

RESEARCH ARTICLE

Editorial Process: Submission:29/01/2026 Acceptance:20/10/2026 Published:24/10/2026

Breast Cancer Screening Uptake and Health Belief Model Constructs by Family History Among Women in Northern India

Harseerat Dhillon¹, Abdul Basith KM¹, Tarundeep Singh^{1*}, JS Thakur¹, Naga Santhosh RN², Pooja Sikka³

Abstract

Introduction: Breast cancer is the most common cancer among women in India. However, screening uptake still remains low. A family history of breast cancer may influence screening behavior through increased risk perception. These psychosocial determinants can be explained using the Health Belief Model (HBM), which further influences the decision to undergo cancer screening. This study aimed to compare the uptake of breast cancer screening methods [breast self-examination (BSE), clinical breast examination (CBE), and mammography] among women with and without a family history of breast cancer. Additionally, sociodemographic and HBM-related correlates of screening uptake were also assessed. **Methods:** A cross-sectional study was conducted in Northern India among 224 women aged ≥ 30 years, including 112 women with a household family history of breast cancer (FH+) and 112 without (FH-). Data were collected using a pre-tested questionnaire covering sociodemographic details, screening practices, and HBM constructs. Screening uptake between groups was compared using the chi-square test. Univariate log-binomial regression was performed to estimate prevalence ratios (PRs) with 95% confidence intervals (CIs) for factors associated with screening uptake. **Results:** Women in the FH+ group had significantly higher uptake of CBE (33.0% vs. 17.9%; $p = 0.009$) and mammography (25.0% vs. 14.3%; $p = 0.044$) compared to the FH- group, while BSE uptake did not show any significant difference. Regression analysis supported these findings, with a higher uptake of CBE (PR = 1.9; 95% CI: 1.2–3.0) and mammography (PR = 1.8; 95% CI: 1.0–3.1), but not BSE. Age > 50 years and employment were associated with higher CBE uptake, while postgraduate education and urban residence were associated with BSE uptake. Women with a family history reported higher mean scores for perceived susceptibility, severity, benefits, and self-efficacy. **Conclusions:** Breast cancer screening uptake remains suboptimal in this population. Family history appears to influence provider-based screening more than self-examination practices. Interventions should prioritize increasing awareness and accessibility of CBE and mammography, particularly among women without a family history, along with an emphasis on psychosocial determinants of screening behavior.

Keywords: Breast neoplasms, Cancer screening, Family history of cancer, Mammography, India

Asian Pac J Cancer Prev, 27 (10), 3739-3745

Introduction

Breast cancer is the leading cancer worldwide with ~1,78,000 cases (13.5% of all cancers) in 2020 and a major cause of cancer-related mortality [1]. Early detection through organised screening programmes can substantially improve survival and treatment related morbidity [2]. In India, breast cancer accounts for a significant proportion of all female cancers and deaths, with increasing incidence over recent years. According to the recent cancer estimates, it contributes more than a quarter of all new cancers among women in India. In the

north-western region, including Punjab and Chandigarh, Population Based Cancer Registry (PBCR) data show that breast cancer is the most common cancer site among women, accounting for approximately one-third of all female cancers in Chandigarh and similar proportion in Punjab, with crude incidence rates exceeding the national average. These regional data underscore the growing burden in North India [3].

Despite this high burden, population level screening coverage is very low. Earlier rounds of the National Family Health Survey (NFHS-4) reported that only about one in ten Indian women aged 15-49 years had ever undergone

¹Department of Community Medicine & School of Public Health, Postgraduate Institute of Medical Education & Research (PGIMER), Chandigarh, India. ²Department of General Surgery, Postgraduate Institute of Medical Education & Research (PGIMER), Chandigarh, India. ³Department of Obstetrics & Gynecology, Postgraduate Institute of Medical Education & Research (PGIMER), Chandigarh, India. *For Correspondence: tarundeep.singh@gmail.com

a breast examination. More recent NFHS-5 data for women aged 30–49 years confirm that uptake of any breast examination remains less than 1% nationally. There is marked state level inequalities and limited coverage in several states, with the screening uptake in Punjab even lower than national average. Poor screening uptake contributes to late-stage diagnosis and poor prognosis [4]. The Government of India, under the National Programme for Prevention and Control of Non-communicable Diseases (NP-NCD), has introduced population-based screening for common cancers, including breast cancer, for all women more than 30 years of age [5]. The programme recommends monthly breast self-examination (BSE), periodic clinical breast examination (CBE), and age-appropriate mammography for high-risk and older women. Despite recent national efforts, including expansion under the NP-NCD programme, recent evidence continues to show persistently low uptake of breast cancer screening in India, indicating that these findings remain highly relevant to current public health practice [4,6,7].

Family history is a well-recognised risk factor for breast cancer and may influence both the perceived risk and screening behaviour. Women who have a family member diagnosed with breast cancer may be more aware of the disease, perceive higher susceptibility, and be more likely to undergo screening [8]. At the same time, socioeconomic and psychosocial barriers may persist even in such high-risk households. The Health Belief Model (HBM) provides a useful theoretical framework to understand uptake of preventive health behaviours, including cancer screening. It posits that perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy shape whether individuals engage in health behaviour [9]. This framework would allow us to compare the belief related to breast cancer screening uptake between women with and without a family history of breast cancer.

Hence, we conducted this study to estimate and compare the uptake of breast cancer screening methods (BSE, CBE, and mammography) among women with a family history of breast cancer and residing in same household as the index case to women without any family history of breast cancer. We also assessed the association of sociodemographic factors with the uptake of different screening modalities and also with the HBM constructs.

Materials and Methods

Study design and settings

We conducted a cross-sectional study in North India, among women recruited through hospital setting and during 2023 from Chandigarh and adjoining regions.

Study population and groups

The study population included women aged more than 30 years, categorised into two groups:

- a. Group 1 (FH+): Female family members of breast cancer patients belonging to the same household as patient
- b. Group 2 (FH-): Females with no breast cancer patients in their household

For FH+ group, breast cancer patients were identified

from the PBCR and from the outpatient records of surgical department in a tertiary care hospital in Chandigarh. Eligible women for FH+ group were the female family members residing in the same household as the index breast cancer patient, with available contact details and willingness to participate. For FH- group, women were identified from outpatient records of the Gynecology Department of the same institute. Eligible women had no breast cancer patients in their household and were willing to participate. Women with personal history of breast malignancy lesions were excluded.

Study size and sampling

The sample size was calculated using the formula for proportions, assuming a 50% prevalence of awareness regarding breast cancer screening among the female family members of breast cancer patients with 7% absolute precision [10]. Final sample size after accounting for 10% non-response rate was 224. Accordingly, 112 participants were recruited in each group. Purposive sampling was used for both groups, based on available records from PBCR and outpatient departments.

Data collection tools and procedures

Data were collected using a semi-structured, pre-tested, interviewer-administered questionnaire. The questionnaire mainly had two parts:

a. Sociodemographic and personal characteristics including items like age, education, marital status, family details. Along with it details on ever screening for breast cancer using BSE, CBE, and mammography was also collected.

b. Health belief model constructs for breast cancer screening from previously validated instruments were used after local adaptation [11,12]. This included items on perceived susceptibility (6 items), perceived severity (12 items), perceived benefits (16 items), perceived barriers (22 items), cues to action (8 items), and self-efficacy (12 items). Each item was assessed on a 5-point Likert scale (1=strongly disagree to 5=strongly agree), with “no response” coded as 0. Prior piloting and pre-testing were performed to ensure clarity and cultural appropriateness. Interviews were conducted after explaining the study and obtaining informed consent in person or telephonically.

Statistical analysis

Data were entered in Epicollect-5 and analysed using STATA v.14 (Statacorp, US, Texas). Categorical variables including sociodemographic variables were summarised as frequencies and percentages whereas HBM scores were presented as mean differences between both the groups. Uptake of BSE, CBE, and mammography between both the groups were compared between the groups using chi-square test. Univariate log-binomial regression analysis between predictors and breast cancer screening uptake were presented as prevalence ratios (PR) with 95% confidence intervals (95% CI). All analysis were performed at 5% level of significance.

Ethical considerations

Institute Ethics Committee approval (IEC-INT/2023/

MPH-1213) was taken prior to data collection and informed or telephonic consent was taken from all participants.

Results

A total of 224 women were included in the analysis, with 112 in each group. The age distribution was comparable between the two groups, with majority of the participants aged 30-50 years. Majority of them were married in both groups. But, educational backgrounds were skewed in both groups with more graduates and post-graduates in FH+ group. Urban, rural, and semi-urban residences are well-represented in both groups, illustrating a heterogeneous geographic distribution. Employment status varies, with a higher proportion of employed participants in FH+ group. Majority of the participants in both groups were uni- or multiparous, and approximately three-fourth of participants reported history of breastfeeding. The distribution of family structure was relatively balanced across both the groups. Other sociodemographic characteristics are detailed in Table 1.

Adherence to breast cancer screening practices was higher among women with family history of breast cancer (FH+ group) compared to those without (FH- group).

BSE was reported by 46.4% of participants in FH+ group and 37.5% in FH- group. However, this difference was not statistically significant ($p=0.176$). CBE uptake was significantly higher in FH+ group compared to FH- group (33.0% vs. 17.9%; $p=0.009$). Similarly, ever-use of mammography was significantly higher in FH+ group than in FH- group (25.0% vs. 14.3%; $p=0.044$).

For BSE, higher prevalence was observed among women aged >50 years (PR=2.1; 95% CI: 1.0-4.3), those with postgraduate education (PR=2.1; 95% CI: 1.2-3.7), and urban residents (PR=1.5; 95% CI: 1.0-2.2). For CBE, women aged >50 years showed higher prevalence compared to those aged <30 years (PR=2.8; 95% CI: 1.0-7.4). Employment was significantly associated with CBE uptake (PR=1.6; 95% CI: 1.1-2.6). Family history of breast cancer was also significantly associated with higher CBE uptake (PR=1.9; 95% CI: 1.2-3.0). For mammography, family history of breast cancer was associated with higher screening prevalence (PR=1.8; 95% CI: 1.0-3.1). No statistically significant associations were observed with age category, education level, residence, parity, breastfeeding status, or family type. Detailed results of the univariate log-binomial regression analysis are presented in Table 2.

Mean scores of the six components of the Health Belief

Table 1. Sociodemographic Characteristics of Females with (FH+ group) and without (FH- group) Breast Cancer Patients in Their Families Residing in the Same Household. (N=224)

Variable	Category	Female family members of breast cancer patients belonging to the same household as the patient (FH+ group) (in %; n= 112)	Females with no breast cancer patient in their household
Age	<30	9.82	9.82
	30-40	50.00	50.00
	41-50	35.71	35.71
	51-60	3.57	3.57
	>60	0.89	0.89
Marital status	Married	92.86	93.75
	Unmarried	7.14	6.25
Education	Primary or below	14.29	15.18
	Matric	12.5	15.18
	Senior secondary	16.96	30.36
	Graduation	37.5	29.46
Residence	Post graduation	18.75	9.82
	Urban	49.11	45.54
	Rural	30.36	31.25
	Semi urban	20.54	23.21
Employment status	Employed	46.43	25
	Unemployed	53.57	75
Progeny	Uni/multiparous	82.14	82.14
	Nulliparous	17.86	17.86
Breast feeding	Yes	75.00	74.11
	No	25.00	25.89
Family type	Joint	52.68	49.11
	Nuclear	47.32	50.89

Table 2. Univariate Log-Binomial Regression Analysis of Factors Associated with Uptake of Breast Cancer Screening Methods among Study Participants (N = 224)

Variable	Screened using BSE† (n=94)		Screened using CBE† (n=57)		Screened using mammography (n=44)	
	n (%)	PR† (95% CI)	n (%)	PR (95% CI)	n (%)	PR (95% CI)
Age category						
< 30 years (ref)	8 (32.0)	(ref)	5 (20.0)	(ref)	6 (24.0)	(ref)
31-50 years	80 (42.3)	1.3 (0.7-2.4)	47 (24.9)	1.2 (0.5-2.8)	37 (19.6)	0.8 (0.4-1.7)
>50 years	6 (66.7)	2.1 (1.0-4.3)	5 (55.6)	2.8 (1.0-7.4)*	1 (11.1)	0.5 (0.1-3.3)
Marital status						
Unmarried (ref)	4 (26.7)	(ref)	2 (13.3)	(ref)	3 (20.0)	(ref)
Married	90 (43.3)	1.6 (0.7-3.8)	55 (26.4)	2.0 (0.5-7.3)	41 (19.7)	1.0 (0.3-2.8)
Education						
Primary or below (ref)	10 (30.3)	(ref)	6 (18.2)	(ref)	7 (21.2)	(ref)
Secondary	12 (38.7)	1.3 (0.6-2.5)	11 (35.5)	2.0 (0.8-4.6)	5 (16.1)	0.8 (0.3-2.1)
Senior secondary	24 (45.3)	1.5 (0.8-2.7)	11 (20.8)	1.1 (0.5-2.8)	9 (17.0)	0.8 (0.3-1.9)
Graduation	28 (37.8)	1.2 (0.7-2.3)	21 (28.4)	1.6 (0.7-3.5)	13 (17.6)	0.8 (0.4-1.9)
Postgraduation	20 (62.5)	2.1 (1.2-3.7)*	8 (25.0)	1.4 (0.5-3.5)	10 (31.3)	1.5 (0.6-3.4)
Residence						
Rural (ref)	23 (33.8)	(ref)	17 (25.0)	(ref)	13 (19.1)	(ref)
Semi urban	17 (34.7)	1.0 (0.6-1.7)	13 (26.5)	1.1 (0.6-2.0)	7 (14.3)	0.7 (0.3-1.7)
Urban	54 (50.9)	1.5 (1.0-2.2)*	27 (25.5)	1.0 (0.6-1.7)	24 (22.6)	1.2 (0.6-2.2)
Employment status						
Unemployed (ref)	57 (39.6)	(ref)	30 (20.8)	(ref)	23 (16.0)	(ref)
Employed	37 (46.8)	1.2 (0.9-1.6)	27 (34.2)	1.6 (1.1-2.6)*	21 (26.6)	1.7 (1.0-2.8)
Progeny						
Nulliparous (ref)	17 (42.5)	(ref)	11 (27.5)	(ref)	9 (22.5)	(ref)
Uni/Multiparous	77 (42.1)	1.0 (0.7-1.5)	46 (25.1)	0.9 (0.5-1.6)	35 (19.1)	0.9 (0.4-1.6)
Breastfeeding						
No (ref)	23 (40.4)	(ref)	16 (28.1)	(ref)	14 (24.6)	(ref)
Yes	71 (42.8)	1.1 (0.7-1.5)	41 (24.7)	0.9 (0.5-1.4)	30 (18.1)	0.7 (0.4-1.3)
Type of family						
Nuclear (ref)	53 (48.6)	(ref)	30 (27.5)	(ref)	26 (23.9)	(ref)
Joint	41 (36.0)	0.7 (0.5-1.0)	27 (23.7)	0.9 (0.5-1.3)	18 (15.8)	0.7 (0.4-1.1)
Family history of breast cancer						
No (ref)	42 (37.5)	(ref)	20 (17.9)	(ref)	16 (14.3)	(ref)
Yes	52 (46.9)	1.2 (0.9-1.7)	37 (33.3)	1.9 (1.2-3.0)*	28 (25.2)	1.8 (1.0-3.1)*

*p-value <0.05 using univariate log-binomial regression; † BSE, Self-breast examination; CBE, Clinical breast examination; PR, Prevalence ratio

Model are summarized in Table 3. Participants in FH+ group had higher mean scores for perceived susceptibility (16.96 vs 14.03) and perceived severity (36.12 vs 25.28) compared to FH- group. Differences were also observed for perceived benefits (25.87) and perceived barriers (32.66). Mean scores for cues to action were similar between the two groups, while self-efficacy scores were higher in FH+ group (27.95) than in FH- group (22.71).

Discussion

This study assessed adherence to breast cancer screening practices like BSE, CBE and mammography among two distinct groups: women with family members diagnosed with breast cancer, residing in the same household (FH+ group) and women with no breast cancer

patients in their families, belonging to the same household (FH- group). The study also assessed the demographic, social and psychological correlates of screening uptake.

The frequency analysis reveals noteworthy differences between the two groups. Overall adherence to screening practices was higher among women with a family history of breast cancer. Consistent with present findings, Khokhar in a Delhi based survey reported positive family history of breast cancer as a determinant of adherence to mammography screening [13]. However, uptake remained suboptimal across all three screening modalities in both groups. This highlights the need for counselling family members of known breast cancer cases in order to improve screening rates. Less than half of participants reported practicing BSE, and uptake of CBE and mammography was below one-third, even among women with a family

Table 3. Comparison of mean Health Belief Model (HBM) Construct Scores among Women with and without a Family History of Breast Cancer

HBM Components	FH+ group	FH- group	Difference
Perceived susceptibility	16.96	14.03	2.93
Perceived severity	36.12	25.28	10.84
Perceived benefits	47.15	21.28	25.87
Barriers	51.32	18.66	32.66
Cues to action	25.12	26.41	-1.29
Self-efficacy	27.95	22.71	5.24

FH+ group, Women with a family history of breast cancer residing in the same household. FH- group, Women with no family history of breast cancer.

history. These findings underscore persistent gaps in screening coverage despite heightened risk awareness within affected households. Findings from a study in Trivandrum, India suggest that familial proximity to breast cancer patients may positively influence screening behaviors [14]. Among the screening methods available, BSE was the most commonly practiced, followed by CBE and mammography. This conforms with the findings from existing relevant studies conducted globally [15–17]. The considerable disparity observed in the uptake of BSE and mammography among various studies could be attributed to demographic factors, levels of awareness, attitudes, the accessibility of healthcare services, ease and cost free nature associated with BSE.

In regression analysis, family history of breast cancer was significantly associated with higher uptake of CBE and mammography, but not BSE. This suggests that family history may influence engagement with provider-based screening modalities more than self-initiated practices. Similar associations between family history and mammography uptake have been reported in Indian and international studies, indicating that perceived risk may preferentially translate into utilization of formal screening services rather than self-screening practices [7,18]. Age above 50 years was significantly associated with CBE uptake, while higher education (postgraduate level) and urban residence were associated with increased BSE uptake. Employment status was independently associated with CBE uptake, with employed women demonstrating higher prevalence of CBE [13,19,20]. These findings highlight that different screening modalities may be influenced by distinct sociodemographic factors, reinforcing the importance of modality-specific strategies for improving screening adherence [19,20]. Importantly, marital status, parity, breastfeeding history, and family structure were not significantly associated with screening uptake after regression adjustment, despite differences observed in crude analyses. The low overall uptake of mammography observed in this study aligns with existing evidence from India and other low- and middle-income countries, where organized population-based screening is limited and opportunistic screening predominates. The findings emphasize the need to strengthen awareness and accessibility of provider-based screening methods, particularly for women without a known family history who may perceive themselves at lower risk [21].

The HBM provides a useful framework to interpret the observed behavioural patterns. In our study participants from FH+ group demonstrated higher mean scores for perceived susceptibility, severity, benefits, and self-efficacy. These constructs translated more strongly into action for provider based screening like CBE and mammography than self initiated practices like BSE. An important finding of this study is the apparent disconnect between higher self-efficacy and absence of corresponding increase in BSE uptake among women with a family history. This reflects an intention-behaviour gap, where perceived capability does not translate into action. In high-risk contexts, elevated perceived severity and cancer-related anxiety may paradoxically lead to avoidance behaviours [22]. Evidence suggests that fatalistic beliefs and fear of cancer diagnosis can act as barriers to proactive screening, particularly self-initiated practices such as BSE [23]. In contrast, provider-based screening may be perceived as more structured and authoritative, which may explain the higher uptake of CBE and mammography. These findings are consistent with studies from LMICs, where higher perceived susceptibility does not always translate into screening behaviors due to structural barriers and limited awareness [9,23]. However, some studies have reported self-efficacy as a significant predictor of BSE, suggesting that contextual and cultural factors may modify this relationship [24]. Our study dissected the constructs of HBM in line with family history of breast cancer in order to implement and inform effective behavioural change interventions.

The perception of breast cancer as a serious, long lasting and life changing disease is observed more in women with history of breast cancer in their families than the ones with no family history of the disease. Similarly, perception of the disease as a risk to their career, academics, financial security and significant relationship is acute in the former group. Women in the FH+ group were more likely to feel nauseous, be tachycardic and scared of the thought of breast cancer. It is necessary to mention the overall low average of perceived barriers score in FH- group as compared to FH+ group due to participants' choice to not respond to questions in the barriers section [21]. More than half of the participants in both the groups consume a well-balanced diet, engage in health related activities, keep themselves updated with health related news, go for yearly physical exams and follow medical orders. Higher susceptibility, higher severity, more benefits, less barriers, more self-efficacy is seen in the group with breast cancer history in their family.

Several limitations should be acknowledged. Firstly, the use of purposive sampling from hospital and registry based sources may introduce selection bias and limit the generalizability of findings to community level. Secondly, the screening practices were self-reported and may be subject to recall and social desirability bias. Thirdly, FH+ group may have more exposure to health information, potentially leading to differential reporting. Also, unmeasured factors such as cost barriers, health insurance coverage, prior healthcare engagement, and provider recommendation were not assessed and may influence screening behaviour. Non-response to certain HBM items,

especially among FH- women due to complete lack of awareness regarding any screening methods may have introduced information bias, limiting the interpretability of HBM constructs. Finally, the cross-sectional nature of study and the absence of multivariable modelling of HBM constructs, limits the causal inferences on screening behaviour. Despite these, this study provides important insights into disparities in breast cancer screening uptake and highlights the differential influence of family history and sociodemographic factors across screening modalities.

Future research should focus on longitudinal or interventional designs to better understand causal pathways between health beliefs and screening behaviours. Additionally, community-based probability sampling and advanced modelling approaches such as structural equation modelling can improve understanding of complex interactions between determinants and screening behaviours. Incorporating qualitative methods would further improve understanding of contextual and cultural barriers. From a policy perspective, our findings support the need for risk-stratified screening approaches within the NP-NCD framework. Routine documentation of family history and counselling at primary care level can enable targeted interventions focusing on benefits of early detection than fear-based messaging which may eventually reduce the intention-behaviour gap. Also, integration of opportunistic CBE during routine outpatient or gynecological visits can leverage the higher acceptability of provider-based screening as observed in our study. Additionally, leveraging community health workers like ASHAs (Accredited Social Health Activists) as patient navigators may help to bridge the gap between awareness and service utilization. These strategies can be operationalized through existing Health and Wellness Centres under Ayushman Bharat.

In conclusion, this study demonstrates that uptake of breast cancer screening practices remains suboptimal among women in Northern India, even among those residing in households with a diagnosed breast cancer patient. Women with a family history of breast cancer exhibited significantly higher uptake of clinical breast examination and mammography, but not breast self-examination, highlighting differential influences of familial risk across screening modalities. Sociodemographic factors such as age, education, residence, and employment showed modality-specific associations with screening uptake, underscoring the need for tailored approaches rather than uniform screening strategies. Differences in Health Belief Model constructs between women with and without a family history indicate higher perceived susceptibility, severity, benefits, and self-efficacy among women from affected households, although these differences did not uniformly translate into optimal screening behaviour.

Author Contribution Statement

HD: Methodology, formal analysis, investigation, data curation, writing-original draft, writing-review and editing. ABKM: Methodology, formal analysis, data curation, writing-original draft, writing-review and editing. TDS: Conceptualisation, methodology,

formal analysis, investigation, data curation, writing-original draft, writing-review and editing, supervision. JST: Conceptualisation, methodology, writing-review and editing, supervision. NSRN: Conceptualisation, methodology, writing-review and editing, supervision. PS: Conceptualisation, methodology, writing-review and editing, supervision.

Acknowledgements

Ethical considerations

Institute Ethics Committee approval (IEC-INT/2023/ MPH-1213) was taken prior to data collection and informed or telephonic consent was taken from all participants.

Data availability statement

The data used to generate the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare that they have no conflicts of interest.

References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, 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):209–49. <https://doi.org/10.3322/caac.21660>
2. WHO Breast Cancer Fact Sheet [Internet]. [cited 2025 Dec 31]. Available from: <https://www.who.int/news-room/fact-sheets/detail/breast-cancer>
3. Thakur J, Malhotra P, Bhadada S, Kapoor R, Vijayvergiya R, Khurana D, et al. Chandigarh Noncommunicable Diseases (NCD) Registry, July 2018 to December 2021. *World NCD Federation*; 2025 Oct.
4. Gopika MG, Prabhu PR, Thulaseedharan JV. Status of cancer screening in India: An alarm signal from the National Family Health Survey (NFHS-5). *J Fam Med Prim Care*. 2022;11(11):7303–7. https://doi.org/10.4103/jfmpe.jfmpe_1140_22
5. Operational Guidelines: National Programme for Prevention and Control of Non-Communicable Diseases (2023-2030). Ministry of Health & Family Welfare, Government of India; 2023.
6. Venghateri JB, Nathani P, Goyal S, Sarang B, Rawtani H, Patil P, et al. Low participation in cancer screening in India: a scoping review of breast and cervical cancer programs. *BMC Cancer*. 2025;25(1):1724. <https://doi.org/10.1186/s12885-025-14859-6>
7. Sharma P, Das D, Khanna D, Budukh A, Khokhar A, Pradhan S, et al. Prevalence and associated factors of mammography uptake among the women aged 45 years and above: policy implications from the longitudinal ageing study in India wave I survey. *BMC Public Health*. 2025;25(1):1073. <https://doi.org/10.1186/s12889-025-22261-x>
8. Haber G, Ahmed NU, Pekovic V. Family History of Cancer and Its Association With Breast Cancer Risk Perception and Repeat Mammography. *Am J Public Health*. 2012;102(12):2322–9. <https://doi.org/10.2105/AJPH.2012.300786>

9. Darvishpour A, Vajari SM, Noroozi S. Can Health Belief Model Predict Breast Cancer Screening Behaviors? *Open Access Maced J Med Sci*. 2018;6(5):949–53. <https://doi.org/10.3889/oamjms.2018.183>
10. Pourhoseingholi MA, Vahedi M, Rahimzadeh M. Sample size calculation in medical studies. *Gastroenterol Hepatol Bed Bench*. 2013;6(1):14–7.
11. Frankenfield KM. Health Belief Model of Breast Cancer Screening for Female College Students. In. 2009 [cited 2026 Apr 8]. Available from: <https://www.semanticscholar.org/paper/Health-Belief-Model-of-Breast-Cancer-Screening-for-Frankenfield/01bc2cbe8b0e792b5d9a4c8f11208e2697379c1c>
12. Champion VL. Instrument development for health belief model constructs. *ANS Adv Nurs Sci*. 1984;6(3):73–85. <https://doi.org/10.1097/00012272-198404000-00011>
13. Khokhar A. Study on knowledge, experiences and barriers to mammography among working women from Delhi. *Indian J Cancer*. 2015;52(4):531–5. <https://doi.org/10.4103/0019-509X.178401>
14. Grosse Frie K, Ramadas K, Anju GA, Mathew BS, Muwonge R, Sauvagat CS, et al. Determinants of participation in a breast cancer screening trial in trivandrum district, India. *Asian Pac J Cancer Prev*. 2013;14(12):7301–7. <https://doi.org/10.7314/apjcp.2013.14.12.7301>
15. Osei-Afryie S, Addae AK, Oppong S, Amu H, Ampofo E, Osei E. Breast cancer awareness, risk factors and screening practices among future health professionals in Ghana: A cross-sectional study. *PloS One*. 2021;16(6):e0253373. <https://doi.org/10.1371/journal.pone.0253373>
16. Kwok C, Tranberg R, Lee FC. Breast cancer knowledge, attitudes and screening behaviors among Indian-Australian women. *Eur J Oncol Nurs Off J Eur Oncol Nurs Soc*. 2015;19(6):701–6. <https://doi.org/10.1016/j.ejon.2015.05.004>
17. Abu-Helalah MA, Alshraideh HA, Al-Serhan AAA, Kawaleet M, Nesheiwat AI. Knowledge, barriers and attitudes towards breast cancer mammography screening in Jordan. *Asian Pac J Cancer Prev*. 2015;16(9):3981–90. <https://doi.org/10.7314/apjcp.2015.16.9.3981>
18. Murabito JM, Evans JC, Larson MG, Kreger BE, Splansky GL, Freund KM, et al. Family Breast Cancer History and Mammography: Framingham Offspring Study. *Am J Epidemiol*. 2001;154(10):916–23. <https://doi.org/10.1093/aje/154.10.916>
19. Anwar SL, Tampubolon G, Van Hemelrijck M, Hutajulu SH, Watkins J, Wulaningsih W, et al. Determinants of cancer screening awareness and participation among Indonesian women. *BMC Cancer*. 2018;18(1):208. <https://doi.org/10.1186/s12885-018-4125-z>
20. Krishnamoorthy Y, Ganesh K, Sakthivel M. Prevalence and determinants of breast and cervical cancer screening among women aged between 30 and 49 years in India: Secondary data analysis of National Family Health Survey - 4. *Indian J Cancer*. 2022;59(1):54–64. https://doi.org/10.4103/ijc.IJC_576_19
21. Goh SA, Lee JK, Seh WY, Ho EQY, Hartman M, Chou C, et al. Multi-level determinants of breast cancer screening among Malay-Muslim women in Singapore: a sequential mixed-methods study. *BMC Womens Health*. 2022;22(1):383. <https://doi.org/10.1186/s12905-022-01972-y>
22. Powe BD, Finnie R. Cancer fatalism: the state of the science. *Cancer Nurs*. 2003;26(6):454–65; quiz 466–7. <https://doi.org/10.1097/00002820-200312000-00005>
23. Squiers L, Siddiqui M, Kataria I, Dhillon PK, Aggarwal A, Bann C, et al. Perceived, Experienced, and Internalized Cancer Stigma: Perspectives of Cancer Patients and Caregivers in India. *RTI Press*. 2021. <https://doi.org/10.3768/rtipress.2021.rr.0044.2104>
24. Secginli S, Nahcivan NO. Factors associated with breast cancer screening behaviours in a sample of Turkish women: a questionnaire survey. *Int J Nurs Stud*. 2006;43:161–71. <https://doi.org/10.1016/j.ijnurstu.2005.02.004>



This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License.