

RESEARCH ARTICLE

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Predictors of Mammography Uptake among Omani Women: A National Cross-Sectional Survey Using the HINTS Framework

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Abstract

Background: Breast cancer is the most common malignancy among women globally and a leading cause of cancer mortality. In Oman, breast cancer incidence has risen sharply over the past decade, yet mammography uptake remains suboptimal, despite free nationwide availability of screening services. Understanding the determinants of screening behavior is critical for designing effective interventions. **Methods:** We conducted a cross-sectional national survey between March and August 2023 across all 11 governorates of Oman. Omani women aged ≥ 18 years were recruited through convenience sampling via social media and Ministry of Health channels. Data were collected using a structured questionnaire adapted from the U.S. National Cancer Institute's Health Information National Trends Survey (HINTS), which was translated and pilot-tested for cultural appropriateness. The survey covered sociodemographic characteristics, health and risk factors, knowledge and attitudes, healthcare system factors, and prior screening practices. The primary outcome was self-reported history of ever having undergone a mammogram. Bivariate associations were tested using chi-square analysis, and predictors were examined in multivariable logistic regression. **Results:** Among 469 participants, 21.5% ($n=101$; 95% CI 17.8%–25.2%) reported ever having undergone a mammogram. In adjusted models, three factors were independently associated with uptake: age ≥ 40 years (adjusted odds ratio [aOR] = 7.83; 95% CI: 4.48–13.71), residence in Muscat governorate (aOR = 3.13; 95% CI: 1.76–5.57), and receiving a healthcare provider's recommendation (aOR 9.34, 95% CI 4.54–19.23). Other sociodemographic variables (marital status, education, employment), risk perceptions, and health beliefs were not significantly associated. **Conclusion:** Mammography uptake among Omani women remains low. Provider recommendation and geographic access were the most powerful determinants, underscoring the need for system-level interventions such as integrating provider prompts into primary care and scaling mobile mammography services. Addressing these barriers is essential to improve early detection and reduce breast cancer mortality in Oman.

Keywords: Mammography, Health Knowledge, Attitudes, Practice, Health Services Accessibility, Mass Screening

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Introduction

Breast cancer is the most common cancer among women worldwide and a leading cause of cancer-related mortality. According to GLOBOCAN 2020, approximately 2.3 million new breast cancer cases and 685,000 deaths were reported globally, representing a substantial public health challenge [1]. Early detection through mammography has consistently been shown to reduce breast cancer mortality by enabling diagnosis at earlier, more treatable stages [2].

Despite these benefits, mammogram uptake remains uneven across countries. High-income settings with organized, population-based programs often achieve screening coverage exceeding 70%, whereas many low- and middle-income countries (LMICs) report far

lower uptake due to restricted access, limited program infrastructure, and sociocultural barriers [3]. This disparity in screening coverage contributes directly to late-stage diagnoses and higher mortality in resource-constrained settings.

The Eastern Mediterranean Region (EMR), including the Gulf Cooperation Council (GCC) states, has experienced rising breast cancer incidence over the past two decades. Yet screening participation remains very low: only 5–16% of eligible women undergo mammography in most GCC nations, and nearly 60% of breast cancers in the region are still diagnosed at advanced stages [4]. Oman mirrors these regional trends. Breast cancer is now the leading cause of cancer-related death among Omani women, accounting for roughly one-third of all female cancers in 2022 [5]. National registry data show

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a sharp rise in incidence, from 139 cases in 2010 to 549 in 2022 [6]. Although the Ministry of Health offers free mammography services, screening remains opportunistic, and uptake is limited [5, 7]

Several barriers specific to Arab and Muslim women have been described, including cultural norms of modesty, stigma, fatalistic health beliefs, fear of diagnosis, embarrassment, and lack of female healthcare providers [5, 8]. In Oman, as in neighbouring countries, awareness of breast cancer and its early detection is relatively high, yet this knowledge has not translated into consistent screening practice.

Previous studies in Oman have primarily assessed knowledge and attitudes, with few examining actual screening behavior. To address this gap, we conducted a national survey of Omani women to quantify mammogram uptake and identify its sociodemographic, perceptual, and healthcare-related predictors. By focusing on screening behavior rather than awareness alone, this study aims to provide evidence to inform targeted interventions and guide the development of a structured, national breast cancer screening framework.

Materials and Methods

Study Design and Setting

This was a cross-sectional national survey conducted in Oman between March and August 2023. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. Oman is divided into 11 governorates; the survey was disseminated online to maximize geographic coverage and capture women from both urban and rural areas.

Study Population and Sampling

Eligible participants were Omani women aged ≥ 18 years residing in any governorate and able to read Arabic. Recruitment used a non-probability convenience sampling approach via social media platforms (Instagram, Facebook, Twitter, WhatsApp) and official Ministry of Health communication channels, which engaged primary and secondary healthcare providers who helped distribute the survey. Participation was voluntary and anonymous. A total of 469 women completed the questionnaire and were included in the analysis. Although response rates could not be calculated, distribution was monitored until responses were obtained from all governorates. To assess representativeness, the distribution of age and geographic residence in the sample was compared with available national demographic statistics. While some overrepresentation of younger and urban women was observed, multivariable adjustment was performed to reduce confounding by demographic imbalance.

Data Collection Tool

Data were collected using a structured, self-administered questionnaire adapted from the U.S. National Cancer Institute's Health Information National Trends Survey (HINTS) [9] with official permission. The instrument was tailored to the Omani context and comprised the domain listed in Table 1.

Translation and Pilot Testing

The questionnaire was forward-translated into Arabic by a certified medical translator and back-translated into English by an independent bilingual expert. Discrepancies were resolved by consensus. A pilot test with 25 Omani women of varied age and education confirmed clarity, cultural appropriateness, and completion time (~10–15 minutes). Minor adjustments were made (e.g., clarifying medical terms such as “mammogram”).

Outcome Definition

The primary outcome was ever having had a mammogram, assessed by the question: “Have you ever had a mammogram (an X-ray of the breasts to check for cancer)?” (Yes/No). Women who responded “Yes” were considered to have utilized mammography at least once, whether for screening or diagnostic purposes. Secondary outcomes (e.g., breast self-examination, clinical breast examination) were collected but not analyzed as primary endpoints.

Statistical Analysis

Survey responses were exported from the online platform into IBM SPSS Statistics software for analysis (Version 28; IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated to summarize the characteristics of the sample and the overall mammography uptake rate.

Binary logistic regression analysis was conducted to understand the various socio-demographic and economic factors determining the decision of undergoing a mammogram for screening breast cancer. The dependent variable is dichotomous in nature. Women who had never undergone mammography served as the reference category. Some inter-related factors were excluded to avoid multicollinearity. The independent variables were broadly re-categorized appropriately for the analysis. Binomial 95% confidence intervals were calculated for

Table 1. The Sections Included in the Survey

Section	Explanation
Sociodemographic characteristics	Age, marital status, education level, employment status, and governorate (region) of residence.
Health and risk factors	tobacco exposure in the household, family history of breast cancer, perceived personal risk.
Knowledge and attitudes toward breast cancer and mammography	general cancer knowledge, perceived seriousness of breast cancer, worry, beliefs about mammography frequency, and screening intentions.
Healthcare access and system factors	regular healthcare provider, physician recommendation for mammography.
Prior screening practices	breast self-examination, clinical breast examination, history of mammography, age at first mammogram, and frequency of prior mammograms.

Table 2. Mammography Uptake by Sociodemographic Characteristics among Omani Women (n = 469)

Variable	Category	Total n (%)	Ever had a mammogram n (%)	p-value
Age*	<40 years	311 (66.3)	25 (8.0)	<0.001
	≥40 years	158 (33.7)	76 (48.1)	
Marital status	Not married	155 (33.0)	32 (20.6)	0.812
	Married	314 (67.0)	69 (22.0)	
Region*	Non-Muscat	366 (78.0)	57 (15.6)	<0.001
	Muscat	103 (22.0)	44 (42.7)	
Education	High school or less	177 (37.7)	39 (22.0)	0.595
	University degree	190 (40.6)	37 (19.5)	
	Postgraduate	102 (21.7)	25 (24.5)	
Employment status	Not employed	166 (35.4)	29 (17.5)	0.113
	Employed	303 (64.6)	72 (23.8)	

*Chi-square test; ***p < 0.001.

key prevalence estimates.

Ethical Considerations

The study received ethical approval from the Medical Research Ethics Committee, Sultan Qaboos University (MREC #2326). An electronic informed consent was obtained from all participants prior to survey initiation. Participation was voluntary, data were collected anonymously, and no personal identifiers were recorded. Data were stored securely and analyzed only in aggregate form.

Results

A total of 469 women participated in the study. Overall, 21.5% (n = 101; 95% CI 17.8%–25.2%) reported ever having undergone a mammogram. The remaining 78.5% (n = 368) had never had a mammogram. Approximately one-third of the participants (33.7%) were aged 40 years or older.

Table 2 presents the distribution of mammogram history among 469 participants, categorized by key demographic variables. In bivariate analyses (chi-square tests), age and region showed significant associations with mammogram uptake, whereas marital status, education level, and employment did not. Age was strongly associated with mammogram uptake (p < 0.001). Among women under 40 years old (66.3% of the sample), only 8.0% had ever had a mammogram, compared to

48.1% of women aged 40 or above. Geographic region was also significantly related to screening history (p < 0.001). Only 15.6% of women living outside the Muscat Governorate had undergone a mammogram, whereas 42.7% of those residing in Muscat reported having been screened. In contrast, marital status was not significantly associated with mammography uptake (p = 0.812), with similar screening rates for currently married women (22.0%) and unmarried women (20.6%). Educational attainment showed no significant relationship with having a mammogram (p = 0.595); the proportion of women screened was comparable across those with a high school education (22.0%), a university degree (19.5%), or higher education (24.5%). Employment status was likewise not significantly associated with past mammogram uptake (p = 0.113), although the uptake was slightly lower among non-employed women (17.5%) than employed women (23.8%).

Table 3 summarizes associations between mammogram history and risk-related variables. Neither family history of breast cancer (p = 0.432), household tobacco exposure (p = 0.810), nor perceived personal risk (p = 0.164) were significantly associated with mammography uptake. Similarly, beliefs about age as a risk factor did not show significant variation in uptake (p = 0.864).

Table 4 details knowledge and attitudinal variables. Neither frequency of worry (p = 0.139), cancer knowledge (p = 0.763), nor perceived likelihood of future breast cancer (p = 0.101) showed statistically significant

Table 3. Mammography Uptake by Health and Risk-Related Factors among Omani Women (n = 469)

Variable	Category	Total n (%)	Ever had a mammogram n (%)	p-value
Household tobacco exposure	No	391 (83.4)	85 (21.7)	0.81
	Yes	78 (16.6)	16 (20.5)	
Perceived risk (health & lifestyle)	Low	279 (59.5)	54 (19.4)	0.164
	High	190 (40.5)	47 (24.7)	
Family history of breast cancer	No	387 (82.5)	86 (22.2)	0.432
	Yes	82 (17.5)	15 (18.3)	
Perceived role of age	Less likely	184 (39.2)	41 (22.3)	0.864
	Same likelihood	222 (47.3)	48 (21.6)	
	More likely	63 (13.5)	12 (19.0)	

Table 4. Mammography Uptake by Knowledge and Attitudinal Factors among Omani Women (n = 469)

Variable	Category	Total n (%)	Ever had a mammogram n (%)	p-value
How often do you worry about breast cancer	Rarely/never	159 (33.9)	28 (17.6)	0.139
	Often/all the time	310 (66.1)	73 (23.5)	
Breast cancer is more common than lung cancer in women?	Disagree	16 (3.4)	4 (25.0)	0.763
	Unsure / lifestyle dependent	90 (19.2)	17 (18.9)	
	Agree	363 (77.4)	80 (22.0)	
Likelihood of developing breast cancer in the future	No	337 (71.9)	66 (19.6)	0.101
	Yes	132 (28.1)	35 (26.5)	

Table 5. Mammography Uptake by Healthcare System and Practice-Related Factors among Omani women (n = 469)

Variable	Category	Total n (%)	Ever had a mammogram n (%)	p-value
Provider recommendation*	No	415 (88.5)	63 (15.2)	<0.001
	Yes	54 (11.5)	38 (70.4)	
Screening intention*	Hesitant	163 (34.8)	15 (9.2)	<0.001
	No plan	153 (32.6)	23 (15.0)	
	Plan to undergo	153 (32.6)	63 (41.2)	
Belief on frequency of mammography*	Only when problem arises	55 (11.7)	5 (9.1)	0.001
	When doctor recommends	91 (19.4)	12 (13.2)	
	Depends on age	90 (19.2)	15 (16.7)	
	Annual/biennial	138 (29.4)	38 (27.5)	
	Every >2 years	95 (20.3)	31 (32.6)	

*Chi-square test; ***p < 0.001.

associations.

In contrast, Table 5 demonstrates that provider recommendation was strongly associated with uptake ($p < 0.001$). Only 15.2% of women without a recommendation reported a mammogram, compared to 70.4% of those advised by a healthcare professional. Similarly, women's intentions were predictive: uptake was 9.2% among hesitant women, 15.0% among those with no plan, and 41.2% among those planning to undergo a mammogram ($p < 0.001$). Beliefs regarding screening frequency also showed significance ($p = 0.001$), with higher uptake among women who considered mammography a regular preventive measure.

Women who felt that mammograms should be done only upon having a health problem or solely at a doctor's recommendation had low screening rates (9.1% and 13.2% respectively). Those who believed that screening frequency "depends on age" had an uptake of about 16.7%. In contrast, uptake was higher among women who viewed mammography as a routine preventive measure: 27.5% of those who thought it should be done annually or biennially had been screened, rising to 32.6% among those

believing it should be done every two or more years. These trends indicate that proactive health beliefs and provider encouragement are linked to higher mammogram uptake.

Results of the adjusted logistic regression model are presented in Table 6. Twelve candidate variables were considered, and three emerged as independent significant predictors of mammography uptake: region of residence, age, and provider recommendation (overall model $p < 0.001$). In the adjusted model, residing in Muscat was associated with significantly higher odds of mammography compared to living in other regions. Women living in Muscat had over three times the odds of having undergone a mammogram than those in non-Muscat areas (adjusted OR = 3.133, 95% CI: 1.764–5.565, $p < 0.001$). Age remained a strong predictor after adjustment: being 40 years of age or older was associated with nearly an eight-fold increase in the odds of having had a mammogram relative to being under 40 (adjusted OR = 7.834, 95% CI: 4.476–13.709, $p < 0.001$). The strongest effect was observed for provider recommendation. Women who had ever received a recommendation for mammography from a health professional had dramatically higher

Table 6. Multivariable Logistic Regression of Predictors of Mammography Uptake among Omani Women (n = 469)

Predictor	aOR	95% CI	p-value
Residing in Muscat	3.13	1.76–5.57	<0.001
Age ≥ 40 years	7.83	4.48–13.71	<0.001
Provider recommendation	9.34	4.54–19.23	<0.001
Other variables (education, marital status, employment, family history, perceived risk, worry, knowledge, attitudes)	–	–	Not significant in adjusted model

odds of being screened than those who had not been advised, with an adjusted odds ratio of 9.342 (95% CI: 4.539–19.227, $p < 0.001$). In summary, after controlling for other factors, only geographic region, older age, and having a physician's recommendation were significantly associated with a woman's likelihood of undergoing a mammogram. All other factors, including marital status, education, employment, perceived risks, and personal health beliefs, were not independently significant in the final model.

Discussion

In this national survey of Omani women, only 21.5% reported ever undergoing a mammogram, indicating persistently low uptake despite free availability of screening services. The strongest independent predictors of screening were age ≥ 40 years, residence in the Muscat region, and receipt of a healthcare provider's recommendation. In contrast, cognitive and belief-related factors, such as perceived risk, worry, or attitudes toward breast cancer, failed to predict screening uptake when system-level variables were accounted for.

The uptake observed in Oman is substantially lower than in high-income countries, where organized screening programs achieve participation rates exceeding 50% [10–12]. It is, however, consistent with findings from the Gulf region, where reported mammography uptake ranges between 5% and 25% [4]. Similar to studies from Saudi Arabia, the UAE, and Kuwait, most Omani women continue to present at later stages of disease, reflecting the absence of a structured, population-based screening program [4].

The Critical Role of Provider Recommendation and Access

The provider recommendation emerged as a powerful determinant of mammography uptake—women who received guidance from healthcare professionals had dramatically higher odds of being screened. This aligns with growing evidence from the Middle East and beyond [13,14]: for example, a Malaysian study found that physician advice was associated with a 7.6-fold increase in uptake, reinforcing the universal importance of provider engagement [13]. In Oman, previous work showed that lack of physician recommendation was one of the top patient-reported barriers to obtaining mammography [15]. Our results reinforce that provider engagement is a critical, modifiable lever. In Oman's context of opportunistic screening, many women will not act unless a healthcare professional initiates the conversation. Interventions that ensure physicians actively counsel and refer eligible women for instance, incorporating electronic medical record prompts for clinicians to recommend mammography during visits, could substantially boost uptake.

Geographic access to screening services is the other major system-level factor identified. Residence outside the capital was associated with significantly lower odds of ever having a mammogram, suggesting that proximity to screening facilities (most of which are in Muscat)

strongly influences uptake. This urban–rural gap is a well-documented phenomenon. Even within targeted outreach programs, women in urban areas tend to utilize mammography at higher rates than those in rural areas [3].

Fortunately, Oman has proactively addressed this issue through the establishment of mobile mammography units (MMUs). The Oman Cancer Association (OCA) operates MMUs that travel across the Sultanate especially targeting women aged 40 and above, to deliver free screenings, triage suspected cases, and raise awareness at the grassroots level. Since its launch in 2009, the MMU program has screened more than 21,500 women, has expanded access to screening and facilitated referral/triage pathways [16, 17]. The MMUs represent a viable model for overcoming geographical barriers, illustrating how existing infrastructure can be leveraged to expand access in under-served regions.

Why Cognitive Factors Did Not Predict Uptake

It is noteworthy that health beliefs and cognitive factors were not independent predictors of screening in our study. Classic behaviour changes models like the Health Belief Model posit that women who perceive themselves to be at higher risk, who worry more about cancer, or who have positive attitudes toward screening should be more likely to attend screening. In unadjusted analyses, we did observe some expected trends (for example, women with greater perceived susceptibility or fewer misconceptions were more inclined toward screening uptake). However, once age, location, and provider recommendation were accounted for, these psychological variables dropped out of significance. This finding resonates with other evidence from low- and middle-income settings suggesting that awareness and attitudes, while necessary, may not be sufficient to drive action when structural barriers are in the way. In Oman, general awareness of breast cancer and screening is relatively high – over 80% of women know mammography is available and believe early detection is lifesaving [15]– yet this has not translated into commensurate uptake (only ~16% had ever been screened in the 2020 study [15] and 21.5% in our current data). Thus, many women with adequate knowledge and even concern about breast cancer still do not get screened, likely due to logistical, cultural, or healthcare system hurdles. It is possible that in our sample, limited variability in knowledge and attitudes (which were moderate-to-good overall) made it hard to detect an effect – most participants knew about screening's importance but lacked the push or means to act on it. It is also plausible that when faced with obstacles like access or no physician advice, individual motivations are overridden. Interestingly, some studies in the region have found certain belief-related factors to matter in bivariate analysis (e.g. fear of diagnosis, embarrassment, fatalism) [15], but when more proximal factors like doctor's recommendation are in place, these fears can be assuaged.

Our results suggest that interventions focusing solely on education or persuasion may not yield large gains in screening uptake unless the healthcare delivery factors are addressed in tandem. That said, the null findings for psychosocial predictors should not be misinterpreted as

implying that women's perceptions don't matter at all – rather, in the presence of strong system influences, their marginal effect was minimal. It remains important to continue public education to correct misconceptions and reduce fear, as these efforts can create a receptive context in which provider-initiated screening is more successful. The challenge is that in Oman's case, belief is ahead of behaviour – most women accept that mammography is beneficial, but practical participation lags far behind.

Policy and Practice Implications

These findings point to several actionable strategies to improve breast cancer screening uptake in Oman and similar contexts. First and foremost, healthcare providers must be empowered and encouraged to recommend screening at every appropriate opportunity. Provider-focused interventions could include training and continuing education to ensure physicians and nurses are up to date on screening guidelines and skilled in communicating the importance of early detection. Creating systematic prompts, for example, automated reminders in electronic health records or clinic registers for women over 40 can cue providers to have the screening conversation during patient visits [15, 16]. Embedding such prompts in primary care workflows has been shown to increase the frequency of physician referrals for mammography [18, 19], which in turn should drive higher uptake.

In parallel, addressing geographic and infrastructure barriers is critical. Policymakers should consider expanding screening services beyond tertiary centres. This could involve establishing mammography units in regional hospitals or deploying mobile mammography buses on scheduled circuits to reach smaller towns and remote communities. Oman has already taken important steps by establishing mobile mammography units operated by the Oman Cancer Association, which travel nationwide to provide free screening, particularly targeting women aged ≥ 40 years in underserved areas. Since their launch in 2009, these units have screened tens of thousands of women and received recognition for expanding access to screening services. Mobile units, in particular, represent a proven strategy to reduce access disparities, as they bring screening directly to underserved populations. Ensuring that screening is convenient and possibly coupling it with other women's health services (e.g. mobile clinics that provide health checks, Pap smears, etc.) could normalize the practice and improve uptake. Another system-level lever is integrating breast cancer screening into existing public health programs – for example, leveraging maternal and child health clinics or chronic disease clinics as points of referral for mammography. Additionally, targeted community outreach and reminder systems could complement provider efforts. While general awareness in Oman is decent, personalized reminders (via phone, SMS, or community health workers) to women overdue for screening might provide an extra nudge. A recent systematic review in the Middle East found that multi-component interventions combining client reminders, education, and reduced structural barriers – achieved modest improvements in screening uptake (for example, one trial increased mammography attendance from

11% to 18%) [3]. This suggests that Oman should adopt a comprehensive approach: strengthen the healthcare provider's role, make the logistics of screening easier, and maintain public education and engagement. Finally, there may be value in moving toward a more organized screening program in the long term. Opportunistic systems tend to miss a large segment of the population. Adopting elements of successful programs elsewhere, such as invitation letters to all women in the target age range, scheduled appointments, and monitoring of attendance, could drastically improve coverage if resources permit. Indeed, authors have argued that Gulf countries should integrate cancer screening into primary healthcare and set national targets for participation.

Strengths and Limitations

This study has several strengths. It is one of the few analyses to quantify mammography uptake and its determinants among Omani women, providing valuable baseline data for monitoring and intervention. The sample included women from a range of ages (20–70+) and from all regions of the country, lending breadth to the findings. The use of multivariable modelling allowed us to identify independent predictors while adjusting for confounders. Nonetheless, certain limitations must be acknowledged. The survey employed a cross-sectional design, which limits our ability to infer causality. We cannot be certain, for instance, whether physician recommendations led to women getting screened or if women who got screened later recalled receiving a recommendation; longitudinal studies would be needed to confirm the direction of effect. Relatedly, there is potential for reverse causation in some associations (e.g. women who actively sought screening might then report that their doctor recommended it, rather than the recommendation coming first). Another limitation is the reliance on self-reported behaviour and perceptions. Mammography history was not verified against medical records, so there may be recall errors or social desirability biases (though self-report of ever having a mammogram is generally considered reasonably accurate). Similarly, variables like risk perception and attitudes were self-reported and might be subject to measurement bias or respondents giving “expected” answers. The use of non-probability convenience sampling introduces potential selection bias. Women who are digitally literate, younger, or more health-conscious may have been overrepresented. As a result, mammography uptake estimates should be interpreted with caution, and true national prevalence may differ. However, associations identified through multivariable regression are less likely to be substantially biased by sampling imbalance. Despite these limitations, the consistency of our core findings with prior regional studies enhances confidence in the results. Future research could build on this work with longitudinal designs and targeted sampling of hard-to-reach groups (e.g. older rural women) and could explore in more depth why certain psychosocial factors did not translate into action. Furthermore, although this study provides national-level quantitative evidence, it does not explore the deeper psychosocial or cultural rationales underlying screening decisions. Future mixed-methods or qualitative studies

could complement these findings by examining beliefs, social norms, and health system perceptions that influence mammography uptake among Omani women

In conclusion, our study highlights an urgent need to address the persistently low uptake of mammography in Oman. Accelerating breast cancer screening through proactive provider involvement and accessible screening services is critical to achieve earlier detection and improve women's cancer outcomes in the Sultanate. The time to act is now – considering these insights to implement policy changes and interventions can save lives by closing the mammography gap.

Author Contribution Statement

Adhari Al Zaabi: conceptualizing and designing the study, overseeing project administration, coordinating and managing data collection, drafting and critically revising the manuscript. Thamra Al Ghafri: data collection, data management, and statistical analysis, and manuscript preparation Preetha V. Mohan and Rajesh J Nair : data analysis and interpretation. All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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Data availability

The data generated in this study are available upon request from the corresponding author.

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