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# DETERMINANTS OF DELAY IN BREAST CANCER DIAGNOSIS AND TREATMENT: A CROSS-SECTIONAL STUDY AT LADY READING HOSPITAL, PESHAWAR

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## ABSTRACT

**BACKGROUND:** : Delayed diagnosis and treatment of breast cancer significantly impact patient outcomes and survival rates. In developing countries, healthcare system challenges and patient-related factors contribute to diagnostic delays, leading to advanced disease presentation and poor prognosis.

**OBJECTIVE:** To assess the extent of delays in breast cancer diagnosis and treatment among patients presenting to Lady Reading Hospital and identify associated factors contributing to these delays.

**METHODOLOGY:** A cross-sectional study was conducted among 384 newly diagnosed breast cancer patients from 1st January 2024 to 30th December 2024. Data were collected through structured interviews and medical record reviews. Delays were categorised into patient delay, provider delay, and treatment delay.

**RESULTS:** The median patient delay was 12 weeks (IQR: 6-20), provider delay was 8 weeks (IQR: 4-14), and treatment delay was 6 weeks (IQR: 3-10). About 68.5% of patients presented with Stage III/IV disease. Significant associations were found between longer delays and rural residence ($p<0.001$), lower education levels ($p=0.002$), and financial constraints ($p<0.001$).

**CONCLUSION**: Substantial delays in breast cancer diagnosis and treatment result in advanced disease presentation. Immediate implementation of better healthcare access, patient education, and an efficient system is essential for better breast cancer outcomes in resource-constrained settings.

**KEY WORDS:** Breast Neoplasms, Diagnostic Delay, Time-to-Treatment, Health Services Accessibility, Cross-Sectional Studies.

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## INTRODUCTION:

Breast cancer represents the most prevalent malignancy among women globally, with approximately 2.3 million new cases diagnosed annually, accounting for nearly 11.7% of all cancers.[1] The disease burden is particularly pronounced in low- and middle-income countries (LMICs), where mortality rates remain disproportionately high despite lower incidence rates compared to developed nations.[2] This paradox largely stems from delayed presentation, suboptimal screening programs, and healthcare system inadequacies that collectively contribute to advanced disease staging at diagnosis.[3]

The concept of delay in breast cancer care refers to the time gaps that occur between different stages of diagnosis and treatment. The Aarhus statement defines these intervals as patient interval, diagnostic interval, and treatment interval.[4] Each component contributes uniquely to overall delay, with cumulative effects on disease progression and patient outcomes. International studies demonstrate significant variation in delay patterns. Patient delays can range from a few weeks to several months, with means typically between 2 and 24 weeks in most studies, but with some patients experiencing even longer delays, especially in low-resource settings.Diagnostic delays are also highly variable, with some healthcare systems reporting delays of 1–12 weeks, but longer delays are common in settings with limited resources.[5,6]

In the South Asian context, breast cancer presents distinct challenges characterized by onset at a younger age, aggressive tumour biology, and advanced stage presentation. Studies from India demonstrate that a large proportion of breast cancer patients present with locally advanced or metastatic disease (typically 45-75%), and that delays from symptom onset to diagnosis and treatment are common, with patient delays often exceeding 3 months in a majority of cases.[7] Similarly, research from Bangladesh found that delays in seeking and initiating treatment for breast cancer are common, with rural residence and lower socioeconomic status identified as key barriers.[8] These findings underscore the critical need for understanding delay patterns within regional healthcare contexts.

Pakistan faces a particularly challenging breast cancer landscape, with age-adjusted incidence rates of 76.7 per 100,000 women, among the highest in Asia.[9] The National Cancer Registry data indicate that 60-70% of patients present with advanced disease (Stage III/IV), compared to 30-40% in developed countries.[10] This stark disparity reflects underlying healthcare delivery challenges, including limited screening infrastructure, inadequate referral systems, and socioeconomic barriers to care access. A multicentred Pakistani study involving 499 patients found mean diagnostic delays of 15.7 months, with significant associations between delay duration and disease stage at presentation.[11]

Healthcare system factors contributing to diagnostic delays in resource-limited settings include inadequate primary care infrastructure, limited specialist availability, and fragmented referral pathways. Provider-related delays often result from misdiagnosis of breast symptoms, particularly in younger women, where malignancy suspicion may be lower.[12] Additionally, diagnostic capacity constraints, including limited mammography and histopathology services, further exacerbate delays in definitive diagnosis. Treatment delays may subsequently occur due to long waiting lists, a lack of diagnostic machines, and higher medical costs.[13]

Patient-related factors significantly influence delay patterns, with health-seeking behaviour being modulated by cultural beliefs, symptom interpretation, and healthcare accessibility. Studies consistently demonstrate longer delays among rural populations, elderly patients, and those with lower educational attainment[14]. Fear of diagnosis, cancer stigma, and preference for traditional healing methods contribute to prolonged patient intervals, particularly in conservative societies[15]. Economic constraints represent another critical barrier, with direct and indirect costs of cancer care often exceeding household financial capacity.

Despite growing recognition of delay impacts on breast cancer outcomes, limited data exist regarding specific delay patterns and contributing factors within the Pakistani healthcare context. While international literature provides valuable insights, healthcare system heterogeneity necessitates local evidence generation to inform targeted interventions. Previous studies have primarily focused on delay documentation rather than comprehensive factor analysis, leaving substantial knowledge gaps regarding modifiable determinants of delay. We hypothesised that delays in breast cancer diagnosis and treatment would be associated with advanced stage at presentation, and that sociodemographic and healthcare system factors such as rural residence, low education, financial hardship, and fragmented referral pathways would significantly contribute to these delays.

The objective of this study was to determine the extent and patterns of delays in breast cancer diagnosis and treatment among patients presenting to Lady Reading Hospital, identify key factors associated with prolonged delays, and evaluate the relationship between delay duration and disease stage at presentation. Understanding these patterns is necessary for developing evidence-based practice to optimise breast cancer care delivery and improve patient outcomes in resource-limited healthcare environments.

## METHODOLOGY:

This cross-sectional study was conducted at Lady Reading Hospital, Peshawar, which is the largest tertiary care hospital across the province, from 1st January 2024 to 30th December 2024. The study adhered to the Declaration of Helsinki principles and local ethical guidelines for medical research.

The target population comprised all newly diagnosed breast cancer patients who presented to the General Surgery Department of Lady Reading Hospital during the study period. Inclusion criteria comprised of female patients aged 18-75 years with histopathological confirmed breast cancer patients presenting for initial treatment, and those willing to provide informed consent. Patients with recurrent breast cancer, male breast cancer patients due to low prevalence in our settings, those with incomplete medical records, patients unable to provide a reliable history due to cognitive impairment, and those declining participation were excluded.

Sample size was calculated using the WHO formula for cross-sectional studies: $n = Z^2pq/d^2$, where $Z = 1.96$ (95% confidence level), p = expected proportion of delayed diagnosis (estimated at 70%[10] based on regional literature), $q = 1-p$ (30%), and d = desired precision (5%). The calculated sample size was 323 patients, which was increased to 384 to account for potential non-response and incomplete data (19% buffer).

Data collection was performed through structured interviews conducted by trained research assistants and comprehensive medical record reviews. A standardized questionnaire captured demographic characteristics (age, education, occupation, residence, income), clinical presentation details (symptom type, duration, severity), healthcare-seeking behaviour, and delay intervals. Medical records were reviewed to extract clinical parameters, including tumour characteristics, staging information, diagnostic modalities used, and treatment timelines.

Delay intervals were defined according to the Aarhus statement framework. Patient delay represented the interval from first symptom recognition to initial healthcare consultation. Provider delay encompassed the period from the first medical consultation to definitive diagnosis. Treatment delay covered the duration from diagnosis to treatment initiation. Total delay was calculated as the sum of all intervals from symptom onset to treatment commencement.

Statistical analysis was performed using SPSS version 26.0. Descriptive statistics included frequencies and percentages for categorical variables, while continuous variables were presented as means with standard deviations or medians with interquartile ranges, depending on data distribution. Normality testing was conducted using the Shapiro-Wilk test. Delay intervals were categorized as acceptable (≤12 weeks) or prolonged (>12 weeks) based on international benchmarks.

Univariate analysis employed chi-square tests for categorical variables and independent t-tests or Mann-Whitney U tests for continuous variables. Multivariate logistic regression analysis identified independent predictors of prolonged delay, with odds ratios and 95% confidence intervals calculated. Variables with p-values <0.25 in univariate analysis were included in the multivariate model. Statistical significance was set at p<0.05 for all analyses.

Ethical approval was obtained from the Institutional Review Board (IRB) of Lady Reading Hospital with Ref: No. 63/LRH/ MTI on 05/12/2023.

## RESULTS

During the study period, a total of 428 newly diagnosed breast cancer patients were approached, with 384 patients meeting the inclusion criteria and providing informed consent, yielding a response rate of 89.7%. The median age of participants was 47 years (IQR: 38-56), with the majority (72.4%) belonging to the 35-60 years age group, as shown in Table 1.

Demographic characteristics revealed that 68.2% of patients resided in rural areas, while 31.8% were from urban locations. Educational status showed that 45.3% had no formal education, 32.6% had primary education, 15.4% had secondary education, and only 6.7% had higher education. Regarding occupation, 78.9% were housewives, 12.5% were employed, and 8.6% were involved in agriculture or other occupations. Monthly household income analysis demonstrated that 62.5% earned less than PKR 30,000, 28.1% earned PKR 30,000-60,000, and 9.4% earned above PKR 60,000.

Clinical presentation patterns showed that a breast lump was the most common presenting symptom (89.6%), followed by breast pain (23.4%), nipple discharge (18.2%), and skin changes (14.1%). The median duration of symptoms before seeking medical care was 14 weeks (IQR: 8-24). At the time of diagnosis, 31.5% of patients presented with early-stage disease (Stage I-II), while 68.5% had advanced disease (Stage III-IV).

**Table 1. Demographic and Clinical Characteristics of Study Participants (n=384)**

| CHARACTERISTIC | FREQUENCY (%) |
|---|---|
| **AGE GROUPS** | |
| 18-35 years | 76 (19.8) |
| 36-50 years | 168 (43.8) |
| 51-65 years | 110 (28.6) |
| >65 years | 30 (7.8) |
| **RESIDENCE** | |
| Rural | 262 (68.2) |
| Urban | 122 (31.8) |
| **EDUCATION LEVEL** | |
| No formal education | 174 (45.3) |
| Primary education | 125 (32.6) |
| Secondary education | 59 (15.4) |
| Higher education | 26 (6.7) |
| **DISEASE STAGE** | |
| Stage I | 45 (11.7) |
| Stage II | 76 (19.8) |
| Stage III | 184 (47.9) |
| Stage IV | 79 (20.6) |

Delay analysis revealed significant variations across different intervals, as shown in Figure 1. Delays in breast cancer care were categorized as patient delay (median 12 weeks, IQR 6–20),provider delay (median 8 weeks, IQR 4–14), and treatment delay (median 6 weeks, IQR 3–10), contributing to a median total delay of 26 weeks (IQR 18–38), as shown in Figure 1. Figure 2 illustrates the impact of total delay, with delays >24 weeks significantly associated with advanced-stage disease (78.3% vs. 58.7%, p<0.001). A 24-week cutoff for total delay was used to highlight its clinical relevance.

Factors associated with prolonged patient delay included rural residence (OR: 2.34, 95% CI: 1.56-3.51, p<0.001), lack of formal education (OR: 1.89, 95% CI: 1.23-2.91, p=0.004), lower income levels (OR: 2.12, 95% CI: 1.43-3.14, p<0.001), and initial consultation with traditional healers (OR: 3.45, 95% CI: 2.18-5.46, p<0.001). Age above 60 years was also significantly associated with longer patient delays (OR: 1.67, 95% CI: 1.02-2.73, p=0.041).

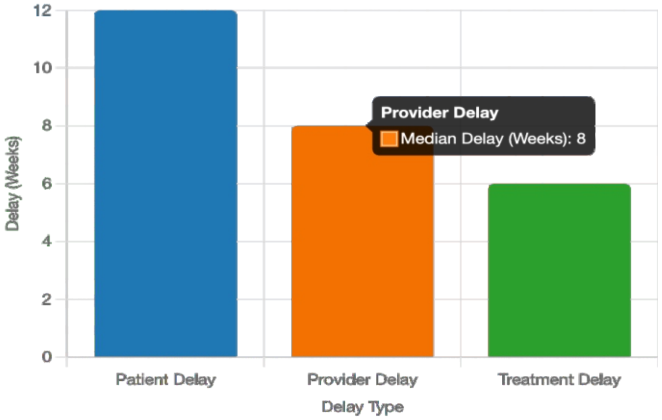

**Figure 1. Distribution of Delay Intervals Among Study Participants**

Bar chart showing median patient, provider, and treatment delays (in weeks) with interquartile ranges (IQR). Patient delay was the longest (median 12 weeks, IQR 6–20), followed by provider delay (median 8 weeks, IQR 4–14), and treatment delay (median 6 weeks, IQR 3–10).

Provider delays were significantly associated with initial presentation to primary healthcare facilities rather than tertiary centers (OR: 2.78, 95% CI: 1.84-4.20, p<0.001), lack of mammography facilities at first consultation site (OR: 2.45, 95% CI: 1.67-3.59, p<0.001), and need for multiple consultations before appropriate referral (OR: 3.12, 95% CI: 2.03-4.79, p<0.001). Patients requiring biopsy procedures showed longer diagnostic intervals compared to those diagnosed through other methods.

Treatment delays were primarily influenced by financial constraints (OR: 2.89, 95% CI: 1.92-4.35, p<0.001), lack of insurance coverage (adjusted OR: 1.12, 95% CI: 0.76–1.65, p = 0.55), and distance from treatment facility (OR: 1.78, 95% CI: 1.21-2.62, p=0.003) as shown in Table 2. Patients requiring neoadjuvant chemotherapy experienced longer treatment delays compared with those proceeding directly to surgery.

**Table 2. Multivariate Analysis of Factors Associated with Prolonged Total Delay**

| Factor | Adjusted OR | 95% CI | p-value |
|---|---|---|---|
| **Rural residence** | 2.14 | 1.38-3.32 | 0.001 |
| **No formal education** | 1.76 | 1.12-2.77 | 0.014 |
| **Monthly income < PKR 30,000** | 1.98 | 1.29-3.04 | 0.002 |
| **Initial consultation with a traditional healer** | 3.21 | 1.96-5.25 | <0.001 |
| **Distance > 50 km from tertiary centre** | 1.85 | 1.24-2.76 | 0.003 |
| **Lack of health insurance** | 1.12 | 0.76–1.65 | 0.55 |

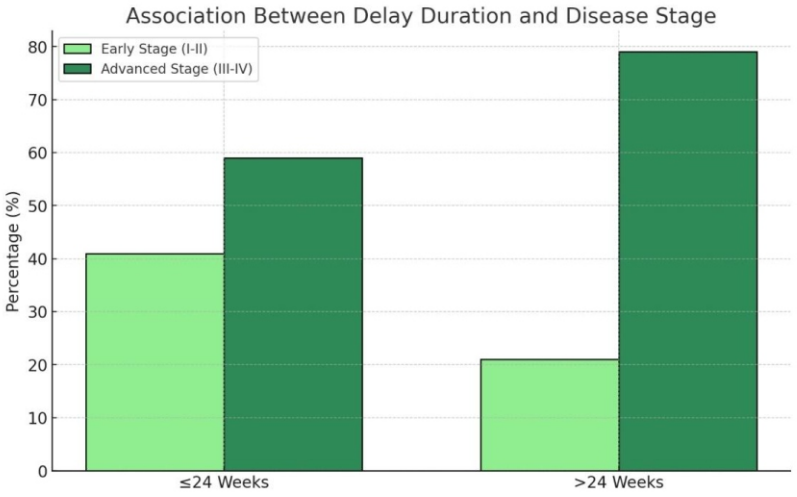

**Figure 2. Association Between Total Delayed Duration and Disease Staging**

Stacked bar chart showing the proportion of early-stage (I–II) and advanced-stage (III–IV) breast cancer among patients with total delay duration ≤24 weeks vs. >24 weeks. Patients with delays >24 weeks were significantly more likely to present with advanced disease (78.3% vs. 58.7%, $p<0.001$).

The relationship between delay duration and disease stage at presentation showed significant associations, as shown in Figure 2. Patients with total delays exceeding 24 weeks were more likely to present with advanced disease (Stage III-IV) compared to those with shorter delays (78.3% vs. 58.7%, $p<0.001$). This pattern was consistent across all delay intervals, with the strongest association observed for patient delay duration.

Symptom interpretation analysis revealed that 34.6% of patients initially attributed their symptoms to benign conditions, 28.4% sought traditional healing methods, and 18.7% delayed due to fear of cancer diagnosis. Cultural and religious factors influenced healthcare-seeking behaviour in 42.3% of cases, with many patients preferring same-gender healthcare providers and expressing concerns about examination procedures.

Healthcare system navigation challenges were evident, with 67.8% of patients requiring multiple consultations before appropriate referral, 45.2% experiencing diagnostic test delays due to facility limitations, and 38.5% facing appointment scheduling difficulties. The median number of healthcare providers consulted before definitive diagnosis was 3 (IQR: 2-5), indicating fragmented care pathways.

## DISCUSSION

and treatment, with findings that underscore critical gaps in healthcare delivery for breast cancer patients in the regional context. The median total delay of 26 weeks from symptom onset to treatment initiation significantly exceeds international benchmarks and represents a concerning pattern that demands immediate attention and systematic intervention.

The observed patient delay of 12 weeks differs from the findings of other South Asian studies, such as the Pakistani study by Hussain et al., which reported a shorter median patient delay of 4 weeks but a considerably longer mean total delay of 56 ± 52 weeks among 334 patients at a tertiary care facility in Karachi.[16] Our findings also contrast sharply with developed country data, where patient delays typically range from 2-6 weeks.[17] This disparity reflects fundamental differences in health literacy, healthcare accessibility, and cultural factors that influence symptom interpretation and healthcare-seeking behaviour. The strong association between rural residence and prolonged patient delay (OR: 2.34) aligns with the findings of LeBlanc et al., where rural women had the largest proportion diagnosed with distant breast cancer compared to women from urban areas.[18]

Educational status emerged as a critical determinant of delay patterns, with patients lacking formal education showing 89% higher odds of experiencing prolonged delays. This finding supports the Polish study of 810 breast cancer patients, which demonstrated that lower education had independent significantly negative influence on local recurrence-free survival time ($p = 0.024$), with the highest risk of recurrence found for patients with elementary education ($p = 0.009$).[19] The mechanism underlying this association likely involves health literacy deficits, limited disease awareness, and reduced capacity for healthcare system navigation. Notably, our study revealed that 34.6% of patients initially attributed symptoms to benign conditions, suggesting significant knowledge gaps regarding breast cancer warning signs.

The substantial provider delay of 8 weeks identifies critical healthcare system inadequacies that require immediate attention. This duration substantially exceeds the 4-week benchmark established by international cancer care guidelines and surpasses findings from most comparable studies in similar healthcare settings. The Thai National Cancer Institute study reported provider delays of more than 12 weeks, with hospital referral from healthcare providers being a major contributor to delayed diagnosis.[20] Our finding that initial presentation to primary healthcare facilities increased provider delay odds by 2.78 times highlights the urgent need for primary care capacity building and streamlined referral protocols.

The relationship between delay duration and advanced disease presentation represents perhaps the most clinically significant finding of this study. The observation that 78.3% of patients with total delays exceeding 24 weeks presented with Stage III-IV disease, compared to 58.7% of those with shorter delays, provides compelling evidence for the clinical impact of diagnostic delays. This pattern aligns with the systematic review by Richards et al., which analysed 87 studies (101,954 patients) and consistently demonstrated that patients with delays of 3 months or more had 12% lower 5-year survival than those with shorter delays.[17] The biological implications of this relationship are profound, as advanced disease presentation directly correlates with reduced survival outcomes and increased treatment complexity.

Treatment delays of 6 weeks, though shorter than diagnostic intervals, are concerning due to their established impact on breast cancer outcomes. A systematic review and meta-analysis by Hanna et al. (2020) found that each 4-week delay in initiating breast cancer treatment (surgery, chemotherapy, or radiotherapy) was associated with a 6–8% increase in mortality risk, with a pooled hazard ratio of 1.07 (95% CI 1.05–1.09) for delays up to 12 weeks.[21] Our finding that financial constraints increased treatment delay odds by 2.89 times reflects the broader challenge of cancer care affordability in resource-limited settings. Pakistani studies indicate that at the 10% threshold, catastrophic health payments are incurred by 13.15% of households, with cancer patients facing particularly severe financial burdens.[22] Cultural and religious factors significantly influenced healthcare-seeking behavior in 42.3% of our patients, with many prioritizing same-gender healthcare providers and expressing unease with breast examination procedures. A study found that 39% of Syrian refugee and Jordanian women delayed breast cancer screening due to cultural barriers, such as discomfort with male providers and stigma surrounding breast health discussions.[23] The preference for traditional healing methods among 28.4% of patients reflects deep-seated cultural beliefs that require sensitive engagement rather than dismissal. Successful intervention strategies must acknowledge and work within existing cultural frameworks while promoting evidence-based care.

The fragmented care pathway, evidenced by patients consulting a median of 3 healthcare providers before definitive diagnosis, indicates substantial system inefficiencies. This pattern significantly exceeds optimized care models, such as the UK's two-week referral system, where 56% of all cancer cases recorded in Cancer Waiting Times data resulted from urgent suspected cancer referrals, though only 6% of urgent referrals for all suspected cancers resulted in a cancer diagnosis.[24] The implementation of structured referral protocols, combined with enhanced primary care training, could substantially reduce these inefficiencies and associated delays.

Healthcare infrastructure limitations emerged as critical contributors to provider delays, with 45.2% of patients experiencing diagnostic test delays due to facility constraints. The lack of mammography facilities at initial consultation sites increased diagnostic delay odds by 2.45 times, highlighting the need for expanded diagnostic capacity. It was found that there are only eleven mammography machines for a 35.5 million population of Khyber Pakhtunkhwa.[25] This infrastructure deficit represents a fundamental barrier that requires investment and strategic planning.

Insurance coverage (Sehat Card) was not significantly associated with treatment delays, likely because cancer-related services such as surgery and chemotherapy are not included under the current benefit package of the Sehat Sahulat Program in Khyber Pakhtunkhwa. As a result, both insured and uninsured patients faced similar financial and access barriers, neutralizing any expected benefit of insurance status on the timeliness of care. This finding contrasts with data from high-income countries such as the United States, where, compared to insured patients, the uninsured are more likely to be diagnosed with advanced-stage breast cancer. [26]

Geographic accessibility represented another critical barrier, with patients residing more than 50 kilometres from tertiary centres experiencing 85% higher odds of prolonged delays. In sub-Saharan Africa, patients residing in the highest distance quartile to diagnostic centres faced 56% higher odds of delayed diagnosis and 47% increased odds of presenting with late-stage disease.[27] The development of satellite diagnostic and treatment facilities, combined with telemedicine initiatives, could help address geographic barriers while maintaining care quality standards.

Age-related delay patterns revealed interesting contradictions to the international literature. In Europe (Estonia), older age was consistently associated with longer patient delays (women aged ≥70 experienced notably greater delays compared to younger women).[28] Conversely, in Iraq, younger women were more likely to delay presentation, arguing that breast cancer is seldom considered in this age group, leading to late detection.[29]

The study's findings have immediate implications for healthcare policy and clinical practice. The development of breast cancer care pathways with defined timelines and accountability mechanisms represents a critical first step. Public health campaigns focusing on symptom awareness and early healthcare-seeking behaviour could address patient-related delays, while primary care provider training programs could enhance diagnostic accuracy and referral appropriateness.

This study has several limitations that should be considered when interpreting the findings. The single-centre design may limit generalizability to other healthcare settings. Recall bias represents a potential concern, particularly for patient delay measurements, though this was minimized through corroboration with family members and medical records. The cross-sectional design precludes causal inference, necessitating longitudinal studies to establish temporal relationships. Selection bias toward more severe cases presenting to a tertiary centre may have influenced delay estimates. Future research should adopt a multi-centre design including both primary and secondary healthcare facilities across Khyber Pakhtunkhwa and other provinces. Since our study was conducted in the largest tertiary hospital, the observed delays may underestimate the true magnitude of barriers faced by women in more remote or underserved regions who never reach tertiary care. Expanding the scope to peripheral facilities would allow a more accurate estimation of systemic delays, capture the role of informal health providers more comprehensively, and help design targeted interventions for high-risk groups such as rural, low-income, and less-educated women.

## CONCLUSION

Delays in breast cancer diagnosis and treatment continue to pose significant challenges in low-resource settings, driven by patient barriers, provider practices, and structural gaps in the health system. This study underscores the importance of locally relevant evidence to guide interventions for reducing diagnostic and treatment delays. Strengthening healthcare infrastructure, improving referral pathways, and addressing socioeconomic barriers remain essential priorities for ensuring earlier diagnosis and treatment of breast cancer.

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A.Conception or Design

B.Acquisition, Analysis, or Interpretation of Data

C.Manuscript writing

D.Critical Review and approval

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved