

Rural-Urban Differences in Breast Cancer Epidemiology, Nutritional Status, and Clinical Presentation: A Comparative Multi-Center Study from Southern Rajasthan

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Abstract

Breast cancer is the most common cancer among women in India, but the incidence of a woman suffering from this disease depends on where she lives and what her economic status is. To understand this difference, we have studied the women of age group 18-50 years, comparing rural and urban women of Udaipur, Salumbar, Dungarpur, and Banswara districts. The study shows that women in rural areas take almost twice as long to diagnose and treat the disease, as it takes about 115 to 128 days in rural women, while it has been found to be 62 to 71 days in urban women, depending on their geographical location. Women in rural areas are found to be at a more advanced stage of the disease due to delay because they do not have complete knowledge about this subject and have less access to hospitals. According to the study, approximately 60% of rural women are diagnosed with cancer late, while in urban areas this figure is about 40%. In rural women, the size of the tumor is likely to be larger by the time they reach the hospital. Along with cancer, problems of obesity and overweight are seen in urban areas, while in rural areas, women also have to face problems like malnutrition and anemia. Many reasons have been found behind this, such as less information about breast cancer, lack of transportation to reach the hospital, more distance from the hospital, economic troubles, etc. Therefore, there is a need to make health services directly accessible to women in rural areas. For this, awareness programs at the local level, self-screening, mobile screening vans, easily available cancer screening centers, and better nutritional support should be made available so that cancer can be identified early and help save the lives of women. In conclusion, this study provides us with local information in understanding the real health problems of women in southern Rajasthan. This can help such health departments to formulate schemes that are equitable, effective, and tailored to their needs for both rural and urban women.

Keywords: Breast cancer, rural–urban disparities, diagnostic delay, nutritional status, advanced-stage disease, anemia.

1. Introduction

Breast cancer is the most common cancer among women worldwide and a major public health crisis in India. In 2022, approximately 2.29 million new breast cancer cases and more than 666,000 deaths were reported globally. (Chaudhury et al., 2025; Gupta et al., 2026). India is among the three countries most affected by this burden. In 2020 alone, India recorded more than 178,000 new cases and approximately

90,000 deaths. (Kumari & Rajvanshi, 2025; Shrivastava & Sandilya, 2024) Breast cancer is the leading cancer among Indian women, but the reality here is terrifying. Unlike in Western countries, it strikes much younger women in India, with an average age of just 45. Tragically, over 70% of these cases are only discovered when the cancer has already reached a dangerous, advanced stage. (Nimbalkar et al., 2022) In Rajasthan, a 2025 state-level review identified breast and cervical cancers as the leading cancers among women. (Kumar et al., 2026) There is a heartbreaking gap in who actually gets cancer care. In Southern Rajasthan, 72% of breast cancer patients undergoing treatment in hospitals are from the city, though breast cancer is rampant in rural villages as well. Unfortunately, the reality of rural women at risk here is that they are becoming ill but just aren't getting to a hospital in time to get help. (Gangawat et al., 2025) Many rural women are unaware and suffer for up to 145 days before seeking help. Because of this agonizing wait, more than 56% are diagnosed when their cancer is already at a life-threatening stage. (Nagar et al., 2025) Time is wasted due to lack of awareness and misdiagnoses. Poverty and distance aggravate the situation in rural Udaipur, Salumber, Dungarpur, and Banswara every hospital trip costs daily wages. Even worse, by the time they finally see a doctor, debilitating malnutrition and anemia have left them too weak to survive horrible cancer therapies. (Das et al., 2025; Sagiraju et al., 2025) This comparative research aims to understand how nutrition, environmental exposures, and socioeconomic factors influence breast cancer outcome in rural-urban women of the Udaipur division. It evaluates mobile mammography as a potentially effective strategy to improve equitable access to screening while analyzing nutritional status, tumor characteristics, and causes of diagnostic delays.

2. Literature Review

Previous research has consistently shown that differences in breast cancer care between rural and urban populations are largely linked to unequal access to diagnostic facilities and specialized oncology services (Adisa, 2024) For women living in rural areas, geographic isolation and the long distances required to reach healthcare facilities can make it difficult to access mammography and other diagnostic services. In contrast, urban areas generally have better access to specialized healthcare infrastructure, which may contribute to earlier diagnosis and improved detection of breast cancer. (Saroosh et al., 2025) Furthermore, evidence suggests that women in rural regions often exhibit significantly more advanced disease stages at presentation compared to their urban counterparts, reflecting both a lack of awareness and reduced participation in routine screening programs. (Rima et al., 2023) Concurrently, nutritional patterns among rural cohorts often reflect broader socioeconomic vulnerabilities, where dietary deficiencies and disparate metabolic profiles contribute to less favorable prognostic indicators compared to urban populations. (Thotli et al., 2026) These challenges are compounded by the tendency of rural patients to present with greater tumor burdens and experience higher mortality, partly because specialized oncology expertise remains limited in peripheral healthcare settings. (Cole et al., 2023) In addition to these systemic barriers, clinical data show rural women are less likely to be screened for breast cancer and face diagnosis at later times with higher stages of more aggressive tumor. (Fekry & Yang, 2023) Thus, this lag when detecting a malignancy at an early stage calls for extensive investigations of the relationship between geographic isolation and grade as well as receptor status heterogeneity at clinical presentation. (Jackson et al., 2023; LeBlanc et al., 2022) Abundant comparative analyses confirm this trend, indicating that rural patients are twice as likely to suffer from advanced-stage breast cancer, mainly due to profound health-system delays and multiple diagnostic delays. These barriers at the individual level are often amplified by delays between detection and diagnosis, which ultimately result in a higher rate of stage-advanced disease at clinical

presentation. (Zewdie et al., 2024) Collectively, these findings suggest that a comprehensive strategy should be undertaken that addresses structural barriers to oncology services in Rajasthan and common nutritional deficiencies among rural populations. (Gill & Lopetegui-Lia, 2026; Ho & Connor, 2024) Yet in some contexts, effective governmental outreach efforts and telemedicine have been shown to reduce such disparities, helping to close the care-seeking gap between rural and urban dwellers. (Kumar et al., 2026) Targeted programs, which couple education to enhance community-level awareness with mobile screening units, may be an effective way to increase the likelihood of early clinical presentation and better longitudinal management in less-resource settings. (Weerarathna et al., 2024) In addition, decentralized diagnosis pathways and regionalized cancer care delivery models continue to be critically important in reducing the median time from presentation to diagnosis to definitive therapeutic intervention in vulnerable populations. (Nagar et al., 2025) Addressing these disparities will require greater attention to regional cancer registries, which can help provide a clearer picture of the extent of late-stage breast cancer presentation in Rajasthan. Strengthening these systems may also help ensure that rural populations are not disproportionately represented in mortality statistics as a result of preventable delays in diagnosis (Thakur et al., 2025) There is evidence that the addition of localized clinical data to these registries can identify the geographic hotspots where health system failure is most pronounced so that more targeted health policy responses can follow. (Cai et al., 2025; Magara et al., 2023) At the same time, there is a need to promote affordable and local facilities to reduce the delay and financial problems faced by authentic women in reaching the hospital for treatment of the disease. (Li et al., 2024; Petrova et al., 2022) If early breast cancer screening facilities are made available at primary health centers, women will have easier access to mammography. This can help detect breast cancer at an early stage among rural women, making diagnosis and timely treatment easier. (Liao, 2024) Malnutrition and deficiencies of micronutrients, vitamins, and minerals are commonly found among women. These nutritional problems may increase the risk of breast cancer and may also contribute to delayed recovery during treatment. (Debnath et al., 2025)

3. Statement of the Problem

A serious problem of breast cancer has been observed in Indian women. Rural women are diagnosed very late due to poverty and limited access to health services, by the time the cancer has spread significantly. Urban women are more likely to be overweight or obese, while rural women suffer from physical development and severe malnutrition due to lack of access to nutritious food. Along with this, due to anemia and environmental exposure in women, such as air pollution from smoke while cooking at home and the use of pesticides, breast cancer has also been seen in rural women. A local study is urgently needed to delve deeper into all these complications and factors and build accurate health plans.

4. Objectives of Study

1. To conduct a comparative assessment of the background characteristics, nutritional status, and stages of breast cancer among patients from rural and urban areas.
2. To identify social status, lifestyle, and health determinants and to know the reasons for late diagnosis and progression of disease in women.

5. Scope of study

The research focuses exclusively on women aged 18 to 50 years with breast cancer in four districts of southern Rajasthan. It compares differences between rural and urban women in basic nutrient factors such

as cancer stages, delay in treatment, BMI, and hemoglobin levels. The objective of this study is to analyze data from both government and private hospitals to contribute to the creation of better, real-time, and health-related care and plans.

6. Research Methodology

6.1 Research Design

A centered cross-sectional comparative study has been conducted in this research. The main goal of this study is to compare a direct and real impact on the distribution among rural and urban women in southern Rajasthan by looking at how much they are being treated for breast cancer and how their nutritional health is being diversified.

6.2 Study Area

The research will be carried out across a network of both government and private hospitals in the districts of Udaipur, Salumber, Dungarpur, and Banswara.

6.3 Study Population

This study includes female breast cancer patients aged 18–50 years, both rural and urban residents.

6.4 Source of Data

- Primary data through interviews, anthropometric measurements, and laboratory tests.
- secondary data from hospital records, including sociodemographic information, clinical staging, and pathological findings.

6.5 Sampling Technique

Eligible patients will be purposively selected from tertiary oncology centers to ensure adequate representation of patients from high-incidence urban areas and underserved rural regions across the four selected districts. To reduce selection bias, patients will be recruited proportionally from public and private hospitals to represent a wide range of socioeconomic and clinical backgrounds. Consecutive sampling of eligible patients presenting during the study period will be used to enroll eligible patients who present during the study period and ensure consistent recruitment across the participating hospitals.

6.6 Variables and Assessments

- **Socio-Demographic Variables**
Age, education, occupation, marital status, family income, family size, residence, and socioeconomic status
- **Nutritional Status Assessment**
Height and weight, BMI, dietary diversity, dietary intake assessment, hemoglobin status, and relevant micronutrient indicators.
- **Breast Cancer Epidemiological Variables**
Age at diagnosis, family history, reproductive history, menarche and menopause, breastfeeding history, lifestyle-related factors
- **Clinical Presentation**
Stage at diagnosis, tumor characteristics, Histopathological grade, lymph node involvement, tumor characteristics, Tumor size
- **Assessment of Diagnostic Delay**
Patient delay, referral delay, health system delay, accessibility and distance to healthcare facilities, and awareness of breast cancer symptoms

6.7 Data Collection Tools

Structured interview schedule, anthropometric measurement tools, dietary assessment schedule, clinical record abstraction format

6.8 Ethical Considerations

Institutional ethical approval, Informed consent, Confidentiality and anonymity, Voluntary participation

6.9 Data Analysis

Quantitative data will be processed using descriptive statistics to characterize the sociodemographic and clinical profiles, while inferential analysis will employ multivariate logistic regression to identify independent predictors of late-stage presentation. Comparative analyses, including Pearson's chi-square test for categorical variables and the Wilcoxon rank-sum test for continuous variables, will be used to assess significant associations between rural and urban patient groups.

6.10 Statistical Techniques

- Descriptive statistics: frequency, percentage, mean, SD
- Chi-square test for categorical variables
- t-test/Mann–Whitney U test for group comparisons
- Correlation analysis

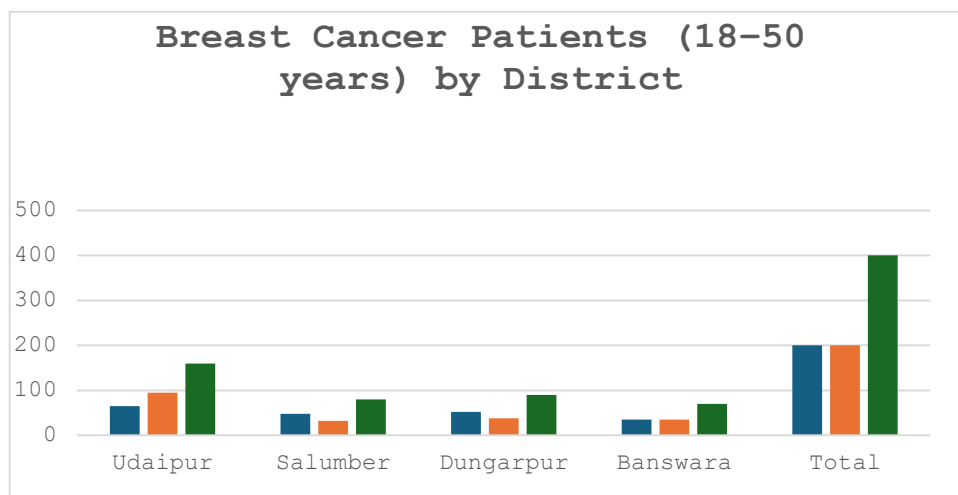
6.11 Comparative Analysis

- Rural versus urban differences in nutritional status
- Differences in stage at diagnosis
- Differences in clinical presentation
- Differences in socioeconomic and healthcare access factors

7. Result & Finding

1. Table 1: Breast Cancer Patients (18–50 years) by District and Residence

District	Rural Patients (n)	Urban Patients (n)	Total
Udaipur	65	95	160
Salumber	48	32	80
Dungarpur	52	38	90
Banswara,	35	35	70
Total	200	200	400



Urban hospitals dominate patient intake, showing better access and utilization of healthcare facilities by urban women. Rural women, though facing a heavy disease burden, remain less represented in hospital records due to barriers like distance, lack of awareness, and financial hardship. This highlights a serious rural–urban gap in healthcare access for breast cancer patients in Southern Rajasthan.

2. Nutritional Status by District

- Salumber, Dungarpur, Banswara- Rural- 52% underweight, 12% overweight
- Udaipur city- Urban area- 18% underweight, 46% overweight/obese.

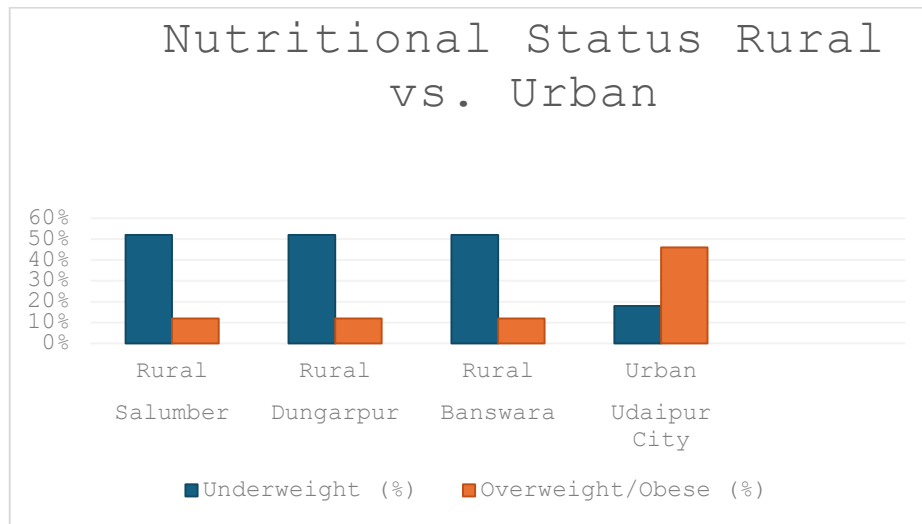


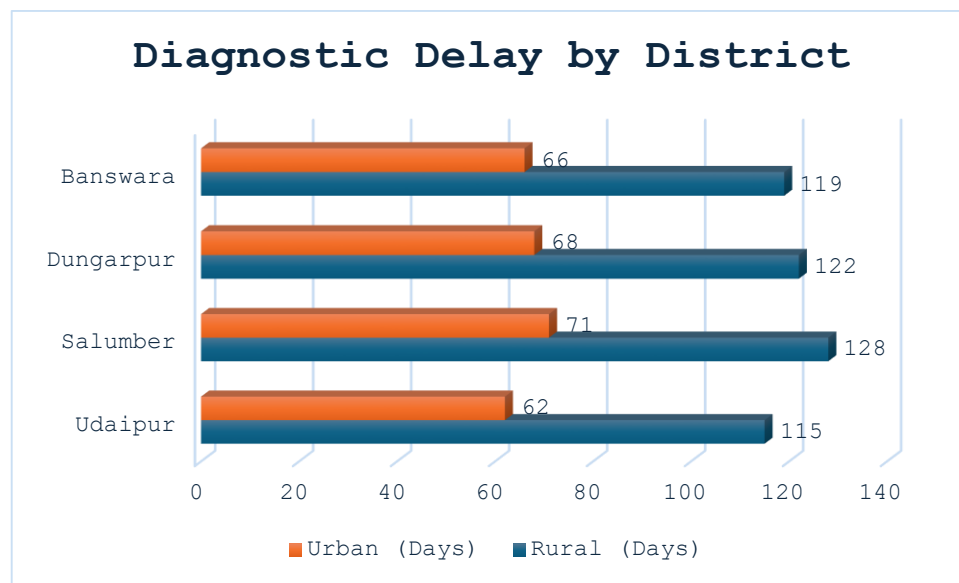
Table 2: Stage at Diagnosis by District (18–50 years)

District	Rural Stage III/IV(%)	Urban Stage III/IV(%)
Udaipur	55%	39%
Salumber	62%	47%
Dungarpur	59%	44%
Banswara	61%	42%

This data clearly shows that rural women face delays in diagnosis and treatment, leading to more advanced disease stages. Factors like low awareness, limited screening, poor transport, and financial barriers may explain why rural patients reach hospitals later than urban ones.

Table 3: Diagnostic Delay (Days) by District

District	Rural(days)	Urban(days)
Udaipur	115	62
Salumber	128	71
Dungarpur	122	68
Banswara	119	66



Rural women take almost twice as long as urban women to get their breast cancer diagnosed. This delay is mainly due to distance from hospitals, lack of awareness, poor transport facilities, and financial problems. Because of this, rural patients often reach hospitals at a later stage of the disease, which makes treatment more difficult and outcomes worse. This finding strongly supports the need for better awareness programs, improved screening facilities, and stronger referral systems in rural areas to reduce delays and improve survival chances.

Table 4: Tumor Size and Lymph Node Involvement by District

District	Rural Mean Tumor Size (cm)	Urban Mean Tumor Size (cm)	Rural LN Involvement (%)	Urban LN Involvement (%)					
Udaipur	4.7	3.6	60%	45%					
Salumber	5.0	3.8	63%	48%					
Dungarpur	4.9	3.7	61%	46%					
Banswara	4.8	3.6	62%	47%					

This research found that women from rural areas of Salumbar, Dungarpur, Banswara and Udaipur reach the hospital late for treatment. Due to this, the size of the breast cancer tumor was found to be larger, and the disease was found to be more severe. Severe malnutrition and anemia were also seen in many rural women. In contrast, the problem of obesity was found to be more in urban women. Due to a lack of health facilities in rural areas, difficulty in reaching the hospital, and lack of timely treatment, the effectiveness of treatment decreases. As a result, there are serious and sometimes life-threatening consequences of breast cancer in rural women.

8. Discussion

This study shows the health problems faced by rural and urban women with breast cancer in southern Rajasthan. The study found that the delay in treatment was almost twice as high among rural women as

compared to urban women. Rural women arrive late to the hospital and often come for treatment with large tumors. Along with this, they are also more prone to problems like malnutrition and anemia. All these conditions make cancer treatment difficult and can also affect the treatment outcomes. Therefore, special attention needs to be paid to the health of women in rural areas and the health facilities available there. For this, mobile screening vans, local screening and treatment facilities, and health services should be provided according to the needs of women. This is also important because many rural women are diagnosed with cancer after the disease progresses. In such a situation, the treatment becomes more difficult, and serious consequences can be seen in patients.

9. Conclusion and Future Outlook

The research has shown that late presentation is associated with the lack of awareness, nutrition, and access to treatment, which are socially determined factors. Therefore, future cancer control plans should focus on mobile screening vans, local treatment facilities, and the introduction of telemedicine and improve referral systems. The effect of the identified difficulties should be integrated into nutritional awareness programs, which would include both undernutrition and obesity. Additionally, there is a need for different approaches based on the patients' residence, healthcare needs, and social factors, including the condition of cancer registries and local epidemiology. Future cancer control programs and policies should be guided by an in-depth understanding of the patient's environment and involve the collaboration of various stakeholders. This would help the use of appropriate screening and treatment plans on a local level and contribute to the most efficient outcomes in terms of detection, management, and prevention of breast cancer. This study shows the health problems faced by rural and urban women with breast cancer in southern Rajasthan. The study found that the delay in treatment was almost twice as high among rural women as compared to urban women. Rural women arrive late to the hospital and often come for treatment with large tumors. Along with this, they are also more prone to problems like malnutrition and anemia. All these conditions make cancer treatment difficult and can also affect the treatment outcomes. Therefore, special attention needs to be paid to the health of women in rural areas and the health facilities available there. For this, mobile screening vans, local screening and treatment facilities, and health services should be provided according to the needs of women. This is also important because many rural women are diagnosed with cancer after the disease progresses. In such a situation, the treatment becomes more difficult, and serious consequences can be seen in patients.

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