



Knowledge and awareness about HPV-related oral cancer among dentists and dental students: A systematic review

Ezatolah Kazeminejad¹ , Fatemeh Mirzaei^{2*} , Shohreh Ghasemi^{3,4} , Mahmood Dashti⁵ , Mohammadreza Esmaily⁶ 

¹Dental Research Center, Golestan University of Medical Sciences, Gorgan, Iran

²Student Research Committee, Golestan University of Medical Sciences, Gorgan, Iran

³OMFS Department, Augusta University, GA, USA

⁴Craniofacial Reconstruction and Trauma Queen Marry, University of London, London, Great Britain

⁵School of Dentistry, Faculty of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

⁶Golestan University of Medical Sciences, Gorgan, Iran

Abstract

Background: Oral cancer is one of the most prevailing neoplasms globally, and human papillomavirus (HPV) is one of the risk factors for this condition. Knowledge and awareness about HPV-related oral cancer can lead to a better diagnosis and prognosis of this disease. This systematic review aimed to evaluate knowledge and awareness about HPV-related oral cancer among dentists and dental students.

Methods: We searched Web of Science, Scopus, PubMed, and ProQuest databases with Medical Subject Headings (MeSH) and non-MeSH keywords to find related articles. Our eligibility criteria were: 1) cross-sectional studies including knowledge and awareness about HPV-related oral cancers, 2) publication date up to August 18, 2021, 3) studies containing dentists or dental students as the main participants, or as part of the participants. The Joanne Briggs Institute (JBI) checklist was used for quality assessment.

Results: A total of 10 studies were included in this systematic review. Five studies have shown that over 80 percent of dental students know HPV can cause oropharyngeal cancer (OPC). More than three-quarters of dentists reported HPV as a cause of oral cancer. Less than half of patients in two studies mentioned biopsy for adequate diagnosis.

Conclusion: HPV-related oral cancer knowledge and awareness need to be improved through focusing on academic and public education. For dental students, it is necessary to identify HPV as a risk factor for oral cancer. Moreover, the significance of routine checkups should not be ignored.

Keywords: Human papillomavirus, Education, Prognosis

Citation: Kazeminejad E, Mirzaei F, Ghasemi S, Dashti M, Esmaily M. Knowledge and awareness about HPV-related oral cancer among dentists and dental students: a systematic review. *J Oral Health Oral Epidemiol.* 2023;12(1):14–20. doi:10.34172/johoe.2023.03

Received: November 28, 2021, **Accepted:** August 1, 2022, **ePublished:** March 29, 2023

Introduction

Cancers involving regions such as oral cavity, oropharynx, and lips represent a growing concern worldwide, with an incidence of about 448 000 cases and up to 228 000 deaths in 2018.¹ Patients are more likely to be middle-aged men demographically, and the disease varies in terms of anatomic location, biologic behavior, prognosis, and treatment among cases.^{2–5}

The most common etiological factors are ultra-violet exposure, tobacco and alcohol usage, areca-nut chewing, and human papillomavirus (HPV).^{6,7} The potential role of high-risk HPV types (specially types 16 and 18) as risk factors for developing oral cancers, especially oropharyngeal cancers (OPCs), is a public health concern.⁸

The prevalence of this virus ranges from 0.6 to 81%,

which can cause both HPV infections and HPV-related head and neck cancers in the oral mucosa.^{9,10} Various studies have reported that 17–56% of all oral cancers are HPV-related.¹¹ The virus can be transmitted to the oral cavity through orogenital sex, so the increased prevalence rate can be explained by sexual behaviors.^{9,10,12}

The high mortality and increasing burden of HPV-related oral cancer make the process of early examination and diagnosis extremely critical.^{13–15} The chief complaint of patients is related to the head and neck region, especially the oral cavity, as the main locations of the HPV-related oral cancers, making dental schools the first place for dental students (as future dentists) to learn the etiology, epidemiology, pathophysiology, oral manifestation, examination, diagnosis and prognosis of such malignancies, and educational programs should



provide them with this opportunity. In addition, dentists working in clinics or private offices need to be academically updated as they are in a good position to detect such malignancies while examining the patient's oral cavity twice a year, so knowledge and awareness of dental students and dentists about HPV-related oral cancers play a vital role in their early diagnosis.

Several studies have examined patients', students', and dental professionals' knowledge and awareness about oral cancer.^{16,17} This systematic review aimed to assess the knowledge and awareness of dentists and dental students about HPV-related oral cancers.

Methods

Protocol and registration

This systematic review and meta-analysis were carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline.¹⁸ The focused PICO (Population, Intervention, Comparison, Outcome) question was "How much Knowledge and awareness do dentists and dental students have about HPV-related oral cancer?"

Eligibility criteria

Inclusion criteria were:

1. Cross-sectional studies,
2. publication date up to August 18, 2021,
3. studies including dentists and dental students as their participants or as part of their participants with data reported separately.

The exclusion criterion was using assessment tools

rather than questionnaires.

Search strategy

Databases including Web of Science, Scopus, PubMed, and ProQuest were searched for studies published up to August 18, 2021 using related terms such as 'knowledge*', 'aware*', 'human papillomavirus,' 'HPV,' 'cancer*', 'dent*' (Table 1). A manual search was carried out for related publications. Our search was not limited to any specific language. The results were added into an Endnote X9 library, and two of the authors assessed the title/abstracts independently to see if they met the inclusion criteria. In cases of disagreement, a third author was involved in all these processes. The full text of selected articles was checked for further information.

Selection of studies and data extraction

Data such as the name of authors, year of publication, country, total sample size, number of dentists or dental students as participants, and academic grade were extracted.

Quality assessment tools

Based on a study by Ma et al¹⁹, The Joanne Briggs Institute (JBI) checklist for analytical cross-sectional studies was used for quality assessment. The quality of the studies was scored in each question as 1 = "yes," 2 = "no," 3 = "unclear," and 4 = "not applicable." Two authors (FM and ME) performed the process separately, and a third author was involved in case of disagreement. All of the

Table 1. Search strategy

Databases	Search strategy	Date	Results
PubMed	((((((((((((aware*[Title/Abstract]) OR (attitude*[Title/Abstract])) OR (opinion*[Title/Abstract])) OR (knowledge*[Title/Abstract]) OR (belie*[Title/Abstract]) OR (percept*[Title/Abstract]) OR (view*[Title/Abstract]) OR (comment*[Title/Abstract]) OR (thought*[Title/Abstract]) OR (uptake*[Title/Abstract]) OR (understand*[Title/Abstract]) OR (concept*[Title/Abstract]) OR (comprehens*[Title/Abstract]) OR (cogni*[Title/Abstract]) OR (recogni*[Title/Abstract]) OR (think*[Title/Abstract]) AND (((papillomaviridae[Title/Abstract]) OR ("human papilloma virus"[Title/Abstract]) OR ("human papillomavirus"[Title/Abstract]) OR (HPV*[Title/Abstract])) AND (((((((((((neoplas*[Title/Abstract]) OR (paraneoplas*[Title/Abstract]) OR (preneoplas*[Title/Abstract]) OR (tumor*[Title/Abstract]) OR (cancer*[Title/Abstract]) OR (precancer*[Title/Abstract]) OR (malignan*[Title/Abstract]) OR (premalignan*[Title/Abstract]) OR (benign[Title/Abstract]) OR (carcino*[Title/Abstract]) OR (precarcino*[Title/Abstract]) OR (sarcoma*[Title/Abstract]) OR (metastas*[Title/Abstract]) OR (anaplas*[Title/Abstract]) OR (dysplas*[Title/Abstract])) AND ((dent*[Title/Abstract]) OR (student*[Title/Abstract]))	18 Aug 2021	462
WOS	TS=(aware* OR attitudes OR opinions OR knowledge* OR belie* OR percept* OR view* OR comments OR thought* OR uptake* OR understand* OR concept* OR comprehens* OR *cogni* OR think*) AND TS=(*neoplas* OR tumor* OR *cancer* OR *malignan* OR benign OR *carcino* OR *sarcoma* OR metastas* OR anaplas* OR dysplas*) AND TS=(papillomaviridae OR "human papilloma virus" OR "human papillomavirus" OR HPV*) AND TS=(dent* OR student)	18 Aug 2021	728
SCOPUS	TITLE-ABS-KEY(aware* OR attitude* OR opinion* OR knowledge* OR belie* OR percept* OR view* OR comment* OR thought* OR uptake* OR understand* OR concept* OR comprehens* OR *cogni* OR think*) AND TITLE-ABS-KEY (*neoplas* OR tumor* OR *cancer* OR *malignan* OR benign OR *carcino* OR *sarcoma* OR metastas* OR anaplas* OR dysplas*) AND TITLE-ABS-KEY(papillomaviridae OR "human papillomavirus" OR "human papilloma virus" OR HPV*) AND TITLE-ABS-KEY(dent* OR student*)	18 Aug 2021	699
ProQuest	ab(aware* OR attitude* OR opinion* OR knowledge* OR belie* OR percept* OR view* OR comment* OR thought* OR uptake* OR understand* OR concept* OR comprehens* OR cogni* OR recogni* OR think*) AND ab(papillomaviridae OR "human papilloma virus" OR "human papillomavirus" OR HPV*) AND ab(neoplas* OR paraneoplas* OR preneoplas* OR tumor* OR cancer* OR precancer* OR malignan* OR premalignan* OR benign OR carcino* OR precarcino* OR sarcoma* OR metastas* OR anaplas* OR dysplas*) AND ab(dent* OR student*)	18 Aug 2021	85

selected studies used a kind of the transtheoretical model or a questionnaire.^{20,21}

Results

By searching the four databases, 1974 studies were found. There were 973 duplicate records, and 74 were removed for other reasons (systematic reviews: 43, books or chapters: 13, case reports: 5, other types of study: 13). The remaining 927 titles/abstracts were checked, and 910 studies did not meet the inclusion criteria. From the 17 remaining articles selected for full-text review, two were assessing HPV-related literacy, two did not adequately evaluate HPV-related oral cancer, one was a pilot test study, and one study was qualitative. The remaining six studies were extracted (Figure 1).

Study characteristics

As shown in Table 2, a total of 10 cross-sectional studies were included in this systematic review. Studies were conducted in different regions (USA: 2, Turkey: 2, Saudi Arabia: 2, Spain: 1, Malaysia: 1, Jordan: 1, and Netherlands: 1). One study was performed on dentists, six studies on dental students, and three studies on both groups separately. A total of 444 dentists and 2463 dental

students participated. Also, Rutkoski et al²⁷ included 120 dental hygienists, and Sallam et al²⁸ included post-graduate residents. Alqhtani et al³¹ used a questionnaire based on the study of Arora et al. Three studies referred to a study by Daley et al²⁰ based on the transtheoretical model with or without additional questions. Rutkoski et al used the questionnaire made in 2018,²¹ and Farsi et al²³ used part of this questionnaire.

Quality assessment

As shown in Table 3, JBI scores varied from 4 to 6. Alqhtani et al³¹ identified the cofounding factors but did not deal with them. None of the studies scored 8 out of 8.

Knowledge and awareness

Five studies showed that over 80% of dental students know that HPV can cause OPC. More than three-quarters of dentists reported HPV as a cause of oral cancer. Two studies compared clinical and pre-clinical groups, and the first group showed higher knowledge. Three studies revealed knowledge about the common site of HPV-related oral cancer. Less than half of the patients in two studies mentioned biopsy as a way for adequate diagnosis. Three studies mentioned the importance of

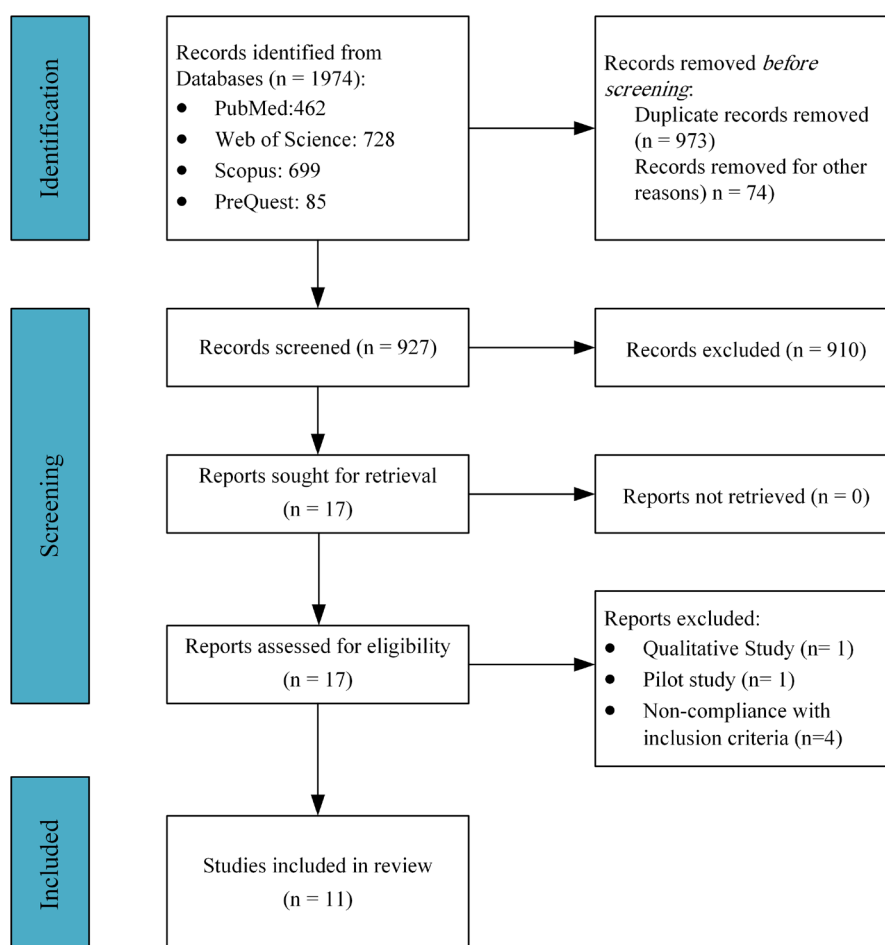


Figure 1. PRISMA flowchart

Table 2. Study characteristics and major findings

Author	Year	Country	Sample size	Dental students	Dentists	Major findings
Arora et al ²²	2018	Malaysia	179	None	General practitioners: 49, Specialist in oral medicine/oral pathology: 28, Other specialists: 102	One hundred sixty-five participants believed that oral cancer could be caused by HPV. Approximately 43% suggested that treatment strategies for HPV-related OSCC were different from other OSCCs.
Farsi et al ²³	2020	Saudi Arabia	500	3 rd and 4 th year	None	Clinical students had significantly higher knowledge. Female students had higher HPV-related OPC knowledge than male students.
Keser et al ²⁴	2020	Turkey	318	3 rd year: 100, 4 th year: 119, 5 th year: 99	None	82.7 of students agreed that some types of HPV cause oral cancer.
Lorenzo-Pouso et al ²⁵	2018	Spain	158	First year: 35 Second year: 22 3 rd year: 32 4 th year: 36 5 th year: 33	None	75% reported that there was a relation between HPV and OPC. In half of the items, participants agreed that dentists need to inform their patients about HPV-related OPC, and that there is a need for an established protocol for OPC. Students felt insecure about their visual and palpation skills concerning OPC diagnosis skills.
Poelman et al ²⁶	2018	Netherlands	126	First 3 years: 70	None	A large proportion of the students liked to have additional training during their education. Availability of reliable screening devices and knowledge about HPV-related oral cancer to the public was suggested. 84.3 of bachelor's and 89.3 of master's students know that some types of HPV cause oral cancer.
Rutkoski et al ²⁷	2020	USA	380	3 rd year: 185 4 th year: 91	None	Only 20% of respondents had adequate HPV-OPC knowledge. 77% did not know that tobacco-related OPC is more deadly than HPV-OPC. Only 39% correctly reported the posterior oropharynx as having the highest risk for oral sites most affected by HPV-OPC.
Sallam et al ²⁸	2019	Jordan	376	Pre-clinical: 155, Clinical, Interns, Residents: 221	None	97.2% of participants in the clinical group and 82.7% of dental students knew HPV could cause oral cancer and 97.2% of the participants in the clinical group reported that it is important to inform the public about this matter, and 68% stated that the best way is to tell them directly that HPV can cause oral cancer.
Rowan et al ²⁹	2015	USA	457	First year: 198 Seniors: 134 Total: 332	51	All respondents were knew that an STD could be a risk for oral cancer. 42% of respondents indicated that a biopsy from the posterior oropharynx should be tested for STDs.
Özdede et al ³⁰	2020	Turkey	209	127	82	There was no statistical difference between the answers of dentists and dental students. The majority of participants knew that HPV could cause OPC, and 75.6% of both groups stated that different HPV types cause OPC. 34.1% of dentists and 28.3% of dental students stated that OPCs caused by HPV have a better prognosis than other OPCs.
Alqhtani et al ³¹	2020	Saudi Arabia	204	Interns: 72	General practitioners: 75, Specialist in oral medicine/oral pathology: 20, Other specialists: 37	Over 76.5% identified HPV as a cause of OSCC or oral cancer while only 38.2% reported informing their patients about this matter. Most participants (44.6%) thought of the lateral border of the tongue as the most affected site. Over half of the participants were aware that vaccines can prevent HPV-related cancers.

OSCC: oral squamous cell carcinoma, OM: oral medicine, OP: oral pathology, GP: general practitioner, OPC: oropharyngeal cancer, SD: standard deviation, STD: sexually transmitted disease.

informing patients. More details are presented in [Table 2](#).

Discussion

The main purpose of this study was to assess the knowledge and awareness among dentists and dental students regarding HPV-related oral cancer. Increased knowledge and awareness can result in early detection of patients with HPV-related oral cancer, especially

those with oral manifestations, and therefore, can lead to a reduction in mortality and morbidity through initial treatments.³²

According to our study, common sites of HPV-related oral cancer were unclear to a large proportion of participants, and they pointed to the lateral or posterior of the tongue instead of the posterior oropharynx.^{22,27,29} This finding of our study reveals the importance of education

Table 3. The JBI checklist and quality assessment

Authors	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Total score
Arora et al ²²	Yes	Yes	Yes	Yes	N/A	N/A	Yes	Yes	6
Farsi et al ²³	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6
Keser et al ²⁴	Yes	Yes	N/A	N/A	N/A	N/A	Yes	Yes	4
Lorenzo-Pouso et al ²⁵	Yes	Yes	N/A	Yes	N/A	N/A	Yes	Yes	5
Poelman et al ²⁶	Yes	Yes	N/A	Yes	N/A	N/A	Yes	Yes	5
Rutkoski et al ²⁷	Yes	Yes	Yes	Yes	N/A	N/A	Yes	Yes	6
Sallam et al ²⁸	Yes	Yes	N/A	Yes	N/A	N/A	Yes	Yes	5
Rowan et al ²⁹	Yes	Yes	N/A	Yes	N/A	N/A	Yes	Yes	5
Özdede et al ³⁰	Yes	Yes	N/A	Yes	N/A	N/A	Yes	Yes	5
Alqhtani et al ³¹	Yes	Yes	Yes	N/A	Yes	N/A	Yes	Yes	6

for dental students as they are directly involved in the diagnosis, screening, and treatment of such cancers. One way is to reinforce dental school curricula regarding HPV-related oral cancers, and several studies have shown the willingness of dentists and dental students toward it.^{20,26,33}

Discussing HPV with patients is an integral skill for dental practitioners, and they should initiate the discussion themselves or discuss it if the patient asks; to achieve this purpose, they need to be well-educated and updated in each grade and, more importantly in different aspects, i.e. microbiological, clinical, and community dentistry.³⁴ They can also use the views and experiences of the experts. A recent study reviewed the benefits of HPV discussions with head and neck cancer patients and confirmed their beneficial effect.³⁵ Student should achieve self-confidence to ask patients about their lifestyle and sexual behavior and inform them about the relation between oral cancer and HPV and factors like gender, culture, and religion should not stand in the way of this process.

Several studies indicated an increase in knowledge through interventions, and the power of social media should not be underestimated.^{33,36-38} Bakr et al reported that social media was the most practical tool for educational approaches.³⁹ In addition, social media and websites have become more accessible information sources to all students and the general public. In the study by Farsi et al,²³ the Internet and media were the second and third sources of knowledge after education. Rajiah et al⁴⁰ reported media as the main source. The importance of evidence-based medicine for acquiring the earliest data in HPV and oral cancers should be emphasized in academic settings and international conferences.

In the study by Sallam et al²⁸ and Farsi et al,²³ significantly higher knowledge was observed in the clinical group, which is rational due to the higher number of clinical courses they pass. Workshops, campaigns, and additional online sessions can help narrow the knowledge gaps between students with different school grades.

Two studies^{26,28} reported the participants' response rate as less than 50%, and since all of the included studies

used self-administration questionnaires, there are some solutions to decrease the possible dropouts, such as giving gift cards to participants, as in one of the studies.²⁷

While evaluating titles/abstracts, we found that dental students were ignored in most studies or made up only a small proportion of the total sample size. Some studies assessed health care professionals other than students and dentists as their target population,^{34,41-43} and some studies evaluated oral cancer knowledge without focusing on HPV, which was not the aim of ours.^{40,44-48}

Rutkoski et al²⁷ reported that HPV-related OPC knowledge was the lowest among Asian students, so further investigations are needed in this field, especially in developing countries. Most of the included studies evaluated knowledge about HPV-related oral cancers in addition to knowledge about HPV vaccination; therefore, further studies are recommended regarding knowledge and awareness of the same target group as this study regarding HPV vaccination.

Conclusion

HPV-related oral cancer knowledge and awareness need to be improved by focusing on academic and public education. For dental students, it is necessary to identify HPV as a risk factor for oral cancer. Moreover, the significance of routine checkups should not be ignored.

Authors' Contribution

Conceptualization: Fatemeh Mirzaei, Shohreh Ghasemi, Mahmood Dashti, Mohammadreza Esmaily.

Data curation: Ezatolah Kazeminejad, Shohreh Ghasemi.

Formal analysis: Mohammadreza Esmaily.

Investigation: Mohammadreza Esmaily, Mahmood Dashti.

Methodology: Mohammadreza Esmaily, Fatemeh Mirzaei.

Project administration: Ezatolah Kazeminejad, Shohreh Ghasemi, Fatemeh Mirzaei.

Supervision: Ezatolah Kazeminejad, Shohreh Ghasemi.

Software: Mohammadreza Esmaily, Mahmood Dashti.

Resources: Mohammadreza Esmaily, Mahmood Dashti.

Validation: Shohreh Ghasemi, Mahmood Dashti.

Visualization: Shohreh Ghasemi, Mahmood Dashti.

Writing—original draft: Fatemeh Mirzaei, Shohreh Ghasemi.

Writing—review & editing: Ezatolah Kazeminejad, Shohreh

Ghasemi.

Competing Interests

None to be declared.

Ethical Approval

Not applicable.

Funding

None to be declared.

References

- Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2018;68(6):394-424. doi: [10.3322/caac.21492](https://doi.org/10.3322/caac.21492).
- Deschler DG, Richmon JD, Khariwala SS, Ferris RL, Wang MB. The "new" head and neck cancer patient-young, nonsmoker, nondrinker, and HPV positive: evaluation. *Otolaryngol Head Neck Surg*. 2014;151(3):375-80. doi: [10.1177/0194599814538605](https://doi.org/10.1177/0194599814538605).
- Chen PH, Shieh TY, Ho PS, Tsai CC, Yang YH, Lin YC, et al. Prognostic factors associated with the survival of oral and pharyngeal carcinoma in Taiwan. *BMC Cancer*. 2007;7:101. doi: [10.1186/1471-2407-7-101](https://doi.org/10.1186/1471-2407-7-101).
- Jan JC, Hsu WH, Liu SA, Wong YK, Poon CK, Jiang RS, et al. Prognostic factors in patients with buccal squamous cell carcinoma: 10-year experience. *J Oral Maxillofac Surg*. 2011;69(2):396-404. doi: [10.1016/j.joms.2010.05.017](https://doi.org/10.1016/j.joms.2010.05.017).
- Genden EM, Ferlito A, Silver CE, Takes RP, Suárez C, Owen RP, et al. Contemporary management of cancer of the oral cavity. *Eur Arch Otorhinolaryngol*. 2010;267(7):1001-17. doi: [10.1007/s00405-010-1206-2](https://doi.org/10.1007/s00405-010-1206-2).
- Kumar M, Nanavati R, Modi TG, Dobariya C. Oral cancer: etiology and risk factors: a review. *J Cancer Res Ther*. 2016;12(2):458-63. doi: [10.4103/0973-1482.186696](https://doi.org/10.4103/0973-1482.186696).
- Gillison ML, Chaturvedi AK, Anderson WF, Fakhry C. Epidemiology of human papillomavirus-positive head and neck squamous cell carcinoma. *J Clin Oncol*. 2015;33(29):3235-42. doi: [10.1200/jco.2015.61.6995](https://doi.org/10.1200/jco.2015.61.6995).
- Liu X, Gao XL, Liang XH, Tang YL. The etiologic spectrum of head and neck squamous cell carcinoma in young patients. *Oncotarget*. 2016;7(40):66226-38. doi: [10.18632/oncotarget.11265](https://doi.org/10.18632/oncotarget.11265).
- Gupta S, Gupta S. Role of human papillomavirus in oral squamous cell carcinoma and oral potentially malignant disorders: a review of the literature. *Indian J Dent*. 2015;6(2):91-8. doi: [10.4103/0975-962x.155877](https://doi.org/10.4103/0975-962x.155877).
- D'Souza G, Agrawal Y, Halpern J, Bodison S, Gillison ML. Oral sexual behaviors associated with prevalent oral human papillomavirus infection. *J Infect Dis*. 2009;199(9):1263-9. doi: [10.1086/597755](https://doi.org/10.1086/597755).
- de Martel C, Ferlay J, Franceschi S, Vignat J, Bray F, Forman D, et al. Global burden of cancers attributable to infections in 2008: a review and synthetic analysis. *Lancet Oncol*. 2012;13(6):607-15. doi: [10.1016/s1470-2045\(12\)70137-7](https://doi.org/10.1016/s1470-2045(12)70137-7).
- Ang KK, Harris J, Wheeler R, Weber R, Rosenthal DI, Nguyen-Tân PF, et al. Human papillomavirus and survival of patients with oropharyngeal cancer. *N Engl J Med*. 2010;363(1):24-35. doi: [10.1056/NEJMoa0912217](https://doi.org/10.1056/NEJMoa0912217).
- Baykul T, Yilmaz HH, Aydin U, Aydin MA, Aksoy M, Yildirim D. Early diagnosis of oral cancer. *J Int Med Res*. 2010;38(3):737-49. doi: [10.1177/147323001003800302](https://doi.org/10.1177/147323001003800302).
- Wissinger E, Griebesch I, Lungershausen J, Foster T, Pashos CL. The economic burden of head and neck cancer: a systematic literature review. *Pharmacoeconomics*. 2014;32(9):865-82. doi: [10.1007/s40273-014-0169-3](https://doi.org/10.1007/s40273-014-0169-3).
- Chaturvedi AK, Anderson WF, Lortet-Tieulent J, Curado MP, Ferlay J, Franceschi S, et al. Worldwide trends in incidence rates for oral cavity and oropharyngeal cancers. *J Clin Oncol*. 2013;31(36):4550-9. doi: [10.1200/jco.2013.50.3870](https://doi.org/10.1200/jco.2013.50.3870).
- Hassona Y, Scully C, Abu Ghosh M, Khoury Z, Jarrar S, Sawair F. Mouth cancer awareness and beliefs among dental patients. *Int Dent J*. 2015;65(1):15-21. doi: [10.1111/ijdj.12140](https://doi.org/10.1111/ijdj.12140).
- Kebabcıoğlu Ö, Pekiner FN. Assessing oral cancer awareness among dentists. *J Cancer Educ*. 2018;33(5):1020-6. doi: [10.1007/s13187-017-1199-2](https://doi.org/10.1007/s13187-017-1199-2).
- 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. doi: [10.1136/bmj.n71](https://doi.org/10.1136/bmj.n71).
- Ma LL, Wang YY, Yang ZH, Huang D, Weng H, Zeng XT. Methodological quality (risk of bias) assessment tools for primary and secondary medical studies: what are they and which is better? *Mil Med Res*. 2020;7(1):7. doi: [10.1186/s40779-020-00238-8](https://doi.org/10.1186/s40779-020-00238-8).
- Daley E, Dodd V, DeBate R, Vamos C, Wheldon C, Kline N, et al. Prevention of HPV-related oral cancer: assessing dentists' readiness. *Public Health*. 2014;128(3):231-8. doi: [10.1016/j.puhe.2013.12.002](https://doi.org/10.1016/j.puhe.2013.12.002).
- Rutkoski H, Fowler B, Mooney R, Pappas L, Dixon BL, Pinzon LM, et al. Pilot test of survey to assess dental and dental hygiene student human papillomavirus-related oropharyngeal cancer knowledge, perceptions, and clinical practices. *J Cancer Educ*. 2018;33(4):907-14. doi: [10.1007/s13187-017-1165-z](https://doi.org/10.1007/s13187-017-1165-z).
- Arora S, Ramachandra SS, Squier C. Knowledge about human papillomavirus (HPV) related oral cancers among oral health professionals in university setting-a cross sectional study. *J Oral Biol Craniofac Res*. 2018;8(1):35-9. doi: [10.1016/j.jobcr.2017.12.002](https://doi.org/10.1016/j.jobcr.2017.12.002).
- Farsi NJ, Al Sharif S, Al Qathmi M, Merdad M, Marzouki H, Merdad L. Knowledge of human papillomavirus (HPV) and oropharyngeal cancer and acceptability of the HPV vaccine among dental students. *Asian Pac J Cancer Prev*. 2020;21(12):3595-603. doi: [10.31557/apjcp.2020.21.12.3595](https://doi.org/10.31557/apjcp.2020.21.12.3595).
- Keser G, Yilmaz G, Pekiner FN. Assessment of knowledge level and awareness about human papillomavirus among dental students. *J Cancer Educ*. 2021;36(4):664-9. doi: [10.1007/s13187-019-01683-3](https://doi.org/10.1007/s13187-019-01683-3).
- Lorenzo-Pouso AI, Gándara-Vila P, Banga C, Gallas M, Pérez-Sayáns M, García A, et al. Human papillomavirus-related oral cancer: knowledge and awareness among Spanish dental students. *J Cancer Educ*. 2019;34(4):782-8. doi: [10.1007/s13187-018-1373-1](https://doi.org/10.1007/s13187-018-1373-1).
- Poelman MR, Brand HS, Forouzanfar T, Daley EM, Jager DHJ. Prevention of HPV-related oral cancer by dentists: assessing the opinion of Dutch dental students. *J Cancer Educ*. 2018;33(6):1347-54. doi: [10.1007/s13187-017-1257-9](https://doi.org/10.1007/s13187-017-1257-9).
- Rutkoski H, Tay DL, Dixon BL, Pinzon LM, Mooney R, Winkler JR, et al. A multi-state evaluation of oral health students' knowledge of human papillomavirus-related oropharyngeal cancer and HPV vaccination. *J Cancer Educ*. 2020;35(5):1017-25. doi: [10.1007/s13187-019-01561-y](https://doi.org/10.1007/s13187-019-01561-y).
- Sallam M, Al-Fraihat E, Dababseh D, Yaseen A, Taim D, Zabadi S, et al. Dental students' awareness and attitudes toward HPV-related oral cancer: a cross sectional study at the University of Jordan. *BMC Oral Health*. 2019;19(1):171. doi: [10.1186/s12903-019-0864-8](https://doi.org/10.1186/s12903-019-0864-8).
- Rowan SD, Hu SL, Brotzman JS, Redding SW, Rankin KV, Vigneswaran N. Knowledge assessment of the dental

- community in Texas on the role of human papillomavirus in oropharyngeal cancer. *Tex Dent J*. 2015;132(8):528-36.
30. Özdede M, Bağcı N, Gündüz T, Peker I. Evaluation of knowledge and awareness of dentists and dental students about human papillomavirus vaccination and oropharyngeal cancer relationship. *Clin Exp Health Sci*. 2020;10(3):309-15. doi: [10.33808/marusbed.752850](https://doi.org/10.33808/marusbed.752850).
 31. Alqhtani N, Alenazi A, Hattan E, Alqahtani R, Alqahtani A, Alqutaym O, et al. Knowledge of dental practitioners in Saudi Arabia concerning human papillomavirus (HPV) and its correlation with oral cancers. *Int J Med Dent*. 2020;24(3):456-63.
 32. Khode SR, Dwivedi RC, Rhys-Evans P, Kazi R. Exploring the link between human papillomavirus and oral and oropharyngeal cancers. *J Cancer Res Ther*. 2014;10(3):492-8. doi: [10.4103/0973-1482.138213](https://doi.org/10.4103/0973-1482.138213).
 33. Freiser ME, Desai DD, Azcarate PM, Szczupak M, Cohen ER, Raffa FN, et al. Educational value of a medical student-led head and neck cancer screening event. *Otolaryngol Head Neck Surg*. 2016;154(4):638-44. doi: [10.1177/0194599815626147](https://doi.org/10.1177/0194599815626147).
 34. Dodd RH, Forster AS, Waller J, Marlow LAV. Discussing HPV with oropharyngeal cancer patients: a cross-sectional survey of attitudes in health professionals. *Oral Oncol*. 2017;68:67-73. doi: [10.1016/j.oraloncology.2017.03.014](https://doi.org/10.1016/j.oraloncology.2017.03.014).
 35. O'Connor M, O'Donovan B, Waller J, Céilleachair AÓ, Gallagher P, Martin C, O'Leary J, Sharp L. The role of healthcare professionals in HPV communication with head and neck cancer patients: A narrative synthesis of qualitative studies. *Eur J Cancer Care (Engl)*. 2020 Jul;29(4):e13241. doi: [10.1111/ecc.13241](https://doi.org/10.1111/ecc.13241).
 36. Kim HW, Park S, Ahn HY, Park EJ. The effects of an HPV education program by gender among Korean university students. *Nurse Educ Today*. 2015;35(4):562-7. doi: [10.1016/j.nedt.2014.12.014](https://doi.org/10.1016/j.nedt.2014.12.014).
 37. McLeroy TM, Gurenlian J, Rogo EJ. The effect of continuing education on dental hygienists' knowledge, attitudes, and practices regarding human papillomavirus related oropharyngeal cancer. *J Dent Hyg*. 2020;94(3):16-28.
 38. Papadiochou S, Papadiochos I, Perisanidis C, Papadogeorgakis N. Medical practitioners' educational competence about oral and oropharyngeal carcinoma: a systematic review and meta-analysis. *Br J Oral Maxillofac Surg*. 2020;58(1):3-24. doi: [10.1016/j.bjoms.2019.08.007](https://doi.org/10.1016/j.bjoms.2019.08.007).
 39. Bakr MM, Skerman E, Khan U, George R. Oral cancer: an evaluation of knowledge and awareness in undergraduate dental students and the general public. *Oral Health Prev Dent*. 2016;14(5):403-11. doi: [10.3290/j.ohpd.a36471](https://doi.org/10.3290/j.ohpd.a36471).
 40. Rajiah K, Maharajan MK, Fang Num KS, How Koh RC. Knowledge about human papillomavirus and cervical cancer: predictors of HPV vaccination among dental students. *Asian Pac J Cancer Prev*. 2017;18(6):1573-9. doi: [10.22034/apjcp.2017.18.6.1573](https://doi.org/10.22034/apjcp.2017.18.6.1573).
 41. Kavanagh FG, McNamara AT, Fopohunda O, Keogh IJ. Human papillomavirus-associated head and neck cancer: a 21st century pandemic; assessing student awareness and knowledge. *Ir Med J*. 2018;111(10):837.
 42. Rohde RL, Adjei Boakye E, Christopher KM, Geneus CJ, Walker RJ, Varvares MA, et al. Assessing university students' sexual risk behaviors as predictors of human papillomavirus (HPV) vaccine uptake behavior. *Vaccine*. 2018;36(25):3629-34. doi: [10.1016/j.vaccine.2018.05.022](https://doi.org/10.1016/j.vaccine.2018.05.022).
 43. Shetty S, Prabhu S, Shetty V, Shetty AK. Knowledge, attitudes and factors associated with acceptability of human papillomavirus vaccination among undergraduate medical, dental and nursing students in South India. *Hum Vaccin Immunother*. 2019;15(7-8):1656-65. doi: [10.1080/21645515.2019.1565260](https://doi.org/10.1080/21645515.2019.1565260).
 44. Boroumand S, Garcia AI, Selwitz RH, Goodman HS. Knowledge and opinions regarding oral cancer among Maryland dental students. *J Cancer Educ*. 2008;23(2):85-91. doi: [10.1080/08858190701821238](https://doi.org/10.1080/08858190701821238).
 45. Dodd RH, Freeman M, Dekaj F, Bamforth J, Miah A, Sasieni P, et al. Awareness of the link between human papillomavirus and oral cancer in UK university students. *Prev Med*. 2021;150:106660. doi: [10.1016/j.ypmed.2021.106660](https://doi.org/10.1016/j.ypmed.2021.106660).
 46. Rakhra D, Walker TWM, Hall S, Fleming CA, Thomas SJ, Kerai A, et al. Human papillomavirus (HPV) and its vaccine: awareness and opinions of clinical dental students in a UK dental school. *Br Dent J*. 2018;225(10):976-81. doi: [10.1038/sj.bdj.2018.1024](https://doi.org/10.1038/sj.bdj.2018.1024).
 47. Saranya M, Dhanraj. Knowledge and awareness on oral manifestation of human papillomavirus (HPV) among dental students. *J Pharm Sci Res*. 2017;9(4):486-9.
 48. Torres E, Richman A, Wright W, Wu Q. Assessing dental students' HPV health literacy and intention to engage in HPV-related oropharyngeal cancer prevention. *J Cancer Educ*. 2022;37(4):950-6. doi: [10.1007/s13187-020-01905-z](https://doi.org/10.1007/s13187-020-01905-z).

© 2023 The Author(s); Published by Kerman University of Medical Sciences. This is an open-access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.