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

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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

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. 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. 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 al., 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**

<table>
<thead>
<tr>
<th>Databases</th>
<th>Search strategy</th>
<th>Date</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed</td>
<td>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 <em>cogni</em> OR think* AND TS = (human papillomavirus OR &quot;human papilloma virus&quot; OR HPV*) AND TS = (dent* OR student))</td>
<td>18 Aug 2021</td>
<td>462</td>
</tr>
<tr>
<td>WOS</td>
<td>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 <em>cogni</em> OR think* AND TS = (human papillomavirus OR &quot;human papilloma virus&quot; OR HPV*) AND TS = (dent* OR student))</td>
<td>18 Aug 2021</td>
<td>728</td>
</tr>
<tr>
<td>SCOPUS</td>
<td>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 <em>cogni</em> OR think* AND ab:human papillomavirus OR &quot;human papilloma virus&quot; OR HPV*)</td>
<td>18 Aug 2021</td>
<td>699</td>
</tr>
<tr>
<td>ProQuest</td>
<td>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 <em>cogni</em> OR think* AND ab:human papillomavirus OR &quot;human papilloma virus&quot; OR HPV*)</td>
<td>18 Aug 2021</td>
<td>85</td>
</tr>
</tbody>
</table>
selected studies used a kind of the transtheoretical model or a questionnaire.\textsuperscript{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 al\textsuperscript{27} included 120 dental hygienists, and Sallam et al\textsuperscript{28} included postgraduate residents. Alqhtani et al\textsuperscript{31} used a questionnaire based on the study of Arora et al. Three studies referred to a study by Daley et al\textsuperscript{20} based on the transtheoretical model with or without additional questions. Rutkoski et al used the questionnaire made in 2018,\textsuperscript{21} and Farsi et al\textsuperscript{23} used part of this questionnaire.

**Quality assessment**

As shown in Table 3, JBI scores varied from 4 to 6. Alqhtani et al\textsuperscript{31} 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

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![Figure 1. PRISMA flowchart](image-url)
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. Over half of the participants were aware that vaccines can prevent HPV-related cancers. Over 76.5% identified HPV as a cause of OSCC or oral cancer while only 38.2% reported informing their patients about this matter. Over 76.5% of both groups stated that different HPV types cause OPC. 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. Approximately 43% suggested that treatment strategies for HPV-related OSCC were different from other OSCCs.

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Sample size</th>
<th>Dental students</th>
<th>Dentists</th>
<th>Major findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arora et al(^{22})</td>
<td>2018</td>
<td>Malaysia</td>
<td>179</td>
<td>None</td>
<td>General practitioners: 49, Specialist in oral medicine/oral pathology: 28, Other specialists: 102</td>
<td>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.</td>
</tr>
<tr>
<td>Fani et al(^{31})</td>
<td>2020</td>
<td>Saudi Arabia</td>
<td>500</td>
<td>3rd and 4th year</td>
<td>None</td>
<td>Clinical students had significantly higher knowledge. Female students had higher HPV-related OPC knowledge than male students.</td>
</tr>
<tr>
<td>Keser et al(^{24})</td>
<td>2020</td>
<td>Turkey</td>
<td>318</td>
<td>3rd year: 100, 4th year: 119, 5th year: 99</td>
<td>None</td>
<td>82.7% of students agreed that some types of HPV cause oral cancer.</td>
</tr>
<tr>
<td>Lorenzo-Pouso et al(^{25})</td>
<td>2018</td>
<td>Spain</td>
<td>158</td>
<td>First year: 35, Second year: 22, 3rd year: 32, 4th year: 36, 5th year: 33</td>
<td>None</td>
<td>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.</td>
</tr>
<tr>
<td>Poelman et al(^{26})</td>
<td>2018</td>
<td>Netherlands</td>
<td>126</td>
<td>First 3 years: 70</td>
<td>None</td>
<td>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.</td>
</tr>
<tr>
<td>Rutkoski et al(^{27})</td>
<td>2020</td>
<td>USA</td>
<td>380</td>
<td>3rd year: 185, 4th year: 91</td>
<td>None</td>
<td>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.</td>
</tr>
<tr>
<td>Sallam et al(^{28})</td>
<td>2019</td>
<td>Jordan</td>
<td>376</td>
<td>Pre-clinical: 155, Clinical, Interns, Residents: 221</td>
<td>None</td>
<td>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.</td>
</tr>
<tr>
<td>Rowan et al(^{29})</td>
<td>2015</td>
<td>USA</td>
<td>457</td>
<td>First year: 198, Seniors: 134, Total: 332</td>
<td>51</td>
<td>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.</td>
</tr>
<tr>
<td>Özdede et al(^{30})</td>
<td>2020</td>
<td>Turkey</td>
<td>209</td>
<td>127</td>
<td>82</td>
<td>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.</td>
</tr>
<tr>
<td>Alhhtani et al(^{31})</td>
<td>2020</td>
<td>Saudi Arabia</td>
<td>204</td>
<td>Interns: 72</td>
<td>General practitioners: 75, Specialist in oral medicine/oral pathology: 20, Other specialists: 37</td>
<td>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.</td>
</tr>
</tbody>
</table>

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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{31,36-38} Bakr et al reported that social media was the most practical tool for educational approaches.\textsuperscript{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,\textsuperscript{23} the Internet and media were the second and third sources of knowledge after education. Rajiah et al\textsuperscript{40} 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 al\textsuperscript{28} and Farsi et al,\textsuperscript{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\textsuperscript{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.\textsuperscript{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,\textsuperscript{34,41-43} and some studies evaluated oral cancer knowledge without focusing on HPV, which was not the aim of ours.\textsuperscript{40,44-48} Rutkoski et al\textsuperscript{27} 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.

Table 3. The JBI checklist and quality assessment

<table>
<thead>
<tr>
<th>Authors</th>
<th>Item 1</th>
<th>Item 2</th>
<th>Item 3</th>
<th>Item 4</th>
<th>Item 5</th>
<th>Item 6</th>
<th>Item 7</th>
<th>Item 8</th>
<th>Total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arora et al\textsuperscript{22}</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>6</td>
</tr>
<tr>
<td>Farsi et al\textsuperscript{23}</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>6</td>
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<tr>
<td>Keser et al\textsuperscript{14}</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>4</td>
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<tr>
<td>Lorenzo-Pouso et al\textsuperscript{12}</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>5</td>
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<tr>
<td>Poelman et al\textsuperscript{26}</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
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<td>Rutkoski et al\textsuperscript{27}</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>N/A</td>
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<td>Yes</td>
<td>Yes</td>
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<td>N/A</td>
<td>Yes</td>
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<tr>
<td>Rowan et al\textsuperscript{29}</td>
<td>Yes</td>
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<td>N/A</td>
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<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Ozdele et al\textsuperscript{16}</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
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<td>Alqhtani et al\textsuperscript{17}</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>6</td>
</tr>
</tbody>
</table>

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.
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