

Impact of demographic and treatment factors on short-term survival outcomes in Breast Cancer patients: A Retrospective study

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Abstract: Background: Breast cancer is the most frequently diagnosed cancer among women and remains a leading cause of cancer-related mortality worldwide. Understanding the relationship between demographic characteristics, treatment modalities, and survival is essential for improving patient management. This study evaluated the association of demographic characteristics with treatment modalities and one-year overall survival among patients with breast cancer treated at a tertiary cancer centre. **Methods:** A retrospective observational study was conducted among 313 patients with histopathologically confirmed breast cancer managed between January and December 2023 at a tertiary cancer centre in Maharashtra, India. Demographic characteristics, treatment modalities, and one-year overall survival were retrieved from hospital records. Associations between categorical variables were analysed using the Pearson chi-square test or Fisher's exact test, as appropriate. A P value <0.05 was considered statistically significant. **Results:** The mean age at diagnosis was 54.0 ± 12.5 years, and 49.8% of patients were aged 50–70 years. Urban residents accounted for 58.5% of the study population. Chemotherapy was the predominant principal treatment modality (69.6%), followed by surgery (19.2%) and other treatment modalities (11.2%). At one-year follow-up, 311 (99.4%) patients were alive and two (0.6%) had died. Age was significantly associated with treatment modality ($P = 0.047$), whereas place of residence was not associated with treatment modality ($P = 0.85$) or one-year overall survival ($P = 0.63$). Treatment modality demonstrated a statistically significant association with one-year overall survival ($P = 0.0003$). **Conclusion:** Among patients with breast cancer treated at a tertiary cancer centre, age influenced treatment selection, whereas place of residence did not affect treatment modality or one-year overall survival. The observed association between treatment modality and one-year overall survival should be interpreted in the context of disease severity and clinical decision-making inherent to observational studies. Larger prospective multicentre studies with longer follow-up are required to identify independent predictors of survival.

Keywords: Breast neoplasms; Demographic characteristics; Chemotherapy; Survival; India.

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INTRODUCTION

Breast cancer is the most frequently diagnosed malignancy among women worldwide and remains the leading cause of cancer-related cancer mortality in females. According to the Global Cancer Observatory (GLOBOCAN) 2020 estimates, approximately 2.3 million new breast cancer cases and 685,000 deaths occurred globally, accounting for nearly one in four cancers diagnosed among women and one in six cancer-related deaths among females [1]. Although remarkable advances in screening, molecular diagnostics, systemic therapies, and multidisciplinary management have substantially improved survival in high-income

countries, considerable disparities persist across low- and middle-income countries because of delayed diagnosis, limited access to specialised oncology services, and variations in treatment availability. The SURVCAN-3 population-based benchmarking study further demonstrated marked international differences in cancer survival, highlighting the influence of healthcare infrastructure, early detection, and quality of cancer care on patient outcomes [2].

Breast cancer has emerged as the most common malignancy among Indian women and represents a major public health challenge. The National Cancer Registry

Programme (NCRP) has reported a steady increase in breast cancer incidence across successive decades, with projections indicating a further rise in the number of newly diagnosed cases in the coming years [3,4]. Age-period-cohort analyses have similarly demonstrated increasing breast cancer incidence across successive birth cohorts, reflecting changing reproductive patterns, urbanisation, lifestyle modifications, and increasing life expectancy [5]. Beyond its rising incidence, breast cancer contributes substantially to years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life years (DALYs), imposing a considerable socioeconomic burden on patients, families, and the healthcare system [6]. Despite improvements in awareness and treatment infrastructure, many Indian women continue to present with locally advanced disease, resulting in poorer survival compared with developed nations [7].

Early diagnosis remains one of the most effective strategies for improving breast cancer outcomes. In a landmark cluster-randomised controlled trial conducted in Mumbai, Mittra *et al.* demonstrated that repeated clinical breast examination performed by trained primary healthcare workers significantly reduced the incidence of advanced breast cancer and facilitated earlier diagnosis among women in resource-limited settings [8]. However, equitable implementation of breast cancer screening continues to be challenging. Socioeconomic inequalities, educational status, and rural–urban differences substantially influence participation in breast cancer screening programmes and timely utilisation of healthcare services in India, contributing to delayed diagnosis among vulnerable populations [9, 10].

Breast cancer management has evolved considerably over the past two decades and now requires a multidisciplinary approach integrating surgery, systemic chemotherapy, endocrine therapy, targeted therapy, immunotherapy, and radiotherapy. Treatment decisions are individualised according to tumour stage, histopathological characteristics, hormone receptor status, HER2 expression, molecular subtype, patient comorbidities, and performance status [11]. Contemporary reviews and national data emphasise that improvements in treatment accessibility, adherence to evidence-based guidelines, and multidisciplinary care have contributed to better survival outcomes among Indian women with breast cancer, although regional variations continue to exist in healthcare delivery and patient outcomes [7, 12].

Population-based and institutional studies have demonstrated considerable heterogeneity in the demographic characteristics, clinicopathological profile, treatment practices, and survival outcomes of breast cancer patients across different regions of India [13–16]. Furthermore, disparities in cancer care between rural and urban populations continue to influence diagnosis, treatment, and long-term survival, underscoring the need

for institution-specific evidence to better understand local disease patterns and healthcare delivery [10, 17]. Although several registry-based studies have evaluated breast cancer incidence and survival at the national level, relatively few studies have simultaneously assessed demographic characteristics, treatment modalities, and short-term survival outcomes among patients managed at individual tertiary care centres. Such real-world evidence is essential for evaluating current treatment practices, identifying factors associated with patient outcomes, and guiding improvements in breast cancer care. Therefore, the present retrospective observational study was undertaken to evaluate the demographic characteristics, treatment modalities, and one-year overall survival among patients with breast cancer treated at a tertiary care centre.

MATERIALS AND METHODS

This retrospective observational study was conducted at a tertiary cancer care centre in Maharashtra, India, to evaluate the association between demographic characteristics, treatment modalities, and one-year survival among patients with histopathologically confirmed breast cancer. Medical records of patients diagnosed between 1 January 2023 and 31 December 2023 were reviewed. Clinical, demographic, treatment, and follow-up information were retrieved from the institutional medical records. The study protocol was approved by the Institutional Ethics Committee of the participating institution. Owing to the retrospective design of the study and the use of anonymised hospital records, the requirement for informed consent was waived by the Institutional Ethics Committee. All patient identifiers were removed before data analysis to ensure confidentiality.

Study population: The study included all consecutive patients with histopathologically confirmed breast cancer who fulfilled the predefined eligibility criteria during the study period. A total of 313 patients were included in the final analysis.

Eligibility criteria

Inclusion criteria

Patients were included if they:

- had histopathological confirmation of breast carcinoma;
- were diagnosed and treated at the study centre during the study period;
- had complete demographic information, including age and place of residence;
- had complete treatment records; and
- had documented follow-up for at least one year after diagnosis.

Exclusion criteria

Patients were excluded if they:

- had incomplete medical records;



- were lost to follow-up before completion of one year after diagnosis; or
- had missing information regarding treatment modality or survival status.

Data collection procedure

Data were extracted using a structured data collection proforma developed for the study. The following variables were recorded from the medical records.

Demographic variables

Age at diagnosis (years)

Place of residence (classified as rural or urban)

For descriptive analysis, age was categorised into four groups: <30 years, 30–50 years, 50–70 years, and 70–90 years.

Treatment variables

The principal treatment modality received during the study period was recorded and categorised as: Chemotherapy, Surgery and Other treatment modalities.

The "other treatment modalities" category included patients managed primarily with radiotherapy, endocrine

therapy, targeted therapy, immunotherapy, palliative treatment, or treatment combinations in which neither surgery nor chemotherapy constituted the principal treatment modality.

Outcome variable

The primary outcome was one-year survival, defined as survival status (alive or deceased) at one year from the date of histopathological diagnosis.

Statistical analysis

Data were entered into Microsoft Excel and analysed using IBM Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM Corp., Armonk, NY, USA).

Continuous variables were summarised as mean $\pm$ standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Associations between categorical variables were evaluated using the Pearson chi-square (χ^2) test. Fisher's exact test was considered wherever expected cell frequencies were less than five. A two-sided P value <0.05 was considered statistically significant.

RESULTS

Table 1: Basic characteristics

Characteristics	Number	Percentage
Age		
< 30	06	1.9
30 – 50	108	34.5
50 – 70	156	49.8
70 – 90	43	13.7
Place of residence		
Rural	130	41.5
Urban	183	58.5

A total of 313 patients with histopathologically confirmed breast cancer were included in the study. The mean age at diagnosis was 54.0 ± 12.5 years. Nearly half of the patients (49.8%) belonged to the 50–70 years age

group, followed by 30–50 years (34.5%), 70–90 years (13.7%), and <30 years (1.9%). Regarding place of residence, 183 (58.5%) patients were from urban areas, whereas 130 (41.5%) were from rural areas (Table 1).

Table 2: Distribution of Treatment modalities

Treatment modalities	Number	Percentage
Chemotherapy	218	69.6
Surgery	60	19.2
Other	35	11.2

Chemotherapy was the most frequently administered principal treatment modality and was received by 218 (69.6%) patients. Surgery was the principal treatment modality in 60 (19.2%) patients, while 35 (11.2%)

patients received other treatment modalities, including radiotherapy, endocrine therapy, targeted therapy, immunotherapy, or palliative treatment (Table 2).

Table 3: One-Year Survival rates by Treatment modality

	Number	Percentage
Survival	311	99.4
Death	2	0.6

At one-year follow-up, 311 (99.4%) patients were alive and 2 (0.6%) had died, indicating an excellent short-term survival rate in the study cohort (Table 3).

Table 4 : Survival distribution according to demographical factors

Demographical factors	Number	Survival (%)	Death (%)	χ^2 value	p-value
Age					
< 30	06	6 (100)	0	2.66	0.45
30 – 50	108	108 (100)	0		
50 – 70	156	155 (99.4)	1 (0.6)		
70 – 90	43	42 (97.7)	1 (2.3)		
Place					
Rural	130	130 (100)	0	0.23	0.63
Urban	183	181 (98.9)	2 (1.1)		

No statistically significant association was observed between age group and one-year survival ($\chi^2 = 2.66$; $P = 0.45$). One death occurred each in the 50–70 years and 70–90 years age groups, whereas no deaths were recorded among patients younger than 50 years (Table 4).

Similarly, place of residence was not significantly associated with one-year survival ($\chi^2 = 0.23$; $P = 0.63$). All patients from rural areas survived during the follow-up period, while the two deaths occurred among patients residing in urban areas (Table 4).

Table 5 : Relationship between demographic characteristics and treatment modalities

Age	Chemotherapy (%)	Surgery (%)	Other (%)	χ^2 value	p-value
< 30	2 (33.3)	3 (50)	1 (16.7)	12.77	0.047
30 – 50	79 (73.1)	20 (18.5)	9 (8.3)		
50 – 70	109 (69.9)	32 (20.5)	15 (9.6)		
70 – 90	28 (65.1)	5 (11.6)	10 (23.3)		
Place					
Rural	92 (70.8)	25 (19.2)	13 (10.0)	0.32	0.85
Urban	126 (68.9)	35 (19.1)	22 (12.0)		

Age demonstrated a statistically significant association with treatment modality ($\chi^2 = 12.77$; $P = 0.047$). Although chemotherapy remained the predominant treatment across all age groups, younger patients (<30 years) underwent surgery more frequently, whereas patients aged 70–90 years had a comparatively higher

proportion of treatment classified under other treatment modalities (Table 5).

In contrast, place of residence was not significantly associated with treatment modality ($\chi^2 = 0.32$; $P = 0.85$). The proportions of patients receiving chemotherapy, surgery, and other treatment modalities were comparable between rural and urban populations (Table 5).

Table 6 : Outcome based on treatment modalities

Treatment modality	Number	Survival (%)	Death (%)	χ^2 value	p-value
Chemotherapy	218	218 (100)	0	15.99	0.0003
Surgery	60	60 (100)	0		
Other	35	33 (94.3)	2 (6.1)		

Treatment modality demonstrated a statistically significant association with one-year survival ($\chi^2 = 15.99$; $P = 0.0003$) (Table 6). All patients whose principal treatment modality was chemotherapy or surgery were alive at one-year follow-up, whereas the

two deaths observed in the study occurred among patients receiving treatment classified under other treatment modalities.



DISCUSSION

The present retrospective observational study evaluated the demographic characteristics, treatment modalities, and one-year overall survival among 313 patients with breast cancer managed at a tertiary care centre. The study demonstrated that the mean age at diagnosis was 54.0 ± 12.5 years, with nearly half of the patients (49.8%) belonging to the 50–70-year age group. Chemotherapy was the most frequently administered treatment modality (69.6%), followed by surgery (19.2%). One-year overall survival was 99.4%, with only two deaths (0.6%) recorded during follow-up. Age showed a statistically significant association with treatment modality ($P=0.047$), whereas place of residence was not associated with treatment modality or one-year overall survival. Although treatment modality demonstrated a statistically significant association with one-year survival ($P=0.0003$), the interpretation of this finding should be made cautiously because of the extremely small number of outcome events.

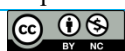
The demographic profile observed in the present study is consistent with recent Indian evidence. The mean age of 54.0 ± 12.5 years closely resembles the 54.0 ± 13.2 years reported by Sathishkumar *et al.* in their population-based analysis of 17,331 women from 11 cancer registries across India [16]. Similarly, Sukpan *et al.* reported a mean age of 52.6 ± 12.0 years among 234 patients in Thailand, while Upadhyay and Prakash observed that the majority of patients presenting to a tertiary cancer centre in Jharkhand belonged to the 41–60-year age group [15, 18]. Babu *et al.*, in a retrospective study involving 816 women from southern India, reported a median age of 49 years, whereas Paul *et al.* observed a median age of 46 years among 252 patients managed at a tertiary teaching institute [13, 19]. These differences probably reflect regional demographic variations, referral patterns, and healthcare accessibility rather than true biological differences in disease occurrence. Collectively, these findings indicate that breast cancer in India predominantly affects women during the fifth and sixth decades of life, which is younger than that reported in many Western populations.

In the present study, 53.7% of patients were from urban areas and 46.3% were from rural areas. Place of residence was not significantly associated with treatment modality or one-year survival. Similar observations have been reported in hospital-based studies where patients reaching tertiary centres generally receive comparable treatment irrespective of residence. However, this finding should not be interpreted as evidence that rural–urban disparities no longer exist. Khanna *et al.*, using population-based cancer registry data, demonstrated significant differences in cancer burden and healthcare utilisation between rural and urban populations in India, while Bhatia *et al.* highlighted that patients residing in rural areas continue to experience poorer cancer outcomes because of delayed diagnosis, reduced access to specialist oncology services, and socioeconomic

barriers [10, 17]. The absence of a significant association in the present study is therefore likely attributable to the hospital-based design, which included only patients who had successfully accessed specialised cancer care.

Chemotherapy constituted the principal treatment modality in the present study, being administered to 69.6% of patients, whereas surgery was performed in 19.2%. The proportion of patients receiving chemotherapy was comparable to the 76.1% reported by Sukpan *et al.*, although surgery was performed more frequently (53.0%) in their cohort [18]. Paul *et al.* reported that 88.9% of patients underwent modified radical mastectomy, while 47.6% presented with locally advanced breast cancer and 9.5% had metastatic disease at diagnosis [19]. Likewise, Babu *et al.* observed that 46.8% of patients had stage III disease, 72.8% had hormone receptor-positive tumours, and 21.9% had triple-negative breast cancer, reflecting the advanced disease profile commonly encountered at tertiary oncology centres [13]. These differences probably reflect variations in tumour stage at presentation, treatment intent, institutional protocols, and reporting methods. Current treatment guidelines emphasise that breast cancer management should be individualised according to tumour stage, lymph node involvement, histological grade, hormone receptor status, HER2 expression, molecular subtype, patient comorbidities, and performance status rather than demographic characteristics alone¹¹. In the present study, age demonstrated a significant association with treatment modality ($P=0.047$), which is clinically plausible because advancing age frequently influences treatment selection through its association with frailty, comorbid illness, and anticipated treatment tolerance.

The present study demonstrated an excellent one-year overall survival of 99.4%, with 311 of 313 patients remaining alive during follow-up. This estimate was higher than the 85.4% one-year overall survival reported by Sathishkumar *et al.* in the National Cancer Registry Programme, which also documented 69.6% three-year and 61.2% five-year overall survival among Indian women with breast cancer [16]. Similarly, Sukpan *et al.* reported a five-year overall survival of 54% among patients treated in Thailand, while Nathani *et al.* observed 5-year and 10-year overall survival rates of 85.2% and 79.0%, respectively, among women with early-stage breast cancer treated in a comprehensive breast cancer programme in India [18, 20]. Louis *et al.*, analysing 3,256 patients managed over two decades in South India, also demonstrated favourable long-term survival among patients who completed treatment and follow-up²¹. Furthermore, the SURVCAN-3 international benchmarking study highlighted substantial variation in breast cancer survival across low- and middle-income countries, reflecting differences in early diagnosis, treatment accessibility, and healthcare infrastructure [2]. The higher short-term survival observed in the present study should therefore be



interpreted in the context of its relatively short follow-up period, hospital-based setting, and the extremely small number of deaths.

Although treatment modality demonstrated a statistically significant association with one-year survival ($P=0.0003$), this finding should not be interpreted as evidence that chemotherapy or surgery independently improved survival. Treatment allocation in routine clinical practice is influenced by multiple clinicopathological variables, including tumour stage, biological subtype, receptor status, patient performance status, and multidisciplinary treatment planning, none of which were available for analysis in the present study [11]. Consequently, residual confounding cannot be excluded. Moreover, only two deaths occurred during follow-up, making multivariable survival analysis statistically inappropriate. Therefore, the observed association should be regarded as exploratory rather than causal. Nevertheless, the findings provide valuable real-world evidence regarding demographic characteristics, treatment practices, and favourable short-term outcomes among patients receiving care at a tertiary oncology centre. Continued efforts to promote early detection, strengthen referral pathways, improve access to multidisciplinary treatment, and reduce inequalities in cancer care remain essential to improving long-term breast cancer outcomes in India [6, 8, 9].

Limitations

The present study has several limitations. First, its retrospective design relied on routinely maintained medical records, limiting control over potential confounding variables such as tumour stage, molecular subtype, comorbidities, performance status, and treatment adherence, all of which may influence treatment selection and survival. Second, the analysis was restricted to one-year survival; therefore, important long-term outcomes, including disease recurrence, disease-free survival, overall survival, and treatment-related complications, could not be evaluated. Third, the study was conducted at a single tertiary cancer centre, which may limit the generalisability of the findings to other healthcare settings. Fourth, only two deaths occurred during the follow-up period, limiting the statistical power for survival comparisons and warranting cautious interpretation of statistically significant associations. Finally, because information on tumour stage and molecular subtype was unavailable, their potential influence on treatment decisions and survival could not be assessed.

CONCLUSION

This study demonstrates that one-year survival outcomes in breast cancer patients are high and do not differ significantly across age groups or between rural and urban. Chemotherapy and surgery were associated with good short-term outcomes, while non-standard treatment modalities showed slightly reduced effectiveness. Importantly, access to treatment appeared equitable across geographic locations, suggesting progress in

bridging rural-urban disparities in cancer care. Future research should focus on multi-center data collection, extended follow-up for long-term survival and recurrence analysis, and exploration of the clinical and socioeconomic factors influencing treatment effectiveness—especially among patients receiving non-chemotherapy therapies.

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