

RESEARCH ARTICLE

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Breast Cancer Awareness in a High-Risk Indian Population: A Study on First-Degree Female Relatives

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Abstract

Background: Female first-degree relatives of women diagnosed with breast cancer have higher risk of developing the disease. This study aims to estimate the awareness, heightened risk perception, and screening practices in this high-risk population of women. **Methods:** A cross-sectional study was undertaken from August 2023 to January 2024 in a tertiary cancer centre of Eastern India. First-degree female relatives of breast cancer patients, aged ≥ 18 years, who provided informed consent, were interviewed face-to-face using a pre-tested, semi-structured questionnaire, followed by data analysis. **Results:** Among 307 women enrolled, 109 (35.5%) participants perceived being at higher risk for developing breast cancer. While breast lump was the most commonly (93.8%) known warning sign, few acknowledged other signs. Only 42.3% and 26.7% respectively, knew that previous breast cancer diagnosis and having blood relation with the patient were known risk factors. Most were oblivious to other potential risks. Despite wide agreement (92.8%) on benefits of early detection, only 26.7% believed screening to be essential. Only 120 (39.1%) participants had ever performed a breast self-examination [BSE] (regular 5.9%) and 15 (4.9%) had ever undergone a clinical breast examination [CBE] (regular 0.3%). Only 32 (10.4%) had heard of mammography, and only 3 (0.9%) had ever undergone mammography. Logistic regression analysis predicted the likelihood of screening practices. Regarding diagnosis, only 18.6% knew that biopsy was the best method for confirmation. Regarding treatment, the majority were informed about chemotherapy (91.86%), surgery (91.2%) and radiotherapy (64.2%) but few knew about hormonal therapy (14%) and targeted therapy (0.98%). Composite awareness score (0-37) was calculated where only 3.3% were high scores (25-37), mostly urban graduates. **Conclusion:** Our study exposes the lack of awareness regarding breast cancer risks and prevention among this high-risk group of Indian women. Focused interventions in health policy need to be strategized to mitigate this problem.

Keywords: Awareness, Breast cancer, Breast self-examination, Early detection of cancer, First-degree relatives

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Introduction

Breast cancer is the most frequently diagnosed cancer among women and one of the leading causes of cancer related deaths across the globe [1]. There are several hereditary and non-hereditary factors associated with increased lifetime risk of breast cancer [2, 3]. Women with first-degree female relatives (mother, daughter, sister) diagnosed with breast cancer are at higher risk of developing this disease compared to general population [4]. Having a single first-degree relative with breast cancer doubles a woman's risk of developing the disease, while having two or more, increases it by 3-5 folds [5, 6].

As family history is a non-modifiable risk factor, and there is significant survival benefit of early detection, therefore awareness regarding breast cancer and adherence to screening methods are crucial [7, 8]. A recent SURVCAN-3 study (2023) reported that the 3-year

median survival for breast cancer across countries was 84%, whereas in India it was 68% [9]. As per IARC-WHO, India ranks highest in breast cancer mortality for the year 2022 [1, 10]. The Indian Council of Medical Research (ICMR)–National Cancer Registry Programme (NCRP) 2024 report provides consolidated data from 43 Population-Based Cancer Registries (PBCRs) and Hospital-Based Cancer Registries (HBCRs) across the country, which reported nearly 192,000 new breast cancer diagnoses and about 98,000 deaths annually, reflecting a mortality-to-incidence ratio of nearly 50%, which is significantly higher than in high-income countries [11]. According to National Family Health Survey (NFHS)-5 (2019-2021) report, breast cancer screening rate is only 0.9% among women aged 30-49 in India [12].

Evidence from multiple studies indicates that heightened awareness of breast cancer among first degree female relatives often influences their perception

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of personal risk, which in turn increases the likelihood of engaging in screening practices. This behavioral pathway is well explained by the Health Belief Model, which suggests that awareness heightens perceived susceptibility and subsequently motivates individuals to adopt preventive measures [13-16].

In India, a few studies have explored the knowledge and awareness of breast cancer and breast screening methods among the female population in general [17-23]. A cross-sectional study conducted in Prabhadevi, Mumbai by Prusty et. al found that only about half (49%) were aware of breast cancer; while knowledge regarding warning signs were relatively poor, less than one-fifth of the women were aware of breast cancer risk factors [17]. A community-based cross-sectional survey by Pradhan et. al from Odisha revealed inadequate knowledge and practice of breast cancer screening. Awareness of breast self-examination (BSE) and mammography was particularly low among women from medium- and low-income households. Most participants reported neither performing BSE nor undergoing mammography [18].

Though, few studies have examined the knowledge and awareness of breast cancer and its screening methods among the general women population in India, but none have looked at women who were first-degree relatives of breast cancer patients. However, considering the perceived risk and potential benefit of this knowledge and awareness, conducting such a study is highly essential. To the best of our knowledge, this is the first such study in this specific population of women reported from India.

The Primary objectives of the study were

- To estimate the awareness of the risk factors, signs and symptoms of breast cancer and the perception of being at heightened risk among the first-degree female relatives of female breast cancer patients.
- To assess their knowledge and attitude towards breast cancer screening practices and also factors affecting these behaviors.

The Secondary objective was

- To correlate the findings with various socio-demographic factors.

Materials and Methods

Study design and selection of participants

A cross-sectional observational study was carried out among the female first-degree relatives of breast cancer patients attending the oncology clinic of a peripheral tertiary cancer care center of Eastern India, which was the only tertiary cancer care centre in that district, between August 2023 and January 2024. A convenience sampling strategy was used to enroll the subjects.

Women who were first-degree female relative (sister, daughter, mother) of breast cancer patients, aged 18 years or over were included in the study. Health care professionals (doctors, nurses), those who themselves had been diagnosed with breast cancer at any time or those who were unable to sufficiently comprehend the questionnaire, were excluded.

Sample size calculation

Formula for sample size for cross-sectional study=
$$\frac{\{z^2 * p(1-p)/e^2\}}{[1 + \{z^2 * p(1-p)/e^2 N\}]}$$

Applying the above formula, estimated sample size came to be 367 (Detailed in supplementary File 1).

Study tools and technique:

1. Semi structured questionnaire prepared based on thorough literature review.
2. Breast Cancer Awareness Measure (Breast CAM) Toolkit v2.0 [24].
3. Modified B.G. Prasad Socioeconomic scale, 2022 [25].

A semi-structured questionnaire was prepared after thorough literature review. The questionnaire was initially forward translated into the regional language (Bengali) version and followed by back translated into English. The authors acted as Translation co-ordinators. The translated questionnaire was pilot tested among twenty subjects, subsequent validation resulted in minor changes, and final version was attained. Content validity of the questionnaire was done by consulting a group of local experts who carefully assessed the essentiality, relevance, comprehensiveness, simplicity, clarity and ambiguity of the individual items of the questionnaire. Cronbach's alpha value was calculated to test the internal consistency of the questionnaire, which came to be 0.79 suggesting the reliability as acceptable.

The questionnaire [26] comprised of six parts

- Part 1 collected information regarding the patient (women with breast cancer) [total 10 questions].
- Part 2 collected information regarding socio-demographic characteristics and personal medical history of the participant (first degree relative of the patient) [total 12 questions].
- Part 3 inquired some general knowledge questions on breast cancer and assessed the perceived lifetime risk of developing breast cancer in the participant [total 4 questions].
- Part 4 comprised of questions on awareness of risk factors and warning signs of breast cancer (as adopted from BREAST CAM toolkit 2.0 [24]) [total 21 questions].
- Part 5 inquired knowledge and attitude towards screening practices [Breast self-examination (BSE), Clinical breast examination (CBE) and Mammography] and factors affecting them [total 22 questions].
- Part 6 included questionnaire items regarding diagnosis and treatment of breast cancer [total 6 questions].

Finally, a total of 37 questions were selected from the main questionnaire to calculate a composite awareness score for each participant by assimilating all the six parts detailed above (questions related to socio-demographic profile, frequency and descriptive type questions were excluded for composite scoring). For a correct response to any question, a score of 1 was assigned while an incorrect response or a response indicating 'don't know' was scored as 0. The scoring criteria was formulated based on

questions on awareness of warning signs and risk factors of breast cancer adapted from Breast CAM tool kit 2.0 [24] combined with some added questions directed to assess awareness on disease epidemiology, inheritance possibility, importance of screening, Breast self-examination, Clinical breast examination, Mammography and confirmatory test for diagnosing the disease. In total this section comprised of 37 questions. Responses were scored as: Having awareness/correct knowledge- scored as '1' and being unaware/having incorrect knowledge- scored as '0'. Responses received on all the questions received from the individual subjects were summed to obtain the composite awareness score for each subject with minimum score- '0', maximum score- '37'.

Individual composite awareness scores received from the subjects from the survey were arranged in an ascending order and thereafter were divided into three tertiles (First tertile- '0-12', Second tertile- '13-24', Third tertile- '25-37'). Those having scores falling under first tertile were named to have low, those having scores falling under second tertile were named to have moderate and those having scores falling under third tertile were named to have high composite awareness score respectively.

After institutional ethics committee approval, face-to-face interview of the participants were conducted.

Ethical considerations and study oversight

The study was commenced after permission and approval from the Institutional Ethics Committee, Burdwan Medical College. The approval reference number is BMC/I.E.C/220 dated 17.07.2023.

The eligible participants were required to read and sign the consent form prior to participation. The study was conducted according to ethical guidelines which conform to Good Clinical Practice Guidelines and the Declaration of Helsinki. All the authors vouch for the authenticity of the results of the study.

Statistical Analysis

The data was analysed using Microsoft Excel (Microsoft Corp., USA) and Statistical Package for Social Sciences (SPSS) version 26.0 (IBM Inc., USA).

Descriptive statistics were calculated along with graphical and tabular presentation. Kruskal-Wallis test was used for assessment of association among the variables. The data was initially analysed for normality with Shapiro-Wilk test which showed p value to be 0.002 and when plotted on histogram, was found to have a right skewed curve, both indicating a non-normal distribution. Moreover, most of the independent variables in the study had three or more categories. So Kruskal Wallis test was chosen as the suitable non-parametric test to determine significant relationship between variables.

The data being non-parametric, Spearman correlation analysis was used for assessment of multicollinearity among the independent variables in pairs for the Logistic regression model. In all cases, values of the coefficient were found to be <0.7, thus ruling out multicollinearity.

Hosmer- Lemeshow test was used for assessment of goodness of fit of data for logistic regression analysis. In some cases, p value was found to be <0.05, thus indicating

that the model did not fit the data well in some cases.

Logistic regression analysis along with estimation of crude odds ratio were done to detect potential predictors of likelihood of performing BSE, CBE and Mammography. Independent variables which were used for Logistic regression analysis were:

1. Perception that early detection of breast cancer can improve survival
2. Perception of heightened risk of breast cancer due to positive family history in a close relative
3. Number of first degree relatives affected with breast cancer
4. Relation with patient
5. Residing with patient
6. Address location of subject
7. Highest education of the subject
8. Occupation of the subject
9. Socio-economic status of the subject
10. Time elapsed since diagnosis of affected relative (patient)
11. Stage of disease of relative (patient)
12. Intent of treatment of relative (patient)
13. Treatment status of relative (patient)
14. History of any past/present benign breast disease in subject
15. Awareness of warning signs of breast cancer (all those included in questionnaire)
16. Awareness of risk factors of breast cancer (all those included in questionnaire)
17. Being informed of being at high risk by a health worker
18. Awareness score

These independent variables were selected due to potentially impactful role in the subjects in perceiving the importance of the above-mentioned screening methods as well as in decision making to opt for the same for their own benefit.

The 95% confidence interval was taken into account and p value less than 0.05 was considered as being statistically significant. All p values reported are two tailed.

Results

Parameters related to the patients

Of 170 patients contacted, majority (43.5%) had stage III disease [27] and most (70%) were undergoing treatment at our centre. Median number of first-degree female relatives per patient was 4. Number of first-degree female relatives found to be affected with breast cancer per patient was one in 5.3% and more than one in 1.8% cases. Patients related parameters are given in Supplementary File 2.

Parameters related to the participants

Initially 334 subjects who fulfilled the inclusion criteria were screened for eligibility. Among them 27 subjects were excluded based on predefined exclusion criteria (among 27 subjects, 16 were non-responders). Finally, 307 first degree female relatives (of 170 patients) who fulfilled the selection criteria were enrolled as participants in our

study (Detailed in supplementary File 3).

Socio-demographic characteristics

The mean age of our study participants was 38.5 years (SD 12.22). The majority of participants – 161 (52.4%) were daughters of breast cancer patients, while 130 (42.3%) were sisters and 16 (5.2%) were mothers. Majority were married (91.2%), from a rural area (81.4%), homemakers (73.6%) and belonged to a lower socio-economic strata (55.3%) [elaborated in Table 1].

General knowledge of breast cancer and perceived lifetime risk

Around 60.6% of study participants were aware that breast cancer is the most common cancer in women. Out of 307 participants only 66 (21.5%) acknowledged that breast cancer could be inherited and 109 (35.5%) participants perceived themselves being at higher risk of developing the disease than the general population. Only 5 (1.6%) reported having received any information about being at higher risk from a healthcare worker at any point of time.

Only a minority of the participants were found to be familiar with the heritable nature of the disease along with very few reporting of being informed by a healthcare worker.

Awareness of breast cancer warning signs and risk factors

The percentages of participants giving correct response regarding warning signs and risk factors are shown in Figures 1 and 2.

Discovery of a breast lump was found to be the most known warning sign of breast cancer followed by change in size/shape of breast and redness/ulceration of underlying skin. As for the risk factors of for breast cancer—past history of breast cancer, smoking/alcohol abuse and having a first degree relative with breast cancer were acknowledged by less than half of the participant. Less than one-fifth of the subjects appreciated factors related to menstruation and life style patterns, in this regard.

Participant's screening behaviours and related factors

Despite a wide agreement (92.8%) that early detection of breast cancer could improve survival, only 26.7% of

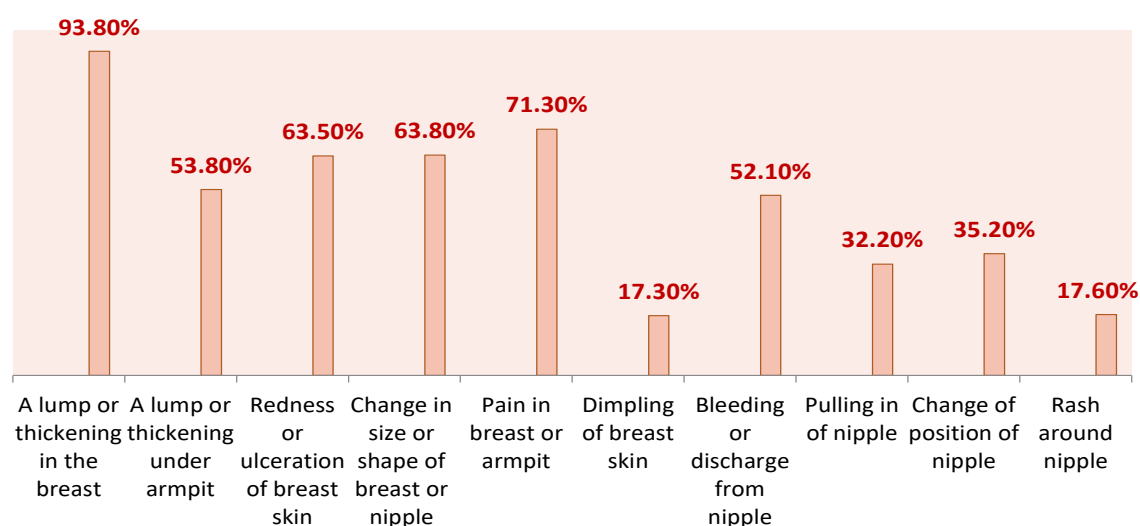


Figure 1. Percentages of Correct Responses Regarding Breast Cancer Warning Signs (n=307)

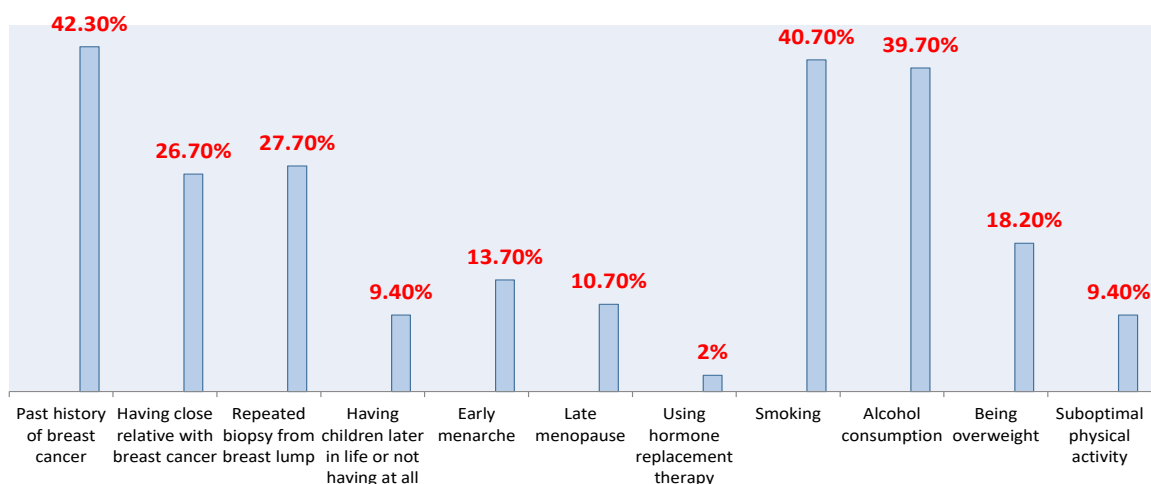


Figure 2. Percentages of Correct Responses Regarding Breast Cancer Risk Factors (n=307)

Table 1. Socio-Demographic Characteristics of Participants (n=307)

Categories	Frequency	Percentage
Age:		
Median age: 36 years (IQR: 29-48)		
Marital status		
Married	280	91.20%
Unmarried	14	4.60%
Widow	13	4.20%
Residence		
Rural	250	81.40%
Urban	57	18.60%
Education		
Illiterate	67	21.80%
Primary	86	28.00%
Middle school	55	17.90%
Secondary	51	16.60%
Higher secondary	22	7.20%
Intermediate or diploma	3	1.00%
Graduate or post graduate	23	7.50%
Occupation:		
Unemployed	12	3.90%
Unskilled worker	10	3.30%
Semi-skilled worker	12	3.90%
Skilled worker	7	2.30%
Clerical/ shop owner/ farmer	28	9.10%
Semi-professional	7	2.30%
Professional	5	1.60%
Homemaker	226	73.60%
Socio-economic status:		
Lower class	79	25.70%
Lower middle class	91	29.60%
Middle class	91	29.60%
Upper middle class	35	11.40%
Upper class	11	3.60%
Relation with patient		
Daughter	161	52.40%
Sister	130	42.30%
Mother	16	5.20%
Residing with patient		
Yes	34	11.10%
No	273	88.90%
History of any present or past benign breast disease:		
Yes	36	11.70%
No	265	86.30%
Don't know	6	2.00%

them knew that screening is helpful for early detection. Table 2 summarizes responses related to breast cancer screening techniques.

Out of 307 participants, 168 (54.7%) had previously

Table 2. Breast Screening Practices among Participants (n=307)

	BSE		CBE		Mammography	
	n	%	n	%	n	%
Heard of	168	54.70%	159	51.80%	32	10.40%
Practices	120	39.08%	15	4.90%	3	0.90%
Regular	18	5.90%	1	0.30%	0	0.00%

heard of Breast Self-Examination (BSE). 120 (71.42%) of these 168 participants who heard of BSE, reported performing it (overall 39.08%) and only 18 (overall 5.9%) of them reported doing so on a regular basis. In total 14% and 18.2% correctly answered that BSE should be started at an early age and it should be performed on a monthly basis respectively. Compared to BSE, lesser number, 159 out of 307 participants (51.8%) had heard of Clinical Breast Examination (CBE). Fifteen out of 159 (9.4%) who had heard of CBE, reported undergoing it (overall 4.9%). Only one of them (overall 0.3%) reported doing so on a regular basis. Only 2.6% correctly answered that it should be performed annually.

Only 32 participants (10.4%) had previously ever heard of mammography and 20 (6.5%) of them acknowledged it being a useful tool for the early detection of breast cancer. Amongst the 32 participants, only 3 had ever undergone a mammography examination, no one either knew about the recommended frequency or underwent regular mammography.

Association of screening practices with the variables

BSE practice was more pronouncedly associated with daughters, who resided with the patient, possessed graduate-level education, reported a personal history of benign breast disease, and perceived themselves as being at risk for breast cancer. BSE practice was more prevalent among participants who recognized a breast lump as a warning sign and those who achieved higher scores on the composite awareness index. CBE practice was significantly associated with individuals reporting a personal history of benign breast disease, perceiving themselves as susceptible to breast cancer, and identifying breast lump and nipple rash as warning signs. Mammography practice was more common among participants residing in urban areas and belonging to higher socio-economic strata (Table 3).

Logistic regression analysis predicted the likelihood of BSE practice to be 5.9 times greater in those who were cognizant about breast lump being a warning sign, 3.6 times greater in those who perceived their susceptibility of being at higher risk and 3.2 times greater in those who were residing with the patient. Likelihood of CBE was predicted to be 3.3 times greater in those who acknowledged nipple rash as warning sign. No significant predictors were found for mammography (Table 4 and 5).

Screening practices- perceived barriers and factors affecting these behaviours

Among the participants who practiced any of these screening methods, 78.8% of them stated that they

Table 3. Association of Screening Practices with the Variables; (Kruskal-Wallis test: p value <0.05 considered as significant)

	Variables	BSE practice	CBE practice	Mammography practice
Socio-demographic characteristics	Age of the relative	0.065	0.208	0.098
	Relation with the patient	0.0001	0.453	0.996
	Residing with the patient	0.001	0.26	0.079
	Highest education of the relative	0.0002	0.344	0.07
	Occupation of the relative	0.828	0.083	0.227
	Marital status	0.527	0.964	0.987
	Address location	0.086	0.409	0.003
	Socio-economic status	0.186	0.805	0.014
Patient related parameters	Stage of the disease	0.104	0.432	0.468
	Time elapsed since diagnosis	0.103	0.471	0.094
	Treatment status	0.141	0.578	0.67
	Intent of treatment	0.299	0.439	0.578
Personal history	History of any present or past benign breast disease	0.0002	0.0001	0.606
	Number of first-degree relatives affected with breast cancer	0.430	0.542	0.654
Perceived susceptibility	Perceived susceptibility of higher risk	0.0001	0.042	0.668
Informed of being at higher risk by any health worker		0.335	0.61	0.855
	Breast lump as warning sign	0.009	0.023	0.716
	Armpit lump	0.867	0.583	0.93
Warning signs	Nipple discharge	0.419	0.248	0.952
	Pulling of nipple	0.356	0.074	0.591
	Nipple rash	0.341	0.02	0.513
	Ulceration of breast skin	0.767	0.795	0.691
	Change in size or shape of breast	0.073	0.816	0.683
Risk factors	Past history of breast cancer	0.03	0.051	0.826
	Having close relative with breast cancer	0.009	0.234	0.456
	Repeated biopsy from breast lump	0.022	0.275	0.381
	Suboptimal physical activity	0.008	0.706	0.647
Awareness score	Composite awareness score	2	0.104	0.967

practiced it because of a breast cancer diagnosis in their family or because it was advised by a healthcare worker (23.9%) (Figure 3). For those who did not undergo

screening, the reported reasons were lack of knowledge in majority (79.9%) or lack of any symptoms (40.2%) (Figure 4).

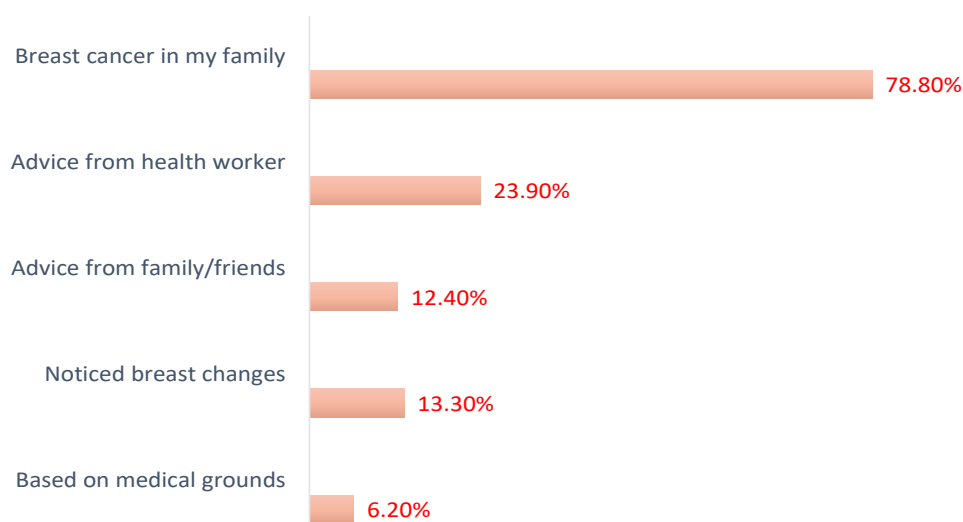


Figure 3. Percentages of Responses Stated as Reason of Practising Any of the Screening Methods (n=307)

Table 4. Logistic Regression Analysis Showing Prediction of the Likelihood of BSE

Variables	p value	Odds ratio	95% CI
Residing with the patient	0.002	3.274	1.553-6.900
Highest education of relative	0.0001	1.425	1.232-1.649
Perceived susceptibility	0.0001	3.606	2.207-5.892
Breast lump as warning sign	0.019	5.9	1.338-26.019
Past history of breast cancer as risk factor	0.03	1.671	1.050-2.660
Close relative with breast cancer as risk factor	0.009	1.979	1.185-3.304
Repeated biopsy from breast lump as risk factor	0.023	1.803	1.086-2.993
Suboptimal physical activity	0.01	2.824	1.283-6.214
Awareness score	0.0002	1.128	1.080-1.179

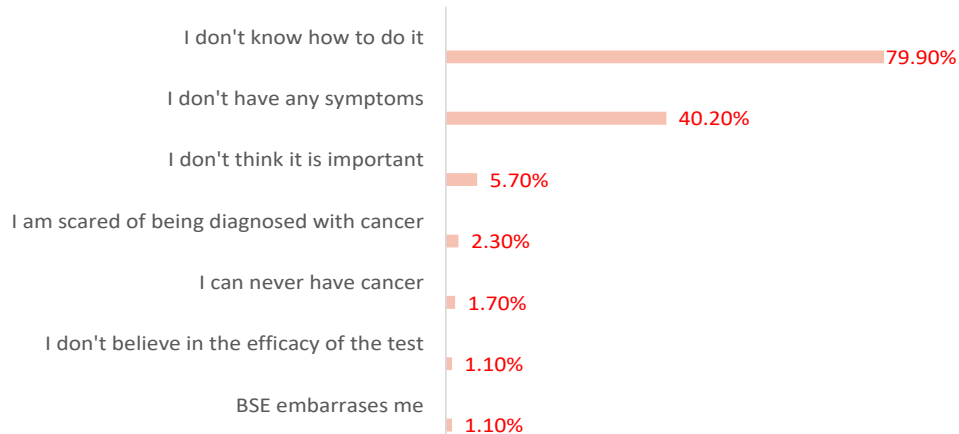


Figure 4. Percentages of Responses to Questionnaire on Barriers to Breast Screening Practices (n=307)

As for behavioural/lifestyle changes embraced, among the 109 participants who believed themselves to be at higher risk, 44.9% adopted BSE, 7.33% assured doing regular physical activity, 5.5% adopted CBE, while only 0.9% adopted getting an annual mammography or eating less oily food. No behavioural changes were reported in 40.4% of participants.

54 out of 307 (17.58%) reported that they had presence of breast symptoms but only 30 of them ever visited a doctor. When enquired about reasons for not consulting

a doctor, 25% of them stated that they were afraid of dreadful diagnosis, 20.8% were afraid that surgery could result in removal of the breasts and 16.7% reported that they were not comfortable with their breast being examined (Figure 5).

Knowledge regarding diagnosis of breast cancer and its treatment

Regarding diagnosis, majority of the participants had heard about FNAC or biopsy (64.5%) but only 18.6%

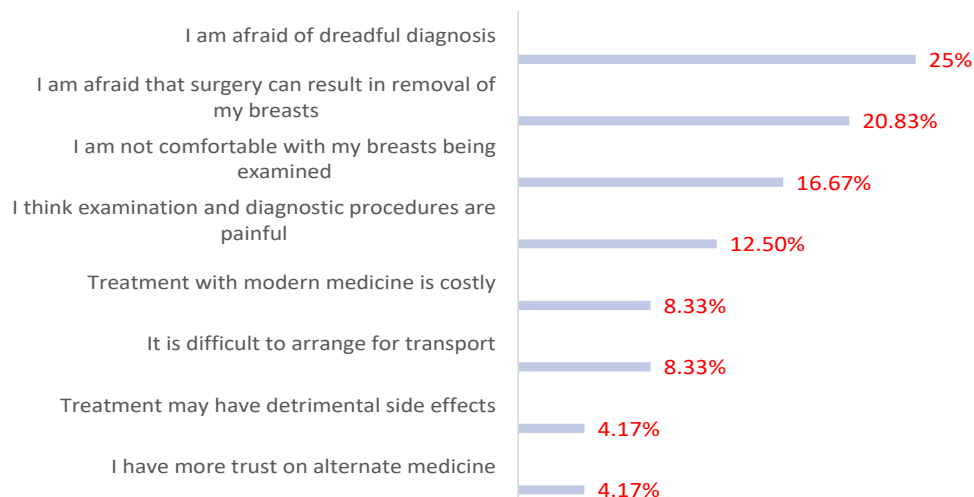


Figure 5. Percentages of Responses to Questionnaire on Barriers to Visiting Doctor Despite having Breast Symptoms (n=307)

Table 5. Logistic Regression Analysis Showing Prediction of the Likelihood of CBE

Variables	p value	Odds ratio	95% CI
Breast lump as warning sign	0.035	0.232	0.059-0.905
Nipple rash as warning sign	0.027	3.389	1.153-9.963

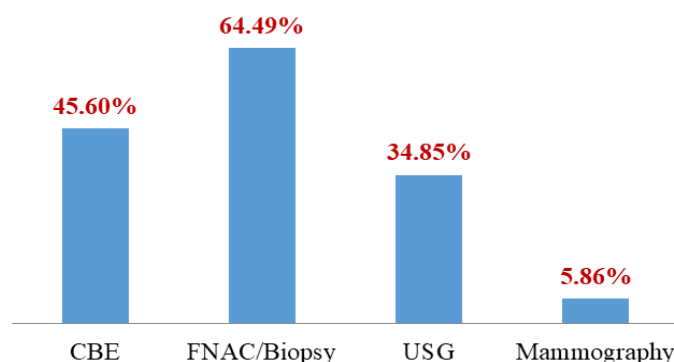


Figure 6. Percentages of Correct Responses Regarding Breast Cancer Diagnosis (n=307)

knew that biopsy is superior method for confirmation of the disease. Related to treatment, most of them knew about surgery (91.2%) and chemotherapy (91.9%) but less knew about radiotherapy (64.2%). Knowledge about endocrine (hormonal) therapy was poor (14%). Only 3 participants (0.9%) had ever heard of targeted therapy (Figure 6 and 7). Half (51.1%) of all participants thought that breast cancer treatment is severely toxic. While 54.7% participants acknowledged that some breast cancers are curable, 55.3% of them believed that the disease universally recurs after initial cure.

Overall awareness

The composite awareness score was calculated as detailed above. Among all participants, 53.1% scored low scores (0-12) and 43.6% scored moderate (13-24). Only 3.3% participants had high scores (25-37). The median score was 12 (IQR 8-16). Most of the high scorers were aged less than 40 years, daughters of patients, graduate, resided with the patient and resided in an urban locality (Supplementary File 4).

Discussion

First-degree relatives of breast cancer patients are at

higher risk of developing breast cancer [28]. Our study provides insights on lack of awareness and potential barriers to performing breast cancer screening in this population of women. The population was predominantly young, rural and belonging to lower socio-economic strata.

Regarding perceived higher risk of developing breast cancer

Only 35.5% of our study participants perceived of being at higher risk of developing breast cancer and only 1.6% reported that they were informed about being at higher risk by any healthcare worker at any point of time. Our study findings are markedly different from those reported by Audrain et al. [29] where 75% of women believed their risk of breast cancer as 'higher or much higher' than women without family history and 55% reported they were notified of being at higher risk by any health care provider.

This reflects that our study population of Indian women, are oblivious to their higher risk status, a fact which might adversely impact efforts of population screening. The fact that very few were informed about their risk by a healthcare worker, also exposes the lacunae of proper implementation of breast cancer awareness campaigns and would need urgent health policy decisions.

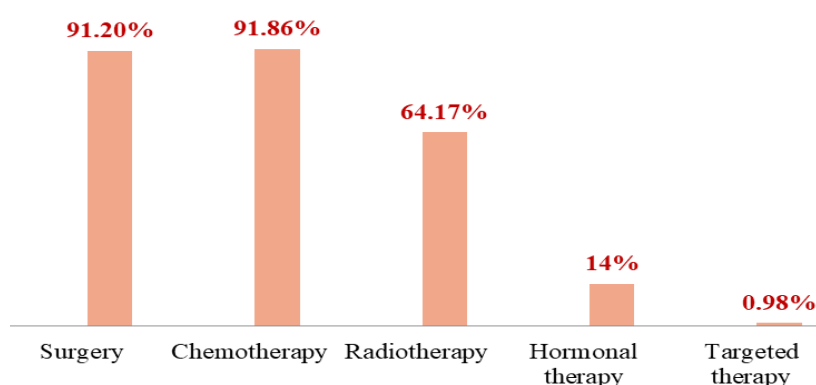


Figure 7. Percentages of Correct Responses Regarding Breast Cancer Treatment (n=307)

Knowledge on risk factors for breast cancer

When enquired about the knowledge of risk factors, only 42.3% and 26.7% respectively knew that a past history of breast cancer and having close blood relation with the patient were known risk factors. Very few participants were aware of other potential risks particularly the modifiable risk factors. Similar findings were reported from multiple countries. A study conducted by Subramanian et al. [30] revealed that 71% respondents had poor knowledge on the risk factors. A study done by Mulmi et al [31] also reported that only two-fifth of the participants had a high level of awareness on risk factors of breast cancer. Our study findings are in congruence with the findings of a study conducted by El Maouchi et al. [32], which reported that majority agreed that having a history of breast cancer (81%) or having a close relative with breast cancer (84%) were risk factors for breast cancer. However, they were less knowledgeable about other risk factors like hormone replacement therapy (50%), alcohol consumption (28.5%), suboptimal physical activity (8.5%), early menarche or late menopause (15.5% and 17% respectively). Insufficient awareness was also found in a study conducted in China [33], which reported that a vast majority of the study participants were unable to recognize modifiable risk factors.

Knowledge on warning signs of breast cancer

Regarding warning signs of breast cancer, our study found that breast lump was the most commonly known sign (93.80%), whereas knowledge regarding other warning signs was relatively poor. Similar findings were also reported in the Chinese study [33]. On the contrary, in the study reported by El Maouchi et al. [32] majority were well-informed about most breast cancer warning signs. Our findings also mirror the results reported by Mulmi et al. [31] where they reported that only two-fifth of them had a high level of awareness on warning signs of breast cancer.

These findings reveal a unanimous lack of awareness among many women, especially from Asia and lower middle-income countries with a positive family history which suggest the need for organizing large scale awareness programs especially in the high-risk populations.

Awareness of screening practices

With regard to awareness of screening practices, although 168 participants had previously heard of BSE, only 18 (overall 5.9%) of them reported practising BSE regularly. Only one out of 159 participants who heard of CBE reported visiting a physician regularly for the same. No one underwent mammography regularly. In a study done in Turkey by Kirca et al. [34] lower participation in screening practices was also observed. In the study by Mulmi et al [31], the majority of the respondents had heard about the breast cancer screening methods, however the regular performers of the same were rather low. Contrary to our study findings, in studies from Malaysia and Lebanon [30, 32], there was sufficient awareness regarding screening practices. The Malaysian study [30] revealed that majority of the participants were aware of BSE (92.4%), and mammography (87.8%). Similarly, in

the study done among Lebanese females [32], majority of the participants were aware about BSE and CBE (9 out of 10 participants). These differences portray that screening behaviour among Indian women is lagging far behind than that in many Asian countries.

Attitude and practices with respect to BSE, CBE and Mammography.

Our study found that BSE and CBE practices were more pronounced in daughters, who were graduates, had a personal history of benign breast disease, perceived themselves to be susceptible to breast cancer and those who recognized of breast lump as a warning sign. Mammography practice was more in those who were from urban area and with upper socio-economic status similar to other studies [30, 34]. Perceived risk of breast cancer was found to be predictor for screening practices, also similar to other studies [16, 34]. A study by Fair et al. [35] reported high perceived risk might cause fear of cancer diagnosis, thus preventing women from getting mammography.

According to the report of National Family Health Survey- 4, only 1 in 10 women aged 30-49 years is screened for breast cancer in India [36]. A systemic review from India, conducted by Pal et al. reported that only 27.37% of the women practiced BSE, while practice of CBE and Mammography was even lower i.e. 16.71% and 7.12% respectively [21]. According to National Noncommunicable Disease Monitoring Survey (NNMS) 2017-18 report, only 1.6% of women aged 30-69 years in India have ever undergone screening for breast cancer [37]. This could be attributed to poor female literacy rate and lack of adequate screening facilities and counselling centres in the many health institutions of India.

The Government of India launched the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) under the National Health Mission (NHM), with a mandate to implement population-based screening for breast cancer among women aged 30 years and above at primary health centres and community health settings [38]. Despite this endeavour, uptake of opportunistic clinical breast examinations has remained limited, reflecting challenges that closely parallel our study findings. Recognizing these gaps, the National Academy of Medical Sciences (NAMS) established a task force to address critical shortcomings, noting that while NPCDCS screening initiatives represent an important step forward, they remain fragmented and unevenly implemented [39]. By situating our results within the NPCDCS framework, it can be realised how epidemiological evidence can inform ongoing national strategies along with strengthening their programmatic delivery, and guide policy refinement for breast cancer control in India.

Nationwide campaigns should be launched at a large scale to enhance public awareness on breast cancer and to improve accessibility of screening services across India. There is an urgent need for setting up of screening centres at population level coupled with registry-based monitoring, expanding the availability of mammography units and training of health care providers to perform CBE at grass root level, which could significantly improve

early detection and survival outcomes. There should be more robust integration of breast cancer care services across all levels of the healthcare system from primary care facilities to specialized oncology centres along with a robust referral system to ensure seamless continuum of care and unnecessary delay in treatment initiation.

First-degree relatives of breast cancer patients are readily accessible, particularly at cancer care centres, and require minimal effort to be educated about breast cancer and appropriate screening methods. We recommend strengthening genetic counselling clinics and implementing targeted Information-Education-Communication (IEC) initiatives for this high-risk population. This combined approach will enable effective risk stratification, promote early detection, and empower women at elevated risk with knowledge and preventive options. In addition, counselling can address lifestyle modifications, facilitate germline BRCA testing, and provide evidence-based risk-reduction strategies.

In our study, participants with lower awareness scores were predominantly from rural areas, aged over 40 years, had lower educational and socio-economic attainment, were relatives other than daughters, and were not residing with the patient. These specific groups should be prioritized for targeted screening interventions and compulsory counselling sessions. Expanding community-based IEC campaigns in local languages and strengthening frontline health worker engagement along with decentralized screening facilities, mobile mammography units are essential to improve breast cancer awareness and screening uptake among rural and socio-economically disadvantaged women. Furthermore, germline BRCA testing ought to be integrated into government health services and offered at subsidized rates to improve accessibility.

We recommend that policymakers prioritize breast cancer as a pressing public health concern. Initiatives must be taken in order to secure sustainability of cancer care programs including special drives regularly for awareness and screening campaigns, especially in the rural and low socio-economic areas along with endeavours to expand healthcare access and to advance oncology research in India, through appropriate funding and long-term support.

The limitation of our study was that this was a single institutional cross-sectional study, conducted over a short period of time. The women in our study were predominantly from a rural background, less educated and belonged to lower socio-economic strata. Therefore, our interviewed subjects might not be representative of the population at large. Moreover, the use of convenience sampling increases the risk of selection bias leading to low generalizability of the findings from our study. The reliance on self-reported screening behavior introduces the possibility of social desirability and reporting bias which make the participants giving ideal answers as opposed to what they actually know, believe and practise. Also, recall bias may have influenced responses from those with past exposure to health communication and awareness activities. The findings may lack generalizability beyond clinic-attending families, as the sample excludes individuals who do not seek care in formal health facilities.

Also, the absence of a qualitative component limits understanding of the psychosocial drivers of screening behaviour.

To conclude, our study depicts considerable lack of awareness, an alarming level of inadequacy of risk perception and poor adherence to screening practices among the female first-degree relatives of breast cancer patients from India. To the best of our knowledge, this is the first study to shed light on this issue in this specific population. Promoting breast cancer awareness in this high-risk group and ensuring adherence to screening programs is indispensable for early detection, which holds the key to potentially greater chances for improved cure and survival rates. We hope that our study will help tailor future healthcare policies to address this important problem.

Future research directions: Further research works can be carried out in larger population, multi-institutional setting to provide more robust evidence. Research exploring the cultural, socio-economic, and psychological factors behind their screening behaviours will be valuable in understanding barriers and facilitators to participation. Further work should also examine how caregiver's awareness influences patient's treatment compliance. In addition, prospective studies incorporating structured education, awareness sessions, and genetic counselling for first-degree relatives of breast cancer patients could provide important insights into their attitudes and screening practices.

Author Contribution Statement

Pratibha Kole: Conceptualization, design, literature search, data acquisition, data analysis, drafting, manuscript preparation, critical review, final approval. Abhishek Basu: conceptualization, design, validation, resources, data acquisition, data analysis, supervision, drafting, writing-review and editing, critical review, final approval. Suman Dhabal: Conceptualization, design, literature search, data acquisition, data analysis, drafting, writing- review and editing, critical review, final approval.

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Data Availability

Due to sensitive nature of the questions asked in this study, participants were assured raw data would remain confidential and would not be shared. The data, without any personal identifiers, would be made available upon reasonable written request from the authors for strictly academic purposes.

Ethical Approval

The study was commenced after approval of the protocol from the Institutional Ethics Committee, Burdwan Medical College. The approval reference number is BMC/I.E.C/220 dated 17.07.2023.

Conflict of Interest

The authors declare no conflict of interest.

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