.8) were more likely to have had a mammogram.

**Conclusion:** Mammography utilization and knowledge are low in Saudi Arabia. Increasing the awareness of breast cancer screening through educational programs could help women overcome existing barriers and misconceptions.

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Breast cancer is a serious public health issue worldwide. Approximately 1.67 million new cases of breast cancer, representing 25% of all cancers, were diagnosed among women in 2012.[1] Its incidence is the highest in developed countries, with rates as high as 92 per 100,000 people in North America compared with 27 per 100,000 people in Middle Africa and Eastern Asia.[1] It is the leading cause of death among women in developing countries and the fifth cause of mortality among all cancers.[1] In Saudi Arabia, a total of 1,473 cases of breast cancer were diagnosed among women in 2010, representing 27.4% of all newly diagnosed cancers.[2] It ranked first among all cancers diagnosed in women in the same year, with patients aged 48 years on average at the time of diagnosis.

Mammography screening has been associated with a decreased risk of death from breast cancer.[3] The National Comprehensive Cancer Network recommends annual mammograms for women ≥ 40 years.[4] Approximately 6.5% of breast cancers occur in women aged 30-40 years,[5] and a large proportion of these cancers occur in women without a family history of breast cancer.[6] In these cases, the disease tends to be aggressive and is often associated with a poorer prognosis.[7] Consequently, early identification, irrespective of family history of breast cancer, is beneficial.

In Saudi Arabia, a few studies investigated women's knowledge, attitudes, and practices about breast cancer. In a study conducted on adult women attending primary health care centers in Al-Khobar, it was found that approximately 85% of the 400 surveyed women were knowledgeable about mammography.[8] Unfortunately, the authors surveyed women who fell in the age bracket of 18 to 29 years, for whom mammography is not typically recommended. In another survey conducted in the eastern province,[9] only 6.5% of the women reported ever having a mammogram. A multistage survey of individuals aged 15 years and older found that 92% of women aged 50-74 years old reported never having had a mammogram.[10] In addition, women were more likely to have had a mammogram in the past 2 years if they were educated, had received a routine medical exam within the last 2 years and were diagnosed with hypertension.

Most studies that explored women's knowledge and practices of breast cancer screening in Saudi Arabia were conducted in specific regions or cities. In addition, in many studies, mammography use was assessed among women with a wide age range, including ages not intended for mammography. This study is novel as it attempts to assess in a comprehensive manner the breast cancer screening practices of women more than 40 years old in 5 geographic regions of Saudi Arabia. The aims of our study were: (i) to assess mammography use and the factors associated with it, (ii) to investigate mammography knowledge and the factors associated with it, and (iii) to determine the barriers associated with mammography utilization.

**Methods.** *Research design and data collection.* This cross-sectional survey is part of a larger study designed to assess men and women's knowledge of breast cancer and

mammography use. We selected a convenience sample of women residing in the 5 main geographic regions of Saudi Arabia (Northern, Southern, Western, Eastern, and Central). The inclusion criteria were; (i) to be fluent in English or Arabic, (ii) to have no mental disabilities, (iii) to be residents of Saudi Arabia. Participants who did not meet these criteria were not eligible to participate. After reviewing the published literature, a structured questionnaire was developed based on questions used in a previous study that investigated breast cancer knowledge and mammography use.[11] The questionnaire was reviewed by 4 consultants in different fields that dealt with breast cancer—i.e., medical oncologist, radiation oncologist, imaging radiologist and breast surgeon. The questionnaire was structured into the following sections: (i) socio-demographic characteristics of the participants, (ii) knowledge of breast cancer symptoms and risk factors, (iii) mammography use and knowledge of mammography practice, (iv) barriers to the utilization of mammography screening and (v) perceptions about breast cancer awareness and campaigns in Saudi Arabia. Questionnaire sections (i), (iii) and (iv) were the focus of this analysis.

In section (i), information about age, the number of children, marital status, family income, education, the region of residence and the family history of breast cancer were collected. Section (iii) included questions about mammography use and knowledge. First, mammography use was measured by asking women the following question: "Have you ever had a mammogram?" Second, information about mammography practice knowledge was obtained by asking women 3 questions: "Is the mammogram the standard method to identify breast cancer?", "At what age should a woman obtain a mammogram?", and "How often should a woman obtain a mammogram?" Third, women were asked to self-rate their knowledge about mammograms. In section (iv), the women were asked to identify the barriers to mammography use, including reasons for not getting a mammogram and feelings before a mammogram appointment.

Electronic and paper-based questionnaires were distributed and promoted through social media. The electronic questionnaires were distributed through Twitter, Facebook and WhatsApp. To ensure broad distribution of the questionnaires, especially to individuals with limited access to social media, hard copies of the questionnaire were distributed at schools and malls in each geographic region. The data were collected from the beginning of February 2015 to the end of May 2015. The questionnaire and the study proposal were approved by the Biomedical Ethics

Research Committee of King Abdulaziz University, Jeddah, Saudi Arabia.

*Statistical Analysis.* Because the study focused on mammography use, the analyses were restricted to women >40 years. The main outcome variables were mammography use (never/ever had a mammogram) and the mammography knowledge score. The knowledge of mammography practice was evaluated by assessing perceived knowledge and actual knowledge. Perceived knowledge was measured by asking the

**Table 1 -** Associations between socio-demographic characteristics and mammography use.

| Variables | Total | Ever had a mammogram | Never had a mammogram | P-value* |
|---|---|---|---|---|
| Total† | 3,048 | 1,227 (40) | 1, 821 (60) | --- |
| *Age (years)* | | | | |
| 41-50 | 2,274 (77.2) | 1, 007 (44.3) | 1,267 (55.7) | 0.001 |
| 51-60 | 563 (19.1) | 188 (33.4) | 375 (66.6) | |
| 60+ | 107 (3.6) | 26 (24.3) | 81 (75.7) | |
| *Number of children* | | | | |
| No children | 331 (10.4) | 98 (32.3) | 205 (67.7) | 0.001 |
| One child | 156 (4.9) | 47 (32.4) | 98 (67.6) | |
| >2 children | 2,709 (84.8) | 1,072 (41.8) | 1,490 (58.2) | |
| *Marital Status* | | | | |
| Married | 2,519 (78.1) | 1,006 (42.3) | 1,374 (57.7) | 0.001 |
| Single | 207 (6.4) | 48 (26.4) | 134 (73.6) | |
| Widowed | 228 (7.1) | 78 (36.3) | 137 (63.7) | |
| Divorced | 271 (8.4) | 89 (34.6) | 168 (65.4) | |
| *Education* | | | | |
| Below high school | 412 (12.8) | 125 (33.4) | 249 (66.6) | 0.028 |
| High school/ Diploma | 1,134 (35.3) | 443 (42.0) | 613 (58.1) | |
| University | 1,401 (43.6) | 553 (41.3) | 786 (58.7) | |
| Postgraduate | 270 (8.4) | 104 (40.2) | 155 (59.9) | |
| *Family income (SAR/month)* | | | | |
| <8,000 | 620 (19.6) | 217 (38.3) | 350 (61.7) | 0.149 |
| 9,000-15,000 | 1,186 (37.5) | 480 (43.1) | 634 (56.9) | |
| 16,000-25,000 | 885 (28.0) | 331 (39.3) | 512 (60.7) | |
| >26,000 | 469 (14.8) | 179 (40.0) | 272 (60.3) | |
| *Region* | | | | |
| Western | 1,112 (34.5) | 446 (42.6) | 600 (57.4) | 0.002 |
| Eastern | 660 (20.5) | 212 (34.2) | 408 (65.9) | |
| Central | 981 (30.5) | 406 (43.1) | 536 (56.9) | |
| Northern | 233 (7.2) | 77 (36.3) | 135 (63.7) | |
| Southern | 233 (7.2) | 79 (38.0) | 129 (62.0) | |
| *Family history of breast cancer* | | | | |
| Yes | 828 (27.9) | 255 (32.4) | 532 (67.6) | 0.001 |
| No | 2,140 (72.1) | 866 (42.9) | 1,152 (57.1) | |

*Chi-square test was used, †Total (3,048 women) less than grand total (3,245 women) due to missing values. Values are presented as number and percentage (%)

women to rate their own knowledge with one of 4 responses: "Excellent", "Very good", "Fair" and "Poor". Actual knowledge was measured by asking women three general questions about mammography: whether mammograms were the best methods for breast cancer diagnosis, the age at which women should start having mammograms, and the frequency of mammograms for women of applicable age. The response to each knowledge question was assigned a score of 1 for a correct answer and 0 for "don't know" or an incorrect answer. For each woman, a total knowledge score was calculated by summing the scores of the responses, with a final score ranging from 0 to 3. The main predictors in this study were age, the number of children, marital status, education, family income, region and family history of breast cancer.

Frequencies and percentages are reported for categorical data, while means and standard deviations are reported for continuous data. Associations between socio-demographic predictors and mammography use and between actual knowledge and perceived knowledge were tested using the chi-square test. To identify the significant predictors of mammography use, a logistic regression was performed using stepwise selection technique. The significance levels for removal and entry of variables from the model were 0.1 and 0.05, respectively. Associations between socio-demographic predictors and actual knowledge scores were tested using a one-way ANOVA, followed by Tukey's post-hoc test if the results were significant. Associations between mammography knowledge and mammography use were tested using a chi-square test and t-test, as indicated. The significance level was set at 0.05. All data analyses were performed using Stata version 13.0 (StataCorp LP, College Station, TX, USA).

**Results.** A total of 3,245 women above 40 years old were included in this study. The majority of the participants were aged between 41 and 50 years (77%), married (78%), and had more than one child (85%). Thirteen percent of the participants did not have a high school degree, while 44% had a university degree (**Table 1**). Approximately 35% of the women resided in the western region, 31% in the central region, 21% in the eastern region, and 7% each in the northern and southern regions. Twenty-six percent of women reported a family history of breast cancer.

Forty percent of the participants reported ever having a mammogram. Mammography use decreased with age; 44% of women aged 41-50 had ever had a mammogram versus women aged 51-60 (33%) and women aged >60

**Table 2 -** Association between self-perceived knowledge and actual knowledge about mammography practice.

| Knowledge variables | | Self-perceived knowledge n (%) | | | | |
|---|---|---|---|---|---|---|
| | Total | Excellent | Very Good | Fair | Poor | *P*-value* |
| Total | - | 771 (24) | 597 (19) | 700 (22) | 1,143 (36) | --- |
| *Mammography is the standard method to identify breast cancer* | | | | | | |
| Correct (Yes) | 2,252 (71.7) | 733 (95.7) | 547 (92.9) | 603 (87.3) | 366 (33.6) | 0.001 |
| Incorrect/Don't know | 889 (28.3) | 33 (4.3) | 42 (7.1) | 88 (12.7) | 723 (66.4) | |
| *Age at which a woman should start having mammograms* | | | | | | |
| Correct (≥ 40 years) | 1,415 (44.2) | 309 (40.2) | 310 (52.0) | 321 (46.0) | 473 (42.0) | 0.001 |
| Incorrect/Don't know | 1,783 (55.8) | 460 (59.8) | 286 (48.0) | 377 (54.0) | 653 (58.0) | |
| *Frequency at which a woman should have a mammogram* | | | | | | |
| Correct (Every 1-2 years) | 1,938 (60.3) | 601 (78.2) | 401 (67.2) | 462 (66.1) | 469 (41.2) | 0.001 |
| Incorrect/Don't know | 1,275 (39.7) | 168 (21.9) | 196 (32.8) | 237 (33.9) | 669 (58.8) | |
| Total knowledge score, mean (SD) | 1.78 (0.92) | 2.14 (0.72) | 2.13 (0.76) | 2.00 (0.80) | 1.19 (0.90) | 0.001† |

*Chi-square test was used, †One-way analysis of variance test followed by a Tukey post-hoc test were used. Excellent >fair; excellent > poor; very good > fair; very good > poor; fair > poor. The numbers in some of the cells do not add up to the total, because of missing values

(24%). Mammography use was higher among women with more than one child (42%). Mammography use also varied by marital status; it was highest among married women (42%) and lowest among single women (26%). Compared with more educated women, women with an educational level below high school reported ever having a mammogram less often (33%). The highest prevalence of mammography use was reported by residents of the western and central regions (43%), followed by the southern (38%) and northern regions (36%), and the eastern region (34%). Women who had a family history of breast cancer reported lower mammography use (32%) than those without a family history of the disease (**Table 1**).

Approximately 36% of the women perceived their knowledge as poor; 24% perceived their knowledge as excellent, 22% perceived their knowledge as fair and 19% of the respondents perceived their knowledge as very good (**Table 2**). A large percentage of women correctly stated that mammography was the standard method to identify breast cancer (72%) and that a woman should have a mammogram every 1-2 years (60%). Only 44% of the respondents reported the correct age women should start having mammograms. Women's self-rating of their mammography knowledge (perceived knowledge) was significantly associated with their corresponding answers to actual knowledge questions (**Table 2**). Ninety-six percent of the women who perceived that they had excellent knowledge responded that a mammogram was the standard method to detect breast cancer. The relative frequency of a correct response to the question regarding the age

at which a woman should start having mammograms varied by perceived knowledge: excellent, 40%; very good, 52%; fair, 46%; and poor knowledge, 42%. Approximately 78% of the participants who perceived that they had excellent knowledge correctly determined how often women should obtain mammograms. The actual knowledge scores were significantly associated with perceived knowledge (*p*-value=0.01). Women who perceived that they had excellent knowledge had higher scores than participants who perceived that they had lower knowledge levels.

The associations between socio-demographic characteristics and mammography knowledge scores are illustrated in **Table 3**. Knowledge of mammography was significantly associated with age, number of children, marital status, education, income and area of residence (*p*-value=0.001) as well as family history of breast cancer (*p*-value=0.008). The mean knowledge scores were lowest among single and older women aged ≥60 years, participants with less than a high school degree, and those with a monthly family income <8,000 SAR. Conversely, the mean knowledge scores were highest among women with more than one child, residents of the eastern and central regions, and those with a family history of breast cancer.

As shown in **Table 4**, women who correctly reported the recommended age to start getting mammograms were more likely to report ever having a mammogram compared with women who responded incorrectly (*p*-value=0.001). However, mammography use was significantly higher among women who responded incorrectly to the question concerning mammography

frequency (*p*-value=0.028). Perceived knowledge about mammography and knowledge on whether mammograms were the best methods for breast cancer diagnosis were not significantly associated with mammography use. Subjects with higher knowledge scores were more likely to have had a mammogram (*p*-value=0.012).

The main reasons why women failed to obtain a mammogram were the belief that the examination was not important (31%) and worries about the results (25%). Regarding how participants would feel before a mammography appointment, 45.5% reported they would be worried about the results, 15.7% reported they would be scared of pain, 11.1% reported they would not be able to sleep, 10.3% reported that they would be embarrassed, and 7.5% reported that they would not want to go (**Table 5**).

**Table 6** presents the logistic regression univariable and multivariable associations of socio-demographic indicators and mammography knowledge with mammography use. In the univariable analyses, participants aged >51 years were less likely to have had mammography than younger participants. Respondents with the following characteristics were more likely to have had a mammogram, higher than high school education level vs. lower level, low, intermediate and high mammography knowledge scores vs. a score of zero. Single, and divorced participants compared with married participants, and participants from the eastern province compared with those from the western province, were less likely to have had a mammogram. Participants with no family history of breast cancer were 1.5 times more likely to have had a mammogram, compared with those with a family history. Age [OR 51-60 vs. 41-50= 0.6, 95% CI= 0.5-0.7 and OR >60 vs. 41-50=0.5, 95% CI= 0.3-0.8, respectively], marital

**Table 3 -** Association between socio-demographic characteristics and mammography knowledge scores.

| Socio-demographic variables | Knowledge scores mean (SD) | P-value* | Multiple comparisons† |
|---|---|---|---|
| *Age (years)* | | | |
| 41-50 | 1.82 (0.90) | | 60+ <41-50; |
| 51-60 | 1.83 (0.90) | 0.001 | 60+ <51-60 |
| 60+ | 1.17 (1.12) | | |
| *Number of children* | | | |
| No children | 1.58 (0.95) | | Two or more children > No children |
| One child | 1.71 (0.91) | 0.001 | |
| 2 children+ | 1.81 (0.91) | | |
| *Marital status* | | | |
| Married | 1.84 (0.89) | | Married >Single; |
| Single | 1.45 (0.98) | 0.001 | Married >Widowed; |
| Widowed | 1.50 (0.97) | | Married >Divorced |
| Divorced | 1.64 (0.94) | | |
| *Education* | | | |
| Below high school | 1.36 (1.02) | | Below high school < High school/Diploma; Below high school < University; Below high school < Postgraduate |
| High school/Diploma | 1.78 (0.90) | 0.001 | |
| University | 1.88 (0.09) | | |
| Postgraduate | 1.88 (0.89) | | |
| *Family income SAR/month* | | | |
| <8,000 | 1.57 (0.96) | | Less than 8,000 <9,000-15,000; Less than 8,000 <16,000-25,000; Less than 8,000 <More than 26,000 |
| 9,000-15,000 | 1.78 (0.89) | 0.001 | |
| 16,000-25,000 | 1.89 (0.90) | | |
| >26,000 | 1.94 (0.90) | | |
| *Region* | | | |
| Western | 1.69 (0.93) | 0.001 | |
| Eastern | 2.03 (0.81) | | Eastern > Western; Eastern > Northern; Eastern > Southern; Central > Western; Central > Northern; Central > Southern; Western > Southern; Northern > Southern |
| Central | 1.90 (0.89) | | |
| Northern | 1.53 (0.89) | | |
| Southern | 1.27 (0.97) | | |
| *Family history of breast cancer* | | | |
| Yes | 1.88 (0.89) | 0.008‡ | |
| No | 1.79 (0.92) | | |

*One-way analysis of variance test was used, †Tukey post hoc test was used, ‡Two-sample t-test was used, the numbers in some of the cells do not add up to the total, because of missing values

**Table 4 -** Association between mammography knowledge and mammography use.

| Knowledge variables | Ever had a mammogram | Never had a mammogram | *P*-value* |
|---|---|---|---|
| *General perceived knowledge about mammography* | | | |
| Excellent/Very good | 820 (41.2) | 1,168 (58.7) | 0.547 |
| Fair/Poor | 401 (40.1) | 599 (59.9) | - |
| *Mammogram is the standard method of identifying breast cancer* | | | |
| Correct (Yes) | 906 (41.2) | 1,295 (58.8) | 0.365 |
| Incorrect/Don't know | 317 (39.3) | 489 (60.7) | - |
| *Age a woman should start having mammograms* | | | |
| Correct (≥40 years) | 595 (43.8) | 763 (56.2) | 0.001 |
| Incorrect | 630 (37.6) | 1,046 (62.4) | - |
| *Frequency a woman should have a mammogram* | | | |
| Correct (Every 1-2 years) | 724 (38.6) | 1,152 (61.4) | 0.028 |
| Incorrect/Don't know | 503 (43.2) | 662 (56.8) | - |
| Total Knowledge Score, mean (SD) | 1.82 (0.87) | 1.79 (0.95) | 0.012† |

*Chi-square test was used, †Two-sample t-test was used. The numbers in some of the cells do not add up to the total, because of missing values. Values are presented as number and percentage (%)

**Table 5 -** Barriers to mammography use among women.

| Barriers to mammography use | n | (%) |
|---|---|---|
| *Reasons for not getting a mammogram* | | |
| Don't think it's important | 1,069 | (31.0) |
| Don't know where to go | 402 | (11.7) |
| Worry about the results | 862 | (25.0) |
| Don't want anyone to see/touch this private area | 405 | (11.8) |
| Don't want the radiation exposure | 333 | (9.7) |
| Exam is painful | 374 | (10.9) |
| *Feelings before mammogram appointment* | | |
| Can't sleep | 432 | (11.1) |
| Don't want to go | 290 | (7.5) |
| Worried about the result | 1,770 | (45.5) |
| Scared of pain | 612 | (15.7) |
| Embarrassed | 399 | (10.3) |
| Indifferent | 389 | (10.0) |

status [OR divorced vs. married= 0.6, 95% CI= 0.5-0.8] and family history of breast cancer [OR no family hx vs. family hx=1.5, 95% CI=1.3-1.8] remained statistically significant in the multivariable model.

**Discussion.** We found that 40% of the respondents reported ever having a mammogram, which may reflect women's limited awareness of this screening tool. Similar to our findings, a previous report indicated a low rate of mammography use among women in Saudi Arabia,[10] although our reported prevalence is relatively higher. In their study, El Bcheraou et al.[11] reported that 8% of women aged 50–74 years old had ever had a mammogram.

Low levels of mammography utilization have also been reported in various Middle Eastern population-based studies conducted in Iran,[12] Egypt,[13] the United Arab Emirates,[14] and Lebanon.[15] The situation is different from developed countries; mammography rates of 75% have been reported in Australia and 83% have been reported in Scotland.[16] In the United States, the proportion of women aged 40 years and above who had a mammogram within the previous two years was 66.8% in 2014.[17] While breast screening services are available at no cost to all women in the screening age group in Saudi Arabia, as is also the case in Scotland and Australia, it is not clear why mammography rates are lower in our setting. One possible reason to explain this observation is the difference in the screening service delivery between these countries and Saudi Arabia. In Australia and Scotland, healthcare authorities use mobile breast screening coupled with local advertising and invitation letters to promote and ensure that the rural population has access to screening mammography services.[16] On the other hand, mobile screening units have only been used in the eastern region of Saudi Arabia. From 2009-2010, the program covered only four centers, and 14 centers were covered by October 2013.[18]

Similar to our findings, other authors reported an association between socio-demographic characteristics, such as age, marital status, income, and women's likelihood of getting a mammogram.[19] Among women aged <65 years and those aged ≥65 years, screening mammography adherence behaviors were reportedly higher among married women and respondents with higher incomes.[19] Conversely, other researchers did not find an association between age and marital status and women's likelihood of having a mammogram.[9] However, the effect of demographic characteristics on mammography could be affected by other factors, such as access to screening services,[20] which we did not measure.

Of note, our finding that women with a family history of breast cancer reported lower mammography use than their peers without a family history of the disease is contrary to that reported by other authors.[21] Although the investigators thought women with a family history of breast cancer would have an increased perceived risk than their peers without a family history, they did not place much emphasis on the lack of family history of breast cancer and how it would influence women's attitudes towards screening. Previous studies also suggested a moderate increase in mammography use among women with a family history of breast cancer.[6,22] For example, an analysis of data from the

2005 California Health Interview Survey demonstrated that 83.5% of women with a family history of breast cancer in a first-degree relative had a screening mammogram in the past 2 years, compared to 76% of those at average risk.[22] Our finding of a low level of mammography knowledge has been reported by other investigators in studies conducted in Saudi Arabia.[23,24] In a study conducted in Abha,[23] only 22% of the 1,092 women surveyed had ever heard about mammography. In another survey of 200 women aged ≥ 20 years who resided in Jeddah, it was observed that participants had poor knowledge of mammography use as a screening tool.[24]

We found that mean knowledge scores were lowest among women with primary and secondary school education. Education level was also found to be significantly associated with better mammography knowledge in previous studies conducted in Saudi Arabia.[8,11,25] This finding was reported elsewhere[26,27] and is expected, as education level reflects the individuals' social environment and affects their understanding of disease and prevention.[28] Our finding that underprivileged women had a lower knowledge about mammography is consistent with those of other authors.[27,29] The relationship between income and knowledge score may show that women with a higher income had better access to medical and screening services. Thus, they were more likely to learn about breast health practices. Although an association was found in our study between marital status and mammography knowledge, no clear reason explains why married women appeared to be more knowledgeable about mammography.[8] Moreover, other investigators[30] did not find a significant association between marital status and mammography knowledge.

A previous study demonstrated that perceived self-efficacy to perform breast health practices was strongly related to perceived knowledge and not actual knowledge because perceived knowledge appears to be a crucial component of successful behavior change.[31] Health campaigns aimed at promoting breast cancer screening should focus on this construct. On the other hand, perceived knowledge may not be easy to determine, especially for individuals who believe they have excellent knowledge to begin with. Indeed, prior research suggests that people are not usually accurate in differentiating between perceived and actual knowledge[32] and tend to judge the accuracy of their knowledge too positively.[33] However, this was not the case in our participants, whose self-rating of their mammography knowledge was significantly associated with their actual knowledge.

**Table 6** - Logistic regression of sociodemographic characteristics and mammography knowledge score.

| Variables | Univariable logistic regression model | Multivariable logistic regression model* |
|---|---|---|
| | OR (95 % confidence interval) | |
| *Age* | | |
| 41-50 | 1 | 1 |
| 51-60 | 0.6 (0.5 – 0.8) | 0.6 (0.5 – 0.7) |
| >60 | 0.4 (0.3 – 0.6) | 0.5 (0.3 – 0.8) |
| *Number of children* | | |
| No children | 1 | --- |
| One child | 1.0 (0.7 – 1.5) | --- |
| > One child | 1.5 (1.2 – 1.9) | --- |
| *Marital Status* | | |
| Married | 1 | 1 |
| Single | 0.5 (0.3 – 0.7) | 0.8 (0.5 – 1.2) |
| Widowed | 0.8 (0.6 – 1.0) | 0.9 (0.7 – 1.2) |
| Divorced | 0.7 (0.6 – 0.9) | 0.6 (0.5 – 0.8) |
| *Occupation* | | |
| Not employed | 1 | --- |
| Employed | 1.0 (0.8 – 1.2) | --- |
| Retired | 0.9 (0.7 – 1.1) | --- |
| *Education* | | |
| Below high school | 1 | --- |
| High school/Diploma | 1.4 (1.1 – 1.8) | --- |
| University | 1.4 (1.1 – 1.8) | --- |
| Postgraduate | 1.3 (1.0 – 1.9) | --- |
| *Family income (monthly in Saudi Riyals)* | | |
| <8,000 | 1 | --- |
| 9,000-15,000 | 1.2 (1.0 – 1.5) | --- |
| 16,000-25,000 | 1.0 (0.8 – 1.3) | --- |
| >26,000 | 1.1 (0.8 – 1.4) | --- |
| *Region* | | |
| Western | 1 | --- |
| Eastern | 0.7 (0.6 – 0.9) | --- |
| Central | 1.0 (0.9 – 1.2) | --- |
| Northern | 0.8 (0.7 – 1.0) | --- |
| Southern | 0.8 (0.6 – 1.1) | --- |
| *Family history of breast cancer* | | |
| Yes | 1 | 1 |
| No | 1.6 (1.3 – 1.9) | 1.5 (1.3 – 1.8) |
| *Mammography knowledge Score* | | |
| No | 1 | --- |
| Low | 1.6 (1.2 – 2.1) | --- |
| Intermediate | 1.6 (1.2 – 2.1) | --- |
| High | 1.3 (1.0 – 1.7) | --- |
| *A stepwise selection technique was used, OR - odds ratio | | |

Women who were aware of the recommended age for women to start getting mammograms were more likely to have received a mammogram. Previous data suggested that the lack of knowledge and the awareness about breast screening procedures were factors associated with the underutilization of mammography.[34] On the contrary, women who responded correctly to the question concerning mammography frequency were less

likely to report ever having a mammogram. There is no clear explanation for this finding. Despite the consensus that mammography is a valuable screening tool for early breast cancer detection, some researchers[35] have shown that many women remain unconvinced of its efficacy. Mammography has been available in all regions of Saudi Arabia since 2005,[10] and recently, a nationwide breast cancer screening program was initiated in Riyadh.[36] However, only 19% of men and 24% of women in our study were aware of these breast cancer-screening programs. Similarly, a recent study reported low rates of breast cancer screening in Saudi Arabia, despite the fact that mammography is free and widely available.[10] Furthermore, while breast cancer awareness campaigns are widespread in Saudi Arabia (for example, the "Think Pink" campaign), it has been reported that they are not providing sufficient knowledge about the disease.[11]

In the current survey, one of the main reasons why women failed to obtain a mammogram was the belief that the examination was not important, which highlights the importance of educational programs to enhance women's perceived self-efficacy associated with having a mammography. Another interesting finding was women's fear of mammography results, which was the second most frequent barrier to having a mammogram. One of the possible consequences of underlying fear is that women may not show up for their mammography even after booking an appointment.[35] While fear of breast cancer diagnosis has also been reported to preclude Saudi women from getting a mammogram,[8] other authors suggest that fear or anxiety regarding getting cancer may, in general, facilitate screening, especially when the target population has access to and is aware of available screening procedures.[9,37]

This study has a few limitations; first, although the study covered five geographic regions in Saudi Arabia, random sampling was not used to select the regions and/or participants; thus, the results might not be generalizable to all women living in Saudi Arabia. Second, the data were self-reported so they might suffer from reporting bias. Third, the questionnaire was not validated; however, it was reviewed by several experts in the field. Fourth, there may be differences in breast cancer screening between rural and urban/cosmopolitan areas (e.g., Riyadh or Jeddah), but information was not collected to examine rural and urban differentials.

In conclusion, the utilization of mammography is low in Saudi Arabia, especially among older, married and less educated women as well as women with a family history of breast cancer. A considerable percentage of women did not know that mammography is the standard method to detect breast cancer and

did not know the correct frequency and age to have a mammogram. Increasing the awareness of breast cancer screening through education and community programs could help women overcome existing barriers and misconceptions.

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