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Original Research Article

Sociodemographic determinants of early and late presentation of breast cancer: a hospital-based cross-sectional study from a tertiary care centre in Western Uttar Pradesh, India

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ABSTRACT

Background: Breast cancer is the leading cancer among women in India, with late presentation substantially worsening treatment outcomes. Understanding sociodemographic profiles of early versus late presenters is essential for designing targeted interventions in tertiary care settings.

Methods: A hospital-based cross-sectional study was conducted at Sarojini Naidu Medical College, Agra, from 2023 to 2025, enrolling ninety-five breast cancer patients (≥18 years) attending OPD. Early presenters had no delay in seeking treatment after symptom recognition, whereas late presenters reported a delay. Sociodemographic characteristics (age, education, occupation, marital status, parity, family income) were collected using a pre-tested semi-structured questionnaire and analyzed using chi-square tests and multivariable logistic regression, with $p<0.05$ considered significant.

Results: Of 95 patients, 31 (32.6%) were early presenters and 64 (67.4%) late presenters. The mean age was 39.2±11.8 years; most were housewives, married and from lower-income families. Late presenters had a higher mean number of children (2.67±1.31 vs 1.87±1.01), and 53.1% had ≥3 children compared with 22.6% among early presenters. Illiteracy was independently associated with 5.2-fold higher odds of late presentation (95% CI 1.54–17.4). Homemaker status also significantly predicted delay, while breast self-examination practice and screening awareness were more common among early presenters.

Conclusions: Illiteracy, homemaker status and higher parity independently predicted late breast cancer presentation, with education level emerging as the strongest sociodemographic determinant. Greater reproductive burden was significantly associated with delays, underscoring the need for empowerment-focused, culturally sensitive interventions targeting low-literacy homemakers with higher parity, alongside structural health system strengthening to facilitate timely care.

Keywords: Breast cancer, Presentation delay, Sociodemographic factors, Early presenter, Late presenter, Breast self-examination

INTRODUCTION

Breast cancer incidence in India has risen dramatically, with an estimated 162,468 new cases and 87,090 deaths reported in 2018, making India the third globally after the United States and China.[1] In Northern India specifically, breast cancer rates continue to rise, with recent hospital-based studies documenting prevalence exceeding national averages.[2] The cancer incidence rate across India increased by nearly 35% from 1991 to 2021, while mortality rose 46% during the same period, underscoring the urgency of early detection and intervention.[3] Late presentation—defined as presentation beyond 3-6 months of symptom onset or at advanced disease stages (Stage III-IV)—remains alarmingly common. A recent North Indian hospital study reported 56.57% of breast cancer patients presented with late delays beyond 6 months, consistent with global LMIC patterns documenting 20-74% late or advanced-stage presentation rates.[4-5] Late presentation significantly compromises treatment success, correlates with larger tumor sizes, increased lymph node involvement, and higher metastatic disease rates, directly translating to inferior survival outcomes.[6]

India faces unique challenges in cancer control due to its diverse sociocultural and economic landscape. Low health literacy, cultural stigma, gender norms, and reliance on traditional healing systems contribute substantially to healthcare-seeking delays.[2-5] Women in lower socioeconomic strata face compounded barriers: financial limitations, weak referral pathways, shortages of trained healthcare providers, and limited access to screening facilities.[6] Gender dynamics further constrain women's healthcare autonomy, with household responsibilities, family prioritization, and reproductive burden often superseding personal health concerns.[2-5] Reproductive factors, particularly parity and number of children, represent important but understudied sociodemographic dimensions influencing healthcare-seeking behavior.

Higher parity is associated with increased household and childcare responsibilities, potentially limiting women's time and autonomy for self-care and healthcare access.[7,8] Women with multiple children face competing demands—financial constraints from larger family size, limited personal decision-making capacity, and reduced healthcare-seeking priority relative to family needs. These reproductive and social dimensions intersect with education and occupational status to create compounded barriers to timely presentation.[5] Sociodemographic factors consistently predict presentation timing across global literature. Studies document that lower education levels, rural residence, lower socioeconomic status, unemployment or informal occupation and limited health literacy significantly increase delayed presentation odds.[7,8] Particularly concerning, illiterate women and those with higher parity show substantially higher delay rates, while homemakers—though often overlooked in quantitative analyses—face unique barriers related to financial dependence and reduced decision-making autonomy.[5] Understanding the sociodemographic profile of early versus late presenters, including reproductive factors, is crucial for developing targeted interventions, planning resource allocation, and improving healthcare delivery in tertiary care settings. Context-specific data can guide design of community awareness programs, strengthen referral pathways, and identify high-risk populations requiring intensive education and support.[4,5]

Rationale

Western Uttar Pradesh, encompassing the Agra region, exhibits diverse sociodemographic characteristics with significant rural-urban differentials in healthcare access and health awareness. Limited quantitative data exist on specific sociodemographic patterns, particularly including reproductive factors, influencing breast cancer presentation in this region. This study is designed to fill this evidence gap and provide evidence-based findings for policy and program planning.

Study objectives

To characterize and compare the sociodemographic profiles of early and late presenters of breast cancer attending the OPD of a tertiary care hospital in Western Uttar Pradesh.

METHODS

Study design and setting

This is a hospital-based, cross-sectional, observational study conducted in the Department of Community Medicine and Department of Radiotherapy at Sarojini Naidu Medical College, Agra, Western Uttar Pradesh, India. The college is a tertiary care teaching hospital serving as a regional referral centre for patients from urban and rural areas within Western Uttar Pradesh and neighbouring districts. The hospital provides comprehensive breast cancer diagnostic, treatment, and management services.

Study duration

The study is conducted from 2023 to 2025 (24-month period).

Study population

Inclusion criteria

Women who have aged ≥18 years, registered for anti-cancer management at the hospital, attending the outpatient department, willing to provide informed written consent, and able to communicate in Hindi or English.

Exclusion criteria

Patients with recurrent or metastatic disease on follow-up treatment, patients with psychiatric illness or unable to provide reliable information, terminally ill patients.

Sample size

Sample size is calculated using NFHS-5 (2019-21) estimate of 1.2% prevalence of breast cancer screening among urban women.[9] Using formula $n=Z^2pq/e^2$ with

P=1.2%, q=98.8%, absolute error=2.5%: $n=(1.96)^2\times1.2\times 98.8/(2.5)^2\approx75$. After adding 10% non-response rate, minimum sample size required was 84. A total of 95 participants is enrolled to account for potential data quality issues.

Sampling: Consecutive sampling is used. All patients meeting inclusion criteria during the study period are enrolled systematically until the target sample size is achieved.

Data collection

Study instruments and data sources: A pre-tested, semi-structured questionnaire is administered through face-to-face interviews in the outpatient department while patients waited for consultations. The questionnaire, developed by the research team and adapted from previously published studies, is also pilot-tested for clarity, feasibility and cultural appropriateness. Written informed consent is obtained from all study participants before data collection. Participants were assigned unique identification codes, and no personal identifiers were stored in the analysis dataset.

Data collected included: part A: sociodemographic characteristics

Age (in years), religion/caste, marital status (married/unmarried/separated/widow), educational status (illiterate/primary/ high school/intermediate/graduate/ postgraduate), occupation (housewife, agricultural worker, skilled/unskilled worker, self-employed, service/professional), husband's occupation (where applicable), number of children currently living, family size and type (nuclear/joint), residential status (rural/urban), monthly household income (in Indian Rupees).

Part B: clinical presentation data

Age at breast cancer diagnosis, duration of symptoms before presentation, presenting symptoms (lump, pain, discharge, skin changes, ulceration, other), clinical stage of breast cancer at diagnosis, first point of care visited

Part C: barriers, facilitators, and health behaviors

Barriers to healthcare access (transport, financial, psychological, cultural, system-related), facilitators enabling timely care (healthcare provider recommendation, family support, workplace flexibility, awareness programs), breast self-examination practices and frequency, awareness of breast cancer screening, use of indigenous/alternative medicine, healthcare-seeking experiences and perceived mistreatment, clinical details including disease stage, date of first presentation, and tumor characteristics are also reviewed from hospital records.

Operational definitions

Early presenter: Patient with no delay in seeking treatment after symptom recognition.[10]

Late presenter: Patient who delayed seeking treatment after symptom recognition.[10]

Conceptual framework

The study was oriented by the Social Ecological Model-based framework proposed by Saldaña-Téllez et al, which classified barriers and facilitators at individual, interpersonal, organizational, sociocultural, and health policy levels.[11]

This multi-level approach enabled comprehensive understanding of factors influencing presentation timing, including reproductive burden as a dimension affecting household responsibilities and health autonomy.

Data management and analysis

Quality control and data entry: Data is entered into microsoft excel with built-in validation checks. A 10% random sample of completed questionnaires is selected for quality verification. Data is checked for completeness, consistency, and accuracy before analysis.

Statistical analysis: Descriptive statistics are calculated for all variables. Continuous variables are presented as mean±SD. Categorical variables are presented as frequencies and percentages. Sociodemographic characteristics are compared between early and late presenters using:

Chi-square (χ^2) test for categorical variables

Independent T-test for normally distributed continuous variables

Appropriate tests applied based on data distribution and sample size

Binary logistic regression analysis is also performed to identify independent sociodemographic predictors of late presentation. Univariate analysis is first conducted for each variable, and those associated with late presentation at $p\leq0.20$ are included in the multivariable model. Results are presented as adjusted odds ratios (aOR) with 95% confidence intervals (CI). Statistical significance is set at $p<0.05$ (two-tailed). All analyses are performed using SPSS version 25.0.

RESULTS

Demographic characteristics of study population

A total of 95 breast cancer patients attending the OPD during the study period met inclusion criteria and further enrolled. The sociodemographic characteristics of the study population are presented in Table 1.

Overall population profile

Mean age is 39.2±11.8 years (range: 18-65 years). The majority are middle-aged, with 26.3% aged 30-40 years, 25.3% aged 40-50 years and only 5.3% were below 20 years. Most participants are housewives (75.8%), reflecting a predominantly non-working female population. Educational status varied considerably: 50.5% are educated up to high school, 26.8% have higher education (graduate or postgraduate), and only 3.2% are illiterate. The large majority are married (70.5%), with smaller percentages unmarried (16.8%), separated (7.4%), or widowed (5.3%).

Table 1: Sociodemographic characteristics by presentation status.

Characteristics	Early presenters (n=31)	Late presenters (n=64)	P value
Age (years)			
<40	22 (71.0%)	31 (48.4%)	0.269
≥40	9 (29.0%)	33 (51.6%)	
Education			
Illiterate/primary	6 (19.4%)	51 (79.7%)	0.007
High school or higher	25 (80.6%)	13 (20.3%)	
Occupation			
Housewife	19 (61.3%)	53 (82.8%)	0.036
Working/employed	12 (38.7%)	11 (17.2%)	
Number of children			
Mean±SD	1.87±1.01	2.67±1.31	
0-1 child	10 (32.3%)	13 (20.3%)	0.004
2 children	14 (45.2%)	16 (25.0%)	
≥3 children	7 (22.6%)	35 (54.7%)	
Marital status			
Married	22 (71.0%)	45 (70.3%)	0.608
Unmarried/separated/widow	9 (29.0%)	19 (29.7%)	
Monthly income			
<₹20,000	19 (61.3%)	46 (71.9%)	0.765
≥₹20,000	12 (38.7%)	18 (28.1%)	

Reproductive profile

Mean number of living children is 2.36±1.22 (range: 0-5). Among the 95 women, 6.3% have no children, 18.9% have one child, 29.5% have two children, 24.2% three children, and 21.1% four or more children. This distribution reflects the predominantly reproductive-age population attending tertiary care for breast cancer management.

Other family characteristics

Regarding husband's occupations, agriculture is most common (35.8%), followed by private employment (17.9%). Monthly household income showed that 36.8% earned less than ₹10,000 and 31.6% earned ₹10,000-20,000, indicating that 68.4% of the population belonged to lower-income groups (<₹20,000 monthly).

Sociodemographic characteristics by presentation status

Breast self-examination practices

Breast self-examination (BSE) practice showed a clear and highly significant association with presentation status. Over half (54.8%) of women without delay reported practicing BSE compared to only 18.8% of those who delayed ($\chi^2=12.78$, $p<0.001$). This substantial difference indicates that BSE practice is strongly protective against delayed presentation.

Among women who did perform BSE, the frequency of practice is also significantly important (p=0.009). Monthly BSE is reported by 52.9% of women without delay but by none of those who delayed, whereas occasional BSE is much more common among women who delayed (81.8%) than among those without delay (29.4%). This indicates that irregular or occasional practice is insufficient; regular, particularly monthly, BSE practice is associated with earlier presentation.

Screening awareness

Prior awareness of breast cancer screening is significantly higher among early presenters (77.4%) than late presenters (51.6%) ($\chi^2=5.94$, p=0.016), suggesting that screening knowledge is protective against delayed presentation.

Source of information

The source of information about breast cancer (doctor, media, friends/family) did not show statistically significant association with delay status (p=0.165), although descriptively, women counselled by doctors are somewhat more represented in the non-delay group, while those informed mainly through media appeared more frequently in the delayed group.

Key barriers reported

The most frequently reported barriers included emotional distress (58.9%), lack of personal vehicle (66.3%), belief that symptoms would resolve spontaneously (41.1%), and social stigma (40.0%). Among women with higher parity (≥3 children), childcare responsibilities emerged as a prominent barrier (48.3% of those with ≥3 children vs 16.1% of those with <3 children). Financial constraints such as inability to afford diagnostic tests, lack of health insurance (57.9%), and high transport costs are also common. Additional barriers included discomfort with male doctors due to shyness/cultural norms (67.4%), reliance on alternative medicine beliefs, and inadequate healthcare system responsiveness (Figure 1).

Table 2: Multivariable logistic regression analysis of sociodemographic factors associated with late presentation.

Variables	Adjusted OR	95% CI	P value
Education (illiterate/primary vs higher)	5.20	1.54-17.4	0.007
Occupation (housewife vs working)	2.41	0.89-6.51	0.036
Number of children (≥3 vs <3)	2.78	1.18-6.54	0.019
Age (<40 vs ≥40 years)	0.62	0.18-2.14	0.269
Income (<₹20k vs ≥₹20k)	0.88	0.27-2.86	0.765
Marital status (married vs others)	1.04	0.35-3.09	0.608

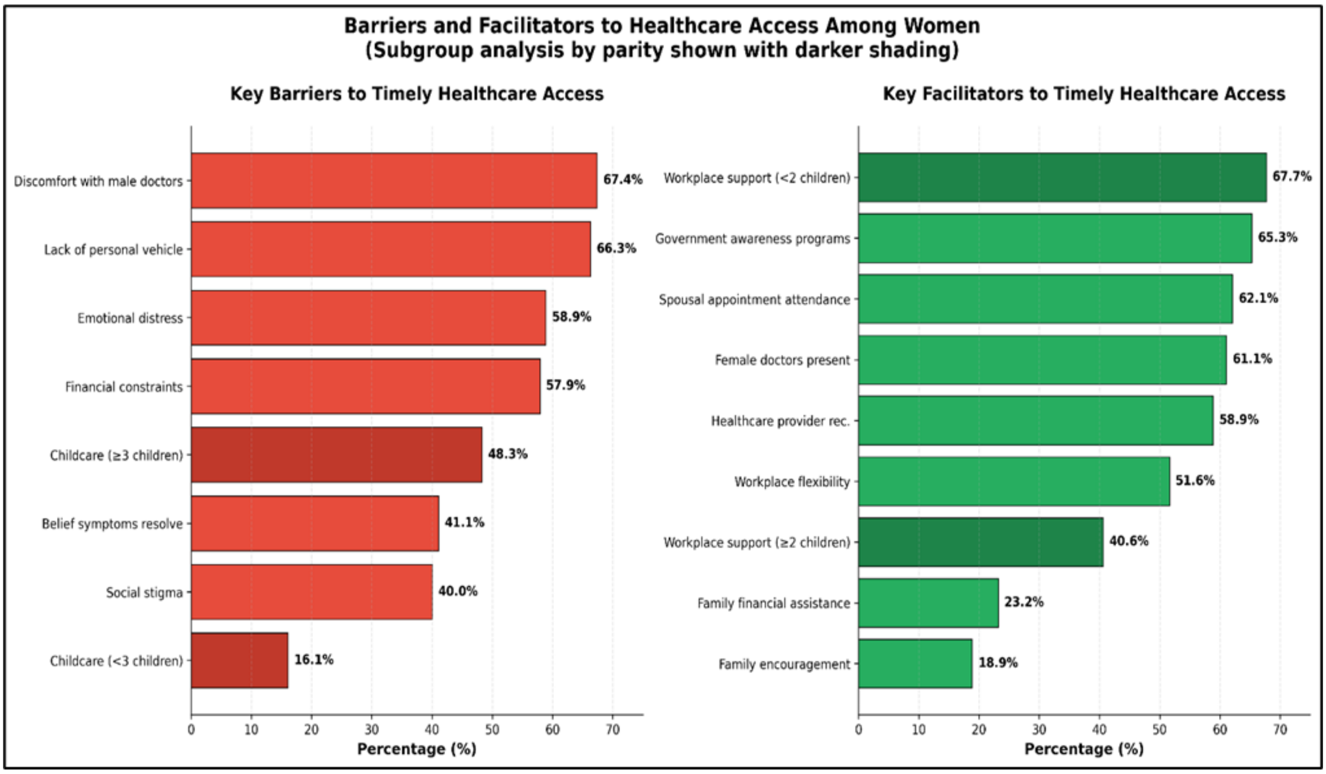

Figure 1: Barriers and facilitators to timely healthcare access among women with breast cancer, with subgroup.

Key facilitators reported

Important facilitators included healthcare provider recommendations (58.9%), government awareness programs (65.3%), presence of female doctors (61.1%), spousal appointment attendance (62.1%), family encouragement (18.9%), and financial assistance from family (23.2%). Workplace flexibility—particularly time off for treatment (51.6%)—and support from trained healthcare workers through motivation and counselling also facilitated timely care.

Among women with lower parity (<2 children), workplace support was more frequently cited (67.7% vs 40.6% for those with ≥2 children). (Figure 1). Notably, while awareness programs and healthcare worker contact were common in both delay and non-delay groups, they did not independently prevent delay (p>0.05), suggesting that awareness exposure alone is insufficient without individual empowerment and behavioral reinforcement.

Figure 2 illustrates the temporal dynamics of the care continuum, revealing a U-shaped trajectory where the initial "Awareness Phase" and final "Follow-Up and Recovery" stages exhibit the longest durations (peaking at ~12 months). A critical inverse relationship characterizes the diagnostic window: while the "Stage of Diagnosis" is temporally brief, it coincides with a resurgence in barrier intensity (e.g., misdiagnosis, late-stage presentation) and the lowest levels of facilitator support, highlighting a significant structural gap in the pathway.

Conversely, the post-diagnosis trajectory demonstrates a progressive rise in facilitator intensity—driven by interventions such as insurance schemes and survivorship programs—which appears to buffer the patient experience despite the re-emergence of high temporal duration and persistent financial barriers during recovery.

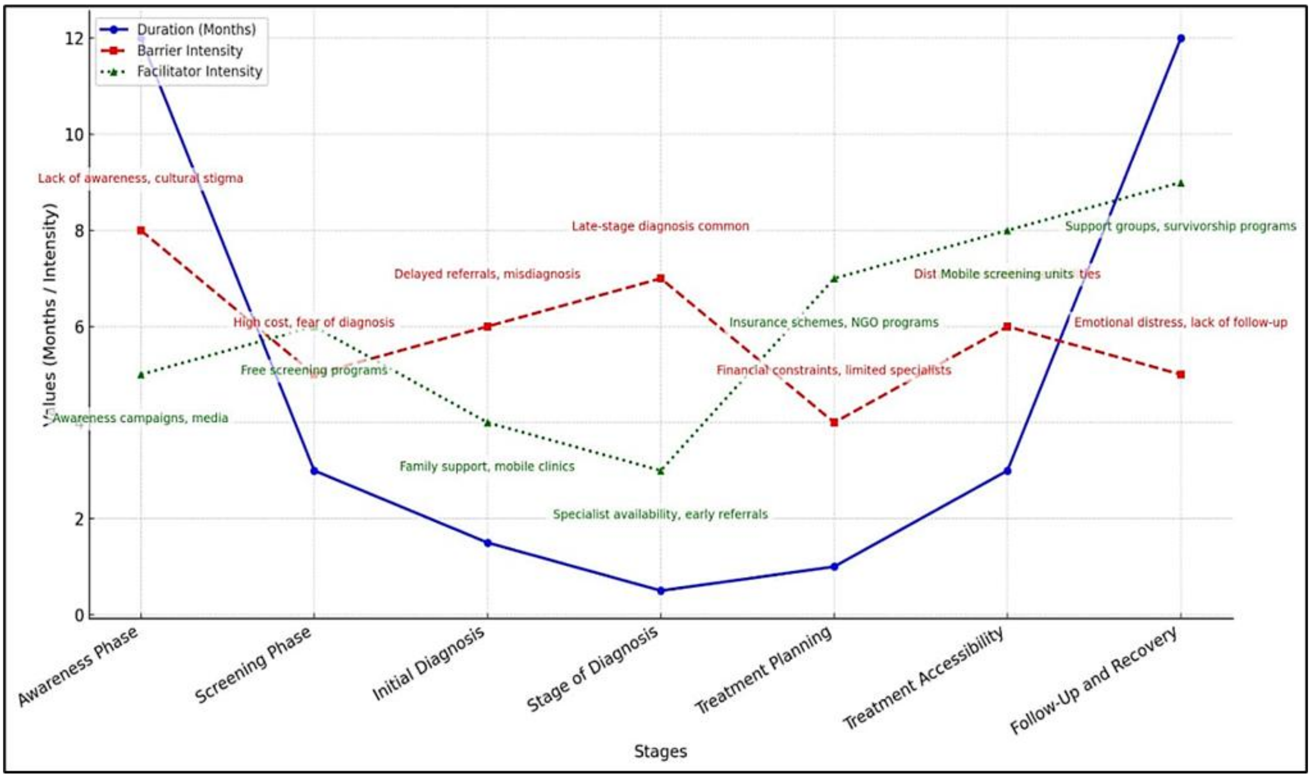

Figure 2: Timeline for early diagnosis and treatment with barriers and facilitators.

Illiteracy and low education emerged as the strongest independent predictor of late presentation. Women with illiterate or primary education have approximately 5.2 times higher odds of delayed presentation compared to those with high school or higher education (aOR=5.20, 95% CI 1.54-17.4, p=0.007). This fivefold increased risk underscores education as a critical determinant of presentation timing.

Housewife status is independently associated with increased odds of late presentation (p=0.036), indicating that domestic role and economic dependence significantly impede timely healthcare access. Having ≥3 children is independently associated with 2.78 times higher odds of late presentation compared to women with <3 children (95% CI 1.18-6.54, p=0.019). This novel quantitative finding highlights reproductive burden as a significant, independent sociodemographic determinant of presentation delay. Women with higher parity face compounded demands from larger families and correspondingly increased constraints on personal healthcare-seeking behavior. In contrast to education, occupation, and parity, age (<40 vs ≥40 years), marital status, and family income level are not independently associated with delay in multivariable analysis (all p>0.05). This finding suggests that individual age categories, marital arrangements, and income levels alone are insufficient predictors when education, occupation, and reproductive burden are accounted for; rather, structural factors related to education, economic autonomy, and family responsibilities appear more deterministic.

DISCUSSION

This hospital-based cross-sectional study from Western Uttar Pradesh systematically characterized sociodemographic profiles of early versus late breast cancer presenters and identified education as the dominant determinant, with novel findings regarding the independent impact of parity (number of children) on presentation timing. The study's key contributions are quantifying the independent impacts of illiteracy (5.2-fold increased delay odds), housewife status and reproductive burden (≥3 children: 2.78-fold increased delay odds), contributing novel evidence to the predominantly qualitative Indian literature on breast cancer delay. Late presentation affected 67.4% of the study cohort, exceeding the 56.57% reported in a comparable North Indian hospital study but falling within the 20-74% range documented across LMICs.[2-5]

This high prevalence—affecting nearly two-thirds of patients—represents a substantial public health challenge and underscores the urgency of multi-level interventions. Lower education (specifically illiteracy and primary education) is the single strongest independent predictor of late presentation (aOR=5.20, p=0.007), quintupling delay odds. Although only 3.2% of the cohort are completely illiterate, even this small subgroup exhibited substantially elevated delay risk. Kaur et al reported similar findings, documenting that low education and low socioeconomic status significantly increased perceived barriers, while our quantitative odds ratio provides precise effect magnitude.[12] In Western Uttar Pradesh, with documented rural-urban educational disparities, low education prevalence is substantially higher in rural and disadvantaged populations. These findings support urgent prioritization of targeted health education in regional languages, engaging community health workers, and integrating cancer awareness into existing literacy programs. Number of children emerged as a novel, independent sociodemographic predictor of late presentation. Women with ≥3 children have 2.78 times higher odds of delayed presentation than those with <3 children (aOR=2.78, 95% CI 1.18-6.54, p=0.019). This finding, uncommon in published breast cancer delay literature, highlights reproductive burden as a significant structural factor influencing healthcare-seeking behavior, 54.7% of late presenters have ≥3 children versus only 22.6% of early presenters. Mean number of children is significantly higher in late presenters (2.67±1.31 vs 1.87±1.01, t=-2.97, p=0.004), with the modal category shifting from 2 children (early presenters) to 3-4 children (late presenters).

This finding aligns with broader literature on gender equity and health, where women's reproductive roles constrain health autonomy.[12,13] The barriers reported—childcare responsibilities (48.3% among women with ≥3 children), financial constraints (71.9%), and reduced workplace flexibility (40.6% among those with ≥2 children)—directly relate to parity-associated constraints. Housewife status significantly predicted delay (p=0.036), representing a novel quantitative validation of qualitative findings.

Our study aligns with Kaur et al, who documented that prioritizing family duties over personal health (70.2%) and economic dependence heighten barriers.[12] Nandini et als qualitative work similarly highlighted financial constraints and weak family support as key reasons for late presentation.[13] This finding underscores that delay is not merely due to lack of awareness but reflects deeper gender inequities in health autonomy. Interventions must go beyond information provision to address women's empowerment, financial independence, and decision-making capacity.

Strategies should include spousal engagement in counseling, financial literacy programs, and community leadership involvement in normalizing independent health-seeking behavior. Notably, age, marital status, and income level alone were not independent predictors in multivariable analysis. This finding contrasts with some literature but reinforces those structural factors (education, occupation role, reproductive burden) matter more than demographic categories alone. Awareness program participation, despite being common (65.3% attended government programs), did not independently prevent delay, consistent with Palaniraja et al's observation that awareness exposure alone is insufficient without behavioral reinforcement and system-level support. 14BSE practice showed robust protection against delay (54.8% early vs 18.8% late, p<0.001), with monthly practice significantly more effective than occasional practice (p=0.009). This finding emphasizes translating general awareness into concrete behavioral actions—consistent with Kathrikolly et al's emphasis on culturally sensitive strategies promoting individual preventive practices.[15]

Study limitations

Single-center design may limit generalizability to other regions and healthcare settings. Self-reported data introduces recall bias regarding symptom onset, time intervals, and awareness program participation.

CONCLUSION

This hospital-based cross-sectional study from Western Uttar Pradesh identified education level—specifically illiteracy and low education—as the strongest independent sociodemographic determinant of late breast cancer presentation, quintupling delay odds. Housewife status additionally predicted delay, reflecting gender inequities in health autonomy and financial independence. Breast cancer presentation delays in this population are driven less by simple lack of awareness and more by intersecting sociodemographic and structural barriers, particularly low educational attainment, limited economic/decision-making autonomy, and reproductive burden (higher parity). Addressing these determinants requires multi-level interventions targeting women's education and empowerment, family engagement, reproductive health-aware service delivery, and health system strengthening rather than awareness campaigns alone. Targeted efforts to improve healthcare access and cancer literacy in educationally disadvantaged populations, coupled with gender-transformative strategies enhancing women's autonomy and accommodating family responsibilities, have substantial potential to reduce presentation delays and improve breast cancer outcomes in Western Uttar Pradesh and similar resource-constrained settings.

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