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Prevention of HPV-related oral cancer: assessing dentists' readiness

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Abstract

Objectives—Epidemiological research indicates an association between the Human Papillomavirus (HPV) with a subset of oral cancers (OC). Dentists may play a role in primary prevention of HPV-related OC by discussing the HPV vaccine with patients. This study assessed dentists' readiness to discuss the HPV vaccine with female patients.

Study design—Cross-sectional web-based survey.

Methods—A web-based survey based on the Transtheoretical Model was administered among Florida dentists ($n = 210$).

Results—The majority of participants (97%) fell into the precontemplation and contemplation stages of readiness to discuss the HPV vaccine with patients. Perceived role and liability were determined to be predictive of dentists in contemplation stage as opposed to those in precontemplation ($P < 0.05$).

Conclusions—Findings suggest liability and perceived role as processes of change necessary to guide dentists to primary prevention of HPV-related OC despite high levels of knowledge. As public awareness of HPV-related OC increases, dentists may become more involved in primary prevention. Results of the current study may assist in developing intervention strategies for engaging dentists in discussing the HPV vaccine with patients.

Keywords

HPV vaccination; Oral cancer; Prevention; Public health

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Competing interests
The authors have no financial or competing interests related to this study.

Introduction

Human Papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the US¹ and is associated with a subset of oropharyngeal cancers (OPC) and oral cavity cancers (OC).^{2,3} More than 90% of OPC and OC diagnosed each year are oral squamous cell carcinomas (OSCC).⁴ Although the majority of OC and OPC are typically attributed to tobacco and alcohol use⁴ within the past decade research has confirmed oral HPV infection as an additional risk factor, particularly for OPC.⁵ The most recent national prevalence study found that oral HPV infection is present in 6.9% of males and females ages 14–69, with higher prevalence found among individuals ages 30–34 (7.3%) and 60–64 (11.4%) and among men (10.1%).⁶ A review of HPV-related OPC demonstrated that HPV was present in ~22–26% of the cases, and of those cases, ~90–95% were attributable to HPV types 16 and 18.⁷ Other sources have reported even higher proportions (38–65%) of HPV-related OSCC.^{8,9}

Due to the growing link between OSCC and specific HPV types 16 and 18, researchers have hypothesized that use of the two available HPV vaccines may cause a reduction in the increasing incidence of OPC.^{7,10,11} Plausibility of this hypothesis is strengthened through published studies demonstrating evidence of the HPV vaccine's ability to prevent other cancers, such as anal cancer and HPV-related non-cervical cancers, such as vulvar and vaginal lesions.¹² Moreover, the two Food and Drug Administration—approved HPV vaccines, GardasilTM and CervarixTM, have been shown to prevent transmission of HPV 16 and 18—the same two strains attributable to 90–95% of HPV-related OPC.⁷ In 2006, the Advisory Committee on Immunization Practices¹³ recommended the HPV vaccine for the prevention of cervical cancer and genital warts among females age 9–26 years;¹³ and in 2011, recommendations extended to the prevention of anal cancer among males age 11–26 years.¹⁴ While there is currently no conclusive data on the effectiveness of HPV vaccines in preventing OC or OPC, as the research continues to build, it is anticipated that the HPV vaccine will be shown to be effective in preventing a range of cancer, including oral cancer.

While physicians primarily administer HPV vaccines, dentists typically perform oral cancer screening examinations, inspecting the face, neck, lips, gums, mucous membranes and floor of the mouth, alveolar ridge, hard and soft palates, and the tongue for lesions or other signs of cancer.¹⁵ Additionally, dentists are among the most frequently visited health provider.¹⁶ This regular interaction with patients offers dentists a unique opportunity to contribute to primary prevention of HPV-related oral cancer by discussing the HPV vaccine with their patients. This is a promising arena for increasing vaccine uptake, as a recent systematic review of HPV vaccine acceptability indicated the important role that health providers have in increasing vaccine coverage among their patients.¹⁷ Furthermore, evidence of dentists playing this preventative role has been demonstrated in the area of tobacco cessation.^{18,19} Moreover, the public health significance of primary and secondary prevention performed by dentists has been noted in the newly developed Healthy People 2020 Oral Health Objective: 'Increase the proportion of adults who receive preventive interventions in dental offices'.²⁰ Engaging OHPs in HPV-related prevention activities may be a meaningful strategy to reduce HPV-related cancer incidence.

Previous studies employing psychological models have shown utility in explaining and predicting dental providers' clinical behaviours.^{21–25} Contributing to this research on theory-guided behaviour change research among dental providers, the purpose of this exploratory study was to: (a) assess dentists' readiness to discuss HPV vaccines as a prevention measure against HPV-related OSCC with adult patients and/or parents of underage patients during routine visits; and (b) determine processes of change associated with increasing readiness to discuss HPV vaccines as a prevention measure against HPV-related OSCC. A priori hypotheses stated the majority of dentists would not be willing or 'ready' to discuss the HPV vaccine or the HPV–OSCC link with their patients. This paper presents findings from a larger mixed-methods study assessing oral health providers' (OHP) intention and capacity for engaging in primary and secondary prevention of HPV-related OSCC.²⁶

Methods

Theoretical framework

This research was guided by the Transtheoretical Model (TTM),²¹ specifically, the Stages of Change and Processes of Change constructs. The Stages of Change construct extracted from the TTM was used to segment dentists into distinct stages of behavioural adoption. Reed and colleagues²⁸ suggest assessing behavioural readiness represented by current stage of behaviour is most effectively examined by using a four-item algorithm corresponding to a criterion-specific behaviour. As such, individuals are placed in one of four stages: 1) precontemplation (not planning to perform criterion-specific behaviour, and no intention of doing so); 2) contemplation (intends to adopt the behaviour, but has not made a commitment); 3) action (practicing criterion-specific behaviour for six months or less); and 4) maintenance (practicing criterion-specific behaviour for longer than six months). The criterion-specific behaviour for the current study pertains to dentists' discussing HPV vaccines with female patients for primary prevention of cancers.

The Processes of Change construct of the Transtheoretical model encompasses both internal and external factors that enable progression through the stages of readiness.²⁷ For example, movement from the precontemplation to contemplation stage is facilitated by the following change processes: 1) increased consciousness of relation between criterion-specific behaviour and health outcome (e.g., knowledge and awareness of the oral/systemic link between HPV and OC); 2) dramatic relief (e.g., discomfort pertaining to discussing HPV and the vaccine with patients); and 3) environmental reevaluation (e.g., dentists' perceived role regarding HPV vaccine and cancer prevention). Once identified processes of change become critical leverage points intended to move individuals from not ready to performing criterion-specific behaviour to consistently performing the criterion-specific behaviour.

Study design

This study employed a cross-sectional design using a convenience sample of Florida dentists. Licensed dentists in the state of Florida with contact information published in the 2008 Florida Dental Association membership directory ($n = 4480$) received an email invitation and link to participate in the web-based study. Consent to participate was obtained

online. Survey participation was anonymous; no personal identifiers were obtained from participants or their computers. The University of Florida and the University of South Florida IRBs approved the study.

Instrument

The 44-item web-based self-report survey was guided by 1) previous literature; 2) previous studies from the authors; 3) and the Stages of Change and Process of Change constructs of the TTM. The survey was also reviewed for content validity among four expert panel members with combined expertise in HPV, dentistry, health behaviour theory, and survey research. In addition, the survey was pilot-tested among a sample of students ($n = 5$) receiving dental training to assess readability, wording of questions, flow and time considerations, and minor modifications were made accordingly. The final survey took approximately 5–10 min to complete. The electronic quantitative survey administered via Survey-Monkey was designed to: (a) determine stage of readiness among respondents regarding the criterion-specific behaviour of discussing the HPV vaccine with their patients; and (b) determine appropriate processes of change serving as leverage points to increase respondents' state of readiness to perform the criterion-specific behaviour.

A four-item algorithm corresponding to discussing the HPV vaccine with patients was used to assess stage of readiness. The algorithm included the following: *I am not discussing the HPV vaccine with my female patients and do not intend to start* (precontemplation stage); *I am not discussing the HPV vaccine with my female patients but I have considered it* (contemplation stage); *I am discussing the HPV vaccine with my female patients, but only sometimes* (action stage); and *I am discussing the HPV vaccine with all of my female patients* (maintenance stage).

The Process of Change construct of the TTM was assessed using knowledge of HPV and the HPV vaccine (increased consciousness). Items assessed included concern with the safety of the HPV vaccine, discomfort discussing sexual history topics with patients, concern with liability (dramatic relief); perceived role regarding primary prevention of HPV-related OC and professional guidelines (self-evaluation); and patient appointment time (environmental reevaluation).

Additionally, demographic variables (e.g., sex, race/ethnicity, age, type of practice, years in practice, and geographic region of practice), focus group findings (an earlier phase of the larger study)²⁶ and previous validated studies assessing HPV knowledge²⁹ and OHPs' knowledge, attitudes, and perceived roles regarding eating disorders^{30,31}—another sensitive topic among OHPs—guided the survey design. Survey validation was achieved using an expert panel with content, clinical, and methodological expertise (i.e., HPV and OC; oral health practice; professional development among OHPs). Dental students pilot-tested the survey; suggested changes and revisions were incorporated into the final survey, including re-ordering and clarifying questions to facilitate understanding and flow of the items.

Data collection and analyses

An electronic invitation was emailed simultaneously to batches of approximately 25 addressees from the master spreadsheet containing contact information. Electronic invitations were blind copied to one of the investigators to monitor email notifications of invalid addresses. After receiving an 'undeliverable' email notice, research assistants verified the address, corrected data entry errors as applicable, and re-sent the invitation to the identified contacts. If no data entry error was detected, research assistants attempted to find an alternate email address, with dental practice websites serving as the sole source for alternate email contact information. The web-based survey was available for a four-week period. During this period, dentists with active email addresses received weekly reminders to complete the survey.

The outcome variable of interest was readiness to discuss HPV vaccine with female patients and was operationalized as dentists who were in the precontemplation, contemplation and action stages. Chi-square tests of independence were used to test associations between stage of readiness and the independent variables. Expected cell counts were low in some of the contingency tables given the low number of dentists classified in the action stage of readiness, so in these instances (e.g., years in practice and region) the Fisher Exact Test was used to compute the probabilities. Stage of readiness was later dichotomized between precontemplation and contemplation due to the low number of dentists in the action group. Logistic regression analysis was used to assess processes of change associated with contemplation stage of readiness as opposed to precontemplation (no intention). Odds ratios and 95% confidence intervals (CI) were used to evaluate associations between the processes of change variables and state of readiness. Only those variables with significant bivariate associations ($P \leq 0.05$) were retained in the multivariable model.

Results

Participants

Of the 4480 surveys emailed, 368 surveys were returned. A response rate could be calculated by simply dividing the number of responses from the number of emails sent to the Florida Dental Association membership ($368/4480 = 8.2\%$). However, this would likely lead to a gross underestimate of the response rate, as it does not account of the high number of invalid email addresses and undelivered messages. Therefore, it was not possible to calculate an actual final response rate for this study. Of 368 returned surveys, 210 contained complete responses for the stage of change. Table 1 depicts participant demographic characteristics including background variables, knowledge of HPV and HPV vaccine, perceived barriers of discussing the HPV vaccine with female patients, as well as sources of HPV vaccine-related information. Respondents were primarily male (72%), non-Hispanic White (85%), and 50 years of age or older (51%). The majority worked in solo private practice (60%) with a median of 22 years of experience (IRQ = 20). Dental practices were located across the state of Florida, with the greatest proportion residing in central Florida (33%). The sample demographics closely resemble age and gender demographics of dentists nationally. According to the American Dental Association (ADA), nearly 76% of all dentists in the United States are male, 65% are over the age of 45, and 42% are over the age of 55.³²

Stage of readiness

As depicted in Fig. 1, the majority of participants self-identified as being in the precontemplation (52%) or contemplation (40%) stages of readiness to discuss the HPV vaccine with their female patients. Only 18 (9%) dentists were currently discussing the HPV vaccine with their female patients. There were no statistically significant demographic characteristics differentiating the three groups (Table 1). There were differences, however, in stage of readiness based on perceived barriers to action as well as the source of HPV vaccine-related information. A larger proportion of those in the precontemplation stage expressed agreement with the seven identified barriers, compared to those in the contemplation or action stages. Similarly, stage of readiness differed based on HPV vaccine-related information sources. Due to the small number of respondents ($n = 18$) who were identified to be in the action stage of readiness, further analyses explored differences specifically between dentists identified to be in the contemplation stage compared to those in the precontemplation stage.

Bivariate models

As depicted in Table 2, neither demographic factors nor HPV-related knowledge significantly predicted stage of readiness ($P > 0.05$). However, results do reveal differences between stages of readiness with regard to perceived barriers and HPV-related information sources. Specifically, participants who reported liability issues (OR = 0.41; 95% CI, 0.22–0.76), role conflicts (OR = 0.18; 95% CI, 0.06–0.34), lack of professional policies/guidelines (OR = 0.52; 95% CI, 0.28–0.98), limited time during scheduled appointments (OR = 0.41; 95% CI, 0.20–0.85), and discomfort discussing sexual history/topics with their patients (OR = 0.38; 95% CI, 0.20–0.72) were statistically significantly *less likely* to be in the contemplation stage of readiness ($P < 0.05$). In contrast, dentists who reported professional journals (OR = 2.38; 95% CI, 1.29–4.38), oral health colleagues (OR = 3.18; 95% CI, 1.68–6.02), and continuing education courses (OR = 2.33; 95% CI, 1.26–4.28) as a source of HPV vaccine-related information were significantly *more likely* to be in the contemplation stage ($P < 0.05$).

Multivariable model

After controlling for all statistically significant bivariate correlates pertaining to stage of readiness, only two of these correlates remained statistically significant. As depicted in Table 2, participants who perceived it was not their role to discuss the HPV vaccine with patients (OR = 0.28; 95% CI, 0.13–0.59), as well as those who expressed concern about liability issues (OR = 0.46; 95% CI, 0.22–0.97), were *less likely* to be in the contemplation stage. HPV vaccine information sources no longer predicted stage of readiness after controlling for all other variables in the model ($P > 0.05$).

Discussion

As awareness of HPV-related OC increases, dentists may be a key healthcare provider for discussing the HPV vaccine with their patients, demonstrating how OHPs may be important in future HPV prevention efforts. Although dentists may play a crucial role in primary prevention of HPV-related OSCC, results suggest the majority of dentists are not ‘ready’ to

do so. Additionally, results suggest dramatic relief and self-revaluation as two processes of change that may be effective in moving dentists from 'not ready' to 'ready' to discuss the HPV vaccine with female patients.

Regarding the dramatic relief process of change, liability concerns were identified as a barrier to discussing the HPV vaccine with female patients. Supporting these results, Daley and colleagues²⁶ found dentists specifically described discomfort in having sexual health-related discussions with patients; in particular male dentists felt greater discomfort discussing HPV with female patients.²⁶ While female dentists represented 28% of respondents, results revealed a greater willingness to discuss the vaccine with female patients as compared to their male counterparts. Furthermore, more female dentists in the current study were in the action stage (44%) than any other stage of readiness. This finding highlights the importance of addressing concerns dentists may have about sensitive conversations with opposite sex patients. Moreover, the relatively recent epidemiological findings about HPV and oral cancer may further contribute to dentists' uneasiness in discussing HPV with patients, particularly when compared to the longer-established research linking oral cancer with tobacco and alcohol. Thus, future research could also examine behaviour change with regards to dentists discussing HPV by stage of adoption (e.g., early adopters).³³

An additional liability issue concerns the current lack of professional guidelines for recommending the HPV vaccine as a primary prevention measure for OSCC. The effectiveness of the HPV vaccine for this purpose has not been proven to date.²⁶ In a previous qualitative study, dentists indicated that even if the HPV vaccine had been proven to prevent HPV-related OSCC, they would be uneasy about having this conversation without guidelines.²⁶

The second identified process of change pertains to self-reevaluation regarding role beliefs. This finding corroborates findings from a qualitative study which revealed that dentists often thought these conversations should be left to family practitioners and gynaecologists because of the sexual health-related nature of the topic.²⁶ Moreover, despite the connection to sex this particular conversation makes, dentists have not traditionally played a role in vaccine-prevention conversations.

HPV-related OSCC prevention will become increasingly important as HPV-related OSCC is on the rise⁵ and as dentists become more aware of the HPV–OSCC connection. The potential role of the HPV vaccine in preventing OSCC is strengthening in the literature and becoming apparent in the media. Subsequently, patients are turning to dental providers for information and guidance.³⁴ Oral health providers should consider the likelihood that patients may be inquiring about the HPV–OSCC connection, and should prepare themselves to discuss the connection with patients. Cleveland et al.² have even suggested possible responses to questions that might be posed by patients, including discussions around the HPV vaccine. Findings from this exploratory study reveal processes of change that can guide strategies necessary to ready the dental community for action. This contributes to previous literature that provides evidence that theoretically-driven processes and constructs

can assist in not only explaining and predicting behaviour, but also in facilitating behavioural change among dentists.^{21–25}

The above findings must be considered in light of limitations. For instance, the small response rate and the recruitment of members of the Florida Dental Association limit the generalizability of study results. Unfortunately response rates have been historically very low among medical professionals,^{35,36} and the feasibility and acceptability of employing electronic surveys among this population warrants further exploration. Moreover, the authors could not compare responders to non-responders, thus selection bias may be present. Nevertheless, this study was exploratory, and to the authors' knowledge, was the first study to examine dentists' readiness to discuss HPV vaccines as a prevention measure against HPV-related OSCC. The goal was not to estimate population parameters regarding the number of dentists in each proposed stage of readiness throughout the state of Florida, but rather to test theoretical hypotheses of factors differentiating dentists in these stages.

Conclusion

Findings from this study highlight that dentists seek approval and guidance from their professional organizations, such as the ADA. The ADA can therefore assist in guiding dentists through preparation of guidelines for HPV–OSCC discussions. Moreover, changing the dental community's perception of their 'role' as a healthcare provider is critical for moving into the future; however it will also be difficult to achieve because it requires a 'cultural shift' or paradigm change for the profession. The dental profession is a major player in the effort to reduce future cases of HPV-related OSCC. It is likely the public recognition of this role will occur before professional acceptance and readiness. Professional organizations such as the ADA have traditionally provided the profession with information and tools to enable advancement. The profession may also benefit from additional training, through continuing education and strengthening content on this topic in curriculum in dental schools.

This study sought to assess dentists' stage of readiness to discuss the HPV vaccine with patients as primary prevention of HPV-related OSCC. Despite study limitations, findings reveal the majority of dentists in this sample are not engaging in this primary prevention behaviour. Additionally, factors exist that impede dentists' action in recommending these vaccines. Recommendations include preparing dentists for sensitive conversations with patients of both sexes and increased involvement of the ADA in providing professional guidance in this area. As public awareness of the OPC and HPV association increases, dental providers may be expected to address this topic with their patients.

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Fig. 1.
Stage of readiness among dentists to discuss HPV vaccine with female patients.

Table 1
Stage of readiness to discuss HPV vaccine with female patients by characteristic of the study sample.

Variable	Total number (%)	Number (%) of dentists by stage of readiness to discuss HPV vaccine with female patients			P
		Precontemplation (n = 109)	Contemplation (n = 83)	Action (n = 18)	
Background variables					
Sex					0.124
Male	152 (72)	77 (71)	65 (78)	10 (56)	
Female	58 (28)	32 (29)	18 (22)	8 (44)	
Age					0.628
39 or younger	59 (28)	33 (30)	22 (27)	4 (22)	
40–49	44 (21)	19 (17)	19 (23)	6 (33)	
50–59	59 (28)	32 (29)	21 (25)	6 (33)	
60 or older	48 (23)	25 (23)	21 (25)	2 (11)	
Race/Ethnicity					0.885
Non-Hispanic white	179 (85)	93 (85)	70 (84)	16 (89)	
Other	31 (15)	16 (15)	13 (16)	2 (11)	
Type of practice					0.291
Solo	127 (60)	64 (59)	49 (59)	14 (78)	
Other	83 (40)	45 (41)	34 (41)	4 (22)	
Years in practice					0.976 ^a
1–10 years	57 (27)	30 (28)	22 (27)	5 (28)	
11–21 years	48 (23)	26 (24)	17 (20)	5 (28)	
22–30 years	53 (25)	26 (24)	22 (27)	5 (28)	
31–55 years	52 (25)	27 (25)	22 (27)	3 (17)	
Region					0.270 ^a
Northern Florida	51 (24)	21 (19)	24 (29)	6 (33)	
Central Florida	70 (33)	35 (32)	31 (37)	4 (22)	
Southwest Florida	36 (17)	24 (22)	9 (11)	3 (17)	
Southeast Florida	53 (25)	29 (27)	19 (23)	5 (28)	
Process of change					0.042
Not enough information about the vaccine	165 (81)	90 (86)	64 (79)	11 (61)	

Variable	Total number (%)	Number (%) of dentists by stage of readiness to discuss HPV vaccine with female patients			P
		Precontemplation (n = 109)	Contemplation (n = 83)	Action (n = 18)	
Concern with safety of vaccine	45 (22)	25 (24)	20 (25)	0 (0)	0.058
Liability reasons	78 (39)	53 (51)	24 (30)	1 (1)	<0.001
Not my role as oral health provider	102 (50)	75 (71)	25 (31)	2 (11)	<0.001
No professional policies/guidelines	133 (66)	76 (75)	49 (60)	8 (44)	0.017
Appointments not long enough	49 (24)	33 (32)	13 (16)	3 (17)	0.035
Discomfort discussing sexual history/topics with patients	125 (62)	80 (76)	44 (55)	1 (6)	<0.001
Most cited HPV vaccine information sources					
Professional journal/publication	133 (63)	57 (52)	60 (72)	16 (89)	0.001
Oral health colleague	69 (33)	22 (20)	37 (45)	10 (56)	<0.001
Non-oral health colleague	80 (38)	37 (34)	36 (43)	7 (39)	0.410
Continuing education	72 (34)	28 (26)	37 (45)	7 (39)	0.022
Television	129 (61)	68 (62)	50 (60)	11 (61)	0.955
General HPV knowledge (Median = 17; IQR = 1)					
17 items correct	108 (52)	53 (49)	47 (57)	8 (44)	0.400
HPV vaccine knowledge (Median = 9; IQR = 1)					
9 items correct	106 (51)	53 (50)	47 (57)	6 (33)	0.167

^a Fisher exact test.

Table 2

Predicting dentists' stage of readiness (contemplation vs precontemplation) to discuss HPV vaccine with female patients.

Variable	Odds ratio (95% confidence interval)		Odds ratio (95% confidence interval)	
Background variables	Bivariate	P	Multivariable	P
Sex				
Male	1.00			
Female	1.50 (0.77–2.92)	0.23		
Age				
39 or younger	1.00			
40–49	1.50 (0.65–3.45)	0.36		
50–59	0.98 (0.45–2.13)	0.49		
60 or older	1.26 (0.57–2.78)	0.77		
Race/Ethnicity				
Non-Hispanic white	1.00			
Other	1.08 (0.49–2.39)	0.85		
Type of practice				
Solo	1.01 (0.57–1.81)	0.96		
Other	1.00			
Years in practice				
1–10 years	1.00			
11–21 years	0.89 (0.39–2.03)	0.58		
22–30 years	1.15 (0.52–2.54)	0.66		
31–55 years	1.11 (0.51–2.44)	0.77		
Region				
Northern Florida	1.29 (0.60–2.76)	0.07		
Central Florida	1.00			
Southwest Florida	0.42 (0.17–1.05)	0.05		
Southeast Florida	0.74 (0.35–1.57)	0.77		
Process of change				
Not enough information about the vaccine	0.63 (0.29–1.35)	0.23		
Concern with safety of vaccine	1.05 (0.54–2.07)	0.88		
Liability reasons	0.41 (0.22–0.76)	0.01	0.46 (0.22–0.97)	0.04
Not my role as oral health provider	0.18 (0.10–0.34)	<0.00	0.28 (0.13–0.59)	<0.00
No professional policies/guidelines	0.52 (0.28–0.98)	0.04	1.23 (0.56–2.73)	0.61
Appointments not long enough	0.41 (0.20–0.85)	0.02	0.70 (0.30–1.62)	0.40
Discomfort discussing sexual history/topics with patients	0.38 (0.20–0.72)	<0.00	0.54 (0.24–1.19)	0.13
Most cited HPV vaccine information sources				
Professional journal/publication	2.38 (1.29–4.38)	0.01	1.84 (0.83–4.08)	0.13
Oral health colleague	3.18 (1.68–6.02)	<0.00	1.75 (0.77–3.97)	0.18
Non-oral health colleague	1.49 (0.83–2.68)	0.18		
Continuing education	2.33 (1.26–4.28)	0.01	1.98 (0.86–4.55)	0.11

Variable	Odds ratio (95% confidence interval)		Odds ratio (95% confidence interval)	
Background variables	Bivariate	<i>P</i>	Multivariable	<i>P</i>
Television	0.91 (0.51–1.64)	0.76		
General HPV knowledge (Median = 17; IQR = 1)				
17 items correct	1.42 (0.80–2.53)	0.23		
HPV vaccine knowledge (Median = 9; IQR = 1)				
9 items correct	1.34 (0.75–2.40)	0.32		