Factors influencing mammogram uptake among women attending primary care clinics in Terengganu, Malaysia

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ABSTRACT

Introduction: Breast cancer ranks as the most common cancer among women in Malaysia with its incidence rate steadily rising over the years. Mammograms are crucial for early detection, yet their usage remains low in Malaysia, especially in Terengganu where the services are scarce. This study seeks to explore the factors influencing mammogram uptake among women visiting public primary care clinics in Terengganu.

Materials and Methods: A cross-sectional study was conducted at six public primary care clinics in Terengganu, selected using cluster random sampling from both urban and rural areas. A total of 739 women participated, of whom 231 met the eligibility criteria for mammogram screening according to Ministry of Health guidelines. A validated questionnaire was utilized to gather information on sociodemographic factors, knowledge and attitudes towards breast cancer and screening behaviours. Both univariable and multivariable logistic regression analyses were conducted to examine the relationships between independent variables and mammogram uptake.

Results: Only 16.5% of the eligible participants reported having undergone a mammogram at some point. The multivariable analysis indicated that age and education level significantly predicted mammogram uptake. Women with higher education levels exhibited 2.6 times greater odds (95% CI: 1.22, 5.43) of having undergone mammography, and each additional year of age increased the probability of screening by 7% (aOR: 1.07, 95% CI: 1.01, 1.13).

Conclusion: The uptake of mammograms among women in Terengganu is alarmingly low and mirrors national trends. Women who possess higher education and are older were more likely to participate in mammography, proving the critical role of health literacy in screening behaviour. Addressing access and awareness are vital challenges in areas where mammogram services are limited. Implementing targeted educational initiatives and enhancing healthcare access, particularly in rural settings is crucial for improving breast cancer screening rates.

KEYWORDS:
Breast cancer, cancer screening, cancer, mammogram, screening

INTRODUCTION

Breast cancer remains the most prevalent cancer in Malaysia, accounting for 17.6% of all cancer cases and is the most common cancer among women, with an incidence rate of 38.9 per 100,000 population.[1] This incidence rate shows a steady increase from 31.1 per 100,000 population between 2007 to 2011[2] to 34.1 per 100,000 between 2012 to 2016,[3] which could be partly attributed to improved detection and reporting mechanisms.[1] The incidence begins to rise at the age of 30, plateaus at around 50 years, peaks between the ages of 60-64 and decreases thereafter.[1]

Early detection of breast cancer in Malaysia faces significant challenges, as many patients present at advanced stages. The percentage of late-stage (stage III and IV) breast cancer diagnoses increased from 43.2% between 2007 and 2011[2] to 47.9% between 2012 to 2016.[3] Moreover, one-third of patients delay seeking medical attention for over three months after recognizing symptoms.[4] This delay highlights the need for enhanced awareness and access to early screening services, such as mammograms, as delayed diagnosis significantly affects survival outcomes. Mammography, especially among women aged 50–74, has been shown to reduce breast cancer mortality (relative risk [RR] 0.77) with smaller reductions among younger women (RR 0.88).[5] Early diagnosis through mammogram screening allows for more effective therapy, less invasive interventions, and reduced treatment costs, thereby improving overall cancer outcomes.

Malaysia's breast cancer screening guidelines recommend a risk-stratified approach, where biennial mammograms are advised for women aged 50-74.[6] For women at high risk of breast cancer, screening mammogram may be initiated between 30-39 years of age, followed annually between 40-59, and biennially after age 60. Carriers of BRCA1, BRCA2, and PALB2 are advised to undergo annual magnetic resonance imaging from ages 30-49, annual mammograms from 40-69 and biennial mammograms after age 70.[6]

In Malaysia, mammogram services are available at public hospitals, private hospitals and certain private clinics. Patients may walk in or receive a referral for these services, with government hospitals offering mammograms at minimal charges, while private centres charge between RM100 and RM400, depending on the type of mammogram. The Ministry of Health, in collaboration with other government bodies and private organizations, has launched several initiatives aimed at increasing public awareness and promoting early screening. The annual Pink October campaign, in conjunction with Breast Cancer Awareness Month, is a major event that emphasizes the importance of

This article was accepted: 10 December 2024
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screening, early detection and treatment of breast cancer. Public and private organizations, including hospitals and non-profit groups, participate by organizing educational programs on breast self-examinations and offering free or subsidized mammograms.

Despite these ongoing campaigns and subsidized screening programs, mammogram uptake remains low in Malaysia.[7] The National Health and Morbidity Survey 2023 reported a national mammogram uptake rate of only 12.8% within the past three years.[8] Disparities exist between urban and rural areas, with uptake rates slightly higher in Selangor (27%)[9] and Putrajaya (30%)[10] while significantly lower in Kedah (2.8%).[11] Barriers to mammogram screening include lack of knowledge, poor attitudes, financial constraints and perceived low risk.[12]

Terengganu, located on the east coast of Malaysia, has a population of approximately 1.2 million, most of whom live in urban areas.[13] The female population aged 30-74 is around 200,000.[14] Geographically, Terengganu is divided into eight districts, spanning about 200 kilometres along the coastline, with Kuala Terengganu as the capital.[13] There are 52 health clinics throughout the state,[15] but at the moment, only two public facilities, one in Kuala Terengganu and one in Kemaman offer mammogram services. Additionally, there are two private hospitals, both in Kuala Terengganu, providing mammograms. This limited accessibility predominantly restricts mammogram services to Kuala Terengganu. According to the National Health and Morbidity Survey, 2019, Terengganu ranks among the lowest in mammogram uptake, following Kelantan, Pahang and Perak.16 The present study aims to determine factors that influence mammogram uptake among women attending public primary care clinics in Terengganu.

MATERIALS AND METHODS

A cross-sectional study was conducted among women attending six primary care clinics in Terengganu. The clinics were selected via cluster random sampling from 52 health clinics in all eight districts in the state. To ensure representation from both rural and urban settings, the districts were first categorized into urban (Kuala Terengganu, Kuala Nerus, and Marang) and rural (Setiu, Besut, Hulu Terengganu, Dungun, and Kemaman) groups. Three health clinics were selected from each group using simple random sampling. The selected urban clinics were Bukit Tunggal Health Clinic, Hiliran Health Clinic, and Seberang Takir Health Clinic, while the rural clinics were Bukit Besi Health Clinic, Kuala Berang Health Clinic, and Telemong Health Clinic.

The questionnaire used in the study comprised of sections on sociodemographic characteristics, breast cancer knowledge and attitudes toward breast cancer screening and breast cancer screening practices. The breast cancer knowledge section, developed by the researcher, consisted of 24 items related to symptoms, risk factors, and screening methods. Attitudes toward screening were measured using 56 items adapted from the Champion Health Belief Model (CHBM)[17], assessing perceived susceptibility, severity, benefits, barriers, self-efficacy, and cues to action. Responses were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The practice section assessed engagement in breast self-examinations, clinical breast examinations, and mammogram screening, aligned with guidelines from the Ministry of Health.[6]

A pilot study involving 30 university librarians was conducted to assess the reliability of the questionnaire, yielding Cronbach's alpha values of 0.7 for the knowledge section and 0.9 for the attitude section.

The study recruited 739 consecutive women aged 18 years and above attending the selected clinics. Of these, 231 women met the Ministry of Health's criteria for mammogram screening: (1) age 30 or older with a first-degree relative diagnosed with breast cancer or (2) age 50 years and above.

Data Analysis

The data were analyzed using IBM SPSS Statistics (Version 21.0). Descriptive statistics were used to summarize sociodemographic characteristics, with means and standard deviations were reported for continuous variables while frequencies and percentages were used for categorical variables. Total scores were calculated for the knowledge and attitude domains. Univariable logistic regression was used to examine the associations between independent variables and mammogram uptake. Variables with a p-value <0.25 or those deemed clinically relevant were included in the multivariable logistic regression model. The final adjusted model was constructed, and statistical significance was set at $p<0.05$. Interaction effects, multicollinearity, and model fit (using the Hosmer-Lemeshow goodness-of-fit test) were assessed for the final model. Crude and adjusted odds ratios (OR and aOR) were used to report associations between the independent variables and mammogram uptake.

RESULTS

A total of 231 eligible participants were included in the final analysis.

Socio-demographic characteristics of respondents

All 231 respondents were Malay, with the majority being married (95.7%) and having attained either primary or secondary education (72.3%). Approximately 85.3% reported a history of breastfeeding, while only 3.9% had a first-degree relative diagnosed with breast cancer. The sociodemographic details of the participants are presented in Table I.

Mammogram Uptake

Only 38 out of 231 participants (16.5%) reported having undergone mammogram screening at least once in their lifetime. This measure did not account for the frequency of screening or adherence to recommended intervals (i.e., annually or biennially).

Factors associated with mammogram uptake

Univariable logistic regression was conducted to examine the association between each independent variable and mammogram uptake. As shown in Table II, age, marital status, and educational level were associated with a p-value

Table I: Demographic data of the respondents (n=231)

Variable	Mean (SD)	No. (%)
Age	34.36 (9.59)	
No. of children	2.31 (2.42)	
Knowledge score	81.53 (9.13)	
Attitude score	178.24 (21.27)	
Race		
Malay		231 (100.0)
Education level		
Primary/secondary school		167 (72.3)
Certificate & higher		64(27.7)
Marital status		
Single		10 (4.3)
Married/ever married		221 (95.7)
Occupation		
Employed		87 (37.7)
Housewife		144 (62.3)
Breastfeeding Practice		
Yes		197 (85.3)
No		34 (14.7)
1st degree with breast cancer		
Yes		9 (3.9)
No		222 (96.1)

Table II: Association between respondents' demographics and mammogram practice (n=231)

Variable	Mammogram		Chi-square (df)	Wald statistics (df)	p-value
	Done n (%)/mean	Not done n (%)/mean			
Malay	38 (16.5%)	193 (83.5%)	-	-	
Marital status			2.06	0.01	*0.151
Single	0 (0.0%)	10 (100.0%)			
Married/ever married	38 (17.2%)	183 (82.8%)			
Occupation			0.72	0.71	0.397
Housewife	26 (18.1%)	118 (81.9%)			
Working	12 (13.8%)	75 (86.2%)			
Educational status			4.71	4.57	*0.030
Primary/ secondary	22 (13.2%)	145 (86.8%)			
Certificate & above	16 (25.0%)	48 (75.0%)			
Breastfeeding practice			0.42	0.04	0.838
Yes	32 (16.2%)	165 (83.8%)			
No	6 (17.6%)	28 (82.4%)			
1st degree with breast cancer			0.22	0.82	0.634
Yes	2 (22.2%)	7 (77.8%)			
No	36 (16.2%)	186 (83.8%)			
Age	49.24	47.42	-	2.95	*0.086
No. of children	4.58	4.47	-	0.06	0.813
Knowledge score	81.84	81.47	-	0.05	0.816
Attitude score	178.68	178.16	-	0.20	0.888

*p-value <0.25

Table III: Association between particiants' demographics and mammogram practice using multivariable logistic regression

Variable	Exp (B) (odds ratio)	95% CI	p-value
Age	1.07	1.01, 1.13	0.035
Education level	2.6	1.22, 5.43	0.013

[a]Forward LR Multiple Logistic Regression model was applied
Hosmer-Lemeshow test (p=0.720), classification table (overall correctly classified percentage=83.5%) and area under the ROC curve were applied to check the model fitness.

less than 0.25 and were subsequently included in the multivariable analysis. Knowledge and attitude scores were not significantly associated with mammogram uptake and were excluded from further analysis.

Multivariable logistic regression revealed that both age and educational level were significantly associated with mammogram uptake. Older age was associated with a higher likelihood of screening, with each additional year of age increasing the odds by 7% (adjusted Odds Ratio [aOR]: 1.07; 95% Confidence Interval [CI]: 1.01, 1.13). Participants with higher education levels were also more likely to undergo mammogram screening (aOR: 2.60; 95% CI: 1.22, 5.43). These findings are summarized in Table III.

DISCUSSION

Mammogram Screening Uptake

This study found that only 16.5% of eligible women in Terengganu had undergone mammogram screening at least once. This rate is notably lower than the prevalence reported in the National Health and Morbidity Survey (NHMS) 2023, which indicated that 25.9% of women aged 40 and above in Terengganu had ever participated in mammogram screening.[8] However, it is important to note that the study population here differed slightly, focusing on women aged 50 years and above or women aged 30 years and above with a first-degree family history of breast cancer. Despite these differences, both findings suggest that mammogram screening rates remain low and have not improved substantially in recent years. This represents a significant public health concern, given the established role of mammography in the early detection and treatment of breast cancer.

Mammogram uptake across Malaysia varies considerably, ranging from as low as 3.6% among the general population to 80.3% among healthcare professionals in tertiary hospitals.[18] The lowest uptake was reported among Malay women aged 40 and above in rural Kedah, with a mere 2.8% participation rate.[11] These findings highlight a significant disparity in mammogram uptake, which is influenced by various demographic and socioeconomic factors.

Factors Influencing Mammogram Uptake

In the current study, age and education level were identified as significant factors associated with mammogram uptake. The association between increasing age and higher mammogram participation may be linked to greater awareness of breast cancer risk as women age. Several studies have found that age is an important factor influencing mammogram uptake.[18-22] Increased awareness of breast cancer risk with advancing age could drive women to seek screening more actively. Additionally, higher education levels were found to positively correlate with better breast cancer knowledge and a higher likelihood of undergoing mammography, consistent with other studies.[20,23-26]

Education plays a pivotal role in enhancing health literacy, which is directly linked to better health-seeking behaviours. Women with higher education are more likely to understand the importance of early detection and adhere to screening recommendations. This finding shows the need for educational campaigns to improve knowledge about breast cancer and the benefits of mammography, particularly among women with lower educational backgrounds.

While this study did not find a significant association between knowledge or attitude scores and mammogram uptake, previous research has identified perceived susceptibility, such as having a family history of breast cancer, as a strong motivator for mammogram screening.[27-29] The perception of breast cancer risk, coupled with healthcare provider recommendations, significantly influences screening behaviours. Women who perceive themselves to be at higher risk are more likely to undergo mammograms, but this alone may not be sufficient to prompt action. The role of healthcare providers in offering clear recommendations during routine check-ups is crucial in encouraging mammogram participation. Consistent advice from healthcare professionals has been shown to positively impact screening uptake by reducing uncertainty and reinforcing the importance of early detection.[12,19,21]

Barriers to Mammogram Screening

A number of studies have identified key barriers to mammogram screening. Fear of a cancer diagnosis remains one of the most significant barriers.[10,12,25,30] This fear is often compounded by stigma and the perception of cancer as a death sentence, which can deter women from seeking early screening. Cultural beliefs, particularly in some rural areas, may also contribute to the perception that a cancer diagnosis leads to poor prognosis, resulting in avoidance of mammograms. A study by Mohan (2021) found that up to 74.8% of women reported fear of cancer as the primary reason for not undergoing mammogram screening.[25] However, fear of cancer diagnosis and cultural beliefs were not looked into in our study.

Geographical access to healthcare services, especially in rural areas, remains another significant barrier. A key challenge in Terengganu is, access to mammography services is limited due to the concentration of services in only two public hospitals and two private facilities, three of which are in the state capital, Kuala Terengganu. This geographical disparity forces women to travel long distances, adding time and financial burdens that further discourage screening participation. Furthermore, long waiting times for mammogram appointments, particularly in public hospitals, add another layer of inconvenience, especially for women in rural areas. The limited availability of mammography services in rural and semi-urban areas has been consistently linked to lower screening rates.[31-35] This issue mirrors findings from other regions, where proximity to healthcare facilities is strongly associated with mammogram participation.[11,19]

Role of Health Education and Awareness Campaigns

Several studies have demonstrated that breast cancer knowledge and awareness among women remain low and this lack of knowledge negatively influences screening behaviour.[10,12,27,30,36] Several factors affect knowledge and awareness, which include race, marital status, educational level, income and whether women live in rural or urban areas.[24,26,37]

Current awareness campaigns, such as the annual Pink October initiative, aim to address misconceptions and promote breast cancer screening. However, these campaigns may not adequately reach women in rural and semi-urban areas. More localized and culturally appropriate interventions are necessary to address the specific barriers faced by these populations. A national mass media campaign promoting breast cancer symptoms, screening benefits and addressing perceived barriers has been shown to significantly improve awareness and participation in screening programs.[20,38] The effectiveness of such campaigns can be enhanced through partnerships with non-governmental organizations and healthcare providers. For instance, collaborating with organizations such as the National Cancer Society Malaysia could improve women to participate in screening programs through subsidized mammograms and incentives.[32]

A review of national mammogram screening data from 2016 to 2020 concluded that the rate of mammogram uptake is closely linked to the intensity of health promotion campaigns.[34] Sustainable awareness programs and community involvement are critical for the success of breast cancer screening initiatives. Annual national campaigns, particularly during Pink October, have been associated with a significant increase in screening rates.[39]

Primary care providers play a critical role in promoting breast cancer screening. Referral for mammograms should be made mandatory in indicated women during routine consultation and as one of the key indicators to be achieved in primary care settings. In addition, addressing patients' concerns about the screening process, healthcare providers can significantly influence women's decisions to undergo mammography.

Public awareness campaigns need to be more targeted and localized to effectively reach populations in rural areas. These campaigns should aim to correct myths and address cultural misconceptions about breast cancer and its screening. Expanding subsidized mammogram programs and financial incentives, particularly for women from lower socioeconomic backgrounds, can further increase screening rates by reducing financial barriers. Lastly, further research should be conducted to explore how psychosocial factors such as fear and stigma impact mammogram uptake, with the aim of developing more effective interventions to address these barriers.

LIMITATIONS

One of the limitations of this study is that all participants were Malay women attending public primary care clinics. Approximately 95% of the population in Terengganu is Malay.[40] Thus, the ethnic homogeneity and the healthcare setting may limit the generalisability of the findings to Malaysia's more diverse multi-ethnic population and to women who seek care in private or alternative healthcare settings. Furthermore, the sampling strategy might have systematically excluded women who do not engage with the healthcare system, who may be at higher risk of not undergoing mammogram screening.

This study was based on a cross-sectional design, which provides a single-point evaluation of mammogram uptake. Without longitudinal follow-up, it does not allow for assessment of whether participants adhered to recommended screening intervals or maintained consistent screening behaviour over the years.

This study also did not assess the major barriers for mammogram screening which was fear of diagnosis and cultural beliefs. However, geographical barrier may indirectly implicate mammogram uptake due to poor accessibility. Efforts should focus on increasing accessibility, particularly for women living in rural and semi-urban areas. Expanding mammogram services through mobile units or establishing more screening centres in rural clinics can help reduce the geographical barriers that many women face. Since 2024, a newly established Hospital Sultan Zainal Abidin in Kuala Nerus is offering its mobile mammogram service. The new service should benefit women especially in the outlying areas.

CONCLUSION

This study highlights the critically low mammogram uptake among women in Terengganu, with only 16.5% of eligible participants had ever undergone mammogram screening. This rate reflects broader national trends where breast cancer screening remains suboptimal, despite efforts to promote early detection. Factors such as age and education were found to be significantly associated with mammogram uptake, with older women and those with higher education levels being more likely to participate in screening. These findings suggest that awareness of breast cancer risks and the importance of early detection increases with age and educational attainment.

Women living in semi-urban and rural parts of Terengganu face challenges related to long distances to screening facilities, additional financial and time burdens and a lack of localized awareness campaigns. This disparity in access and knowledge reinforces the need for more targeted interventions to improve screening participation.

Efforts to increase mammogram uptake must focus on improving access to screening facilities, particularly for rural populations and addressing the psychosocial barriers that deter women from seeking screening. Healthcare providers can play a pivotal role by actively recommending mammograms and providing clear information on the benefits of early detection. Public health campaigns should be tailored to the specific needs and cultural contexts of underserved populations, with an emphasis on dispelling fears and correcting misconceptions about breast cancer. A comprehensive approach involving enhanced healthcare access, education, and community engagement is essential to increasing mammogram uptake and improving breast cancer outcomes in Terengganu and similar regions.

ACKNOWLEDGEMENT

The authors would like to thank Universiti Sultan Zainal Abidin, the Ministry of Health Malaysia, the Terengganu

State Health Department, and the health clinic staff for their support and assistance in conducting this study.

FUNDING

This study was funded by the Ministry of Education, Malaysia under the grant of FRGS/1/2015/ UNISZA/03/1-RR153 and registered under the Ministry of Health National Medical Research Register (NMMR-17-1752-97 (IIR) and the Malaysian Research Ethics Committee.

REFERENCES

1. Ministry of Health, Malaysia. 2024. Malaysia National Cancer Registry Report (2017–2021); National Cancer Registry Department, National Cancer Institute, Ministry of Health, Malaysia: Putrajaya, Malaysia. [cited August 2025]. Available from: https://nci.moh.gov.my/images/pdf_folder/SUMMARY-OF-MALAYSIA-NATIONAL-CANCER-REGISTRY-REPORT-2017-2021.pdf
2. Ministry of Health, Malaysia. 2015. Malaysia National Cancer Registry Report (2007–2011); National Cancer Registry Department, National Cancer Institute, Ministry of Health, Malaysia: Putrajaya, Malaysia. [cited August 2025]. Available from:https://www.moh.gov.my/moh/resources/Penerbitan/Rujukan/Malaysian_National_Cancer_Registry_Report_2007-2011.pdf
3. Ministry of Health, Malaysia. 2019. Malaysia National Cancer Registry Report (2012–2016); National Cancer Registry Department, National Cancer Institute, Ministry of Health, Malaysia: Putrajaya, Malaysia. [cited August 2025]. Available from: https://nci.moh.gov.my/images/Laporan/MNCR_2012-2016_FINAL_PUBLISHED_2019.pdf
4. Mujar NMM, Dahlui M, Taib NA. Presentation, diagnosis, and treatment among patients with breast cancer in Malaysia. J Glob Oncol 2018; 4(Supplement 3): 25s-25s.
5. Canelo-Aybar C, Ferreira DS, Ballesteros M, Posso M, Montero N, Solà I, et al. Benefits and harms of breast cancer mammography screening for women at average risk of breast cancer: A systematic review for the European Commission Initiative on Breast Cancer. J Med Screen 2021; 28(4): 389-404.
6. Ministry of Health Malaysia. 2019. Clinical Practice Guidelines. Management of breast cancer. Third edition.
7. Mahmud A and Aljunid SM. Availability and accessibility of subsidized mammogram screening program in peninsular Malaysia: A preliminary study using travel impedance approach. PLoS One 2018; 13(2): 1-15.
8. Institute for Public Health (IPH). 2024. Technical Report National Health and Morbidity Survey (NHMS) 2023: Non-Communicable Diseases and Healthcare Demand, Malaysia.
9. Htay MNN, Dahlui M, Schliemann D, Siew LL, Tamin NSBI, Somasundaram S, et al. Women's health beliefs and uptake of breast cancer screening in Malaysia. Eur J Cancer Care (Engl) 2022; 31(5).
10. Zaman NLB, Haza NM, Khairudin NA, Al-Junid AMA. View of knowledge and practice towards the importance of screening mammography among women in Putrajaya. Nat Volatiles Essent Oils 2021; 8(4): 3901–11.
11. Zahali ZI. Knowledge, Beliefs, And Practices on Breast Cancer, Clinical Breast Examination, Mammography Screening and Associated Factors Among Rural Malay Women in Kedah Malaysia [master's thesis]. Universiti Putra Malaysia; 2011
12. Momenimovahed Z, Tiznobaik A, Taheri S, Hassanipour S, Salehiniya H. A review of barriers and facilitators to mammography in Asian women. Ecancermedicalscience 2019; 14: 1-16.
13. Department of Statistics, Malaysia. 2020. Sejarah Terengganu Darul Iman. [cited Nov 2024]. Available from: https://statsdw.dosm.gov.my/wp-content/uploads/2021/11/DOSM_DOSM.TERENGGANU_1.2020_Siri-85.pdf
14. Department of Statistics, Malaysia. 2024. Jadual Penduduk: Negeri. [cited August 2025]. Available from: https://open.dosm.gov.my/ms-MY/data-catalogue/population_state?state=terengganu&visual=table
15. Ministry of Health Malaysia. Fasiliti Kesihatan. Klinik Kesihatan. Terengganu. [cited May 2025]. Available from: https://www.moh.gov.my/index.php/pages/view/4378?mid=1451
16. Institute for Public Health (IPH). 2019. National Health and Morbidity Survey (NHMS) 2019: NCDs - Non-Communicable Diseases: Risk Factors and other Health Problems.
17. Champion VL. Revised susceptibility, benefits, and barriers scale for mammography screening. Res Nurs Health 1999; 22(4): 341-8.
18. Mahmud A, and Aljunid SM. The uptake of mammogram screening in Malaysia and its associated factors: A systematic review. Med J Malaysia 2018; 73(4): 202-11.
19. Abdullah N, Baharudin N, Mohamad M, Mohamed-Yassin MS. Factors Associated with Screening Mammogram Uptake among Women Attending an Urban University Primary Care Clinic in Malaysia. Int J Environ Res Public Health 2022; 19(10): 6103.
20. Htay MNN, Dahlui M, Schliemann D, Cardwell CR, Loh SY, Tamin NSBI, et al. Changing Health Beliefs about Breast Cancer Screening among Women in Multi-Ethnic Malaysia. Int J Environ Res Public Health 2022; b19(3): b1-14.
21. Mohd Azmi NA, Muhammad J, Mohd Yusoff SS, Nik Hussin NR. Mammogram Screening Uptake and Its Associated Factors among Female Staff in Health Campus, Universiti Sains Malaysia, Kelantan, Malaysia. Malays J Med Sci 2023; 30(5): 144-54.
22. Tan MM, Jamil ASA, Ismail R, Donnelly M, Su TT. Breast cancer and breast cancer screening use—beliefs and behaviours in a nationwide study in Malaysia. BMC Public Health 2023; 23(1): 1-10.
23. Ghazi H, Abdalqader M, Baobaid MF, Hasan TN, Maratha Pillai P, Hassan MR, et al. Awareness and Belief Regarding Breast Cancer Among Women Living in Selangor, Malaysia. Malaysian J Public Heal Med 2020; 20(1): 30-9.
24. Kanaga KC, Nithiya J, Noor Shatirah MFV. Awareness of breast cancer and screening procedures among Malaysian women. Asian Pacific J Cancer Prev 2011; 12(8): 1965-7.
25. Mohan D, Su TT, Donnelly M, Hoe WMK, Schliemann D, Tan MM, et al. Breast cancer screening in semi-rural Malaysia: Utilisation and barriers. Int J Environ Res Public Health 2021; 18(23): 1-13.
26. Norlaili AA, Fatihah MA, Nik Daliana NF, Maznah D. Breast cancer awareness of rural women in Malaysia: Is it the same as in the cities? Asian Pacific J Cancer Prev 2013; 14(12): 7161-4.
27. Al-Naggar RA and Bobryshev Y V. Practice and barriers of mammography among Malaysian women in the general population. Asian Pacific J Cancer Prev 2012; 13(8): 3595-600.
28. Baig MR, Subramaniam V, Chandrasegar AA, Khan TM. A population-based survey on knowledge and awareness of breast cancer in the suburban females of Sungai Petani, Kedah, Malaysia. Int J Collab Res Intern Med Public Heal 2011; 3(9): 671-9.
29. Parsa P, Kandiah M, Zulkefli NAM, Rahman HA. Knowledge and behavior regarding breast cancer screening among female teachers in Selangor, Malaysia. Asian Pacific J Cancer Prev 2008; 9(2): 221-8.
30. Lee MS, Ma'ruf CAA, Izhar DPN, Ishak SN, Jamaluddin WSW, Ya'acob SNM, et al. Awareness on breast cancer screening in Malaysia: a cross-sectional study. Biomed 2019; 9(3): 19-25.

31. Ho GF, Taib NA, Pritam Singh RK, Yip CH, Abdullah MM, Lim TO. What if all patients with breast cancer in Malaysia have access to the best available care: how many deaths are avoidable? Glob J Health Sci 2017; 9(8): 32-9.
32. Nair V, Nazri VD, Lau A, Hashim R, Ratnasingham C, Munisamy M. Impact of a targeted free mammography screening program for underprivileged women in Malaysia. J Glob Oncol 2018; 4(Supplement 3): 28s-28s.
33. Schliemann D, Hoe WMK, Mohan D, Allotey P, Reidpath DD, Tan MM, et al. Challenges and opportunities for breast cancer early detection among rural dwelling women in Segamat District, Malaysia: A qualitative study. PLoS One 2022; 17(5 May): 1-14.
34. Said ZM, Sutan R. Are we doing enough in promoting breast cancer screening: an evaluation of Malaysia breast cancer screening program. Malaysian J Public Heal Med. 2021; 21(3): 230-9.
35. Htay MNN, Donnelly M, Schliemann D, Loh SY, Dahlui M, Somasundaram S, et al. Breast cancer screening in Malaysia: a policy review. Asian Pacific J Cancer Prev 2021; 22(6): 1685-93.
36. Segar JAP, Xuan TR, Alahakoon AMGN, Ravi HAL, Moe S, Uthamalingam M, et al. Women's knowledge, attitudes, and perception on personalized risk-stratified breast cancer screening: a cross-sectional study in Malaysia. Asian Pacific J Cancer Prev 2024; 25(4): 1231-40.
37. Dahlui M, Gan DEH, Taib NA, Lim JNW. Breast screening and health issues among rural females in Malaysia: how much do they know and practice? Prev Med (Baltim) 2013; 57(SUPPL): 2011-3.
38. Schliemann D, Htay MNN, Dahlui M, Paramasivam D, Cardwell CR, Ibrahim Tamin NSB, et al. Impact of a mass media campaign on breast cancer symptoms awareness and screening uptake in Malaysia: findings from a quasi-experimental study. BMJ Open 2020; 10(8): e036503.
39. Mohamad M, Kok HS. Using Google trends data to study public interest in breast cancer screening in Malaysia. Asian Pacific J Cancer Prev 2019; 20(5): 1427-32.
40. Department of Statistics, Malaysia. 2022. Key Findings. Population and Housing Census of Malaysia, 2020. [cited June 2025]. Available from: https://www.dosm.gov.my/uploads/publications/20221020150523.pdf