RESEARCH ARTICLE

Editorial Process: Submission:12/15/2025 Acceptance:07/18/2026 Published:07/28/2026

Determinants of System and Patient Delays in Breast Cancer Diagnosis and Treatment: A Multi-Level Observational Analysis in a Tertiary Care Setting

Pratibha Singh[1]*, Renu Agrawal[1], Surabhi Gupta[2]

Abstract

Background: Delays in breast cancer diagnosis and treatment significantly impact patient outcomes. Understanding the determinants of system-related and patient-related delays is crucial for improving cancer care pathways. **Objectives:** To identify and analyse the sociodemographic, clinical, psychological, and awareness factors associated with system and patient delays in breast cancer diagnosis and treatment in a tertiary care setting. **Methods:** A cross-sectional observational study was conducted at a tertiary care hospital involving 95 breast cancer patients. Participants were interviewed using a comprehensive questionnaire assessing sociodemographic factors, barriers and facilitators to care, clinical characteristics, and psychological factors. Bivariate and multivariate logistic regression analyses were performed to identify significant associations. **Results:** Illiteracy (OR = 5.20, p = 0.007) and housewife status (p = 0.036) were significant predictors of patient delay. Major barriers included financial constraints (67.4%), fear of excessive treatment (40%), discomfort with male doctors (67.4%), and transportation challenges (66.3%). Healthcare provider recommendations (58.9%), female doctors (61.1%), and spousal support (62.1%) were key facilitators. Multivariate analysis revealed that the first point of care (p = 0.009), emotional distress (p = 0.041), and personal shyness (p = 0.007) significantly influenced delays. Homeopathy use was associated with delay (p = 0.010), while early breast self-examination practice was protective (p = 0.000). **Conclusions:** Delays in breast cancer care are multifactorial, stemming from sociodemographic disparities, cultural beliefs, psychological factors, and system-level challenges. Interventions addressing health literacy, gender-sensitive care, financial assistance, and family/workplace support are essential for reducing delays and improving treatment outcomes.

Keywords: Breast cancer- Patient delay- System delay- Multi-Level Hierarchical Determinants

Asian Pac J Cancer Prev, **27 (7)**, 2681-2688

Introduction

Breast cancer remains the most common malignancy among women, representing a significant public health burden globally and in India [1]. Early detection and timely treatment are critical determinants of survival and quality of life [2]. Delays in cancer care are classified into two categories: system delay (time from first medical contact to definitive diagnosis or treatment initiation) and patient delay (time from symptom onset to first medical consultation) [3]. Both types of delays have been associated with advanced disease stage at presentation and reduced survival rates [4].

In the Indian context, multiple factors contribute to delays in breast cancer care, including socioeconomic constraints, limited health literacy, cultural beliefs, inadequate awareness, transportation barriers, and limited access to specialized healthcare facilities [5]. Additionally, gender-specific issues such as reluctance to disclose symptoms to male healthcare providers and social stigma further compound delays [6]. This tertiary care observational study aimed to comprehensively identify and analyze the multifactorial determinants of system and patient delays in breast cancer diagnosis and treatment.

Materials and Methods

Study Design and Setting

A cross-sectional observational study was conducted at a tertiary care hospital in western Uttar Pradesh from 2023 to 2025 (24-month period).The hospital serves as a regional referral center for cancer care with dedicated oncology and surgical departments.

Study Population and Sample

A total of 95 breast cancer patients aged ≥20 years, with confirmed diagnosis, were enrolled using purposive sampling based on willingness to participate and

*[1]Department of Community Medicine, SN Medical College, Agra, Uttar Pradesh, India. [2]Department of Radiotherapy, SN Medical College, Agra, Uttar Pradesh, India. *For Correspondence: pratibhasingh86547@gmail.com*

availability.

Inclusion Criteria

1. Women aged ≥18 years
2. Registered for anti-cancer management at the hospital
3. Attending the outpatient department
4. Willing to provide informed written consent
5. Able to communicate in Hindi or English

Exclusion Criteria

1. Patients with recurrent or metastatic disease on follow-up treatment
2. Patients with psychiatric illness or unable to provide reliable information
3. Terminally ill patients (Diagram 1)

Data Analysis

Descriptive statistics (frequencies, percentages) were calculated for all variables. Bivariate analysis using chi-square tests identified associations with $p < 0.05$ considered statistically significant. Multivariate logistic regression analysis identified independent predictors with calculation of odds ratios (OR) and 95% confidence intervals (CI).

Ethical Considerations

The study is approved by the Institutional Ethics Committee (IEC) of SN Medical College, Agra (SNMC/IEC/DHR/2024/112). Informed written consent was obtained from all participants with maintenance of confidentiality.

Results

This comprehensive infographic illustrates the hierarchical structure of determinants affecting breast cancer delays across five distinct levels, with color-coded significance indicators and odds ratios for each factor (Figure 1).

Among 95 participants, the majority (51.6%) were middle-aged (30-50 years), with 75.8% being housewives. Education varied: 50.5% were educated up to high school, 26.8% had higher education, and 3.2% were illiterate. Married women constituted 70.5% of the sample. Monthly household income was predominantly low, with 68.4% earning <₹20,000 monthly.

Multivariate logistic regression identified education level as a significant predictor of patient delay ($p = 0.007$). Illiterate women had 5.20 times higher odds of patient delay (95% CI: 1.54-17.40) compared to literate women. Occupation showed significant association ($p = 0.036$), with housewife status associated with higher delay risk compared to working women. Age, marital status, and monthly income were not significantly associated with delay type after multivariate adjustment.

The multi-level framework demonstrates that delays are not caused by single factors but emerge from the complex interaction of five distinct levels:

Sociodemographic Level

Illiteracy (OR=5.20) emerges as the strongest independent predictor, followed by housewife status (OR=2.15). These represent reduced health literacy and limited occupational exposure to healthcare information, rather than mere poverty.

Individual/Psychological Level

Financial barriers were substantial: 67.4% faced family financial issues, 57.9% had no health insurance, and 27.4% experienced income loss due to breast cancer. Patient-related barriers included fear of excessive treatment (40%), high cost of care (30.5%), and alternative treatment preference (16.8%). Emotional distress (OR=2.24) and personal shyness (OR=2.67) are significant but often overlooked determinants. Fear of death and cultural

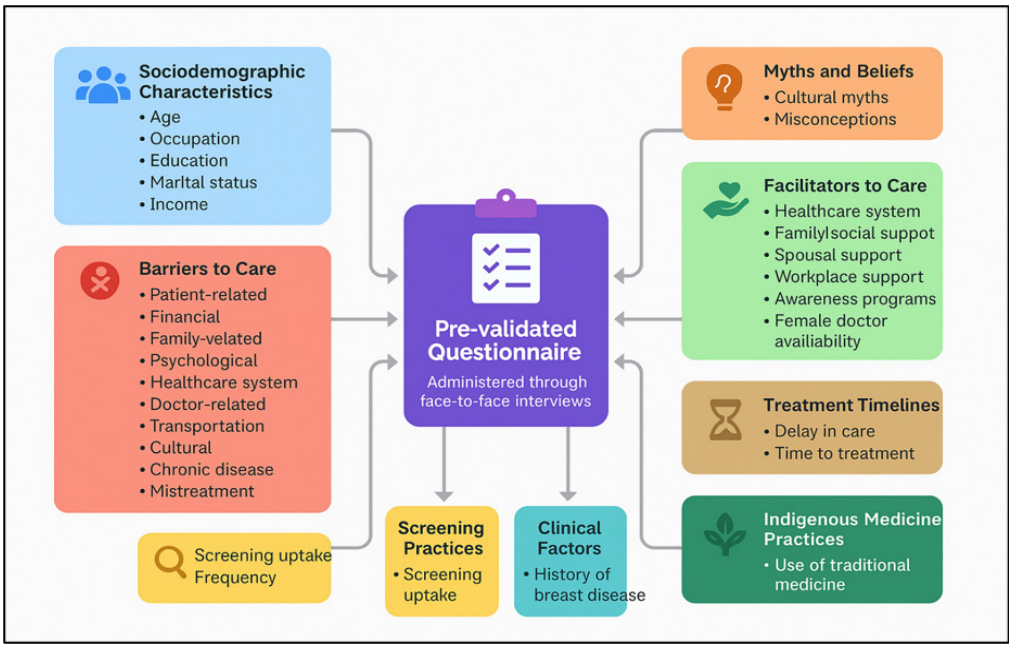

Diagram 1. Hierarchy Showing the Data Collection Process

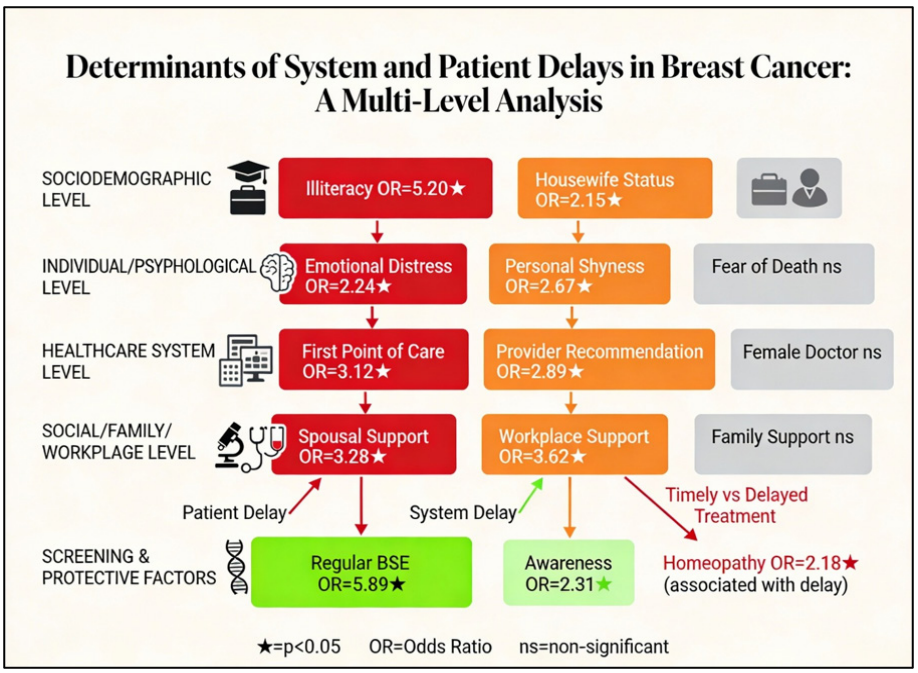

Figure 1. Multi-Level Hierarchical Determinants of Breast Cancer Delays

myths, while prevalent (62.1% believed breast cancer was punishment, 61.1% held family history-only myth), do not independently predict delay, suggesting that awareness alone without structural support is insufficient.

Healthcare System Level

67.4% expressed discomfort with male doctors due to shyness or cultural norms. First point of care showed significant association with delay (p = 0.009). Those initially consulting primary care physicians (54.7%) experienced greater delays compared to those visiting specialists directly (3.1% of delayed group). Healthcare provider recommendations (OR=2.89) emerge as a powerful modifiable factor. The choice of first medical contact dramatically influences outcomes primary care physician consultation creates a 3.12-fold higher risk compared to specialist consultation.

Social/Family/Workplace Level

Spousal support: 62.1% had spouses attending appointments, 27.4% received encouragement for adherence, and 10.5% participated in support groups.

Workplace facilitators

Time off for treatment (51.6%), emotional support from colleagues (27.4%), and financial support (13.7%) helped reduce practical barriers. Spousal emotional support (OR=3.28) and workplace support (OR=3.62) are among the strongest predictors, demonstrating that supportive contexts are as important as clinical factors.

Screening and Protective Factors Level

Breast self-examination was significantly protective against patient delay (p = 0.000). Among women without delay, 54.8% performed breast self-examination compared to only 18.8% among those who delayed. Frequency of practice was important (p = 0.009): monthly BSE was reported by 52.9% of women without delay but by none of those who delayed, whereas occasional BSE was much more common among delayed presenters (81.8%). Regular monthly breast self-examination (OR=5.89) is the single most protective factor stronger than any barrier.

Clinical Factors and Type of Delay

No statistically significant associations were found between type of delay (system vs. patient) and history of breast disease or family history of breast cancer. History of breast disease was absent in 92.8% of system delay and 100% of patient delay cases. Family history was absent in 86.7% of system delay and 91.7% of patient delay cases. These findings suggest that delays operate at both system and patient levels across similar patient profiles.

Treatment Initiation and Referral Timelines

No significant differences were observed in treatment initiation timing between early and delayed presenters (p = 0.858). Most initiated treatment within 1 week (54.8% of non-delay group vs. 54.7% of delay group). Specialist referral was similarly comparable (p = 0.801): 67.7% of early presenters and 60.9% of delayed presenters received referrals within 1 week. Reasons for delay included personal circumstances (54.8% vs. 60.9%), insurance-related issues (12.9% vs. 18.8%), and administrative problems (32.3% vs. 20.3%), with no significant difference (p = 0.409). These findings indicate that once within the healthcare system, treatment pathways are comparable regardless of initial delay in seeking care.

Indigenous Medicine Use and Type of Delay

A significant association was found between indigenous medicine use and delay (p = 0.010). Delayed presenters more frequently used homeopathy (64.1%) and Ayurveda

(20.3%), while early presenters more often practiced yoga (35.5%). Cultural beliefs (71.9%) and previous positive experiences (15.6%) were common reasons for preferring alternative medicine. Distrust of conventional medicine (12.5%) was observed only among delayed participants, suggesting that exclusive reliance on alternative medicine may postpone conventional care-seeking.

Intervention Leverage Points and Strategic Framework
Multi-Domain Intervention Leverage Points

This radial/petal design visualization shows six critical intervention domains sized and colored to represent patient reach potential and impact magnitude, with each domain identified as a strategic priority (Figure 2).

The circular/radial framework identifies six critical domains where interventions can be targeted to reduce delays.

Each intervention domain is sized and colored to represent the number of patients it can potentially reach and its impact magnitude:
Screening Education (59 patients reachable; Highest Impact)

Regular monthly BSE with OR=5.89 represents the single most powerful intervention lever. Breast self-examination was significantly protective against patient delay (p = 0.000). This should be the centerpiece of any delay reduction strategy, with emphasis on consistency, frequency, and self-confidence building rather than awareness alone.

Health Literacy & Occupational Empowerment (75 patients; High Impact)

Illiteracy (OR=5.20) and housewife status (OR=2.15) highlight that educational interventions must extend beyond disease awareness to include general health literacy, occupational opportunities, and economic empowerment. Women with independent income and workplace exposure to health information show earlier presentation.

Financial Support & Insurance (64 patients; Critical Bottleneck)

With 67.4% reporting financial barriers and 57.9% lacking insurance, this represents the largest bottleneck. The comparable treatment outcomes once patients reach the system indicates that cost barriers primarily affect access to diagnosis, not subsequent care quality. Insurance schemes and cost assistance programs should be prioritized.

Gender-Sensitive Healthcare (64 patients; Culturally Significant)

The 67.4% discomfort with male providers is significant and actionable. While female doctor availability (61.1%) is important, its independent effect in multivariate analysis is modest, suggesting that gender-sensitivity in communication from all providers may be as important as provider gender itself.

Family & Spousal Engagement (62 patients; Powerful Social Determinant)

With spousal support showing OR=3.28 and workplace support OR=3.62, interventions should explicitly engage families and employers. Spousal awareness and encouragement, coupled with workplace policies allowing treatment time, represent powerful forces. Spousal support: 62.1% had spouses attending appointments,

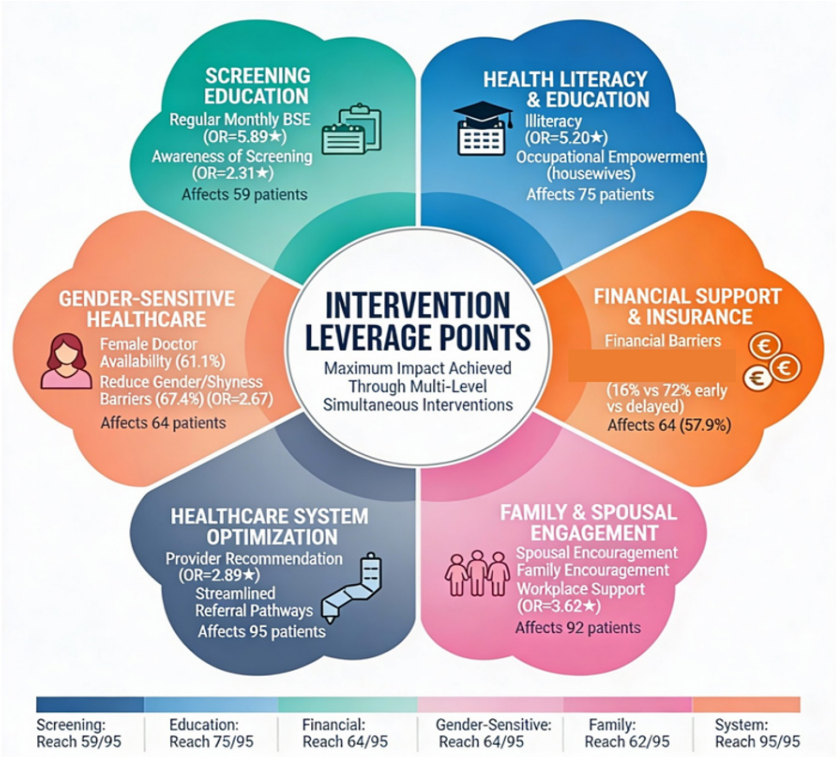

Figure 2. Multi-Domain Intervention Leverage Points for Reducing Breast Cancer Delays

demonstrating the critical role of intimate partnerships.

Healthcare System Optimization (All 95 patients; Universal Impact)

First point of care selection (OR=3.12) and provider recommendations (OR=2.89) highlight that system-level changes particularly strengthening primary-to-specialty referral pathways and training providers in persuasive health communication can benefit the entire patient population.

Patient Journey Timeline and Intervention Windows

This horizontal timeline visualization demonstrates three distinct phases in the breast cancer care journey (Patient Delay Phase in red, System Delay Phase in orange, Treatment Phase in green), showing specific barriers, intervention windows, and patient flow numbers through each phase (Figure 3).

The timeline visualization reveals three distinct phases in the breast cancer care journey, each with specific challenges and intervention opportunities

Phase 1

Patient Delay Phase (0-6+ months from symptom recognition)

Represents the longest and most variable phase. Key barriers emerge immediately

Symptom misperception

- 41% think symptoms "not serious"
- Fear of excessive treatment: 40%
- Emotional distress: 58.9%

Intervention Window

Early detection through screening (BSE, clinical examination) can bypass symptom misperception entirely. For symptomatic presentations, clear health messaging about red flags and immediate provider contact is essential. Family/spousal encouragement at this stage is critical.

Phase 2

System Delay Phase (typically 1-4 weeks from first contact)

Surprisingly uniform across early and delayed presenters, with comparable timelines. However, the choice of first contact point (p=0.009) creates 3.12-fold difference in delays at this stage

Primary care physicians

Longer delays (requires referral step)

Specialists

Minimal delays (diagnostic imaging immediately)

Intervention Window

Community awareness should emphasize direct specialist consultation or urgent PCP referral protocols. Healthcare system can implement rapid-access pathways for breast symptoms (similar to chest pain protocols in cardiology).

Phase 3

Treatment Phase (1-7+ days from diagnosis)

Shows minimal variation (p=0.858), with 54.8% initiating treatment within 1 week regardless of prior delays. This indicates adequate system capacity once diagnosis confirmed.

Critical Finding

System delays post-diagnosis are minimal; the critical bottleneck is in achieving diagnosis. The timeline analysis reveals that total delay from symptom to treatment ranges from 1-3 months in early presenters versus 6+ months in delayed presenters. The entire difference resides

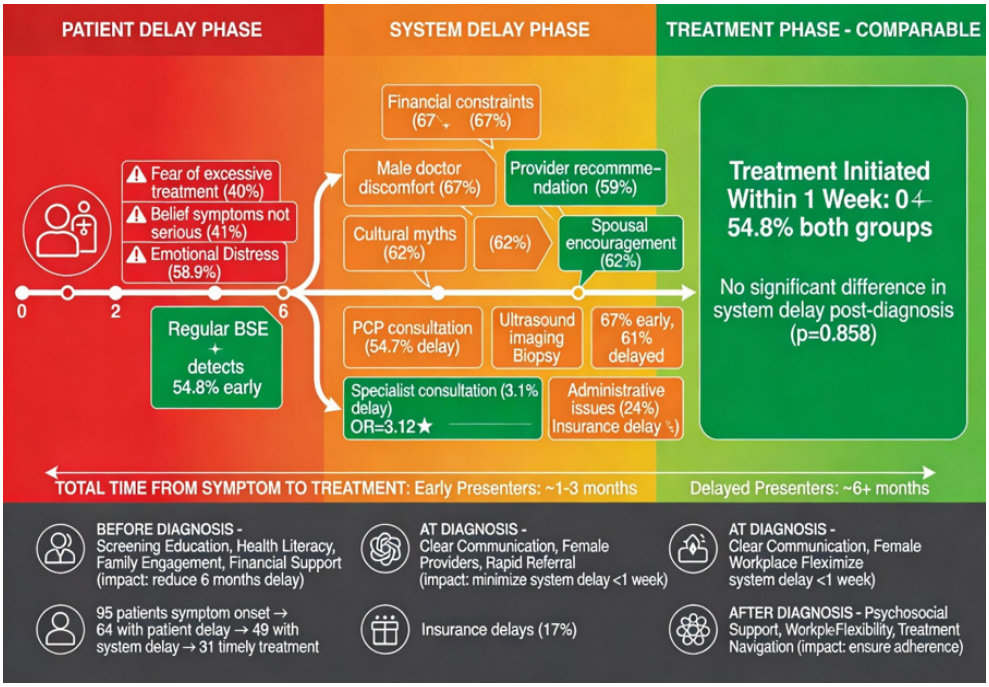

Figure 3. Patient Journey Through Breast Cancer Care - Timeline of Delays and Intervention Opportunities

in the patient delay phase, underscoring that patient empowerment through education, family engagement, and financial support are more impactful than healthcare system efficiency measures for reducing total delays.

Patient Flow Through System

95 patients at symptom onset → 64 experience patient delay (67.4%) → 49 with system delay (51.6%) → 31 achieve timely treatment (32.6%)

Discussion

Sociodemographic Determinants of Delays

This study identified education level and occupation as significant independent predictors of patient delay in breast cancer presentation.Illiterate women had 5.2 times higher odds of delayed presentation(OR=5.20,p= 0.007),underscoring the central role of functional health literacy in facilitating early care-seeking [7]. Similar associations have been reported by Paasche-Orlow et al., who demonstrated that limited health literacy adversely affects preventive health behaviours and timely healthcare utilization [7]. Baker et al. further observed increased mortality among individuals with poor health literacy, highlighting its long-term impact on health outomes [8].

However,in contrast to our findings, Sreekutty et al. reported that while education was associated with stage at presentation,it did not remain independently significant after multivariate adjustment,suggesting regional variation in the strength of this association [4]. This variation may reflect contextual differences in healthcare accessibility,cultural norms and the effectiveness of public awareness programs.

Housewife status was significantly associated with delay(p=0.036),suggesting that economic dependence and limited exposure to structured social networks may restrict healthcare autonomy. Chou et al.observed that participation in workplace health programs improved cancer screening uptake [9], supporting our finding that occupational engagement may serve as a protective social determinant.Conversely,some studies in urban populations have shown minimal occupational influence after adjusting for education and income,indicating that the protective effect of employment may be stronger in semi-urban or resource-limited settings such as ours.

Interestingly,income level alone was not independently associated with delay,despite 67.4% reporting financial constraints. Wang et al. similarly noted that perceived financial barriers often coexist with educational and informational gaps rather than functioning as isolated determinants [10]. This contrasts with studies from low-income African settings where household income was the strongest predictor of diagnostic delay.The discrepancy suggests that in tertiary-care-accessible regions,financial barriers may influence access indirectly through health literacy and decision-making pathways rather than absolute affordability.

Multi-Level Barriers and their Association with Delays

The multi-layered nature of delays observed in this study reinforces the concept that breast cancer delay is not unidimensional.First point of care significantly influenced delay(p=0.009).

Patients initially consulting primary care physicians experienced longer diagnostic pathways compared to those directly approaching specialists.Dey et al.similarly emphasized referral inefficiencies as a contributor to diagnostic delay in India [11]. However, Medeiros et al.reported more pronounced system-level delays in public-sector hospitals compared to teaching institutions [3], suggesting institutional differences in referral efficiency.

Emotional distress(p=0.041) and personal shyness (p=0.007) emerged as independent contributors. Arora et al. [13] demonstrated that psychosocial barriers significantly mediate information access and healthcare engagement. This highlights the contextual importance of culturally embedded psychological barriers in northern Indian populations.

Transportation barriers and cultural myths were prevalent but not independently significant.This differs from findings by Rai et al., who identified transportation distance as a strong predictor of delayed diagnosis in rural cohorts [5]. The absence of independent significance in our study may reflect improved road connectivity and tertiary referral access in Western Uttar Pradesh compared to more remote regions.

Facilitators and Their Impact on Reducing Delays

Healthcare provider recommendation was a strong facilitator (OR = 2.89,p=0.007),aligning with evidence that physician endorsement substantially increases screening and treatment adherence.Bish et al. demonstrated that provided ressurance and direct advice reduce symptom appraisal delay [6]. Our findings further quantify this effect in a multilevel framework.

Spousal support(62.1 %) and workplace facilitation were among the strongest contextual enablers. This supports social support theory,wherein family reinforcement reduces decisional conflict and emotional burden.Interesting,while female doctor availability was widely valued(61.1%),it did not retain independent significance in regression analysis.This differs from studies in conservative Middle Eastern settings where gender concordance was a dominant predictor of early presentation.The variation suggests that gender senstivity in communication may be as influential as provider gender itself in this population.

Screening Practices as Protective Factors against Patient Delay

Breast self-examination(BSE) demonstrated the strongest protective association(p=0.000).Early presenters were three times more likely to practice BSE regularly. Nagar et al. also emphasized that structured community education improves early detection behaviours [12]. However,unlike mass screening models reported by Chou et al. [9], where organized screening programs drove early detection,our findings suggest that individual-level self-practice plays a larger role in settings without universal mammography coverage.

Notably,awareness source did not independently

predict delay.This contrasts with studies from high-income countries where organized public screening campaigns significantly alter presentation timelines.The variation suggests that awareness alone is insufficient unless translated into habitual preventive behaviour.

Alternative Medicine Use and Type of Delay

A significant association was observed between homeopathy use and delayed presentation(p=0.010). While alternative medicine utilization is common in South Asian contexts,its relationship with delay varies. Rai et al.reported similar trends in northern India [5], whereas some integrative onclogy studies suggest that complementary therapies do not necessarily delay conventional care when used adjunctively.

In our study, yoga practice was more common among early presenters, suggesting that health-conscious behaviors may cluster together. Arora et al. highlighted that distrust in conventional medicine mediates care avoidance [13], which aligns with the 12.5% distrust observed exclusively among delayed participants. These findings underscore the need for culturally integrative counseling rather than dismissive discouragement of traditional practices.

Type of Delay and Treatment Pathways

Importantly, no significant differences were observed in treatment initiation or referral timelines once patients entered the healthcare system. This finding contrasts with earlier reports by Richards et al., who linked system delays directly with poorer survival outcomes [2]. Our data suggest that, within a tertiary care setting, system efficiency post-diagnosis may be adequate.

The major variation lies in the pre-diagnostic phase, reinforcing that patient delay rather than treatment delay is the primary bottleneck in this setting. This aligns with Medeiros et al., who emphasized symptom appraisal delay as the longest component of total delay [3]. The implication is that public health interventions should prioritize early symptom recognition and healthcare engagement rather than solely focusing on tertiary infrastructure expansion.

In conclusion, this tertiary care observational study reveals that delays in breast cancer diagnosis and treatment are multifactorial, with education level and occupational status emerging as significant sociodemographic determinants of patient delay. While financial constraints are frequently reported (67.4%), health literacy appears more proximal in determining timely care-seeking. First point of care, emotional distress, personal shyness, and cultural beliefs significantly influenced delays through multiple pathways.

Regular breast self-examination practice was significantly protective (p = 0.000), while exclusive reliance on homeopathy was associated with delay (p = 0.010). The critical role of healthcare provider recommendations, female doctors, spousal support, and workplace facilitation in promoting timely presentation underscores that healthcare-seeking is embedded within social and institutional contexts.

Once patients access the healthcare system, treatment timelines are comparable regardless of initial delays, emphasizing that prevention of initial delays is paramount. Effective interventions must simultaneously address health literacy, normalize breast cancer discussions across genders and cultures, strengthen family engagement, reduce gender-based hesitation through female provider availability, create organizational environments supporting medical access, and streamline referral pathways. These integrated, multi-level approaches, adapted to local cultural contexts, offer the greatest promise for reducing breast cancer diagnostic and treatment delays and improving outcomes in tertiary care settings.

Author Contribution Statement

All authors contributed equally in this study.

Acknowledgements

None.

References

1. IARC. International Agency for Research on Cancer [Internet]. 2018. Available from: https://www.iarc.who.int/ [cited 2018 Sept 12]
2. Richards MA, Westcombe AM, Love SB, Littlejohns P, Ramirez AJ. Influence of delay on survival in patients with breast cancer: A systematic review. Lancet. 1999;353(9159):1119-26. https://doi.org/10.1016/s0140-6736(99)02143-1.
3. Medeiros GC, Thuler LCS, Bergmann A. Delay in breast cancer diagnosis: a Brazilian cohort study. Public Health. 2019;167:88-95. https://doi.org/10.1016/j.puhe.2018.10.012.
4. J SS, Rohini AM, Thajudheen RB, Elavally S. Determinants of Patient Delay among Women with Carcinoma Breast. Asian Pac J Cancer Prev. 2023;24(9):3109-3115. https://doi.org/10.31557/APJCP.2023.24.9.3109.
5. Rai A, Sharda P, Aggarwal P, Ravi B. Study of Diagnostic Delay among Symptomatic Breast Cancer Patients in Northern India: A Mixed-Methods Analysis from a Dedicated Breast Cancer Centre. Asian Pac J Cancer Prev. 2022;23(3):893-904. https://doi.org/10.31557/APJCP.2022.23.3.893.
6. Stiefel F. Understanding why women delay in seeking help for breast cancer symptoms. J Psychosom Res. 2006;60(3):309-10; author reply 11. https://doi.org/10.1016/j.jpsychores.2006.01.005.
7. Paasche-Orlow MK, Wolf MS. The causal pathways linking health literacy to health outcomes. Am J Health Behav. 2007;31 Suppl 1:S19-26. https://doi.org/10.5555/ajhb.2007.31.supp.S19.
8. Baker DW, Wolf MS, Feinglass J, Thompson JA, Gazmararian JA, Huang J. Health literacy and mortality among elderly persons. Arch Intern Med. 2007;167(14):1503-9. https://doi.org/10.1001/archinte.167.14.1503.
9. Chou P, Chen V. Mass screening for cervical cancer in Taiwan from 1974 to 1984. Cancer. 1989;64(4):962-8. https://doi.org/10.1002/1097-0142(19890815)64:4<962::aid-cncr2820640432>3.0.co;2-b.
10. Wang L, Strigel RM. Supplemental Screening for Patients at Intermediate and High Risk for Breast Cancer. Radiol Clin North Am. 2021;59(1):67-83. https://doi.org/10.1016/j.rcl.2020.09.006.
11. Dey S, Sharma S, Mishra A, Krishnan S, Govil J, Dhillon PK. Breast Cancer Awareness and Prevention Behavior Among Women of Delhi, India: Identifying Barriers to Early Detection. Breast Cancer (Auckl). 2016;10:147-156. https://

doi.org/10.4137/BCBCR.S40358.
12. Nagar A, Madamanchi D, Nair GR, Revikumar A, Ray S, Vajjala SM, et al. Barriers to Cancer Diagnosis and Treatment: A Pilot Qualitative Study of Patient and Practitioner Perspectives in Rural India. Cureus. 2024;16(8):e67249. https://doi.org/10.7759/cureus.67249.
13. Arora NK, Johnson P, Gustafson DH, McTavish F, Hawkins RP, Pingree S. Barriers to information access, perceived health competence, and psychosocial health outcomes: test of a mediation model in a breast cancer sample. Patient Educ Couns. 2002;47(1):37-46. https://doi.org/10.1016/s0738-3991(01)00170-7.