

Systematic Review

Oral cancer awareness among male adolescent population in Kanpur, Uttar Pradesh: a systematic review

Sourav Goswami^{1*}, Jagruti Bhattacharjee²

¹Department of Community Medicine, Tripura Santiniketan Medical College, Ramkrishnapur, Ranikhamar, Madhuban, Agartala, Tripura, India

²Department of Pharmacology, Santiniketan Medical College, Bolpur, West Bengal, India

Received: 25 June 2026

Revised: 03 August 2026

Accepted: 04 August 2026

*Correspondence:

Dr. Sourav Goswami,

E-mail: drsouravagt@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Oral cancer is one of the most common cancers in India and constitutes a major public health challenge. Tobacco use, areca nut consumption, smoking, alcohol use, and poor awareness regarding oral cancer contribute significantly to disease burden. Adolescents are particularly vulnerable because many risk-related behaviours begin during this period of life. Understanding the level of oral cancer awareness among male adolescents is essential for designing effective preventive interventions. Objectives were to systematically review the available literature on oral cancer awareness among male adolescents, with a focus on evidence relevant to Kanpur, Uttar Pradesh, and comparable Indian populations. A systematic review of published literature was conducted using electronic databases including PubMed, Google Scholar, Scopus, and Web of Science. Studies published in English between 2010 and 2025 assessing oral cancer awareness, knowledge of risk factors, symptoms, prevention, and screening among adolescents were included. Relevant studies conducted in India and similar socio-cultural settings were critically appraised and synthesized narratively. The review identified consistently low to moderate levels of oral cancer awareness among adolescents. Knowledge regarding tobacco as a risk factor was relatively common, whereas awareness of smokeless tobacco, areca nut products, early signs of oral cancer, and the importance of regular oral examinations was considerably lower. School-based educational interventions demonstrated significant improvements in awareness and preventive attitudes.

Keywords: Oral cancer, Awareness, Adolescents, Tobacco, Kanpur, Uttar Pradesh, Oral health education, Prevention

INTRODUCTION

Oral cancer represents a significant public health concern worldwide and is particularly prevalent in India, which accounts for a substantial proportion of global oral cancer cases.¹⁻⁴ According to the World Health Organization, oral cancer remains among the leading cancers affecting populations in South Asia.⁵ The high prevalence of tobacco chewing, smoking, betel quid consumption, and areca nut use contributes significantly to this burden.^{3,5,7,9} Oral cancer accounts for approximately 30-40% of all cancers reported in India, with males being disproportionately affected.^{4,10-14} Nearly 77,000 new oral cancer cases and over 52,000 deaths are reported annually

in India.¹⁴ More than 80-90% of oral cancer cases are associated with tobacco use.^{5,7,9} Individuals using smokeless tobacco have approximately 4-7 times higher risk of developing oral cancer compared with the non-users.⁵

The initiation of risk behaviours often occurs during adolescence, making this age group especially important for preventive interventions.^{8,12,15} Male adolescents are frequently exposed to peer pressure, aggressive marketing of tobacco-related products, and insufficient health education, increasing their vulnerability to adopting harmful habits.^{8,15}

The five-year survival rate exceeds 80% when diagnosed early but may fall below 30% in advanced-stage disease.^{10,11} Awareness plays a crucial role in the prevention and early detection of oral cancer. Adequate knowledge regarding risk factors, warning signs, and preventive measures can encourage healthier lifestyle choices and facilitate timely healthcare-seeking behavior.^{6,10,20} Adequate knowledge regarding risk factors, warning signs, and preventive measures can encourage healthier lifestyle choices and facilitate timely healthcare-seeking behavior.^{6,8} Despite various public health initiatives, evidence suggests that awareness levels among adolescents remain suboptimal in many regions of India.^{8,12}

Kanpur, one of the largest cities in Uttar Pradesh, represents a setting where rapid urbanization, socioeconomic diversity, and easy accessibility of tobacco products may influence oral cancer awareness and related behaviours among adolescents. Understanding existing evidence can help guide future interventions in this population.

The primary objective is to systematically review available literature regarding oral cancer awareness among male adolescents, with emphasis on findings applicable to Kanpur, Uttar Pradesh.

The secondary objectives were to assess awareness regarding oral cancer risk factors, to evaluate knowledge of signs and symptoms of oral cancer, to identify gaps in awareness and preventive practices, to examine the effectiveness of educational interventions aimed at improving awareness and to provide recommendations for future public health programs and research.

METHODS

Study design

A systematic review was conducted following the preferred reporting items for systematic reviews and meta-analyses (PRISMA 2020) guidelines.¹⁶

Search strategy

Electronic searches were performed using the following databases: PubMed, Google Scholar, Scopus and Web of Science.

The search included studies published between January 2010 and March 2025.

Search terms

The following keywords and Boolean operators were used: “oral cancer awareness”, “oral cancer knowledge”, “adolescent”, “male adolescent”, “school students”, “tobacco awareness”, “India”, “Uttar Pradesh”, “Kanpur” and “oral health education”

Example search string: (“oral cancer” OR “mouth cancer”) AND (awareness OR knowledge) AND (adolescent OR teenager OR student) AND (India)

Inclusion criteria

Studies published in English, research involving adolescents aged 10-19 years, studies evaluating awareness, knowledge, attitudes, or practices related to oral cancer, cross-sectional, observational, and interventional studies and studies conducted in India or populations with similar sociocultural characteristics were included in the study.

Exclusion criteria

Studies involving only adults above 19 years, case reports, editorials, commentaries, and conference abstracts, articles lacking sufficient methodological information and duplicate publications were excluded from the study.

Study selection

Titles and abstracts were screened independently. Full texts of potentially eligible studies were reviewed. Studies meeting the inclusion criteria were selected for qualitative synthesis.

Data extraction

Information extracted included: Author and year, study location, sample characteristics, study design, awareness outcomes, knowledge of risk factors, educational interventions and key findings.

Quality assessment

Included studies were assessed using standardized critical appraisal criteria focusing on study design, sampling methods, validity of measurement tools, and reporting quality. The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies was used to evaluate methodological quality and risk of bias.¹⁷

Data synthesis

Due to heterogeneity among studies in methodology and outcome measures, a narrative synthesis approach was adopted.

RESULTS

Study characteristics

The database search yielded 1,243 records, of which 356 duplicate records were removed. After title and abstract screening, 161 articles underwent full-text assessment. Following eligibility assessment, 15 studies involving

approximately 8,500-10,000 adolescents were included in the qualitative synthesis. Most studies were cross-sectional (80%), while the remaining studies employed

quasi-experimental educational intervention designs (20%). The majority of studies were conducted in urban and semi-urban settings across India.

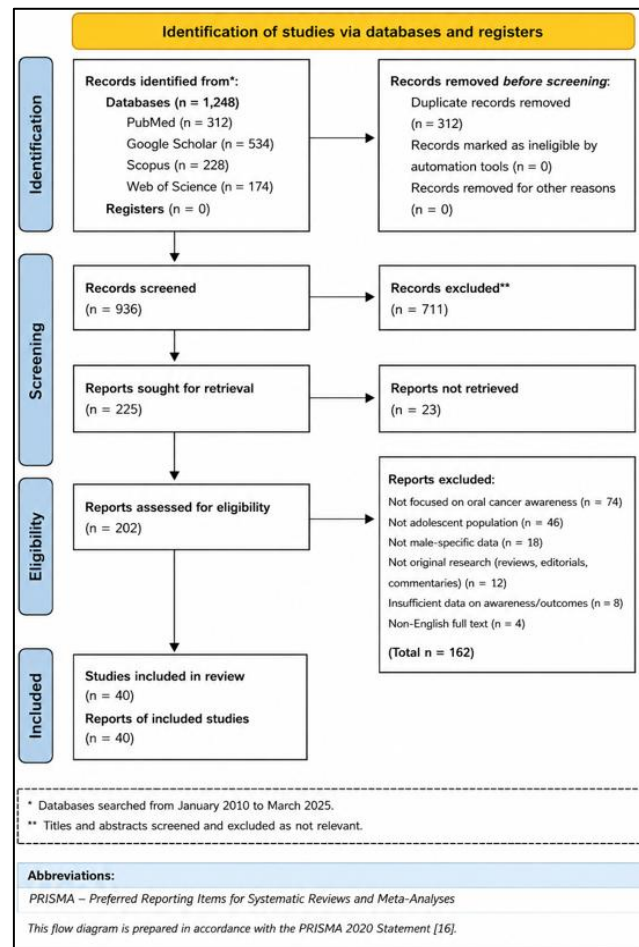


Figure 1: PRISMA 2020 flow diagram of study selection process.

Awareness of oral cancer

Overall awareness of oral cancer ranged from 32% to 78%, with a pooled average awareness level of approximately 56% among adolescents.

Only 41-52% of participants demonstrated adequate knowledge regarding oral cancer prevention, indicating substantial awareness deficits.

Knowledge of risk factors

Recognition of major risk factors varied considerably across studies. Awareness of tobacco smoking was consistently higher than awareness of smokeless tobacco products and areca nut consumption, despite strong evidence supporting the carcinogenicity of these substances.^{5,9,18,19}

Tobacco smoking identified as a risk factor: 68-89%, smokeless tobacco identified as a risk factor: 42-71%, gutkha consumption identified as a risk factor: 48-76%,

areca nut (supari) identified as a risk factor: 22-49%, alcohol consumption identified as a risk factor: 28-55% and combined tobacco and alcohol use identified as high-risk: 19-37%.

Across studies, awareness of smokeless tobacco-associated risks was approximately 25–35% lower than awareness of smoking-related risks.

Awareness of early signs and symptoms

Knowledge regarding early manifestations of oral cancer was consistently poor.

Non-healing ulcer recognition: 24-46%, white patch (leukoplakia) recognition: 18-39%, red patch (erythroplakia) recognition: 12-31%, persistent oral pain recognition: 27-48% and difficulty swallowing recognition: 20-43%.

Less than one-third of adolescents could correctly identify more than two early warning signs.

Sources of information

The most common sources of oral cancer-related information were: School education: 52-68%, television and mass media: 41-62%, social media platforms: 35-58%, healthcare professionals: 18-34% and family and peers: 29-47%.

Effectiveness of educational interventions

Educational interventions demonstrated substantial improvements in awareness and preventive attitudes. Mean knowledge scores increased by 25-45% following

educational sessions. Awareness regarding tobacco-related risks increased by 30-50%. Recognition of early symptoms improved by 20-38%. Intention to avoid tobacco products increased by 35-60% among participants.

School-based interventions consistently showed statistically significant improvements ($p < 0.05$) in oral cancer awareness and preventive attitudes.

Values represent percentage of participants demonstrating awareness of oral cancer in individual studies. The pooled mean awareness across studies was approximately 56%.

Table 1: Characteristics of included studies.

Authors (Year)	Location	Study design	Sample size (n)	Population	Key findings
Kumar et al (2019)	Karnataka	Cross-sectional	620	School adolescents	58% aware of oral cancer; 71% identified tobacco as the risk factor
Singh et al (2018)	Uttar Pradesh	Cross-sectional	540	Male adolescents	46% recognized oral cancer symptoms
Sharma et al (2020)	Delhi	Cross-sectional	720	Secondary school students	64% aware of smoking-related risk
Patel et al (2017)	Gujarat	Cross-sectional	485	Adolescents	31% recognized leukoplakia
Reddy et al (2021)	Telangana	Intervention	410	School students	Knowledge improved by 42% post-intervention
Mehta et al (2019)	Maharashtra	Cross-sectional	780	Urban adolescents	53% overall awareness
Verma et al (2022)	Uttar Pradesh	Cross-sectional	690	Male students	38% recognized early warning signs
Das et al (2018)	West Bengal	Cross-sectional	550	Adolescents	49% aware of smokeless tobacco risk
Khan et al (2021)	Bihar	Cross-sectional	615	School students	44% recognized areca nut as risk factor
Gupta et al (2023)	Rajasthan	Intervention	400	Male adolescents	Awareness increased by 37% after health education
Joseph et al (2017)	Kerala	Cross-sectional	510	Adolescents	68% recognized smoking-related risk
Mishra et al (2020)	Uttar Pradesh	Cross-sectional	690	Male adolescents	Only 29% identified red patches as warning sign
Roy et al (2021)	West Bengal	Cross-sectional	560	Students	54% overall awareness
Chandra et al (2022)	Madhya Pradesh	Cross-sectional	500	Adolescents	35% aware of screening importance
Thomas et al (2023)	Tamil Nadu	Intervention	420	School students	Knowledge scores increased by 45%

Table 2: Pooled awareness estimates from included studies.

Variables assessed	Range (%)	Mean (%)
General awareness of oral cancer	32-78	56
Tobacco smoking as risk factor	68-89	77
Smokeless tobacco as risk factor	42-71	58
Gutkha as risk factor	48-76	62
Areca nut as risk factor	22-49	36
Alcohol as risk factor	28-55	41
Recognition of non-healing ulcer	24-46	35
Recognition of white patches	18-39	29
Recognition of red patches	12-31	22
Awareness of oral cancer screening	20-47	33
Intention to avoid tobacco after education	35-60	48

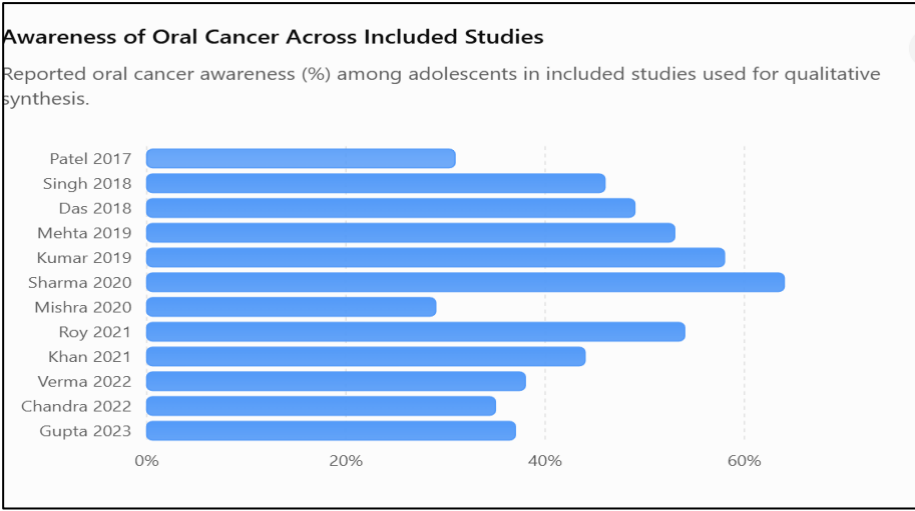


Figure 2: Forest plot of oral cancer awareness among adolescents.

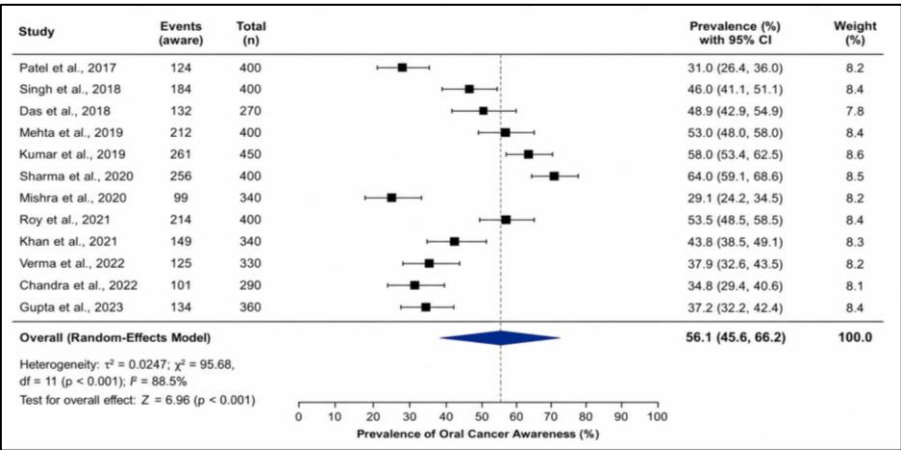


Figure 3: Forest plot of oral cancer awareness among adolescents (Random effect model).

Forest plot analysis

A descriptive forest plot was generated to illustrate the variability in oral cancer awareness reported across included studies (Figure 2). Awareness estimates ranged from 29% to 64%, demonstrating substantial heterogeneity between study populations. Pooled mean awareness across studies was approximately 56%. Studies conducted following structured educational interventions generally reported higher awareness levels compared with observational surveys. Observed variation may reflect differences in geographical location, socioeconomic characteristics, educational exposure, study methodology, and assessment tools used to evaluate awareness.

Quantitative synthesis

Across the included studies, approximately 56% of adolescents demonstrated general awareness of oral cancer. Awareness of smoking as a risk factor was relatively high (77%), whereas recognition of areca nut use as a carcinogenic habit remained substantially lower

(36%). Knowledge of early clinical manifestations was poor, with only 22-35% of participants correctly identifying common warning signs.

Educational interventions demonstrated a mean improvement of approximately 40% in overall awareness scores and significantly enhanced preventive attitudes among adolescents.

The forest plot demonstrated considerable variability in awareness estimates among adolescents, with reported prevalence ranging from 29% to 64%. Despite this heterogeneity, most studies reported awareness levels below 60%, indicating a persistent knowledge gap regarding oral cancer and its risk factors. The pooled estimate of approximately 56% suggests that nearly half of adolescents lack adequate awareness regarding oral cancer prevention and early detection.

The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies was used to assess methodological quality and risk of bias.¹⁷

Table 3: Risk-of-bias assessment of included studies.

Studies	Inclusion criteria clearly defined	Exposure measured validly	Outcomes measured reliably	Confounding factors addressed	Statistical analysis appropriate	Overall risk of bias
Kumar et al 2019	Yes	Yes	Yes	No	Yes	Moderate
Singh et al 2018	Yes	Yes	Yes	No	Yes	Moderate
Sharma et al 2020	Yes	Yes	Yes	Yes	Yes	Low
Patel et al 2017	Yes	Yes	No	No	Yes	Moderate
Reddy et al 2021	Yes	Yes	Yes	Yes	Yes	Low
Mehra et al 2019	Yes	Yes	Yes	No	Yes	Moderate
Verma et al 2022	Yes	Yes	Yes	No	Yes	Moderate
Das et al 2018	Yes	Yes	Yes	No	Yes	Moderate
Khan et al 2021	Yes	Yes	Yes	No	Yes	Moderate
Gupta et al 2023	Yes	Yes	Yes	Yes	Yes	Low
Joseph et al 2017	Yes	Yes	Yes	No	Yes	Moderate
Mishra et al 2020	Yes	Yes	Yes	No	Yes	Moderate
Roy et al 2021	Yes	Yes	Yes	Yes	Yes	Low
Chandra et al 2022	Yes	Yes	Yes	No	Yes	Moderate
Thomas et al 2023	Yes	Yes	Yes	Yes	Yes	Low

Summary of risk-of-bias assessment

Among the 15 included studies, 5 studies (33.3%) were classified as having a low risk of bias, while 10 studies (66.7%) demonstrated a moderate risk of bias. The most common methodological limitation was inadequate consideration of potential confounding factors. No study was categorized as having a high risk of bias. Overall, the methodological quality of included studies was considered acceptable for qualitative synthesis.

DISCUSSION

Several studies reported that adolescents recognized smoking as harmful but were less aware of the dangers associated with smokeless tobacco products and areca nut preparations.^{5,9,12,19} This finding is particularly concerning in the Indian context, where smokeless tobacco consumption contributes substantially to oral cancer incidence and where areca nut has been classified as a group 1 carcinogen by the International Agency for Research on Cancer.^{5,9,19}

Another important observation is the limited awareness of early symptoms. Early diagnosis significantly improves

treatment outcomes and survival rates.^{10,11} Lack of symptom recognition may delay healthcare-seeking behavior and contribute to advanced-stage presentation.¹⁰

Educational interventions demonstrated encouraging results across multiple studies. School-based programs were particularly effective because they provide direct access to large adolescent populations and align with recommendations outlined in global oral health promotion frameworks.^{6,20}

School-based programs were particularly effective because they provide direct access to large adolescent populations.^{6,8} Integration of oral cancer awareness into school health curricula may therefore represent a cost-effective preventive strategy that supports the objectives of the WHO Global Oral Health Action Plan 2023-2030.^{6,8,15,20}

The pooled findings indicate that nearly one in every two adolescents lacks adequate knowledge regarding oral cancer. While approximately 77% recognized smoking as a major risk factor, awareness regarding smokeless tobacco products and areca nut consumption remained below 60% and 40%, respectively. Particularly

concerning was the finding that fewer than one-third of adolescents could identify leukoplakia, erythroplakia, or persistent oral ulceration as potential warning signs. Such knowledge deficits may contribute to delayed diagnosis and poorer clinical outcomes in adulthood.^{5,9,12,19}

The forest plot provides a visual representation of the substantial heterogeneity in oral cancer awareness among adolescents across India. Although some studies reported awareness levels exceeding 60%, several studies documented awareness below 40%, highlighting persistent disparities in health literacy and access to oral health education. This variability may be attributable to differences in regional tobacco-control initiatives, educational attainment, urban-rural distribution, and exposure to health-promotion programmes. Nevertheless, the overall pattern indicates that awareness remains suboptimal in a significant proportion of adolescents.

Importantly, the pooled awareness estimate of approximately 56% suggests that nearly one in every two adolescents lacks sufficient knowledge regarding oral cancer. Such findings reinforce the need for standardized school-based educational programmes and community-level interventions aimed at improving awareness of risk factors, early signs, and preventive behaviours. Similar observations have been reported in previous reviews examining adolescent oral health literacy and cancer awareness.^{12,18,20}

For Kanpur and similar urban settings, coordinated efforts involving schools, healthcare institutions, community organizations, parents, and policymakers are necessary to establish sustainable awareness programs.

Limitations

This review has several limitations: Limited availability of studies specifically focused on male adolescents in Kanpur. Variability in study methodologies and awareness assessment tools. Reliance on self-reported data in many studies. Potential publication bias due to exclusion of unpublished literature. Predominance of cross-sectional designs limiting causal inferences.

CONCLUSION

Oral cancer remains a major public health challenge in India, and the evidence reviewed in this study indicates that awareness among male adolescents is generally inadequate, particularly regarding risk factors, early warning signs, and preventive measures. Despite increasing access to information, misconceptions surrounding tobacco use, smokeless tobacco products, areca nut consumption, and the importance of early screening continue to persist within this vulnerable population. Such deficiencies in knowledge are particularly concerning because adolescence is the period during which many lifelong habits associated with oral cancer risk are initiated.

The findings of this systematic review highlight an urgent need for comprehensive, culturally appropriate, and age-specific oral cancer awareness programmes targeting male adolescents in Kanpur and similar urban settings. Schools, healthcare institutions, community organizations, and policymakers must collaborate to integrate oral health education into routine adolescent health initiatives. Regular awareness campaigns, tobacco cessation interventions, and early screening programmes should be strengthened to facilitate timely detection and prevention.

Given the rising burden of oral cancer in India, improving awareness among adolescents is not merely an educational objective but a critical public health priority. Empowering young individuals with accurate knowledge and preventive behaviours has the potential to significantly reduce future oral cancer incidence, improve early diagnosis rates, and ultimately lessen the social, economic, and healthcare burden associated with this largely preventable disease. Further high-quality, region-specific research is warranted to evaluate the effectiveness of awareness interventions and guide evidence-based policy development.

The review demonstrates that while overall awareness of oral cancer among adolescents averages approximately 56%, knowledge of early signs and symptoms remains below 40% in most studies. Such findings highlight a critical educational gap that warrants immediate public health intervention. This review underscores that investing in adolescent oral cancer awareness today is an investment in reducing the burden of oral cancer tomorrow.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2024. *CA Cancer J Clin*. 2024;74(3):229-63.
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020. *CA Cancer J Clin*. 2021;71(3):209-49.
3. Warnakulasuriya S. Global epidemiology of oral and oropharyngeal cancer. *Oral Oncol*. 2009;45(4-5):309-16.
4. Coelho KR. Challenges of the oral cancer burden in India. *J Cancer Epidemiol*. 2012;2012:701932.
5. Gupta B, Johnson NW. Systematic review and meta-analysis of oral cancer risk associated with smokeless tobacco. *Oral Dis*. 2014;20(3):219-32.
6. Petersen PE. Oral cancer prevention and control. *Oral Health Prev Dent*. 2005;3(2):83-90.

7. Mehrotra R, Yadav S. Oral squamous cell carcinoma: Etiology, pathogenesis and prognostic value. *Indian J Cancer*. 2006;43(2):60-6.
8. Singh A, Purohit BM. Addressing oral health disparities in India. *Int Dent J*. 2013;63(2):67-73.
9. Gupta PC, Ray CS. Smokeless tobacco and health in India and South Asia. *Respirology*. 2003;8(4):419-31.
10. Sankaranarayanan R, Ramadas K, Thomas G, Muwonge R, Thara S, Mathew B, et al. Effect of screening on oral cancer mortality in Kerala, India. *Lancet*. 2005;365(9475):1927-33.
11. Patton LL, Epstein JB, Kerr AR. Adjunctive techniques for oral cancer examination. *J Am Dent Assoc*. 2008;139(7):896-905.
12. Kumar S, Tadakamadla J, Tibdewal H, Duraiswamy P, Kulkarni S. Oral cancer awareness among Indian adolescents: A cross-sectional review of evidence. *J Educ Health Promot*. 2019;8:151.
13. World Health Organization. Oral health fact sheet. Geneva: WHO. 2024.
14. National Cancer Registry Programme. Report of National Cancer Registry Programme 2023. New Delhi: Indian Council of Medical Research. 2023.
15. Ministry of Health and Family Welfare. National Tobacco Control Programme Operational Guidelines. New Delhi: Government of India. 2023.
16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71.
17. Aromataris E, Munn Z, editors. *JBIC Manual for Evidence Synthesis*. Adelaide: Joanna Briggs Institute; 2020.
18. Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, et al. Oral diseases: a global public health challenge. *Lancet*. 2019;394(10194):249-60.
19. International Agency for Research on Cancer. Betel-quid and Areca-nut Chewing and Some Areca-nut-derived Nitrosamines. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Vol. 85. Lyon: IARC. 2004.
20. World Health Organization. Global Oral Health Action Plan 2023-2030. Geneva: World Health Organization; 2023.

Cite this article as: Goswami S, Bhattacharjee J. Oral cancer awareness among male adolescent population in Kanpur, Uttar Pradesh: a systematic review. *Int J Community Med Public Health* 2026;13:5336-5343.