Section: Oncology

Original Research Article

PATTERNS OF OESOPHAGEAL CANCER SURVIVAL ACROSS DISTRICTS OF LOWER ASSAM

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Received *: 09/05/2025*
Received in revised form *: 29/06/2025*
Accepted *: 19/07/2025*

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DOI: 10.70034/ijmedph.2025.3.106

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 579-582

ABSTRACT

Background: Oesophageal cancer represents a significant oncological burden in Northeast India, particularly in Lower Assam. This study aims to evaluate and compare survival outcomes between patients from Kamrup (Metropolitan) and other districts, providing insights into potential geographic disparities despite treatment at a common tertiary care centre.

Materials and Methods: A retrospective cohort analysis was conducted using data from the Hospital-Based Cancer Registry at the State Cancer Institute, Guwahati, spanning 2018–2022. Kaplan–Meier survival analysis was applied to assess differences in survival patterns across eleven districts, grouped as Kamrup (Metropolitan) and ten other districts. Patients were stratified by treatment status, and log-rank tests were used to determine statistical significance.

Results: Among the 879 oesophageal cancer patients analysed, the treated subgroup from outside Kamrup (Metro) showed significantly better survival outcomes than those from Kamrup (Metro) (log-rank $p = 0.03$). No statistically significant difference was observed in the untreated group ($p = 0.73$). The overall survival difference between the two district categories trended toward significance ($p = 0.087$), suggesting potential disparities in treatment-related outcomes.

Conclusion: The study highlights that despite geographical proximity to a tertiary cancer centre, patients from Kamrup (Metropolitan) had poorer survival among those treated, indicating possible systemic or care-related disparities. These findings emphasise the need for contextual interventions, improved care pathways, and further research to address urban–rural inequities in cancer survival.

Keywords: Oesophageal cancer, survival analysis, Lower Assam, geographic disparity, treatment outcome.

INTRODUCTION

Esophageal cancer (EC) is a global oncological challenge, ranking among the top ten cancers in both incidence and mortality worldwide. According to GLOBOCAN 2020, EC accounted for 3.2% of new cases and 5.3% of cancer-related deaths globally, placing it as the 7th most common malignancy and 6th leading cause of cancer death worldwide.[1] In India, the National Cancer Registry Programme (NCRP) reported EC as the fifth most common cancer with a significant burden in the north-eastern states, particularly Assam.[2] Despite therapeutic advances in surgical techniques, radiotherapy, and chemotherapy, the five-year survival rate for EC remains dismally low, especially in low- and middle-income countries (LMICs), with median survival often limited to a few months.[3,4]

Northeast India, including Assam, is known for its unique dietary and lifestyle risk factors, such as high consumption of smoked and fermented foods, tobacco and betel nut use, and late-stage presentation,

all of which exacerbate the EC burden.[5] Studies from tertiary care centres in Manipur and Assam highlight a predominance of squamous cell carcinoma (SCC), particularly in the mid-esophagus, affecting males more commonly than females, and frequently presenting in advanced stages with poor performance status.[6,7] These patterns indicate the deeply entrenched sociocultural and environmental risk exposures that define EC epidemiology in this region.

While urban districts like Kamrup Metropolitan, home to Tertiary Cancer Centres in Guwahati, offer specialised oncological care, this does not automatically translate into better patient outcomes. Conversely, patients from more peripheral or rural districts may face delays in diagnosis but could benefit from structured referral systems and tighter family or community support, contributing to variable survival trends. A study by Baidya et al,[6] reported a median survival of just 6 months among patients treated at a tertiary centre in Northeast India, underscoring the urgent need to contextualise survival outcomes across regional lines.

Most existing Indian studies have focused on descriptive clinicopathological profiling and general survival trends. However, the intersection of geography (urban vs. non-urban), treatment access, and survival outcomes remains underexplored. This study aims to fill that gap by comparing survival patterns of esophageal cancer patients from Kamrup Metropolitan district with those from other districts of Lower Assam.

MATERIALS AND METHODS

This retrospective cohort study was conducted with approval from the Institutional Ethical Committee to evaluate survival outcomes among cancer patients across different districts of Lower Assam, India, using Kaplan–Meier survival analysis. The study population consisted of patients registered at the Hospital-Based Cancer Registry of the State Cancer Institute, Guwahati, between 2018 to 2022. The geographic focus included eleven districts of Lower Assam: Baksa, Barpeta, Bongaigaon, Chirang, Dhubri, Goalpara, Nalbari, Kamrup Rural, Kamrup Metropolitan, Kokrajhar, and South Salmara Mankachar. For the purpose of analysis, Kamrup Metropolitan was assigned a district code of 1, while the remaining ten districts were grouped under district code 0.

Patient-level data included time-to-event information, with the time variable defined as the number of days from the date of diagnosis to the date of death or last follow-up. The primary event of interest was death. Individuals who were alive at the time of last contact or lost to follow-up were considered censored. Data on treatment status (treated vs. untreated) were used to stratify survival analysis and assess the impact of therapy across geographical locations.

Survival functions were estimated using the Kaplan–Meier method, a non-parametric approach widely used to analyze time-to-event data with censoring.[8] Differences in survival distributions between district groups were assessed using the log-rank test, which is appropriate for comparing groups in unadjusted survival analysis.[9] Separate Kaplan–Meier analyses were conducted for the overall cohort, untreated subgroup, and treated subgroup to explore variations in survival associated with treatment and geography. The median survival time and number of individuals at risk at specific time intervals were reported to aid in interpretation.

All statistical analyses were performed using R software (version 4.5.0; R Core Team, 2023),[10] employing the survival package for core functions,[11] and the survminer package for enhanced visualization.[12] A significance level of 0.05 was used throughout the analysis. The study adhered to ethical standards for retrospective analyses using cancer registry data.

Statistical Analysis: Kaplan–Meier survival analysis was conducted to compare the survival patterns of patients from Kamrup Metropolitan district (coded as District_Code = 1) with those from ten other districts in Lower Assam (coded as District_Code = 0), namely Baksa, Barpeta, Bongaigaon, Chirang, Dhubri, Goalpara, Nalbari, Kamrup Rural, Kokrajhar, and South Salmara Mankachar. The primary objective was to investigate geographical disparities in survival, both overall and within subgroups defined by treatment status. The log-rank test was used to assess the statistical significance of differences in survival distributions between the two groups. Additionally, the number of patients at risk over time was recorded to illustrate follow-up trends and attrition across groups.

RESULTS

100 patients of acute pancreatitis were recruited in this study. Their mean age was 35.60±6.3 years. All patients were male. Among these 50 patients were having mild acute pancreatitis based on ATLANTA and BISAP scores; their mean age was similar to entire study population. BISAP SCORE of entire population ranged from 0 to 5 with mean score of 2.40±1.4; while that in mild cases was 1.20±0.8.

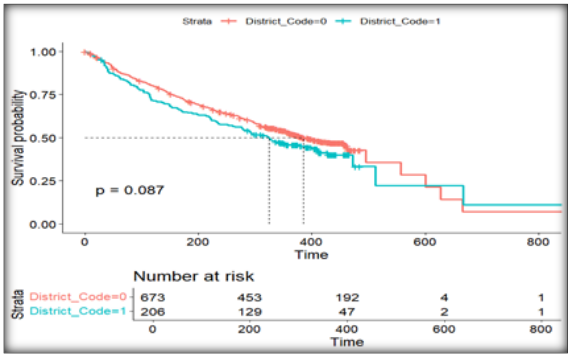

Figure 1: K-M Survival Curves for overall cohort.

In the analysis of overall survival (Figure 1), the survival curve for patients from Kamrup Metropolitan showed a trend toward poorer survival compared to patients from the other Lower Assam districts. The log-rank test yielded a p-value of 0.087, indicating that the observed difference was not statistically significant at the conventional 0.05 level. Nonetheless, the visual separation of the survival curves over time suggested a possible disparity in survival outcomes that may warrant further investigation.

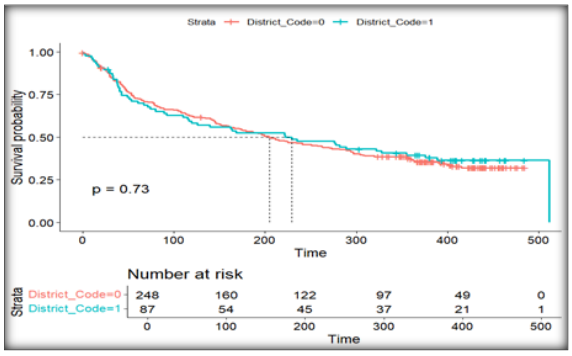

Figure 2: K-M Survival Curve for No-Treatment Group.

When examining the subset of patients who did not receive treatment (Figure 2), the survival distributions for the two district groups were almost identical throughout the study period. The log-rank test confirmed the absence of a significant difference, with a p-value of 0.73. This result suggests that in the absence of medical intervention, geographic location did not appear to influence survival outcomes.

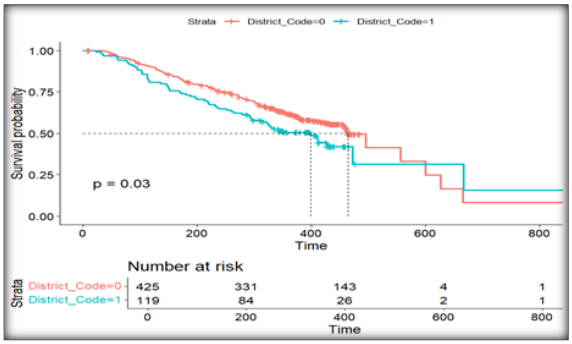

Figure 3: K-M Survival Curve for Treatment Group.

A contrasting pattern emerged in the analysis of patients who received treatment (Figure 3). In this group, survival was significantly better among patients from the Lower Assam districts (District_Code = 0) compared to those from Kamrup Metropolitan (District_Code = 1). The difference was statistically significant, with a log-rank p-value of 0.03. This finding highlights a potential disparity in treatment efficacy or healthcare access between the urban district of Kamrup Metro and the surrounding districts of Lower Assam.

Overall, the survival analysis indicates that geographical disparities may exist in cancer outcomes in Lower Assam, particularly among treated patients. While untreated patients experienced similar survival across districts, treated individuals from Kamrup Metropolitan had significantly worse outcomes compared to those from Lower Assam. This may reflect differences in healthcare infrastructure, socioeconomic conditions, follow-up care, or patient health status, and suggests a need for targeted interventions or further studies to understand and address the underlying causes.

All statistical analyses were performed using R software, utilizing the "survival" and "survminer" packages.

Table 1: Table for the summary of Kaplan Meier Curve Survival Analysis

Group	District Code	n	Median Survival Time (Days)	Log-rank p-value	Interpretation
Overall	0	673	~400		Trend of better survival
	1	206	~330	**0.087**	Not statistically significant (p > 0.05)
Untreated Group	0	248	~210		Nearly identical survival
	1	87	~200	**0.73**	No significant difference
Treated Group	0	425	~450		Clear difference in survival
	1	119	~390	**0.03***	Statistically significant (p < 0.05)

DISCUSSION

This retrospective cohort study draws attention to survival disparities in oesophageal cancer across Lower Assam, particularly between patients residing in Kamrup (Metropolitan) and those in surrounding districts. While overall survival differences were not statistically significant, a deeper stratification by treatment status revealed critical patterns warranting concern and further exploration.

Among patients who underwent treatment, those from non-metropolitan districts had significantly better survival outcomes compared to their Kamrup (Metro) counterparts (p = 0.03). This finding is somewhat counterintuitive, as Kamrup (Metro), hosting the State Cancer Institute itself, would typically be assumed to provide patients with optimal access to diagnosis, therapy, and follow-up. However, previous studies have indicated that the advantages of geographical proximity to tertiary care centres may be offset by healthcare system burden, patient overload, or delays in referral and treatment initiation within urban settings.[13,14] Fragmented care pathways, long waiting times, or socioeconomic

stressors common in urban low-income populations may also adversely affect continuity of care.[15]

Moreover, cancer awareness and proactive screening behaviours may vary across regions, possibly leading to earlier-stage diagnosis and improved outcomes in patients referred from rural districts where targeted screening or outreach efforts (e.g., cancer detection camps) are more actively implemented.[16] Research from other high-burden regions also highlights that social capital and local physician referral patterns significantly influence time-to-treatment, sometimes favouring peripheral populations when central systems are overburdened.[17,18]

Conversely, in the untreated subgroup, survival curves were nearly identical across districts ($p = 0.73$), affirming that without medical intervention, geographic differences have little bearing on outcomes. This reinforces the critical importance of access to and uptake of treatment in modifying the natural course of oesophageal cancer—especially in a disease with notoriously poor prognosis and high mortality.[19]

These findings, however, must be interpreted in the context of certain limitations. The retrospective nature of registry data may introduce reporting or classification biases, especially in censoring and follow-up duration. Additionally, the definition of "treated" was binary; we did not stratify by intent (curative vs. palliative) or modality (surgery vs. chemoradiation), which would provide more nuanced insights.

Sociodemographic variables like literacy, income, and healthcare-seeking behaviour—known determinants of survival in cancer—were also unavailable in this dataset.[20]

Nonetheless, the study offers a valuable starting point to explore geographic inequities in cancer outcomes. The findings call for deeper prospective studies incorporating granular clinical and social determinants. Policy-level interventions aimed at strengthening patient navigation, decentralising follow-up care, and enhancing treatment compliance—especially in urban catchment zones—may be essential to address these emerging disparities.

CONCLUSION

The study underscores a significant disparity in survival outcomes among treated oesophageal cancer patients between Kamrup (Metropolitan) and the other districts of Lower Assam. Despite being home to the tertiary care centre, Kamrup (Metro) reported inferior survival among treated patients, challenging conventional assumptions about urban healthcare advantages. These findings highlight the need for context-specific policy interventions and resource allocation that go beyond mere proximity to care facilities. Targeted strategies to improve care coordination, reduce systemic delays, and address socio-behavioural barriers are crucial to closing this survival gap. Future research incorporating staging, treatment details, and patient-level sociodemographic data will be essential to refine these observations and guide equitable cancer care delivery in the region.

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