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RESEARCH ARTICLE

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Knowledge and Awareness of Dental Students Regarding Human Papillomavirus and Oral Cancer in Saudi Arabia

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Abstract

Objective: This study aimed to evaluate the knowledge and awareness of dental students and interns in Saudi Arabia regarding human papillomavirus and oral cancer using a cross-sectional web-based survey. **Materials and methods:** A cross-sectional survey was undertaken to assess the knowledge of dental students and dental interns regarding oral cancer and awareness of human papillomavirus (HPV) in public and private dental schools in Saudi Arabia. The survey included 18 questions grouped into three sections. The responses were analyzed for variations between dental students and interns, among males and females, and those attending private or public colleges. The Chi-square test assessed the correlation between participants' demographic data and their knowledge/awareness of oral cancer and HPV. **Results:** A total of 451 dental students and dental interns responded. The results show that dental students at private and public dental schools in Saudi Arabia are generally knowledgeable regarding knowledge of oral cancer and awareness of human papillomavirus. The dental interns exhibited significantly superior knowledge compared to the undergraduate dental students ($p < 0.05$), particularly in the areas of identifying the most common location of oral cancer and recognizing the signs and symptoms of oral cancer (76.5% versus 65.1% correct answers). The dental interns showed a significant difference and better awareness ($p < 0.05$) than dental students regarding HPV having a relationship with AIDS and HPV causing common warts. **Conclusion:** Dental students and interns in this study presented a good but less than optimal knowledge and awareness regarding HPV and its prevention. Improving education courses and training for dental students in Saudi Arabia is crucial for improving their knowledge and awareness regarding oral cancer and HPV infection.

Keywords: HPV infection- knowledge- dental students- oral cancer- dental interns- Saudi Arabia- cross-sectional

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Introduction

Oral cancer is one of the most common cancers, the incidence of which has been increasing worldwide [1]. According to the World Health Organization (WHO), it includes cancers of the lip, other parts of the mouth and the oropharynx, and ranks as the 13th most common cancer worldwide [2]. Globally, the incidence of oral cancer varies, mostly as a result of differences in the distribution of risk factors and potential etiologies [3]. Although tobacco, alcohol and areca nut (betel quid)

use have been mostly responsible for oral cancer, human papillomavirus (HPV) infection has been identified as an etiological factor for a growing percentage of oral cancers among young people in North America and Europe [2]. HPV is known to cause an epidemiologically and clinically distinct form of oropharyngeal squamous cell carcinoma (OPSCC) which has risk factors related to sexual behavior and significantly better survival than those caused not due to HPV [4]. Furthermore, the important role of high-risk HPV types, particularly HPV-16, as risk factors for the development of oral cancer, has been established [5, 6].

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Studies have shown that having more than nine lifetime sexual partners increases the risk of having oropharyngeal cancer by 34 times [7], especially HPV 16 and 18 [8]. Recently, it has been observed that there is an increase in HPV-related oral cancer (HPV-OC) [9, 10]. Studies have also shown a significant increase in the incidence of OPSCC in the head and neck region [4, 11]. A systematic review of HPV-associated oropharyngeal carcinoma trends by time and region indicated an increase in its proportion from 40.5% in studies conducted before 2000 to 72.2% in studies conducted after 2005 [11]. Despite the high malignancy potential of HPV in oral cancer [5], most of the epidemiological studies on HPV-OC are from developed nations, with studies from the global south, especially the Middle Eastern countries being very limited [12, 13]. Geographically, studies in North America, Europe, Japan and Australia have indicated that 17–56% of oral cancers are HPV-related [12]. In Saudi Arabia, HPV-related oral cancer incidence for 2020 was estimated at 1.63 and 1.35 for men and women, respectively (per 100,000 for each) [14]. A study on HPV prevalence and its prognostic association with overall survival (OS) in Saudi head and neck squamous cell carcinoma (HNSCC) patients indicated that, apart from age, smoking, tumor stage, and treatment, HPV/p16 status was an important predictor of patients' survival [15]. However, screening studies on HPV and its relation to oral cancer are still limited in the KSA [16]. Currently, there are vaccines available that can be administered to prevent infection with HPV. However, implementation of a vaccination program requires providing information to the public on the availability and importance of HPV vaccines.

Dental professionals are the health practitioners who contribute most to the early detection of oral cancer [17]. Dental professionals and students have concentrated on preventing oropharyngeal cancers by visual and tactile exploration of the oral cavity and neck palpation to identify potentially malignant disorders. However, studies have indicated dentists' attitudes and cancer-specific knowledge to be key factors that contributed to delays in detection [18, 19]. The growing incidence of HPV-attributable oropharyngeal cancers emphasizes the significant role of dental students in educating and recommending their patients to avoid HPV infection.

It has been shown that undergraduate dental students' awareness of the HPV vaccine is disparate or deficient and needs improvement [20]. Since it has been shown that oral cancer is still being detected late [21], it is important to evaluate the knowledge about HPV and its role in oral cancer among dental students. This can help policymakers in future planning strategies, especially in view of modification or updating of the curricula. There are studies focusing on health practitioners' knowledge and attitude towards HPV and HPV-related oral cancer [5, 22]. However, studies focusing on knowledge and awareness regarding HPV and oral cancer in Saudi Arabia are limited. This study aimed to evaluate the knowledge and awareness of dental students in Saudi Arabia regarding HPV and oral cancer.

Materials and Methods

Study design

A cross-sectional, questionnaire-based survey of undergraduate dental students, including dental and intern students at public and private colleges in Saudi Arabia was undertaken and reported according to CHERRIES guidelines [23]. All students in their 2nd to 6th year (dental students) and interns enrolled during the 2022–2023 academic year were eligible to participate.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB) of Prince Sattam University Ethical Review Board (REC-HSD-92-2021) and was conducted in agreement with the Declaration of Helsinki guidelines. Informed consent was obtained from all probable participants to contribute to the present study.

Sampling Technique and Sample Size

There are over 26 dental faculties in Saudi Arabia [24], and the estimated number of dental students and interns is 1300 enrolled in all colleges [25].

The sample size was calculated using the Open-Source Epidemiologic Statistics for Public Health Software – OpenEpi (<https://www.openepi.com/SampleSize/SSCohort.htm>). We used 50% as the hypothesized % frequency of outcome factor in the population, which is recommended for unknown frequency, 5% as absolute precision, and (1300) as the population size. The results were 297 for a 95% confidence interval. We added 5% to overcome the possibility of missing data, so the required minimum sample size was 312. The survey was distributed through social media to known and validated groups of students in their 2nd to 6th year (dental students) and interns in Saudi Arabia. The admin in each student group on social media helped in the identification of the participants to prevent duplication and manipulation.

The author followed a convenience random sampling protocol in recruiting participants. Several known social media Groups of dental students in private and public colleges in Saudi Arabia were targeted to invite participation. A number of 451 dental students and dental interns participated in this study. The demographics of participants can show the involvement of male and female students in this study including dental and intern students from private and public dental schools. The admin of each student group in social media confirms that various geographic locations of the known targeted students' group participated in this study. However, the reviewer's comment has been addressed in the limitations of the study. Please review the limitations of the study.

Google Forms was used to make an electronic copy of the Questionnaire. A pre-validated questionnaire, developed from a previous study [23, 26], was given to all students and was sent to individual students through E-mail, WhatsApp, and other social media platforms, which also contained a consent form and an explanation about the study. The authors followed a convenience random sampling protocol in recruiting participants. Five reminders were sent through WhatsApp groups and other

social media platform channels to increase the response rate. Responses to the questionnaire were sensitive to the IP address, ensuring no duplicated responses.

Data Collection Instrument

The questionnaire in the first section assessed the following demographic variables of the responding students such as age, gender, study level, and type of dental school. The second section of this study focused on the knowledge of participating dental students and interns about oral cancer. The third section focused on assessing dental students and interns regarding awareness towards HPV. Participation was voluntary, and participants were informed that they could withdraw at any time and that their responses would be anonymous and treated confidentially. Before distributing the questionnaire, a pilot study was performed on a random sample of students ($n = 20$), and the questionnaire was modified according to the feedback obtained.

Data analysis

The SPSS statistical package was used for the data analysis (IBM SPSS Statistics for Windows, Version 20.0, Released 2011, IBM Corp, Armonk, New York, USA). Descriptive statistics presented the characteristics of participating dental students, and frequency tables were generated to illustrate the response of dental students to survey questions. The Chi-square statistics were used to assess any possible association between questionnaire items, dental students, interns, study level and type of dental schools. $P < 0.05$ was considered statistically

significant.

Results

A number of 451 dental students and dental interns participated in this study. Forty of them failed to answer the invitation, and 9 questionnaires were rejected as needing to be completed. Table 1 provides the demographic profile of the study participants, consisting of 451 individuals. The male participants accounted for a higher percentage (58.5%) than their female counterparts (41.5%). Most participants attended public colleges (74.9%), while the remaining (25.1%) attended private colleges. The age range of the participants was distributed, with the highest percentage (64.7%) falling between 21 to 25 years and the lowest percentage (6.7%) falling between 18 to 20 years old. The proportion of participants in the study was (52.5%) dental students, whereas dental interns accounted for (47.2%) of the total.

Table 2 and Figure 1 present the responses of the participants regarding their knowledge of oral cancer (OC), categorized by gender, study level (dental students and interns), and type of dental school (public and private). The participants demonstrated a good level of knowledge for most of the questions, except for the location of oral cancer (OC) within the oral cavity, which less than 50% of the participants answered correctly. The male participants demonstrated higher levels of knowledge than their female counterparts, and this difference was statistically significant ($P < 0.05$). Furthermore, the interns exhibited superior knowledge compared to the undergraduate

Table 1. Characteristics of Participants ($n = 451$).

Age (years)	Gender	Study level
18-20 30 (6.7%)	Male 264 (58.5%)	Dental student 238 (52.8%)
21-25 292 (64.7%)	Female 187 (41.5%)	Dental intern 213 (47.2%)
> 25 129 (28.6%)		
Type of dental school	Heard about oral cancer	Heard about HPV
Governmental 338 (74.9%)	Yes 407 (90.2%)	Yes 386 (85.6%)
Private 113 (25.1%)	No 44 (9.8%)	No 65 (14.4%)

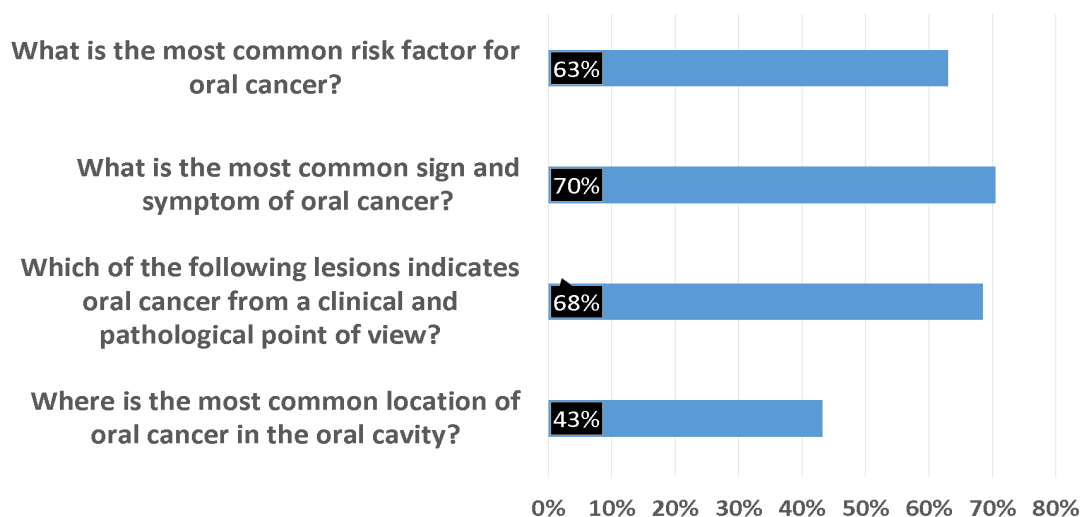


Figure 1. Response of Participants to Knowledge-Related Questions Regarding Oral Cancer (% of correct answers)

Table 3. Response of Participants to Awareness-Related Statements Regarding HPV by Gender, Study Level, and Type of Dental School (no = 451).

Statement	% of "strongly agree/agree" answers based on gender, study level, and type of dental school									
	Sample	Gender		p-value	Study level		p-value	Type of dental school		p-value
		Male	Female		Dental student	Intern		Governmental	Private	
1 HPV causes common warts.	84.7	83.7	86.1	0.227	82.8	86.9	0.014*	86.1	80.5	0.092
2 A person can have HPV without knowing it.	58.1	53.1	65.2	0.004*	54.2	62.5	0.288	58.9	55.8	0.446
3 HPV can cause oral cancer.	62.3	59.8	65.7	0.016*	60.1	64.8	0.1	62.4	61.9	0.389
4 Certain strains of HPV cause cervical cancer.	49	36.4	66.9	<0.001*	55.8	41.3	<0.018*	47.1	54.9	0.119
5 We now have a vaccine for HPV infection.	54.3	46.9	64.7	0.002*	57.1	51.2	<0.097	52.4	60.2	0.55
6 HPV has a relationship with AIDS.	80.9	78.1	85	0.042*	78.6	83.6	0.030*	81.7	78.8	<0.001*
7 Antibiotics can cure HPV infection.	46.8	51.5	40.1	0.007*	44.6	49.3	0.076	42	61.1	0.001*
8 Most HPV infections resolve within a few weeks.	40.8	29.9	56.2	<0.001*	44.5	36.6	0.134	39.1	46	<0.001*

* Denotes significant difference at $p < 0.05$ as indicated by chi-square statistics.

Table 2. Response of Participants to Knowledge-Related Questions Regarding Oral Cancer by Gender, Study Level, and Type of Dental School (no = 451).

No	Question	% of "correct" answers based on gender, study level, and type of dental school									
		Sample	Gender		p-value	Study level		p-value	Type of dental school		p-value
			Male	Female		Dental student	Intern		Governmental	Private	
1	Where is the most common location of oral cancer in the oral cavity?	43.2	50.4	33.2	<0.001*	33.2	54.5	<0.001*	44.7	38.9	0.287
2	Which of the following lesions indicates oral cancer from a clinical and pathological point of view?	68.5	79.5	52.9	<0.001*	65.1	72.3	0.101	70.4	62.8	0.133
3	What is the most common sign and symptom of oral cancer?	70.5	81.8	54.5	<0.001*	65.1	76.5	0.008*	70.1	71.7	0.752
4	What is the most common risk factor for oral cancer?	63	50	81.3	<0.001*	66.4	59.2	0.112	63.6	61.1	0.627

* Denotes significant difference at $p < 0.05$ as indicated by chi-square statistics.

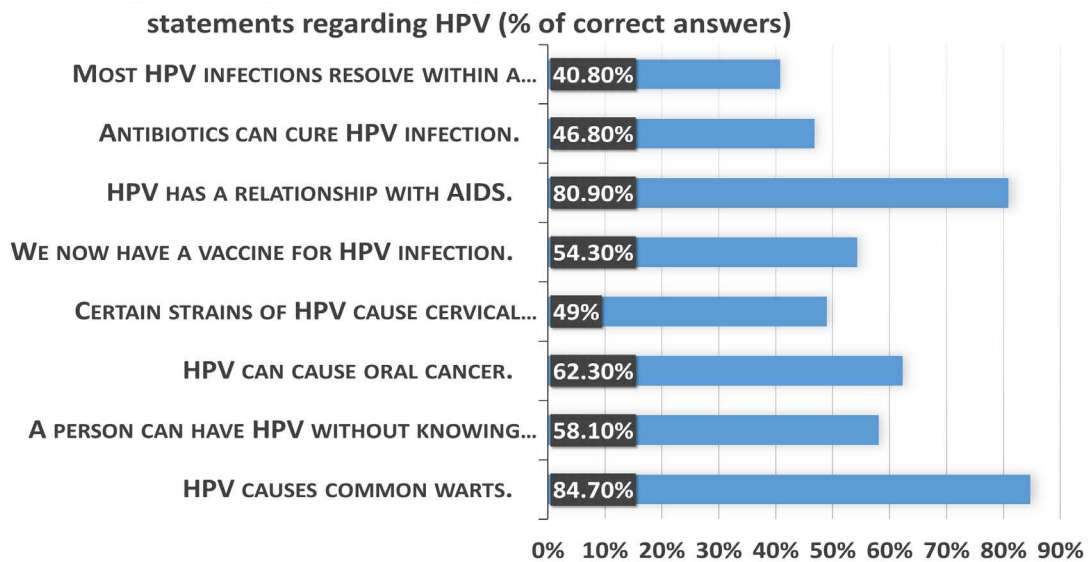


Figure 2. Response of Participants to Awareness-Related Statements Regarding HPV (% of correct answers).

participants, particularly in identifying the location and recognizing the signs and symptoms of oral cancer (OC), as evidenced by statistically significant differences in two out of four questions. Lastly, the results did not reveal any noticeable pattern between participants from public and private institutions about most of the questions asked.

The findings presented in Table 3 and Figure 2 refer to the participants' awareness of Human papillomavirus (HPV), classified by gender, level of study (dental students and interns), and type of dental school (public and private). The participants displayed a good level of awareness for most of the statements, although less than 50% answered correctly for four out of nine statements. The statement with the highest correct response rate (84.7%) was the one regarding the association of Human papillomavirus (HPV) with common warts. In contrast to the results of Table 2, the male participants demonstrated lower levels of awareness than the female participants, with statistically significant differences observed in seven out of nine statements ($P < 0.05$).

As for the types of schools and level of study, the results did not indicate any discernible pattern in favor of one over the other.

Discussion

Our results showed a good response rate (90%). Five hundred dental students and dental interns were contacted. Amongst these, 451 completed this survey, including males (58.5%) and females (41.5%). This study's response rate is better than others [26, 27]. A high percentage of participants who had heard of oral cancer and HPV (Table 1) are observed respectively (90.2%, 85.6%). The early diagnosis of HPV-associated oral cancer is to reduce the associated mortality and morbidity. Dental students have a major role as healthcare providers in the future in preventing HPV-related oral cancer in patients.

Additionally, there seems to be a rise in the incidence of oral cancer among younger who are below 50 years

of age [27]. This study highlights the need for ongoing education for dental students and interns to ensure that they are competent with the necessary knowledge about oral cancer and HPV-related diseases in a high manner. This learning could include continuing education programs and clinical practices, among other methods. This is in accordance with the results of a two cross-sectional study in Saudi Arabia by Kujan et al. [28, 29]. Our results showed that the knowledge of oral cancer (Table 2) indicates that the proportion of correct answers ranged from 43.2% to 70.5% among the study sample.

A significant finding (p -value < 0.001) was that dental interns showed better knowledge than dental students on two occasions regarding identifying the most common location of oral cancer in the oral cavity and recognizing the signs and symptoms of OC, which agree with Sallam et al. [26]. This difference on the clinical side could be due to the interns' exposure to clinical and practical experience, which enhances their knowledge and skills.

Our results indicated that (43.2%, Table 2) of participants answered correctly and identified the tongue and anywhere in the oral mucosa as the most common location of oral cancer in the oral cavity. This result is similar to others Tarakji B et al. [30]. Tarakji indicated that (42.9%) of dental students identified the posterior lateral margins of the tongue as the most common location of oral cancer [30], whereas (Soares et al.) indicated that students identified lip cancer (66.17%) as the most common location of oral cancer [31].

Remarkably, no significant differences were identified between participants from public and private institutions (Table 2). This finding indicates that the type of dental school may not affect knowledge levels, and both types of institutions could benefit from education and training programs on OC. The evaluation of the level of knowledge of dental students in Saudi Arabia is crucial to highlight the limitations of the current dental curriculum.

Our study showed that males have insufficient awareness of HPV compared to females (Table 3). This

difference was statistically significant ($P < 0.01$), especially in awareness regarding the relationship between HPV and cervical cancer. This outcome agrees with Preston et al. and Reimer et al., who found better knowledge among females [32, 33]. However, this is contrary to the results of a study by Ajman University, which found there are no significant differences according to gender [34]. Globally, cervical cancer ranks as the third most frequently diagnosed cancer and is the fourth most common cause of cancer-related death among women [20]. As well as women being more aware of the vaccine, these findings agree with Rashid S et al. [35] this could also explain their increased interest in such related diseases [35].

Overall, the findings of this study underscore the importance of incorporating oral cancer topics into the curriculum of undergraduate and intern programs to ensure adequate knowledge among dental students and interns. Additionally, the findings highlight the positive effect of clinical training on enhancing knowledge and clinical skills among dental interns.

The findings of awareness of HPV among dental students and interns (Table 3) suggest that there is room for improvement in their awareness regarding HPV and its associated topics. The study revealed that although most participants were aware of the association between HPV and common warts, which agrees with Kim et al. [36]. Our results showed insufficient awareness of participants regarding the importance of vaccines for HPV infection. This result is similar to Kim et al. [36]. Kim et al. reported that no significant difference was found regarding the beneficial effects of the HPV vaccine between Chinese and Korean students [36]. Low awareness about the HPV vaccine is a concern since vaccination is a highly effective way of preventing HPV-related diseases; this finding follows the research conducted by Lingam et al. [15]. and differs from Balaji et al. [37].

Balaji et al. [37] reported that 99.13% of participants encouraged using such a vaccine among their close relatives [37]. Our study showed that females exhibited greater awareness of the vaccine than males, which was statistically significant ($P < 0.01$). That could be because females are more interested in these issues than their male counterparts.

Another interesting finding was that a high percentage of participants (80.9%) indicated and correctly answered that they strongly disagree with the relationship between HPV and AIDS. That can be explained by the fact that, While the microbiology and oral medicine courses provide in-depth information, there are still areas that need to be fully covered. These gaps in participants' correct answers suggest enhancing the urgent modification of the dental curriculum regarding oral cancer and HPV infection.

This finding differs from that of Sallam et al. [26] and Lorenzo-Pouso et al. [38]. The gender differences in awareness levels were also notable, with male participants demonstrating lower levels of awareness than their female counterparts, particularly the relation of HPV to cervical cancer. However, both still needed to show better levels of awareness. This result highlights the importance of clear and accurate education on HPV transmission and its potential risks. Therefore, some efforts should

be made to improve the knowledge of dental students and interns about HPV, its associated diseases, and the importance of the HPV vaccine. Dental education should emphasize the significance of oral microbiology. Specific microorganisms, such as HPV, require particular attention in dentistry concerning cancer and other related conditions.

It was not surprising to find that there needed to be more awareness levels among dental students, particularly in questions that require clinical experiences, like the clinical appearance of HPV infection and the fact that patients could have the infection without knowing that. However, it was expected that interns might have lower awareness of some basic knowledge questions compared to dental students, like HPV can cause cervical cancer and the treatment of HPV with antibiotics, due to their concentration in routine dental clinical such as filling and tooth extraction only. We believe that participants in this study need quick revision on topics in basic sciences like microbiology courses. Overall, the findings of this study spotlight the need for improved education of dental students and interns regarding HPV and its associated diseases. Educational programs could cover the gaps in knowledge of oral cancer and awareness of HPV infection identified in this study and should be expanded and involved in the dental curriculum.

Limitations of the study

It is important to note that this study has some limitations, including its dependence on self-reported data and the fact that it was conducted in a single country. Therefore, it is unwise to generalize the findings to other populations. Further research is needed to investigate the awareness levels of dental students and interns in other regions and to determine the most effective methods for improving their knowledge about HPV and oral cancer.

In conclusion, this study found that dental students and interns have an average level of knowledge and awareness regarding HPV and its prevention. Although the findings are promising, enhancing educational courses and training for dental students in Saudi Arabia is essential to further improve their understanding of oral cancer and HPV infection.

Author Contribution Statement

Conceptualization, Faisal Alali, Faisal Alhedyan, Muhannad Alshlwi, and Ali Robaian Alqahtani; Data curation, Nasser Alduaydi, Abdullah Alqahtahni, Fahad Almutairi, and Mohammed Noushad; Formal analysis, Faisal Alhedyan, Abdullah Alqahtahni, Fahad Almutairi, and Mohammad Nassani; Investigation, Bassel Tarakji, Nasser Alduaydi, Muhannad Alshlwi, Nasser Alqhtani, Mohammed Noushad, and Mohammad Nassani; Methodology, Anas B Alsalthani, Bassel Tarakji, Abdullah Alqahtahni, Nasser Alqhtani, Fahad Almutairi, Mohammed Noushad and Mohammad Nassani; Project administration, Abdullah Bin Nabhan and Mohammad Nassani; Resources, Faisal Alali, Faisal Alhedyan, Fahad Almutairi, Ali Robaian Alqahtani; Software, Anas B Alsalthani, Nasser Alduaydi, Muhannad Alshlwi, Abdullah

Bin Nabhan ; Supervision, Anas B Alsahlani, Bassel Tarakji, Faisal Alhedyan, Ali Robaian Alqahtani, and Mohammad Nassani; Validation, Bassel Tarakji, Faisal Alali, Nasser Alqhtani, Abdullah Bin Nabhan, Ali Robaian Alqahtani, Mohammad Nassani; Visualization, Nasser Alqhtani; Writing – original draft, Anas B Alsahlani, Faisal Alali, and Mohammed Noushad; Writing – review & editing, Anas B Alsahlani, Bassel Tarakji, and Mohammad Nassani

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Ethical approval and consent of the participant

The study was approved by the Institutional Review Board (IRB) of Prince Sattam University Ethical Review Board (REC-HSD-92-2021) and was conducted in agreement with the Declaration of Helsinki guidelines. Informed consent was obtained from all probable participants to contribute to the present study.

Consent for publication

Informed consent for publication was gained from the responding participants who completed the questionnaire.

Competing interest

The authors declare no conflict of interest.

Abbreviations

OC: Oral Cancer, HPV: Human papillomavirus, OPSCC: Oropharyngeal squamous cell carcinoma, WHO: World Health Organization, HNSCC: head and neck squamous cell carcinoma,

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