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Factors associated with breast cancer screening coverage in India: A study using a nationally representative survey (NFHS-5)

Nutan Kumari* and Samanwita Paul†

Abstract

Breast cancer is the most prevalent cancer among women globally, including in India. Approximately 1.3 million new cases are diagnosed annually. This study analyzes breast cancer screening patterns in India using the data collected by the fifth round of the National Family Health Survey (NFHS-5) 2019-21. Descriptive and multivariable analyses were conducted to examine socio-demographic disparities and spatial patterns at the state level. The overall breast screening rate was 6 per 1000 women. Women aged 30-49 years (OR: 1.9, 95% Cl: 1.47-2.38), with higher education (OR: 2.4, 95% Cl: 1.58-3.73) and residing in urban area (OR: 1.5, 95% Cl:1.19-1.91) were more likely to undergo breast screening. Southern region (OR: 8.6, 95%, Cl:5.39-13.76) reported relatively higher breast cancer screening rate than the eastern regions of India. However, coverage remains especially low among women in rural area, those with lower education, and in the poorest wealth quintiles. These disparities highlight the urgent need to enhance awareness, accessibility, and affordability of breast cancer screening services across India to ensure early diagnosis and effective management.

Keywords

Breast Cancer, Prevalence, Socio-economic, NFHS-5, India

*Assistant Professor, Population Research Centre, JSS Institute of Economic Research Dharwad, Karnataka-580004, Email: nutan.dudi@gmail.com

†Teaching Fellow, Department of Social Sciences and Humanities, Indraprastha Institute of Information Technology, New Delhi - 110020, Email: samanwitapaul@gmail.com

Background

Cancer is the second highest leading cause of mortality, causing one in six deaths globally, and is an important public health concern worldwide (WHO, 2018; Torre et al., 2017; Deng et al., 2018). The World Health Organization (WHO) projects that the number of global cancer deaths will rise by 45% by 2030 (WHO, 2020). However, around 2.3 million women were diagnosed with breast cancer, and 670,000 deaths globally in 2022 (WHO, 2024). Among women, it is the most commonly diagnosed cancer and the leading cause of cancer death (Torre et al., 2017). According to sustainable development goals (SDGs) 3.4 the target was to reduced premature mortality form non-communicable disease including cancer by one-third by 2030 (WHO, 2017). The strategies to reduce the high burden of breast cancers include risk factor intervention, vaccination, screening, and early diagnosis (Viens et al., 2017).The occurrence of breast cancer is possible in women at any age after puberty but increases in later life (WHO, 2024). Patients with cancer generally have a poorer prognosis in low and middle-income countries, including India, because of relatively low cancer awareness, late diagnosis, and the lack of inequitable access to affordable curative services compared to patients in high-income countries (Britaidou et al., 2014; Sivaram et al., 2018). Screening is the most effective method to reduce mortality and morbidity from breast cancer (Osei et al., 2021).Screening is defined as "the systematic application of a test or an inquiry to identify individuals at sufficient risk of a specific disorder to warrant further investigation or direct preventive action among persons who have not sought medical attention on account of symptoms of that disorder" (Britain 1998). Early screening of breast cancer will reduce the risk of mortality and morbidity and improve women's health (Berkiten et al., 2012; Scholes et al., 1996; Workowski and Bolan, 2015). Diagnostic and clinical confirmation for cancer was significantly higher in urban patients, while verbal autopsy-based confirmation was higher in rural patients (Khanna et al., 2024). While women with higher education, higher incomes, and greater insurance coverage are more likely to undergo breast cancer screening services (Lin, 2008). Employed females are more inclined to go for screening because of their higher opportunity cost, higher incomes, and ability to afford out-of-pocket expenditures (WU, 2003). In India, the first program of breast screening came in 2016, which is known as National programme for prevention and control of cancer, diabetes, cardiovascular disease and stroke for diagnosis. Before this woman use to go the private sector for seeking mammography (Negi & Nambiar, 2021). In light of this, the Government of India (GoI) formulated a population-based cancer-screening program in 2016 where all women above age 30 were eligible for regular breast, cervix and oral cancer screening (GoI, 2016). Despite national guidelines, screening coverage in India is appallingly low. It is important to understand the background characteristics of women who are going for breast cancer screening and also the spatial differences in screening at the state level. A review of cancer screening-related literature in India reveals that the background characteristics and geographical perspective have not been explored yet. The present study attempts to address breast cancer screening among women based on their socio-demographic characteristics which include age at marriage, place of residence, educational qualification, caste group and wealth index among many others. It also looks into the state wise variation of breast cancer screening among women to assess the a regional pat-

tern in breast cancer screening.

Data and Methods

Data

The present paper used fifth round of the National Family Health Survey (NFHS-5), conducted in 2019-2021 which is available in public domain (DHS). NFHS is a nationally representative cross-sectional survey carried out throughout India, covering 707 districts. NFHS-5 survey has been conducted under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India, by the International Institute for Population Sciences (IIPS), Mumbai, as the nodal agency. NFHS-5 fieldwork for India was conducted in two phases such as Phase-I from 17 June 2019 to 30 January 2020, covering 17 states and 5 UTs, and in Phase II from 2 January 2020 to 30 April 2021, covering 11 states and 3 UTs- by 17 Field Agencies and gathered information from 6,36,699 households, 7,24,115 women, and 1,01,839 men. The survey collected information from all eligible women aged 15–49 years, who reported on questions related to family planning, fertility preferences, and other health issues (tuberculosis, current morbidity - diabetes, asthma, goitre, heart disease, cervical and breast cancer) along with the socio-economic characteristics at the state and district levels that yield meaningful insights.

Outcome variable

The self-reported information on screening for breast cancer performed among women aged 15-49 years were used in this study in the binary format: 'Yes' if undergone screening of breast cancer, 'No' otherwise.

Defining Predictor Variables

Consistent with the study objective and given the effect of the outcome variable, a range of individuals, household, and community-level predictor variables were used based on theoretical and empirical importance applied in international literature and availability of the data in the dataset. The detailed predictor variables are given below:

Individual-level variables

The study considered a number of potential individual factors included in the analysis current age of women (15-29, 30-49); and women and husband education (No education, Primary, Secondary, Higher).

Household-level-variables

The study considered a number of household factors; included in the analysis were Caste (Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Castes (OBC), and Others); Religion (Hindu, Muslim, and Others); Household wealth index (Poorest, Poorer, Middle, Richer, and Richest).

Community-level variables

This study included the following community-level factors: the Place of residence (Urban and Rural); and Geographical region of India (North, Central, East, Northeast, West, and South).

Data analysis

Descriptive and bivariate analysis was carried out for the present study for better understanding the breast screening practices among women. Those predictors found significant at $p < 0.015$ were included in the binary logistic regression

analysis odds ratios. The results were presented odds ratios and 95% confidence intervals. STATA version 16.0 was used for data wrangling and visualization. For the special represented of breast cancer at state level, ArcGIS 10.7.1 software used for data analysis.

Results

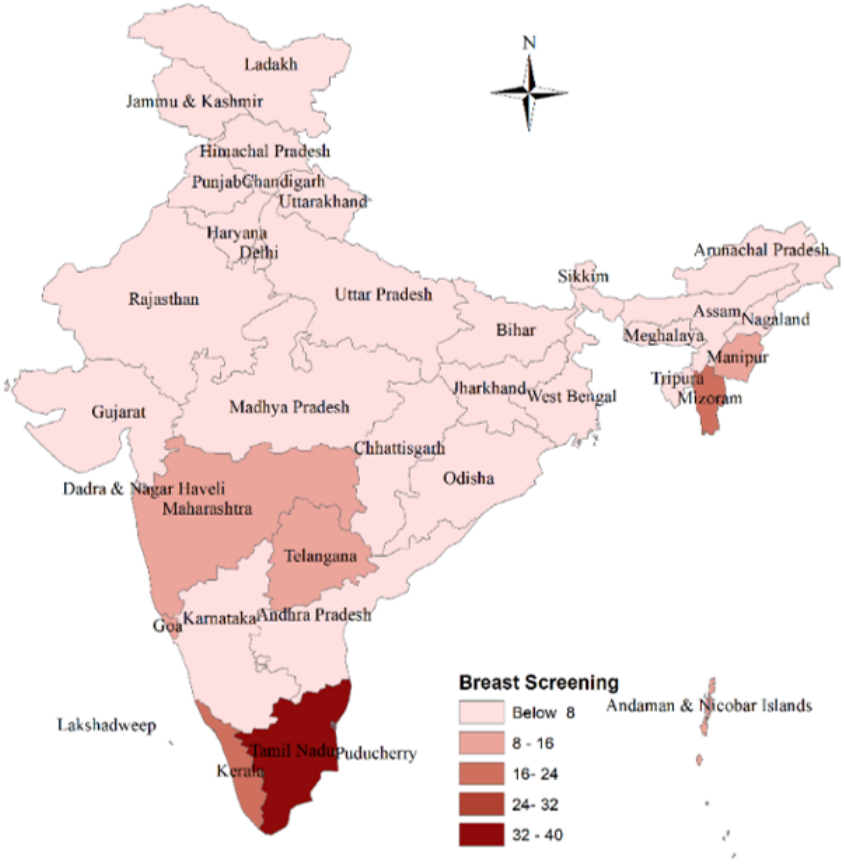
Table 1demonstrates the prevalence of breast cancer screening per 1000 women in selected socio-economic groups of women. The prevalence of screening for breast cancer is 6.0 per 1000 among women at the national level. The breast screening rate is high among women who had higher education (8.4 per 1000) than women who had no education (3.9 per 1000). Similar finding was also found according to husband's education. Women belonging to OBC had high breast screening, followed by SC, Other and ST caste. With increasing the wealth index, breast screening also increased among women. Women belonging to richest wealth index has high breast cancer screening done than women belonging to the poorest wealth index. The southern states of India showed a higher proportion of breast cancer screening rates compared to other regions.

Table 1. Breast cancer screening rates per 1000 women by background characteristics

Background Characteristics	Total	Breast Screening (W)	P-value
Age at marriage			0.001
15-29	359,559	3.2	
30-49	364,556	8.8	
Education of women			0.001
No education	1,63,951	3.9	
Primary	83,470	6.7	
Secondary	3,61,385	6.0	
Higher	98,313	8.4	
Husband's education			0.001
No education	14,570	4.7	
Primary	11,346	7.9	
Secondary	42,713	7.9	
Higher	11,246	11.8	
Caste			0.001
SC	1,36,635	6.6	
ST	1,33,273	3.1	
OBC	2,70,037	7.2	
Other	1,33,235	4.3	
Religion			0.001
Hindu	5,33,521	6.2	
Muslim	87,825	3.6	
Other	85,773	9.1	
Wealth Index			0.001
Poorest	1,46,997	2.7	
Poorer	1,57,411	4.6	
Middle	1,48,486	6.4	
Richer	1,36,317	6.8	
Richest	1,17,908	9.3	
Place of residence			0.001
Urban	1,73,171	8.7	
Rural	5,33,948	4.7	
Region of India			0.001
North	1,43,303	2.0	
Central	1,64,949	3.3	
East	1,16,264	1.7	
Northeast	1,02,427	2.6	
West	70,321	7.9	
South	1,09,855	16.2	
Total	**707119**	**6.0**	

The breast cancer screening rates among women across region of India country is shown in Figures 1.the prevalence of breast screening done by women vary from state to state in India. The prevalence of breast screening varies from 0 to 40 per thousand across the nation. The prevalence of breast cancer screening among women is high in Tamil Nadu, followed by Mizoram and Kerala, while a majority of the states fall in the range of 0-8 per thousand breast screening among women.

Figure1. Prevalence of breast cancer screening per 1000 women at the state level



The predictors found to be significantly associated in the univariate analysis were included in the binary logistic regression (Table 3). Breast cancer screening was more likely among women in the age group 30-49 years as compared to the lower age group [OR = 1.87, 95% Cl=1.47-3.38],and Higher educated women were more likely to report breast screening [OR = 2.43, 95% Cl= 1.58-3.73]. Compared to women in the ST categories, those in SC and OBC categories were more likely screened for breast cancer. The wealth index showed relatively no evidence of an association with screening for breast cancer. Women living in urban areas were more likely to be screened for breast cancer as compared to those living in rural areas [OR = 1.51, 95% Cl = 1.19-1.91]. Compared to the eastern region, the central, western, and southern regions were more likely to have undergone the screening for breast cancer, the highest odds being reported by the south-

ern region.

Discussion

The present article aimed to measure the prevalence of breast cancer screening among women aged 15-49 years from a nationally representative survey at the state and national level of India. It also provides social, economic, and demographic determinants and self-reported reasons for undergoing breast screening. This paper offers a comprehensive analysis of all these critical aspects of breast screening in the Indian context. The breast cancer screening rate is the lowest despite being relatively easier to diagnose and the most common cancer among women in many parts of the country (Agrawa et al., 2014). Early detection through uptake of screening services is the key strategy to control the burden breast cancer attributable to morbidity and mortality.

Table 3. demonstrates the Factors associated with breast cancer screening among Indian women

Background Characteristics	Odds Ratio	95% Conf. Interval	
		Lower	Upper
Age			
15-29®			
30-49	1.87***	1.47	2.38
Education of women			
No education®			
Primary	1.29	0.87	1.90
Secondary	1.89***	1.37	2.61
Higher	2.43***	1.58	3.73
Husband's education			
No education®			
Primary	1.69**	1.14	2.51
Secondary	1.23	0.85	1.78
Higher	1.49*	0.95	2.34
Caste			
ST®			
SC	1.46	1.00	2.13
OBC	1.19	0.83	1.71
Other	0.95	0.62	1.44
Religion			
Muslim®			
Hindu	1.08	0.76	1.55
Other	1.02	0.62	1.68
Wealth Index			
Poorest®			
Poorer	0.72*	0.49	1.05
Middle	0.73	0.50	1.07
Richer	0.69*	0.46	1.03
Richest	0.74	0.47	1.15
Place of residence			
Rural®			
Urban	1.51**	1.19	1.91
Region of India			
East®			
North	1.03	0.57	1.86
Central	1.96**	1.18	3.25
Northeast	2.27**	1.27	4.03
West	4.19***	2.51	6.97
South	8.61***	5.39	13.76

Note: ® Reference, Exponentiate coefficients; 95% confidence intervals; * p<0.05, ** p<0.01, ***p<0.001

This study showed that screening was significantly associated with geographic locations and there were observed differences in the patterns of spatial clusters of breast cancer screening. For breast cancer screening, the southern region of India such as Tamil Nadu, Kerala, Telangana and Maharashtra have hotspots of breast screening among women. Mizoram is the second state of India and high in northern-east region, which has high prevalence of breast screening per thousand women.

The findings depict the prevalence of breast cancer screening characterized by the selected socio-economic and demographic characteristics among women. The study by (Akinyemiju, 2012; Changkun et al., 2022; Lemp et al., 2020) found the high breast screening was found in old age. However, the findings of this study reveal that screening of breast cancer was around two times higher in the age group 30-49 years than women in the age group 15-29 years. Study based on Turkey found low rates of breast cancer screening among women aged 30 years and older (Sözmen et al., 2016). Women, living in rural areas, with no education, those belonging to the poorest wealth quintile, scheduled Tribes (STs), those belonging to Muslim religion, and with no education among their husband were less likely to undergo breast cancer screening, this is mainly due lack of awareness about screening (Abeje et al., 2019; Oswal et al., 2020). Cancer operation was low among those women living in urban areas, belongingto the richest wealth index and to other religion or scheduled Tribes (STs) (Negi & Nambiar, 2021).

Strengths and limitations of the study

The sample size was representative of women of 15-49 years, and therefore, the findings are generalizable for all women. This study has several limitations to report as well. First, the data collected was cross-sectional data, which prevents making any causal inference between the explanatory and outcome measures. Secondly, the data on breast cancer screening is based on self-reporting regarding the frequency and age of the screening service, while NFHS-5 did not collect information on women's knowledge and attitude regarding preventive services could have produced a better picture of the associations. Despite these limitations, the study provides important insights regarding the prevalence and socio-demographic factors of cancer screening services which should be of particular interest among researchers and policymakers involved in cancer prevention projects.

Conclusion

This study looks at the factors affecting breast cancer screening among Indian women aged 15-49, using data from the NFHS-5 survey. The findings reveal alarmingly low screening rates, with significant disparities influenced by socio-demographic determinants. Urban residence, higher education, economic status was positively associated with increased screening uptake. On the other hand, women in rural areas, with less education and lower income, had lower screening rates. Cultural beliefs and lack of awareness also make it harder for some women to get screened. To improve these rates, it is important to strengthen the role of community health workers, offer more insurance coverage, and improve education and outreach programs. The strength of this study is derived from its use of national representative large-scale cross-sectionals from the NFHS-5, Indian version DHS based among all the states of India, which offers the general inability to the study findings. Based on the

study findings, its recommendation there is awareness about breast cancer screening should be increased through focused campaigns, especially for women in rural areas, those with low education, and from poor household. Mobile cancer screening should be integrated into existing maternal and primary healthcare services. Training programs for healthcare workers should be strengthened to improve early detection. For future research, longitudinal studies are needed to explore causal relationships. More research is required to understand cultural and social barriers to screening. Comparative studies between high and low performing states can help identify effective strategies.

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Availability of data and materials

Data and materials are freely available upon making an official request to DHS Team through the DHS website at https://dhsprogram.com/what-wedo/survey-Types/dHs.cfm

Ethics approval and consent to participate

No ethical approval was required as this study is based on survey data available in the public domain.

Consent for publication

Not applicable

Competing interests

We declare that we have no competing interest

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