

## Awareness, Knowledge and Attitude of Saudi Women about Mammogram in Breast Cancer Screening: Systematic Review

Haneen Ali Hussain Alhabes<sup>1\*</sup>, Fawzyah Salem Hamad Alhabes<sup>1</sup>, Ashwag Moshabab Alqhtani<sup>1</sup>, Salem Mubarak Al Gahes<sup>2</sup>, Zahra Abdalrhman Alshehri<sup>3</sup>, Khader Abdulsalam Hawsawi<sup>4</sup>, Awad Ahmed Salem Alsari<sup>5</sup>, Amal Yahya Bin Saeed Alyami<sup>6</sup>, Shaykhah Hanash Al Jawtar<sup>6</sup>, Arwa Salem Almasabi<sup>7</sup>

<sup>1</sup>Radiology Technologist, New Najran General Hospital, Najran, Saudi Arabia

<sup>2</sup>Radiology Specialist, Radiology Management and Applied Services, New Najran General Hospital, Najran, Saudi Arabia

<sup>3</sup>Radiographer Specialist, Radiology Management and Applied Services, Maternity and Children Hospital, Najran, Saudi Arabia

<sup>4</sup>Medical Physics specialist, Radiology Management and Applied Services, Najran, Saudi Arabia

<sup>5</sup>Specialist of Radiological Technology, Knig Khaled Hospital, Najran, Saudi Arabia

<sup>6</sup>Radiological Technologist, Department of Radiology, King Khalid Hospital, Najran, Saudi Arabia

<sup>7</sup>Radiology Technologist, Maternity and Children's Hospital, Najran, Saudi Arabia

DOI: [10.36348/sjimps.2023.v09i11.004](https://doi.org/10.36348/sjimps.2023.v09i11.004)

| Received: 11.10.2023 | Accepted: 14.11.2023 | Published: 17.11.2023

\*Corresponding author: Haneen Ali Hussain Alhabes

Radiology Technologist, New Najran General Hospital, Najran, Saudi Arabia

### Abstract

**Background:** In Saudi Arabia as well as globally, breast cancer is the most common cancer among women. Early diagnosis can lead to a better prognosis, and mammography screening may be an adequate way to get there. Studies on breast cancer and mammography awareness have been conducted in Saudi Arabia. **Objectives:** The current study set out to assess Saudi Arabian female patients' knowledge, attitudes, and awareness regarding breast cancer and mammography screening. **Methods:** A thorough search was carried out in October 2023, mostly using PubMed, in compliance with PRISMA criteria. The search was limited to English-language research that looked at the relationship between mammograms and breast cancer. To guarantee the quality and applicability of the evaluated research, certain inclusion and exclusion criteria were developed. **Results:** A wide spectrum of research from various Saudi Arabian locations was included in the study, with a major focus on female individuals. A discernible pattern indicated a high proportion of individuals with breast cancer and mammography screening. Our study concludes that Saudi women know very little about breast cancer and mammography in general. Interventions must be put into place in order to combat this ignorance.

**Keywords:** Breast Cancer, Awareness, Mammography, Screening Women, and Saudi Arabia.

**Copyright © 2023 The Author(s):** This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

## INTRODUCTION

Breast cancer (BC) is a disease that progresses over time due to abnormal growth and division of breast cells [1]. It is the most prevalent kind of cancer and the second most frequent disease overall, it is accounting for 85–90% of cases [2]. Early diagnosis of tiny tumors increases the likelihood of effective treatment and a favorable prognosis [1].

The Middle East has an unacceptably high prevalence of breast cancer, which may be related to delayed detection that allows the illness to worsen [3]. Breast cancer makes up 11.7% of all cancer cases worldwide. In 2020, there were about 2.3 million new cases in women worldwide [4]. Of those cases, 27,885 were diagnosed in the Kingdom of Saudi Arabia,

compared to 82,640 in the five years prior to 2020. Additionally, over 675,000 deaths from breast cancer were reported worldwide and also, in 2020, 7.8 million women worldwide have received a diagnosis of breast cancer over the preceding five years, placing it among the most common cancer types globally. The incidence of BC is known to rise with advancing age [5]. Over time, Saudi Arabia (SA) has seen an increase in both the number of new cases and the risk of breast cancer-related deaths. The number of new cases is predicted to reach 3549 by 2030. 3400 instances were recorded in 2016. Furthermore, 50% of patients have a late diagnosis, compared to 20% in industrialized nations. Furthermore, estimates indicate that 1 in 8 women will get breast cancer in their lifetime [6].

Previously, it was believed that Saudi Arabian women had a negligible risk of developing breast cancer. However, recent data has refuted this assumption, showing that the incidence of breast cancer in Saudi Arabian women is twice as high as worldwide rates. Furthermore, compared to women in Western nations, premenopausal women under 45 have a higher risk of developing breast cancer in Saudi Arabia, where the majority of cases are detected at a late stage [2]. Women who have a high risk of developing breast cancer are those who have a family history of the disease, have previously experienced breast cancer, are older, smoke, drink alcohol, obese, have a poor diet, don't exercise, use birth control pills and hormone replacement therapy. Additional risk factors include radiation exposure, delayed childbearing, early menarche, late menopause, and not nursing [7].

There are two types of BC symptoms: those that are connected to the breast and those that are not. It is important to remember that not every patient will experience symptoms in the same way; they might differ from person to person and range in severity from moderate to severe. The most common breast-related symptoms include painful or non-painful breast lumps, nipple abnormalities such as discharge or bleeding, breast bruising, abnormalities of the skin on the breast, rash on the breast, ulceration on the breast, abnormalities of the breast contour, and breast pain. In addition, there are a number of symptoms unrelated to breast cancer, the most common of which are weight loss, back pain, and an axillary lump [8].

Identifying risk factors and describing symptoms for establishing an early diagnosis are critical for increasing survival rates (to 90%), which may not be achievable after a late diagnosis. In addition to screening, the worldwide campaign for BC promotes health by teaching every woman about the risk factors and the telltale signs and symptoms of BC. Acquiring this knowledge is necessary for screening, early referral, and prompt identification and treatment of BC [9]. In Saudi Arabian women, cancer is typically detected at an advanced stage, and 14% of cases result in death. However, it has been noted that women with higher levels of awareness and understanding of BC are more likely to be screened and detected early, which improves their prognosis and increases their chances of receiving treatment early and recovering fully [10].

To advance and execute screening programs in society, which will increase the likelihood of early diagnosis of breast cancer and hence enhance quality of life, awareness of screening protocols and sickness warning signals is essential. It is thought that a lack of knowledge in society and the challenge of finding suitable healthcare facilities are to blame for the delayed detection of breast cancer. By implementing proactive screenings for women who are at risk, promoting

mammograms, and increasing awareness, early identification of breast cancer can be achieved [11].

The use of mammography for BC screening has been recommended by the American College of Radiology and several other international organizations. As of right now, mammography stands as the gold standard for early BC identification and screening, and its application has been shown to lower treatment costs and minimize BC-related mortality. All Saudi Arabian citizens are eligible for free mammography screenings. The Ministry of Health in Saudi Arabia advises mammogram screenings once a year for women over 50 and once every two years for those under 40 who do not have a family history of breast cancer. For women who do, the screening should begin 10 years earlier than the age at which the disease first manifests in a family member [12].

Saudi women can have the highest chance of early diagnosis of breast cancer by raising knowledge of the value of mammograms and granting access to mammography equipment. The study aims to highlight the importance of full awareness and knowledge of mammogram for BC patients.

## METHODOLOGY

Preferable Reporting Items for Systematic Reviews and Meta-Analyses, or PRISMA, guidelines were followed for this systematic review.

### Study Design and Duration

A systematic evaluation was completed in November 2023.

### Search strategy

To find the relevant research, a thorough search was conducted across many databases, primarily utilising PubMed as the study search engine. We only looked for English results. The following keywords were converted into PubMed Mesh terms in order to find pertinent research: "breast cancer," "awareness," "mammography," "screening," "women," and "Saudi Arabia." The operators "OR" and "AND" in Boolean logic were used to match the required keywords. Among the search results were human trials, publications in the entire English language, and items that were freely accessible.

### Selection Criteria

#### Inclusion Criteria

The following standards were taken into account for this review's inclusion:

- Research indicating the importance of Saudi women's mammography awareness and knowledge in cases of breast cancer.
- It contained clinical trials.
- Studies using observation were incorporated.
- Articles that are free and easily accessible.
- Studies conducted in Saudi Arabia.

### Exclusion Criteria

- We did not include systematic reviews.
- We didn't include article reviews.
- Meta-analyses were not included.
- Studies before 2020 were excluded.
- All other studies were omitted, with the exception of Saudi Arabia.
- Letters to the editors, case reports, and responses to conflicts were not accepted.
- Language other than English.

### Data Extraction

Duplicates in the search strategy output were found using Rayyan (QCRI) [13]. To evaluate the relevance of the titles and abstracts, the researchers applied a set of inclusion/exclusion criteria to filter the combined search results. Every paper that meets the inclusion requirements is read in full by reviewers. Other approaches to deliberate dispute resolution were provided by the authors. The writers obtained information on research titles, authors, study year, country, gender, participants, diagnostic tool, primary outcomes, and conclusion.

### Strategy for data synthesis

Using data from relevant research, summary tables were made to provide a qualitative summary of the

study's findings and components. The best method for using the data from the included study articles was chosen after the data extraction for the systematic review.

### Risk of bias assessment

The ROBINS-I risk of bias assessment method for non-randomized treatment trials was used to assess the quality of the included studies [14]. Seven aspects were evaluated: confounding, research participant selection, intervention classification, deviation from intended interventions, missing data, outcome evaluation, and choosing the reported result.

## RESULTS

### Search Results

The systematic search produced 570 study papers in total, of which 148 were automatically eliminated. After 422 papers underwent title and abstract screening, 103 research were deemed ineligible for inclusion. Out of the 319 studies that were requested to be retrieved, only 136 papers were found. After 183 papers were screened for full-text review, 171 of them were disqualified due to unsuitable research design or findings. This systematic review comprised 12 eligible study papers. Figure 1 presents a synopsis of the research selection procedure.

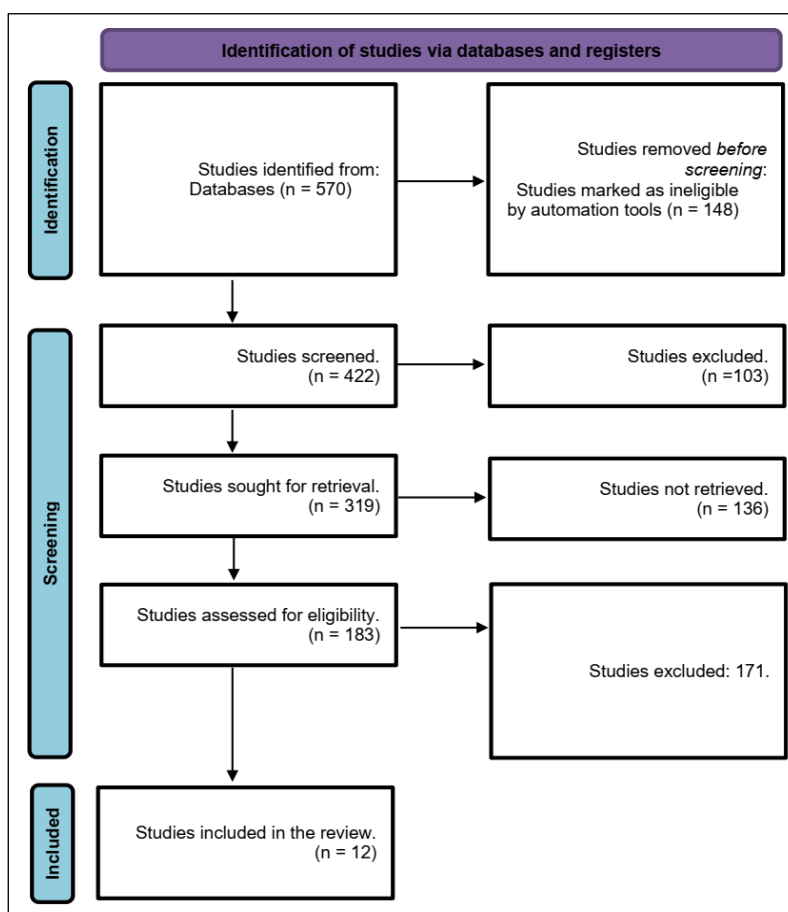


Figure 1: PRISMA flowchart summarizes the study selection process

**Characteristics of the included studies****Table 1: Socio-demographic Characteristics of Participants**

The socio-demographic information of participants from twelve distinct research is included in Table (1), which summarizes the large number of 8377 individuals from references [10, 15-25]. These studies' geographic scope is constrained because they were all selected within Saudi Arabia regions.

The research methodology of all the reviewed studies [15, 16, 18, 23-25] used a cross-sectional design; the only exceptions were studies [10, 17] that used a population-based cross-sectional study and [24] that used an online, anonymous, self-rating, cross-sectional, survey-based study.

The age range of participants was primarily concentrated on those who were 18 years of age or older. The age range recorded in Almeshari, Meshari *et al.*, 2023 [15] was 18 to 50 years old, whereas Alanazi, Muhannad Faleh *et al.*, 2023 [17] indicated an age range of 40 to 69 years old. According to AlSuwaydani, Saleh A *et al.*, 2023 [16], 36.7% of the population was under 40 years old. 52.2% of respondents were between the ages of 20 and 39, according to Qedair, Jumanah T *et al.*, 2022 [18]. This data bears some resemblance to that of Alduraibi, Sharifa K. 2022 [20], whose study found that 55.4% of respondents were under 40. The participants were above 18, according to T. Alqahtani, A. M. Alqahtani *et al.*, 2021 [21] and Alsowiyani, Asma A *et al.*, 2020 [23], without providing any other information. According to Abdel-Salam, Doaa M *et al.*, 2020 [22], the age range was 41–75 years. It was noted by Alsareii, Saeed Ali *et al.*, 2020 [24] that 71.7% of the population was under 25. Only 49% of the population, according to Ashareef, Basem *et al.*, 2020 [10], were between the ages of 36 and 45. However, according to Alshammari, Sulaiman Abdullah *et al.*, 2020 [25], 34% of the population was 41 years of age or older.

**Table (2) Clinical Characteristics and Outcomes of the Included Studies:**

Numerous research have shown the significance of mammography awareness, knowledge, and attitude for individuals with breast cancer. According to studies conducted by Almeshari, Meshari *et al.*, 2023 [15], Alsowiyani, Asma A *et al.*, 2020 [23], Alsareii, Saeed Ali *et al.* 2020 [24], and Alshammari, Sulaiman Abdullah *et al.*, 2020 [25], stated that Saudi Arabia still needs a number of public awareness campaigns using mass media, including radio, television, the Internet, and social media, as Public awareness of breast cancer is still relatively low. Additionally, special awareness campaigns has to be conducted in locations like hospitals, schools, and universities where a lot of ladies are readily accessible. The educational level is a significant factor that affects the level of knowledge regarding BC risk factors and different modalities for diagnosis and approaches for management, according to AlSuwaydani, Saleh A *et al.*, 2023 [16], Alanazi, Muhannad Faleh *et al.*, 2023 [17], Alenezi, Anfal Mohammed *et al.*, 2022 [19], and Ashareef, Basem *et al.*, 2020 [10]. This highlights the importance of raising interest in education in our society. According to studies by Qedair, Jumanah T *et al.*, 2022 [18] and Alduraibi, Sharifa K. 2022 [20], Saudi women have a high degree of low general breast cancer awareness. As a result, interventions to address this lack of knowledge should be put into place, and educational initiatives are increasingly being advised. However, T. Alqahtani, A. M. Alqahtani *et al.*, 2021 [21] clarified that if it is the mammography screening or any other method for detecting breast cancer was performed, This implies that we have to keep stressing how crucial primary care is when breast cancer is first developing.

As a different point, Abdel-Salam, Doaa M *et al.*, 2020 [22] claimed that in order to improve Saudi women's use of mammography screening, it may be very beneficial to address the obstacles and enhance public knowledge of the procedure.

**Table 1: Socio-demographic characteristics of the included participants**

Study	Area in Saudi Arabia	Study design	No. of Participants	Age	Duration of study
Almeshari, Meshari <i>et al.</i> , 2023 [15]	Hail region	cross-sectional study	425 female	18–50 years of age	from January 2021 through February 2021
AlSuwaydani, Saleh A <i>et al.</i> , 2023 [16]	Qassim region	cross-sectional study	1386 women	36.7% younger than 40 years of age	NA
Alanazi, Muhannad Faleh <i>et al.</i> , 2023 [17]	Northern Saudi Arabia	Population-Based cross-sectional Study	400 women	40–69 years	between September 2022 and February 2023
Qedair, Jumanah T <i>et al.</i> , 2022 [18]	all regions of the country	cross-sectional web-based nationwide study	2544 women	52.2% were between 20–39 years	from 20 August to 3 September 2021
Alenezi, Anfal Mohammed <i>et al.</i> , 2022 [19]	Aljouf region	analytical cross-sectional study	414 female	NA	from December 2021 to April 2022
Alduraibi, Sharifa K. 2022 [20]	Buraydah city	cross-sectional study	316 female	55.4% were below 40 years.	from August 2019 to January 2020

Study	Area in Saudi Arabia	Study design	No. of Participants	Age	Duration of study
T. Alqahtani, A.M. Alqahtani <i>et al.</i> , 2021 [21]	Asir region	cross-sectional study	1,021 female	18 years or older	between November 2019 to January 2020.
Abdel-Salam, Doaa M <i>et al.</i> , 2020 [22]	Aljouf region	cross-sectional study	423 women	41–75 years	from October 2019 to February 2020
Alsowiyan, Asma A <i>et al.</i> , 2020 [23]	Al-Qassim Region	cross-sectional study	519 female	above 18 years	NA
Alsareii, Saeed Ali <i>et al.</i> , 2020 [24]	Najran	online-based, anonymous, self-rating, cross-sectional and survey-based study	300 female	71.7% ≤ 25 years	March-2019 to April-2019
Ashareef, Basem <i>et al.</i> , 2020 [10]	Makkah region	Population Based Survey	400 female	49% were between 36 and 45 years old	NA
Alshammari, Sulaiman Abdullah <i>et al.</i> , 2020 [25]	King Saud University	cross-sectional study	229 female	34% were aged 41 years or above	March–May 2015

Table 2: Clinical characteristics and outcomes of the included studies

Study	Methods	Knowledge of breast cancer	Knowledge of screening mammogram	Sources of information	Other outcomes
Almeshari, Meshari <i>et al.</i> , 2023 [15]	The questionnaire comprised of 37 items categorised into seven sections: sociodemographic, information sources about breast cancer, awareness of breast cancer risk factors, knowledge of breast cancer signs and symptoms, knowledge of screening techniques, knowledge of breast cancer screening methods, and opinions regarding breast cancer treatment.	46.36%	NA	awareness campaigns (54.1%), media (38.6%)	A history of breast cancer in the family was present in 11.1% of the participants.
AlSuwaydani, Saleh A <i>et al.</i> , 2023 [16]	NA	73.7%	76.3%	websites or social media 71.8%. family and friends 52.2%	A history of BC in the women's families was reported by 16.1% of them.
Alanazi, Muhannad Faleh <i>et al.</i> , 2023 [17]	NA	NA	46.8%	NA	Knowledge level and a family history of BC were strongly correlated with each other. 12.3% of participants said that a family member had received a BC diagnosis in the past.
Qedair, Jumanah T <i>et al.</i> , 2022 [18]	The Breast Cancer Awareness Measure was employed in the study to gauge participants' knowledge of breast cancer.	68.6%	84%	NA	Inadequate awareness of breast cancer warning signals and screening methods raises the death rate from the disease.
Alenezi, Anfal Mohammed <i>et al.</i> , 2022 [19]	NA	48.6% had low knowledge	66.2%	NA	The results of a logistic regression study showed a strong relationship between age and the category of healthcare personnel and the lack of knowledge about mammograms.

Study	Methods	Knowledge of breast cancer	Knowledge of screening mammogram	Sources of information	Other outcomes
<b>Alduraibi, Sharifa K. 2022 [20]</b>	A legitimate, pretested, structured, self-administered questionnaire was used to gather the data.	NA	22.5%	Reading : 12.65% TV : 7.59% Educational lecture :23.1% Family/Friends : 13.92% Internet : 42.72%	Compared to older women, older working women (40–50) reported greater frequencies of mammograms performed. Additionally, instructors who had acquaintances who had breast cancer underwent mammograms more frequently than their peers.
<b>T. Alqahtani, A.M. Alqahtani <i>et al.</i>, 2021 [21]</b>	NA	NA	44.76%	the primary sources were Leaflets and doctors : 67%	Of the participants, about 40% conducted mammograms, and 40.5% were not aware of this.
<b>Abdel-Salam, Doaa M <i>et al.</i>, 2020 [22]</b>	The primary health centres' waiting rooms were used to find volunteers, who were then briefed on the study's goals.	NA	50.8%	NA	Women's residence and educational attainment strongly predicted their knowledge
<b>Alsowiyan, Asma A <i>et al.</i>, 2020 [23]</b>	NA	95.4%	25%	NA	Fifty percent of them correctly identified that BC affects men as well as women. Of the participants, around 93.6% firmly agreed that breast cancer cannot be spread to another person. Additionally, the majority of them were aware that breast cancer is the most prevalent form among Saudi Arabian women, and 85.2% knew that breast-feeding women had a lower chance of developing breast cancer.
<b>Alsareii, Saeed Ali <i>et al.</i>, 2020 [24]</b>	NA	75.3%	81%	campaigns' educational materials : (43%) internet: (33%) healthcare professionals : (11.3%)	Pregnancy-related family history (18%) and inactivity (66.3%) were the two main non-obstetric risk factors for BC.
<b>Ashareef, Basem <i>et al.</i>, 2020 [10]</b>	An online survey on British Columbia was created and evaluated. There were 23 items in the questionnaire, which addressed four domains: aetiology awareness, BC risk factor knowledge, symptom information, diagnostic and treatment knowledge, and screening attitude.	67%) had a weak knowledge. 6%) had a good knowledge	NA	NA	Better screening and early diagnosis result from education and awareness, which improves prognosis and treatment.
<b>Alshammari, Sulaiman Abdullah <i>et al.</i>, 2020 [25]</b>	using a questionnaire for self-report.	NA	51.5%	awareness campaigns :45.4% television and radio : 43.7%	One of the most important aspects of early breast cancer diagnosis is mammography screening.

## DISCUSSION

Over the next 20 years, there is expected to be a fourfold rise in breast cancer cases in the Middle East. Moreover, breast cancer is the most common kind of cancer in Saudi Arabia. Saudi women get breast cancer at an earlier age and at a higher socioeconomic cost than women in industrialized nations. 20.6% of all newly diagnosed malignancies in women are caused by breast cancer [10]. The general public's knowledge and awareness are essential for the early identification and effective treatment of BC [26]. It is well recognized that increased knowledge and education result in earlier identification and more efficient screening, both of which improve disease treatment. The results of our study demonstrated the level of knowledge among female Saudi patients on breast cancer in general and mammography in particular as a clinical breast screening method.

When L Linsell and his colleagues in England evaluated older women's awareness of breast cancer, they found that most of the participants knew that a lump is a sign of BC, but most were unaware of other symptoms as well. Moreover, around 50% of participants thought there was a smaller than one in 100 probability of having BC [27]. A research assessing awareness, understanding, and practice of BC screening in the United Arab Emirates has shown how little is known about the practice. Furthermore, more than half of the participants had never had a mammogram or clinical breast examination, which suggests that they were unaware of the procedures involved in BC screening [28]. Those conducted in the east of the nation indicated that 29.3% of Saudi women understood very little about BC [29], whereas those conducted in the centre of the country reported that 23.6% of female students knew very little about BC [30]. These studies yielded similar results to the study conducted by AlSuwaydani, Saleh A, *et al.*, [16], which found that 26.3% of participants had inadequate knowledge of BC.

It is noteworthy that a family history of breast cancer poses a substantial chance of contracting the illness. Despite the relatively low number of participants having a family history of BC, it is nevertheless vital to advise women with a history of BC to undertake routine screening and surveillance. This might entail earlier or more frequent MS. It is noteworthy, therefore, that only 40% of the respondents knew they were eligible for MS as mandated by the MOH, KSA, and that fewer than half of the respondents recognized MS as the best approach for screening for early BC [22], but other research stated a differ highlight on women's knowledge of and involvement in MS in a few EU member states [17]. According to recent data on Mammogram Screening adoption among women in the EU, over two-thirds (66%) of women between the ages of 50 and 59 had undergone a mammography-based breast cancer screening. Out of all the nations tested, Sweden had the greatest rate of MS adoption (95%), followed by Finland

(92%) and Denmark (82%). Remarkably, data from Balkan nations inside the European Union, including Bulgaria (36%) and Romania (9%), revealed a lower percentage of women having had MS [31].

However, it was shown that social media and websites accounted for the majority of women's sources of information about British Columbia, with friends and family coming in second. Less than one-third of the participants depend on medical professionals for their information as Various research have indicated [32]. These findings indicate that the majority of women's knowledge on BC is not derived from reliable sources, which might have an impact on the accuracy of the information they learned. Additionally, raising awareness is aided by programs that are run in companies, high schools, and colleges.

This estimate's key finding is that about one-third of cancer cases were identified during mammography as a component of a preventative BC screening program. This demonstrates the value of the program in the early identification and diagnosis of BC as well as the necessity of expanding its operations. Subsequent investigations may examine the influence of additional socio-demographic variables, like earnings, work position, and cultural convictions, on the comprehension and cognizance of BC risk factors and screening techniques.

## CONCLUSION

In conclusion, it was discovered that most of women had poor levels of knowledge, attitudes, and awareness regarding mammograms, risk factors, and breast cancer symptoms. In order to achieve early diagnosis and a lower overall breast cancer death rate in Saudi Arabia and throughout the world, it is critical to raise awareness about breast cancer and the value of screening techniques. Further efforts should be made to raise awareness of breast cancer screening through women's healthcare professionals, social media, schools, universities, campaigns and reading.

## REFERENCES

1. Sharif, F., Abshorshori, N., Tahmasebi, S., Hazrati, M., Zare, N., & Masoumi, S. (2010). The effect of peer-led education on the life quality of mastectomy patients referred to breast cancer-clinics in Shiraz, Iran 2009. *Health and Quality of Life Outcomes*, 8(1), 1-7.
2. Alotaibi, R. M., Rezk, H. R., Juliana, C. I., & Guure, C. (2018). Breast cancer mortality in Saudi Arabia: Modelling observed and unobserved factors. *PLoS one*, 13(10), e0206148.
3. Arafa, M. A., Rabah, D. M., & Farhat, K. H. (2020). Rising cancer rates in the Arab World: now is the time for action. *Eastern Mediterranean Health Journal*, 26(6), 638-640.
4. Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021).

- Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, 71(3), 209-249.
5. Rautela, K., Kumar, D., & Kumar, V. (2022, December). Detection and Localization of Breast Lesion with VGG19 Optimized Vision Transformer. In *2022 4th International Conference on Artificial Intelligence and Speech Technology (AIST)* (pp. 1-4). IEEE.
  6. Jazieh, A. R., Da'ar, O. B., Alkaiyat, M., Zaatreh, Y. A., Saad, A. A., Bustami, R., ... & Alkattan, K. (2019). Cancer incidence trends from 1999 to 2015 and contributions of various cancer types to the overall burden: Projections to 2030 and extrapolation of economic burden in Saudi Arabia. *Cancer Management and Research*, 9665-9674.
  7. Gnant, M., & Harbeck, N. (2017). Breast Cancer. *The Lancet*, 389, 1134-1150.
  8. Koo, M. M., von Wagner, C., Abel, G. A., McPhail, S., Rubin, G. P., & Lyratzopoulos, G. (2017). Typical and atypical presenting symptoms of breast cancer and their associations with diagnostic intervals: Evidence from a national audit of cancer diagnosis. *Cancer epidemiology*, 48, 140-146.
  9. Milosevic, M., Jankovic, D., Milenkovic, A., & Stojanov, D. (2018). Early diagnosis and detection of breast cancer. *Technology and Health Care*, 26(4), 729-759.
  10. Alshareef, B., Yaseen, W., Jawa, W., Barnawe, Y., Alshehry, W., Alqethami, H., ... & Alqumaili, O. (2020). Breast cancer awareness among female school teachers in Saudi Arabia: A population based survey. *Asian Pacific journal of cancer prevention: APJCP*, 21(2), 337.
  11. Wu, T. Y., & Lee, J. (2019). Promoting breast cancer awareness and screening practices for early detection in low-resource settings. *European Journal of Breast Health*, 15(1), 18.
  12. Fatima, A. M., Bakr, R., Almedallah, D., Alkaltham, N., Alotaibi, A., & Alnoaim, S. (2018). Screening mammography and breast self-examination: Attitudes and practices of women in the Eastern Province of Saudi Arabia. *Saudi Journal for Health Sciences*, 7(2), 89-100.
  13. Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan—a web and mobile app for systematic reviews. *Systematic reviews*, 5, 1-10.
  14. Jüni, P., Loke, Y., Pigott, T., Ramsay, C., Regidor, D., Rothstein, H., ... & Shea, B. (2016). Risk of bias in non-randomized studies of interventions (ROBINS-I): detailed guidance. *Br Med J*, 355, i4919.
  15. Almeshari, M., Alzamil, Y., Alyahyawi, A., Abanomy, A., Althmali, O., Al-Enezi, M. S., ... & Khandaker, M. U. (2023). Awareness level, knowledge and attitude towards breast cancer among staff and students of Hail University, Saudi Arabia. *Plos one*, 18(3), e0282916. doi: 10.1371/journal.pone.0282916
  16. AlSuwaydani, S. A., Alshamikh, A. S., Alotaibi, R. A., Almutairi, K. O., Alkhalifi, B. H., AlSuwaydani, S., & Alkhalifi, B. (2023). Breast Cancer Awareness and Screening Among Menopausal Females in Al-Qassim Region. *Cureus*, 15(7), e41680. doi: 10.7759/cureus.41680
  17. Alanazi, M. F., Thirunavukkarasu, A., Alrowily, M., Alaqel, N., Alaqel, A., Alruwaili, M., ... & Altaymani, A. M. (2023). A Cross-Sectional Evaluation of Knowledge About Breast Cancer and Perceived Barriers to the Uptake of Mammogram Screening Among Northern Saudi Women: A Population-Based Study. *Breast Cancer: Targets and Therapy*, 451-460. doi: 10.2147/BCTT.S414635
  18. Qedair, J. T., Al Qurashi, A. A., Alfayea, T., Mortada, H., Alsudais, A., Almunashiri, S., & Hakami, A. Y. (2022). Level and predictors of breast cancer awareness among Saudi women: A nationwide study. *Women's Health*, 18, 17455057221133835. doi:10.1177/17455057221133835
  19. Alenezi, A. M., Thirunavukkarasu, A., Wani, F. A., Alenezi, H., Alanazi, M. F., Alruwaili, A. S., ... & Alshrari, B. D. (2022). Female healthcare workers' knowledge, attitude towards breast cancer, and perceived barriers towards mammogram screening: A multicenter study in North Saudi Arabia. *Current Oncology*, 29(6), 4300-4314. doi: 10.3390/curroncol29060344
  20. Alduraibi, S. K. (2022). Breast cancer knowledge and screening behaviors of female teachers: A cross-sectional survey in Buraydah, Saudi Arabia. *Journal of Family Medicine and Primary Care*, 11(7), 3834-3839. doi: 10.4103/jfmpc.jfmpc\_1256\_21
  21. Alqahtani, T., Alqahtani, A. M., Alshahrani, S. M., Orayj, K., Almanasef, M., Alamri, A. H., ... & Khan, N. A. (2021). Assessment of knowledge and practice of mammography and breast self-examination among the general female population in Asir region of KSA. *European Review for Medical & Pharmacological Sciences*, 25(23).
  22. Abdel-Salam, D. M., Mohamed, R. A., Alyousef, H. Y., Almasoud, W. A., Alanzi, M. B., Mubarak, A. Z., & Osman, D. M. (2020). Perceived barriers and awareness of mammography screening among Saudi women attending primary health centers. *Risk Management and Healthcare Policy*, 2553-2561. doi:10.2147/RMHP.S277375
  23. Alsowiyani, A. A., Almotyri, H. M., Alolayan, N. S., Alissa, L. I., Almotyri, B. H., & AlSaigh, S. H. (2020). Breast cancer knowledge and awareness among females in Al-Qassim Region, Saudi Arabia in 2018. *Journal of Family Medicine and Primary Care*, 9(3), 1712-1718. doi: 10.4103/jfmpc.jfmpc\_1065\_19
  24. Alsareii, S. A., Alqahtani, S. M., Alamri, A. M., Al-Wadei, H. H., Al-Ammari, S. A., Al-Qahtani, A. M.,



- & Abu-Zaid, A. (2020). Awareness of breast cancer among female students and faculty from Najran university, Najran, Saudi Arabia. *Asian Pacific Journal of Cancer Prevention: APJCP*, 21(5), 1415-1422. doi: 10.31557/APJCP.2020.21.5.1415
25. Alshammari, S. A., Alhazmi, A. M., Alenazi, H. A., Alshammari, H. S., & Alshahrani, A. M. (2020). Mammography uptake among the female staff of King Saud University. *Journal of family medicine and primary care*, 9(1), 221-228. doi: 10.4103/jfmprc.jfmprc\_706\_19
26. Heena, H., Durrani, S., Riaz, M., AlFayyad, I., Tabasim, R., Parvez, G., & Abu-Shaheen, A. (2019). Knowledge, attitudes, and practices related to breast cancer screening among female health care professionals: a cross sectional study. *BMC women's health*, 19, 1-11.
27. Linsell, L., Burgess, C. C., & Ramirez, A. J. (2008). Breast cancer awareness among older women. *British journal of cancer*, 99(8), 1221-1225.
28. Elobaid, Y. E., Aw, T. C., Grivna, M., & Nagelkerke, N. (2014). Breast cancer screening awareness, knowledge, and practice among Arab women in the United Arab Emirates: a cross-sectional survey. *PloS one*, 9(9), e105783.
29. Latif, R. (2014). Knowledge and attitude of Saudi female students towards breast cancer: A cross-sectional study. *Journal of Taibah University Medical Sciences*, 9(4), 328-334.
30. Mohamed, E. Y., Sami, W., Alenezi, A. A., Almutairi, A. M., Alsalboud, A. K., Alhusainy, K. M., ... & Ansari, T. (2016). Breast cancer awareness and breast self-examination among future female university graduates: comparison between medical and non-medical students. *Int J Res Med Sci*, 4(3), 685-689.
31. Kan'an, A. (2018). Evaluation of breast cancer (BC) awareness among female university students in Zarqa University, Jordan. *European journal of breast health*, 14(4), 199.
32. Suleiman, A. K. (2014). Awareness and attitudes regarding breast cancer and breast self-examination among female Jordanian students. *Journal of basic and clinical pharmacy*, 5(3), 74.