Research

Exploring factors associated with uptake of breast cancer screening among a subset of women in a South African metropolitan area: research to inform public health interventions

Ernest Peresu[1], Gladys Kigozi-Male[1], Michelle Engelbrecht[1], Ronel van Rooyen[1]

[1] Centre for Health Systems Research & Development, University of the Free State

https://doi.org/10.61473/001c.122473

South African Health Review

Vol. 26, 2023

Aim

Breast cancer represents a significant global health concern and remains a leading cause of cancer-related mortality, particularly among women in developing countries. Despite the South African Department of Health recommending early breast cancer detection to improve overall survival rates and enhance patients' quality of life, there is lack of awareness among women regarding the importance of regular breast cancer screening and available options. This study investigates the factors associated with breast cancer screening uptake among a subset of women attending public health services in a South African metropolitan area.

Methods

A cross-sectional survey of adult women attending primary health care services at a community health centre was conducted in February-March 2020. Data on sociodemographics, health beliefs, access to information, and breast cancer screening uptake were subjected to descriptive and logistic regression analyses.

Results

Out of 252 women, 48.0% were older than 30 years, 69.4% were unemployed, and 56.0% self-reported breast cancer screening non-uptake. After adjusting for other variables, marital status, employment status, home language, and perceived breast cancer screening benefits were significantly associated with breast cancer screening uptake. Married women were twice (AoR: 2.3; CI: 1.19-4.58) as likely to self-report breast cancer screening than their unmarried counterparts. Employed women were almost thrice (AoR: 2.6; CI: 1.41-4.83) as likely to self-report breast cancer screening uptake relative to unemployed women. Women whose home language was Sesotho were almost twice (AoR: 1.9; CI: 1.05-3.43) as likely to self-report breast cancer screening than women reporting other home languages. Self-reported uptake of breast cancer screening was also more likely with every unit increase in perceived benefit scores (AoR: 1.1; CI: 1.02-1.16).

Conclusions

A significant proportion of women were in the age range where breast cancer screening is typically recommended, with more than half self-reporting breast cancer screening non-uptake. Results highlight the necessity of addressing socioeconomic, cultural and individual perceptions to improve breast cancer screening rates and promote early detection.

Introduction

Breast cancer (BC) represents a significant health concern and remains a leading cause of death among women, accounting for approximately 1 in 6 deaths globally.[1] There has been a rapid upsurge of incidence rates of BC in developing countries, particularly in the sub-Saharan African (SSA) region, where low incidence rates

were reported previously. In 2020, in South Africa, for instance, BC was the most frequently diagnosed cancer, accounting for 23.3% of all cancers among women.[2] Even though the lifetime risk is lower than in developed countries, BC mortality-to-incidence ratios have risen simultaneously in developing countries and rank among the top in the world.[1] This disparity in survival rates is largely attributed to a disproportionately high number of women presenting with advanced BC disease at diagnosis; the proportion is reportedly as high as 80% among black women in SSA countries like South Africa.[3]

Developed countries with strong health systems have made progress in increasing BC survival rates, in part owing to a combination of advances in the accessibility of early detection methods and the availability of more effective therapeutic alternatives. A recent study conducted in five SSA countries estimated that earlier diagnosis of symptomatic disease and effective therapeutic options would considerably and equally improve survival and avert a third of BC deaths.[4] Undoubtedly, other than prevention, the most important predictor of long-term BC survival is early detection.

Breast self-examination (BSE), clinical breast examination (CBE) by a professional health worker, and mammography are the main approaches for an early detection of BC.[5-8] Although mammography is the gold-standard test for early BC detection, in South Africa the method is accessible only at certain public hospitals and private healthcare facilities. For this reason, BSE and CBE, although contentious,[6,7,9,10] are widely recommended as an early detection method for women with worrisome clinical features for BC in resource-constrained settings. The South African national screening standards for BC mandate that all women attending primary health care (PHC) should receive comprehensive BC awareness, including printed education material and teaching on BSE. Furthermore, it is recommended that women over 40 years receive biannual CBE.[10] Despite the wide availability and high recommendation of CBE for women in resource-constrained settings that lack most of the costly and technology-intensive diagnostic alternatives, BC screening uptake rates are suboptimal and vary among South African women. There is a lack of awareness among women regarding the importance of regular BC screening and available options.[4,8] In South Africa, this is exercerbated by the lack of population-level screening in the country.[11]

Several studies have attributed the suboptimal BC screening uptake rates by women in SSA to a complex combination of patient sociodemographic and psychosocial factors.[12-15] The health belief model (HBM) with its essential components has been used widely to examine women's beliefs about BC screening behaviour.[14-16] The HBM identifies the main constructs and assumptions influencing health behaviour as: perceived susceptibility (beliefs about the risk of acquiring an illness or disease), perceived severity (beliefs about the seriousness of a disease and its medical and social consequences), perceived benefits (beliefs about the effectiveness of various actions and interventions available to cure the disease), perceived barriers (beliefs about the obstacles to perform a recommended health intervention), cues to action (exposure to stimulus that triggers prompt health action), and self-efficacy (belief in one's ability to perform the desired behaviour successfully).[17]

Although researchers have drawn extensively on behavioural science to understand factors associated with uptake of BC screening among women, country-specific nuances of screening programmes, tailored guidelines and their organisation make it difficult to transfer and generalise broadly the insights on BC screening uptake learnt elsewhere to the South African context. To address this gap and to inform future interventional work on increasing BC screening uptake, this study applies the HBM as a theoretical basis to explore the factors associated with BC screening uptake among women in a metropolitan area in the Free State Province of South Africa.

Methods

Study design and setting

A cross-sectional survey was conducted in February-March 2020 among adult women attending PHC services at a community health centre (CHC) in a metropolitan area in the Free State Province. The province is home to 2.96 million people.[18] Like elsewhere in South Africa, more than 80% of the population in the Free State are assumed to depend on the public health sector services.[19, 20] The CHC was purposively selected for the study. The specific approach to implementing the standards of care varies across the nine South African provinces.[10]

Participants

Purposive sampling was used to recruit study participants, facilitated by healthcare providers. The latter distributed brief information about the project to adult females attending day time PHC services at the CHC. Patients 18 years and older, those who could express themselves in either English or Sesotho, and those who self-reported that they were not currently undergoing BC treatment were included in the study. Exclusion criteria included individuals who had recently received a BC diagnosis or were too ill to participate in the study. The projected sample size of 300 participants was estimated conservatively using a rule of thumb, aiming to provide a large enough sample size with adequate statistical power for advanced statistical analyses, such as binomial regression analysis.[21]

Instrument development and data collection

A semi-structured questionnaire was developed for the survey. The questionnaire covered various aspects including sociodemographic information, health beliefs, BC awareness, health-seeking practices, and self-reported

engagement in BC screening. The Champion's health belief model scale,[17] adapted for BC screening, with both self and clinical breast examinations, was employed to measure health beliefs. The instrument comprises 65 items, divided into six sub-scales, namely: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Respondents provided answers on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was reported to be reliable for use in previous studies.[4,15,22] Likewise, in this study, the sub-scales had acceptable internal consistency ranging from 0.72 to 0.93, demonstrating that the scales were reliable to use among African women in the Free State. Awareness about BC was measured with the questions: 'Have you heard about breast cancer?' and 'Are there any facilities in your area that provide information about breast cancer?' Response options were 'Yes' or 'No'. Women who indicated that they had access to BC information were asked to specify the source of the information, such as a clinic, the media, work, etc. Women's health-seeking practices were measured with the question: 'Do you make use of advice or services of a traditional healer?' Response options were 'Yes' or 'No'. Self-reported BC screening was measured with the question: 'Have you ever been examined or self-examined for BC?' Response options were: 'Yes, I have done a self-examination', 'Yes, I have gone to a health practitioner', 'All of the above', and 'None of the above'. The questionnaire was translated into Sesotho and tested for practicality with a small sample of five adult women in the metropolitan area. A trained fieldworker collected the data through face-to-face interviews. Healthcare providers referred eligible participants to the fieldworker, who was located in a private room within the CHC. Written informed consent was obtained before commencement of the interviews.

Data analysis

Data were analysed using the Statistical Package for the Social Sciences, version 27 and described using frequency counts and percentages for discrete variables and mean and standard deviation for continuous variables. Sum scores were computed for the six health belief sub-scales: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. T-tests of independence were used to determine the relationship between health beliefs and self-reported (non-) uptake of BC screening. Binomial logistic regression analysis was performed to predict factors associated with the uptake of BC screening. The outcome variable was uptake of BC screening, defined as 'uptake of self- or clinic-based breast examination for BC'. The independent variables were: age, employment status, marital status, home language, familial BC history, perceived benefits, perceived severity, perceived susceptibility, perceived barriers, cues to action, and self-efficacy.

Univariate and adjusted odds ratios (ORs) and their corresponding confidence intervals (CIs), and p-values were calculated. Statistical significance was considered at 95% CI and $p<0.05$. All assumptions were tested for performing the binomial logistic regression. Every independent variable had at least 15 cases, and was measured on either a continuous or nominal scale. The independence of observations and categories of the dependent variable and nominal independent variables were mutually exclusive and exhaustive. The assumption of normality – implying that the data should be normally distributed – was inspected using normal Q-Q plots which established that the data were normally disturbed. Linearity of the continuous variables with respect to the logit of the dependent variable, assessed using the Box-Tidwell approach, showed that all continuous variables fulfilled the assumption of linearity, except the sub-scales 'perceived barriers', 'cues to action' and 'self-efficacy'. These variables were subsequently removed from the logistic regression model. In terms of the assumption of multicollinearity, a simple correlation analysis was performed among the continuous independent variables. All correlation coefficients were less than 0.7, implying that multicollinearity was not a problem. Furthermore, outliers were assessed using three approaches: case-wise list, leverage points, and influential cases. There were two outliers. However, there were no leverage points, or influential cases. Thus the two cases were maintained as they were not a result of data entry errors.

Ethical considerations

Ethical clearance was obtained from the Health Sciences Research Ethics Committee, at the University of the Free State (UFS-HSD2019/1847/2502). The Free State Department of Health authorised conducting the research at the CHC. The study adhered to the following ethics principles: Firstly, participants were assured of their autonomy and invited to partipate voluntarily in the study. They were informed of their right to withdraw from the research at any time with no consequences to the services they received at the CHC. Secondly, informed consent was obtained from each participant. They were asked to read an information sheet (if illiterate, the information sheet was read to them), describing the purpose of the study, risks, benefits, and expected outcomes. They were then asked to indicate that they comprehended the information by way of signing an informed consent form (or indicating with an 'X' in the case of illiterate patients). Thirdly, interviews were conducted in a private area within the CHC to respect participants' privacy. Fourthly, participants were assured that all data gathered would be handled confidentially by using unique participant identifiers, keeping hard copies of the data in a locked cabinet, and storing electronic data on a password-protected device which would also be locked in a secure facility. Data would also be anonymised and responses would be aggregated, and would not be directly linked to a particular participant. Fifthly, participants did not receive compensation for participating in this study but were gifted small tokens of appreciation. Sixthly, due to the sensitive nature of the BC topic, it was anticipated

that some participants might experience negative affects. Arrangements were thus made to refer such participants to on-site professionals for further assistance.

Results

Table 1 shows that, of the 252 participants, slightly less than half (48.0%; n = 121) of the women were older than 30 years of age. More than two-thirds (69.4%; n = 121) of the sample were single. A large majority (80.2%; n = 202) of the women had matriculated, with more than two-thirds (69.4%; n = 175) being unemployed. The majority of women (85.7%; n = 216) were unaware of close relatives with BC. Two-thirds (65.9%; n = 166) of the women indicated Sesotho as their home language, and approximately a quarter (26.6%; n = 67) sought advice and health services from traditional practitioners. Almost all (98.0%; n = 247) of the women in the study affirmed that they had access to information on BC, with most accessing such information from the media (58.7%; n = 148) and health facilities (32.5%; n = 82). However, less than half (44.0%; n = 111) had undergone BC screening.

Women's health beliefs about BC screening

From Table 2, it can be seen that women who had engaged in BC screening had statistically significantly ($p<0.05$) higher mean scores on the sub-scales of 'perceived severity', 'perceived benefits', 'cues to action', and 'self-efficacy' compared to those who had not. In contrast, women who had engaged in BC screening had significantly ($p<0.05$) lower mean scores on the 'perceived barriers' sub-scale compared to those who had not screened.

Factors associated with uptake of BC screening

Results of univariate logistic regression analysis identified seven factors that had an independent and statistically significant influence on women's self-reported BC screening (Table 3). These were: patients' age, employment status, marital status, home language, perceived benefits, perceived severity, and familial BC history. Binomial logistic regression analysis was then performed to ascertain the factors influencing BC screening after controlling for all variables in the model. A test of the full model against a constant-only model was statistically significant, indicating that the predictors, as a set, reliably distinguished between self-reported uptake and non-uptake of BC screening (chi-square = 48.835, $p < 0.001$, df = 7). The model explained 23.6% (Nagelkerke's R^2) of the variance in BC screening uptake. The overall prediction success was 70.6% with specificity of 83.7% and sensitivity of 54.1%. The positive predictive value was 72.3% and the negative predictive value was 69.8%.

Results indicated that marital status, employment status, home language, and perceived benefits remained statistically significantly associated with uptake of BC screening after controlling for other variables in the model. More specifically, married women were twice (adjusted odds ratio [AoR]: 2.3; confidence interval [CI]: 1.19-4.58]) as likely to have undergone BC screening compared to their unmarried counterparts. Employed women were nearly three times (AoR: 2.6; CI: 1.41-4.83) more likely to report BC screening relative to unemployed women. Women whose home language was Sesotho were almost twice (AoR: 1.9; CI: 1.05-3.43) as likely to have undergone BC screening compared to women reporting other home languages. In addition, every unit increase in perceived benefits scores was linked with a 10% increased likelihood of BC screening (AoR: 1.1; CI: 1.02-1.16).

Discussion

This study adds to the growing body of literature on factors underlying the uptake of BC screening and ways of improving the uptake of the service among women in South Africa. Using access to information as a proxy for BC education, awareness of BC screening was found to be high (n = 241, 98%). Nevertheless, self-reported BC screening uptake was low, representing a threat to early detection of BC among women in the study area. Deciding to undergo BC screening is a nuanced process that is influenced by a myriad of interacting factors. Consistent with previous studies, findings from this study highlight several salient factors associated with, and opportunities to optimise self-reported uptake of BC screening by women in this setting.[14,23] Women who were married, employed, whose home language was Sesotho, and with awareness of BC screening benefits were more likely to self-report BC screening.

Even though uptake of BC screening was low, the level of BC awareness in this study was higher (n = 241, 98%) than in previous studies in SSA,[14,23] with women accessing BC information from diverse and multiple channels. Similar to findings reported in previous studies,[14,15] participants in this study accessed information about BC screening through the media and PHC clinics (59% and 33%, respectively). Implicitly, professional healthcare providers at PHC clinics in the study area are playing a limited role in providing BC education, leaving women to depend more on media. Previous studies have highlighted the positive role that professional healthcare providers play as a source of trusted information and an important prompt for BC screening uptake.[14,15,24] Meeting BC informational needs through professional healthcare providers could be pivotal in improving BC screening behaviour, a panacea to early diagnosis and improved BC survival rates.

Consistent with results from a systematic review of women living in SSA,[15] marital status had a strong effect on self-reported uptake of BC screening, with married women being twice as likely to self-report BC screening as their unmarried counterparts. Research in a wide range of contexts has consistently found that men play a key role in encouraging and positively influencing their

Table 1. Sociodemographic characteristics (N = 252)

Variable	Frequency	%
Age		
18-29	131	52.0
30-39	66	26.2
40-49	31	12.3
50-59	16	6.3
60-69	6	2.4
70+	2	0.8
Marital status		
Married	65	25.8
Single	175	69.4
Divorced	3	1.2
Separated	2	0.8
Widowed	7	2.8
Level of formal education		
None	1	0.4
Secondary and lower	21	8.3
Matric	202	80.2
Tertiary education	28	11.1
Employed		
Yes	77	30.6
No	175	69.4
Familial BC history		
Yes	36	14.3
No	216	85.7
Home language		
Southern Sesotho	166	65.9
Xhosa	54	21.4
Zulu	2	0.8
Tswana	20	7.9
Afrikaans	5	2.0
Ndebele	1	0.4
Other	4	1.6
Use of traditional healers		
Yes	67	26.6
No	185	73.4
Access to BC information*		
Yes	247	98.0
No	5	2.0
BC screening uptake		
Uptake	111	44.0
Non-uptake	141	56.0

BC= breast cancer
*Access to BC information from media (58.7%; n = 148); public sector clinics (32.5%; n = 82); work (2.4%; n = 6); pharmacy (2.4%; n = 6); other (4.0%; n = 10)

Table 2. Women's health beliefs stratified by BC screening

Health belief model construct	BC screening		t-value	p-value	95% Confidence interval	
	Uptake Mean (±SD)	Non-uptake Mean (±SD)			Lower	Upper
Perceived susceptibility	13.03 (4.94)	12.65 (5.14)	0.595	0.552	-.882	1.645
Perceived severity	34.53 (7.82)	31.41 (7.33)	3.257	0.001	1.233	5.007
Perceived benefits	33.86 (5.08)	31.80 (4.96)	3.230	0.001	.802	3.307
Perceived barriers	29.92 (7.79)	39.65 (6.31)	-10.680	<0.001	-11.522	-7.931
Cues to action	22.11 (3.95)	20.04 (3.89)	4.170	<0.001	1.094	3.052
Self-efficacy	36.66 (4.73)	24.96 (5.88)	17.502	<0.001	10.377	13.009

SD = Standard deviation

Table 3. Factors associated with uptake of BC screening

Variable	Unadjusted odds ratio (confidence interval)	Adjusted odds ratio (confidence interval)	p-value
Age 18-39 (ref) 40 years and older	1 2.3 (1.24-4.21)	1 1.4 (0.67-2.94)	0.361
Marital status Unmarried (ref) Married	1 3.4 (1.89-6.19)	1 2.3 (1.19-4.58)	0.014
Employment status Unemployed (ref) Employed	1 3.2 (1.83-5.57)	1 2.6 (1.41-4.83)	0.002
Familial BC history No (ref) Yes	1 2.9 (1.40-6.24)	1 1.9 (0.85-4.47)	0.116
Language Other (ref) Sesotho	1 1.9 (1.12-3.29)	1 1.9 (1.05-3.43)	0.035
Perceived BC severity	1.1 (1.02-1.09)	1.0 (0.97-1.05)	0.667
Perceived BC screening benefits	1.1 (1.03-1.14)	1.1 (1.02-1.16)	0.008

spouses' decision to attend BC screening services.[25,26] The findings reinforce the argument that public health initiatives designed to optimise BC screening uptake should give more consideration to how to engage with unmarried women with no partner support. Further attention in directly raising BC awareness among men is also recommended, as they play a significant role in encouraging their partners to follow early BC screening recommendations.[25,26]

A salient finding in this study was that women whose home language was Sesotho, the native language in the study area, were almost twice as likely to self-report BC screening compared to women reporting other home languages. The important role of home language in in-

fluencing access to healthcare, the ability to comprehend instructions and to navigate the health system and, potentially, the timeliness in seeking BC screening were reported in a recent systematic review covering various countries.[27,28] Nevertheless, PHC services are often inadequately prepared and configured to meet the needs of patients whose preferred language of communication is different to the local languages. This finding from the current study could mean that non-Sesotho speaking women may have unmet BC information needs. Future interventions aimed at improving uptake of BC screening should be devised to close this disparity gap by targeting the different home language sub-groups.

Lower uptake of BC screening has been observed consistently in unemployed women.[29] Similarly, in the current study, variations in self-reported uptake of BC screening were closely related to employment status, with employed women almost thrice as likely to self-report BC screening participation compared to their unemployed counterparts. Research has suggested lack of time as a major barrier to participation in BC screening for unemployed women in patriarchal communities as they tend to be overwhelmed by caretaking and domestic work schedules, such as caring for children, cooking, and housekeeping.[30] Unemployed women could be prioritising their family's needs above their own. Addressing these socioeconomic determinants of health can have a profound effect on supporting and encouraging unemployed women to participate in BC screening activities.

Noteworthy, and in line with evidence from previous studies elsewhere,[31,32] women who perceived high benefits of participating in BC screening were more likely to be screened for the disease. This finding corroborates the HBM that includes perception of benefits as an underlying determinant of an individual's health behaviour and their decision to participate in a screening programme.[23] Previous studies have demonstrated that support interventions, such as providing information on the relative benefit of screening to BC mortality reduction, to be helpful in fully empowering women to make autonomous and informed decisions about BC screening uptake.[33] Drawing from this finding, the benefits of BC screening to the individual, the family, and society should be at the core of health promotion interventions.

While the current study highlights important factors associated with self-reported BC screening uptake, there are some limitations that should be considered. The present study focused on a metropolitan area in one province that is not a representative region of the very heterogeneous population of South African women. For example, in this study, most women indicated Sesotho as their home language and more than 80% (n = 202) had completed secondary education, which is contrary to the national census statistics.[18] As such, generalisability of the findings to other women in different South African settings is limited. However, while the study area was limited to a subset of women in one metropolitan area, the results of this study are comparable with research from various other South African and SSA country settings.[13,15,31,32]

The purposive sampling applied in this study also limits the generalisability of the results to other settings. The cross-sectional design followed does not allow for a cause-and-effect relationship to be determined between the factors associated with BC screening and self-reported screening uptake in this setting. Given that this study is mostly founded on self-reported responses, with no way to validate what the women self-reported on BC screening, the potential of participants to present themselves in the most socially desirable manner cannot be ignored. Nevertheless, the effect of social desirability bias associated with self-reports was minimised by assuring the participants of confidentiality of their responses. Drawing from extant literature, cultural factors could also influence BC screening uptake in the South African context,[13] yet these factors are not accounted for explicitly in the HBM used in this study. Future studies should focus on understanding the cultural narratives regarding BC screening in order to improve BC screening uptake.

Despite these limitations, findings from this study highlight important insights into the factors influencing self-reported BC screening and opportunities for the development of contextual interventions that could assist in modifying women's BC screening uptake.

Recommendations

This study has implications for the design of programmes aimed at increasing BC uptake among women in the study area. The promotion and conveying of strategic messages targeting existing local psychosocial traits and economic variables, such as marital status, employment status, home language, and awareness of personal and associated public health benefits of BC screening could optimise its uptake and ultimately lessen BC-related morbidity and mortality. Early BC detection programmes should empower women by enhancing their personal health literacy to aid informed decision-making. Also, there is an opportunity to proactively implement strategies that support patients in navigating the healthcare system to access BC screening. Given the positive influence that healthcare providers have in encouraging women to participate in BC screening during patient encounters, there is a need to understand and optimise their (healthcare providers) awareness and knowledge of BC screening. Future research may illuminate the level of awareness and knowledge of BC screening among healthcare providers.

Conclusion

A significant proportion of participants were in the age range where BC screening is typically recommended; however, more than half self-reported BC screening non-uptake. Moreover, several factors that are significantly associated with self-reported BC screening uptake were

identified, including marital status, employment status, home language, and awareness of BC screening benefits. Results highlight the necessity for multifactor interventions and future research addressing socioeconomic, cultural and individual perceptions to improve BC screening rates and promote early detection.

Published: October 01, 2024 CAT.

Abbreviations

Abbreviation	Description
AoR	adjusted odds ratio
BC	breast cancer
BSE	breast self-examination
CBE	clinical breast examination
CHC	community health centre
CI	confidence interval
HBM	health belief model
PHC	primary health care
SSA	sub-Saharan Africa

References

1. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN Estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2021;71(3):313. doi:10.3322/caac.21492

2. Statistics South Africa. *Cancer in South Africa (2008-2019)*. StatsSA; 2023. https://www.statssa.gov.za/publications/03-08-00/03-08-002023.pdf

3. Black E, Richmond R. Improving early detection of breast cancer in sub-Saharan Africa: why mammography may not be the way forward. *Global Health*. 2019:15. doi:10.1186/s12992-018-0446-6

4. Joffe M, Ayeni O, Norris SA, et al. Barriers to early presentation of breast cancer among women in Soweto, South Africa. *PLoS One*. 2018;13(2):906-910. doi:10.7196/SAMJ.2022.v112i11b.16834

5. Udoh RH, Tahiru M, Ansu-Mensah M, Bawontuo V, Danquah FI, Kuupiel D. Women's knowledge, attitude, and practice of breast self- examination in sub-Saharan Africa: a scoping review. *Arch Public Health*. 2020;78. doi:10.1186/s13690-020-00452-9

6. World Health Organization. *WHO Position Paper on Mammography Screening*. WHO; 2014. Accessed October 6, 2023. https://iris.who.int/bitstream/handle/10665/137339/9789241507936_eng.pdf?sequence=1

7. World Health Organization. *Breast cancer: Early diagnosis and screening*. WHO. 2018. Accessed October 6, 2023. https://www.who.int/activities/promoting-cancer-early-diagnosis

8. Seifu W, Mekonen L. Breast self-examination practice among women in Africa: a systematic review and meta-analysis. *Arch Public Health*. 2021;79:149. doi:10.1186/s13690-021-00671-8

9. Ngan TT, Nguyen NTQ, Van Minh H, Donnelly M, O'Neill C. Effectiveness of clinical breast examination as a 'stand-alone' screening modality: an overview of systematic reviews. *BMC Cancer*. 2020;20(1):1070. doi:10.1186/s12885-020-07521-w

10. National Department of Health. *Breast Cancer Prevention and Control Policy*. NDoH; 2017. Accessed October 10, 2023. https://knowledgehub.health.gov.za/elibrary/breast-cancer-prevention-and-control-policy

11. Lince-Deroche N, van Rensburg C, Masuku S, Rayne S, Benn C, Holele P. Breast cancer in South Africa: developing an affordable and achievable plan to improve detection and survival. In: Padarath A, Barron P, eds. *S Afr Health Rev, 2017*. Health Systems Trust; 2017:181-188. Accessed October 11, 2023. https://hdl.handle.net/10520/EJC-c8497946c

12. Phaswana-Mafuya N, Peltzer K. Breast and cervical cancer screening prevalence and associated factors among women in the South African general population. *Asian Pac J Cancer Prev*. 2018;19(6):1465-1470. doi:10.22034/APJCP.2018.19.6.1465

13. Sarmah N, Sibiya MN, Khoza TE. The sociocultural influences on breast cancer screening among rural african women in South Africa. *Int J Environ Res Public Health*. 2023;20(21):7005. doi:10.3390/ijerph20217005

14. Tapera R, Senabye PK, Mhaka-Mutepfa M, January J, Apau SG. The use of the Health Belief Model (HBM) in determining the factors associated with breast cancer screening among female students in Botswana. *Int J Health Promot Educ*. 2019;57(4):203-216. doi:10.1080/14635240.2019.1601026

15. Akuoko CP, Armah E, Sarpong T, Quansah DY, Amankwaa I, Boateng D. Barriers to early presentation and diagnosis of breast cancer among African women living in sub-Saharan Africa. *PLoS One*. 2017;12(2):e0171024. doi:10.1371/journal.pone.0171024

16. Champion VL. Revised susceptibility, benefits, and barriers scale for mammography screening. *Res Nurs Health*. 1999;22(4):341-348. https://doi.org/10.1002/(sici)1098-240x(199908)22:4%3C341::aid-nur8%3E3.0.co;2-p

17. Champion VL. Instrument development for health belief model constructs. *ANS Adv Nurs Sci*. 1984;6(3):73-85. doi:10.1097/00012272-198404000-00011

18. Statistics South Africa. *Statistical Release: Post Enumeration Survey, 2022*. StatsSA; 2023. Accessed October 6, 2023. https://www.statssa.gov.za/publications/P03015/P030152022.pdf

19. Massyn N, Pillay Y, Padarath A. District health barometer 2017/18. In: *S Afr Health Rev., 2018*. Health Systems Trust; 2018:112. Accessed October 6, 2023. https://www.hst.org.za/publications/District%20Health%20Barometers/DHB+2017-18+Web+8+Apr+2019.pdf

20. Malakoane B, Heunis JC, Chikobvu P, Kigozi NG, Kruger WH. Public health system challenges in the Free State, South Africa: a situation appraisal to inform health system strengthening. *BMC Health Serv Res*. 2020;20(1):58. doi:10.1186/s12913-019-4862-y

21. Wilson Van Voorhis CR, Morgan BL. Understanding power and rules of thumb for determining sample sizes. *Tutor Quant Methods Psychol*. 2007;3(2):43-50. doi:10.20982/tqmp.03.2.p043

22. Frankenfield KM. *Health Belief Model of Breast Cancer Screening for Female College Students*. Eastern Michigan University; 2009. Accessed October 6, 2023. https://commons.emich.edu/cgi/viewcontent.cgi?article=1257&context=theses

23. Wuur MM, Duodu DA, Tarkang EE. Factors that influence breast cancer screening among women of reproductive age in the Nandom Municipality, Ghana. *BMC Womens Health*. 2022;22(1):359. doi:10.1186/s12905-022-01946-0

24. Swoboda CM, Van Hulle JM, McAlearney AS, Huerta TR. Odds of talking to healthcare providers as the initial source of healthcare information: updated cross-sectional results from the Health Information National Trends Survey (HINTS). *BMC Fam Pract*. 2018;19(1):146. doi:10.1186/s12875-018-0805-7

25. Donnelly TT, Al Khater AH, Al Kuwari MG, et al. Do socioeconomic factors influence breast cancer screening practices among Arab women in Qatar? *BMJ Open*. 2015;5(1):e005596. doi:10.1136/bmjopen-2014-005596

26. Gadi RU, Merdad LA, Farsi NJ, Al-Wassia RK. Men's knowledge of and behavior toward mammography screening: a cross-sectional study. *Asian Pac J Cancer Prev*. 2021;22(7):2251-2257. doi:10.31557/APJCP.2021.22.7.2251

27. Balazy KE, Benitez CM, Gutkin PM, Jacobson CE, von Eyben R, Horst KC. Association between primary language, a lack of mammographic screening, and later stage breast cancer presentation. *Cancer*. 2019;125(12):2057-2065. doi:10.1002/cncr.32027

28. Al Shamsi H, Almutairi AG, Al Mashrafi S, Al Kalbani T. Implications of language barriers for healthcare: a systematic review. *Oman Med J*. 2020;35(29):e122. doi:10.5001/omj.2020.40

29. Mottram R, Knerr WL, Gallacher D, et al. Factors associated with attendance at screening for breast cancer: a systematic review and meta-analysis. *BMJ Open*. 2021;11(30):e046660. doi:10.1136/bmjopen-2020-046660

30. March S, Villalonga B, Sanchez-Contador C, et al. Barriers to and discourses about breast cancer prevention among immigrant women in Spain: a qualitative study. *BMJ Open*. 2018;8(11):e021425. doi:10.1136/bmjopen-2017-021425

31. Didarloo A, Nabilou B, Khalkhali HR. Psychosocial predictors of breast self-examination behaviour among female students: an application of the health belief model using logistic regression. *BMC Public Health*. 2017;17(1):861. doi:10.1186/s12889-017-4880-9

32. Selçuk KT, Avcı D, Dündar GY, Mercan Y. Breast cancer screening behaviors in women aged 40 years and over in a semi-urban region in Turkey: relationships with health beliefs. *Healthcare*. 2020;8(2):171. doi:10.3390/healthcare8020171

33. Padamsee TJ, Wills CE, Yee LD, Paskett ED. Decision making for breast cancer prevention among women at elevated risk. *Breast Cancer Res*. 2017;19:34. doi:10.1186/s13058-017-0826-5. PMID:28340626