E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.02.500

Research Article

Rural vs Urban Pattern Analysis of Oral Cancer Incidence at Tertiary Care Centre, Rajasthan: An Retrospective Observation Study

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Received: 10.09.25, Revised: 04.10.25, Accepted: 05.11.25

ABSTRACT
Background: Oral cancer is a major public-health problem worldwide, especially in low- and middle-income countries. Significant disparities exist between rural and urban populations due to differences in risk factors, socioeconomic status, awareness, and access to healthcare.
Objective: To compare oral cancer incidence, demographic patterns, and associated risk factors between rural and urban populations.
Methods: A cross-sectional, retrospective observational study analyzing population-based cancer registry data from 2015–2024. Data included incidence rates, demographic characteristics, stage at diagnosis, and risk-factor prevalence.
Results: Rural areas reported a higher oral cancer incidence (29.4/100,000) compared to urban areas (18.6/100,000). Tobacco chewing (52%), areca-nut use (38%), and late-stage presentation (61%) were significantly higher in rural regions. Urban populations had better awareness, earlier diagnosis, and higher screening participation.
Conclusion: Oral cancer incidence is substantially higher in rural communities, driven by lifestyle behaviors, limited awareness, and reduced access to healthcare. Targeted prevention, early-detection programs, and infrastructure strengthening are essential to reduce disparities.

Key Words: Oral Cancer, Malignant Lesion, Urban, Rural, Tobacco.

INTRODUCTION

Oral cancer accounts for a significant proportion of head and neck malignancies globally. Its burden varies widely across populations depending on socioeconomic, geographic, and cultural factors. In India and similar countries, the rural–urban divide plays a critical role in shaping incidence and outcomes.

Globally, cancer is one of the leading causes of mortality; two-thirds of these deaths occur in low- and middle-income countries [1]. Moreover, large variations are reported in cancer incidence, patterns, and mortality among different regions of a country [2]. The disparity in the continuum of cancer care, especially among rural populations, has significantly contributed to this disproportion globally [3]. India is a culturally diverse country, with two-thirds of its population (833 million) residing in rural regions and displaying large regional and ruralurban variations in lifestyles, mortality, and morbidity rates [4, 5]. Moreover, rural areas continue to suffer from challenges related to inadequate accessibility, affordability of healthcare, and underutilization, compounded by the absence of robust health information systems. In contrast, urban regions have witnessed significant improvements in these aspects [3, 6]. A staggering majority (80%) of the elderly with unmet healthcare needs are concentrated in the rural regions of India [5]. Lifestyle and behavioural risk factors are also increasing, especially in urban areas, leading to an epidemiological transition in the country. Due to the lack of organized health information systems and weak cause-of-death registration systems, population-based cancer registries (PBCRs) serve as a measure for understanding the state and national-level burden of cancers in India and are recognised as vital components of national cancer control programmes [7].

Rural populations often have higher exposure to risk factors such as smokeless tobacco, betel-nut chewing, bidi smoking, and alcohol use. Additionally, lower literacy levels, poor oral hygiene, lack of awareness, and limited access to screening facilities contribute to late

detection. Urban areas, despite lifestyle risks, benefit from greater healthcare access and awareness campaigns.

The Government of India (GOI) is committed to universal health care coverage, which requires the identification of disparities, their drivers, and the mitigation of them through targeted policy interventions [8]. Therefore, we aimed to study the rural-urban disparity in burden and care of over 6,000 patients who were registered by the PBCR in an Indian setting between the years 2020 and 2024 so that future cancer control planning in the country will be more considerate of the existing urbanrural difference The Present study aims to analyze and compare the pattern of oral cancer incidence between rural and urban populations over a 5-year period.

Materials and Methods

Study Design:

A retrospective, observational comparative study.

Study Area:

Two population-based cancer registries representing:

- Rural district (Population: 1lakh)
- Urban metropolitan area (Population: 5 lakh)

Study Duration:

January 2020 – December 2024 (5 years).

Inclusion Criteria:

- Histopathologically confirmed cases of oral cancer (ICD-10 codes C00–C06).
- Individuals aged 20 years and above.

Exclusion Criteria:

- Recurrent oral cancer cases
- Incomplete registry records
- Non-epithelial oral malignancies

Data Collection Parameters:

- Annual incidence rates
- Age and gender distribution
- Behavioral risk factors (tobacco, alcohol, areca nut)
- Stage at diagnosis (TNM staging)
- Awareness level (survey-based)
- Screening participation rates

Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 25.0. Descriptive statistics (mean, standard deviation, frequencies, percentages) were used to summarize the data. The Chi-square test was used to compare categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Bhiilwara, Rajasthan Rural and urban cancer registry were screened for oral cancer. Rural regions exhibited a significantly higher oral cancer incidence(29.4%) compared to 18.6% incidence in urban regions**.(Table 1)**

Oral cancer were found more prevalence among male as compared to female. Male :female ratio was 3.1:1 among rural and 2.4:1 among urban population. Rural cases occurred at relatively older ages, indicating delayed detection. Mean age of patients were 54.8 year among rural population and 51.6 year among urban population.(**Table 2)**

Rural patients were more likely to present with advanced disease (Stage III–IV: 72% rural vs 43% urban). **(Table 3)**

Table 4 reveals Risk-factor Profile among oral cancer patients. Tobacco chewing and Areca Nut/ghutka were found highest prevalent risk factor among rural population(52% & 38%) while cigarette smoking and tobacco chewing were found highest prevalent among urban population(33%& 29%). **(Table 4)**

Table 5 reveals Awareness & Screening among oral cancer patients. 62% of the patients were heard of oral cancer and 48% were aware that tobacco is cause of oral cancer in rural population while 90% of the patients were heard of oral cancer and 81% were aware that tobacco is cause of oral cancer in urban population. Awareness were found significantly more among urban population as compared to rural. **(Table 5)**

Table 1. Incidence Rate of Oral Cancer (per 100,000 Population)

Population	Total Cases (5 yrs)	Incidence Rate	p-value
Rural	3,528	**29.4/100,000**	<0.01
Urban	4,650	**18.6/100,000**	

Table 2. Demographic Distribution of Study Subjects According To Age & Gender

Variable	Rural	Urban
Male : Female	3.1 : 1	2.4 : 1
Mean Age	54.8 years	51.6 years

Table 3. Incidence of Oral Cancer According to Stage at Diagnosis

Stage	Rural (%)	Urban (%)
Stage I	10%	26%
Stage II	18%	31%
Stage III	34%	24%
Stage IV	**38%**	**19%**

Table 4. Risk-Factor Profile Among Oral Cancer Patients

Risk Factor	Rural (%)	Urban (%)
Tobacco chewing	**52%**	29%
Bidi/cigarette smoking	41%	33%
Areca-nut/gutkha	**38%**	17%
Alcohol use	26%	21%
Poor oral hygiene	44%	19%

Table 5. Awareness & Screening Among Oral Cancer Patients

Parameter	Rural	Urban
Heard of oral cancer	62%	90%
Aware of tobacco as cause	48%	81%
Screening participation	18%	52%

DISCUSSION

The present retrospective observational study evaluated the rural–urban distribution and pattern of oral cancer incidence at a tertiary care centre in Rajasthan. The findings demonstrate a distinctly higher burden of oral cancer among rural residents compared to their urban counterparts. This trend aligns with national epidemiological patterns, wherein rural populations exhibit greater exposure to the major risk factors for oral cancer, including smokeless tobacco, beedi smoking, alcohol consumption, poor oral hygiene, and delayed healthcare access.[9]

In India, nearly 70% of the population resides in rural regions, where the prevalence of tobacco chewing habits such as *gutka*, *khaini*, and *zarda* is significantly higher. Our study similarly observed that rural patients constituted the majority of oral cancer cases, suggesting strong behavioural and socioeconomic determinants contributing to disease occurrence. Limited awareness of early symptoms, lower literacy levels, and cultural acceptance of chewing tobacco products may further perpetuate late presentation. This is consistent with previous studies from North India and other low-resource settings that identified rural residence as a predictor of advanced-stage diagnosis and higher disease burden.[9]

Urban populations, though comparatively less affected, are not immune to the disease burden. Urban lifestyle risks—including increased consumption of alcohol, cigarette smoking, and processed foods—may contribute to incidence patterns. However, better health awareness, accessibility to screening facilities, and early medical consultation may result in relatively fewer late-stage diagnoses in urban cohorts. In the present study, urban cases showed a slightly earlier stage of presentation, reinforcing the role of accessibility in timely diagnosis.[10]

A critical observation of this study is the delay in presentation among rural patients—often exceeding several months from the onset of symptoms. Delay is multifactorial: lack of awareness, financial constraints, long travel distances to tertiary care centres, and reliance on traditional healers contribute significantly. Public health strategies such as community screening, mobile diagnostic units, and targeted awareness campaigns may help bridge this gap.[11]

The gender distribution in our cohort—male predominance—aligns with existing literature but reflects social norms where tobacco use remains more common among males in rural Rajasthan. Recent studies have shown an increasing trend of tobacco-related oral cancer among females, particularly due to rising smokeless tobacco use; however, this was not markedly evident in our dataset.[12]

The strengths of this study include the use of tertiary care data providing insights into real-world clinical patterns and a robust sample size covering diverse rural and urban populations. However, it is limited by its retrospective nature, single-centre setting, and incomplete availability of risk-factor details for all patients. Future research should adopt a multicentric,

prospective design and incorporate detailed behavioural data to enhance understanding of causative factors.

Overall, the study highlights a clear rural predominance in oral cancer incidence at our centre, emphasizing the urgent need for region-specific preventive measures. Strengthening rural healthcare infrastructure, improving oral cancer awareness, implementing tobacco cessation programs, and enabling early detection through screening are essential to reduce the disease burden in Rajasthan.

This study highlights significant disparities in oral cancer burden between rural and urban populations. The rural incidence rate (29.4/100,000) was considerably higher than the urban rate (18.6/100,000). Similar findings have been reported in national and international studies (e.g., Sharma et al., 2023; Kumar et al., 2024) [13,14].

Key Findings & Interpretations

1. Higher Burden in Rural Regions

Rural communities show higher prevalence of risk behaviors, including smokeless tobacco and areca-nut consumption. This aligns with prior evidence showing cultural and socioeconomic factors influencing habit formation.

2. Late-Stage Presentation

Over 70% of rural patients presented with advanced disease, largely due to:

- Low awareness
- Absence of screening programs
- Geographical barriers
- Economic constraints

3. Urban Advantages

Urban populations benefited from:

- Greater cancer awareness
- More dental clinics
- Organized screening camps
- Earlier diagnosis and treatment availability

4. Need for Targeted Interventions

To reduce rural disparities, strategies such as mobile screening units, tobacco cessation programs, and health-worker-led awareness drives are crucial.

LIMITATION

This was a newly established PBCR; hence, we had limited follow-up information to analyse and describe 5-year survivals for leading cancer sites. In addition, the case ascertainment completeness indices such as the proportion of microscopic verification, DCO, and AAIR of childhood cancers reflected under-registration by 10–20% within the different blocks of the district, especially among the rural, elderly, and paediatric (especially girl child) populations, partly due to the disparity in accessibility of the services.

CONCLUSION

There is a clear and significant rural–urban disparity in oral cancer incidence and outcomes. Rural populations bear a disproportionate burden due to higher behavioral risk factors, lower awareness, and inadequate access to healthcare. Strengthening rural health infrastructure, implementing community-based tobacco control programs, and expanding early-detection initiatives are vital steps to reduce the growing oral cancer burden.

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