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Dental Professionals' Engagement in Tobacco, Electronic Cigarette, and Cannabis Patient Counseling

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Abstract: ***Objectives:*** *California features low smoking prevalence, cautionary electronic cigarette (e-cigarette) public messaging, and legal recreational cannabis: a unique landscape for dental professionals to navigate tobacco cessation promotion. This cross-sectional study assessed California dental professionals' self-reported tobacco patient counseling behaviors and the correlates of providing such assistance.*

Methods: *Statewide surveys of dental hygienists (*n *= 701) and dentists (*n *= 725) were distributed electronically. The dentist survey was weighted for sampling and nonresponse. Prevalence of asking patients about use was compared for cigarette and noncigarette products (e.g., e-cigarettes, cannabis). Multivariable models identified independent correlates of providing cessation assistance to tobacco-using patients.*

Results: *Respondents reported frequently (often/always) documenting patient tobacco use (hygienists: 80%; dentists: 73%) but less commonly provided forms of assistance (hygienists: 27%–49%; dentists: 10%–31%). Most respondents asked patients about cigarette smoking, but noncigarette product use (cigar, hookah, pipe, e-cigarette, or cannabis) was not commonly assessed. Greater confidence and willingness to assist were positively associated with providing assistance in multivariable models, but perceived barriers (e.g., lack of time and remuneration) were not. Results were robust to model specifications.*

Conclusions: *California dental professionals often ask about smoking but lag in providing cessation assistance and inquiring about noncigarette products. Successful efforts to encourage dental professionals' engagement in tobacco prevention and cessation must enhance providers' self-efficacy and motivation and likely will require system and organizational change.*

Knowledge Transfer Statement: *Study findings identify substantial gaps in dental professionals' engagement in patient tobacco cessation. The results identify correlates of providing assistance and of dental professionals' willingness and confidence to do so, which could serve to inform interventions to support and enhance engagement.*

Keywords: medical professionalism, tobacco use cessation, smoking cessation, patient care, cross-sectional studies, dental practice patterns

Introduction

Decisive progress has been achieved in reducing the prevalence of cigarette smoking among US adults—from above 40% in the 1960s to 14% in 2017 (Wang et al. 2018). Despite this meaningful success, tobacco smoking contributes to more mortality and morbidity nationwide than any other preventable risk factor (US Department of Health and Human Services 2014). Furthermore, gains in tobacco control have not been

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A supplemental appendix to this article is available online.

distributed evenly across society, leaving health inequities by geographic region, race/ethnicity, and socioeconomic position (Fagan et al. 2007; Trinidad et al. 2011; Wang et al. 2018). Tobacco use damages nearly all systems of the body, and its effects on oral tissues drive up risk for tooth loss, implant and other surgical failures, periodontal disease, and oral cancer (Johnson and Bain 2000; Warnakulasuriya et al. 2010).

Dental professionals are well positioned to address tobacco use among their patients (Albert and Ward 2012; Walsh and Ellison 2005), and well-designed tobacco cessation interventions in dental practices can lead to successful quitting (Carr and Ebbert 2012). The US Public Health Service promotes the "Five As" (i.e., Ask, Advise, Assess, Assist, and Arrange) as a systematic framework for clinicians to encourage and support patients through each step of tobacco cessation (Fiore et al. 2008). Although the Five As approach is brief and widely taught, health professionals, including dentists and dental hygienists, are much more likely to ask their patients about tobacco use than to connect their tobacco-using patients with tangible, evidence-based assistance to quit (Chase et al. 2007; Tong et al. 2010; Albert and Ward 2012). Dentists notably fall behind their physician counterparts, being less likely to ask about tobacco or provide cessation assistance, whether assessed by self-report (Tong et al. 2010) or patient recall (Agaku et al. 2014). Lack of time, training, and remuneration are among the obstacles dental professionals frequently cite as barriers to greater involvement (Watt et al. 2004; Prakash et al. 2013; Kengne Talla et al. 2016).

Overlaying these longstanding challenges to tobacco cessation engagement, a rapidly evolving tobacco regulatory and behavioral context creates new uncertainty for health professionals. Expanded marketing of electronic cigarettes (e-cigarettes, commonly "vaping") and liberalizing cannabis policies have coincided with an increasing portion of American adults (and, presumably, dental patients) using noncigarette tobacco and cannabis (Azofeifa et al. 2016; Couch et al. 2016; Wang et al. 2018). California is an apt setting to examine whether and how dental providers navigate and adapt to a changing tobacco landscape, particularly given the state's long history of legal medicinal cannabis use and cautionary public messaging regarding e-cigarettes (Rosenhall and Garrison 2015). California is among the US states with the lowest overall prevalence of cigarette smoking, but due to its large population and elevated burden of tobacco use in rural and low-income communities, more deaths are attributable to tobacco use in California than any other state (Ma et al. 2018).

The present study contributes insight into dental professionals' tobacco cessation beliefs and behaviors within this context of rising use of noncigarette tobacco and cannabis. Specifically, the objectives of this analysis were to 1) describe California dental professionals' (dental hygienists and dentists) engagement in patient tobacco cessation, 2) assess how often dental professionals inquire about noncigarette tobacco products, and 3) identify correlates of actively assisting patients to quit tobacco use, with specific attention to dental professionals' confidence, willingness, and perceived barriers related to tobacco cessation.

Methods

Web-based cross-sectional surveys were distributed via e-mail in fall 2018 to members of the California Dental Hygienists' Association (CDHA) and California Dental Association (CDA). Respondents followed an embedded link and viewed a description of the survey, research purpose, and voluntary nature of the research, including a statement that continuing the survey implied electronic consent. Participants were asked to verify their age (18 y or older) and whether they are currently in clinical practice, at least part time. Individuals younger than 18 y or not involved in patient care were deemed ineligible and routed to exit the survey. Median completion time was 15 min (hygienists and dentists). Participants who completed the survey had the option to receive a code for a $10 credit at an online retailer. The Institutional Review Board of the University of California San Francisco approved all study procedures. Study reporting followed Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement guidelines.

Participants

Dental Hygienists

The CDHA distributed an e-mail message to their active members (N = 3,232) on behalf of the investigators in September 2018. Reminder messages followed after 3 and 8 d. Undeliverable were 103 messages (invalid addresses); 1,428 members opened the first e-mail message. In total, 860 participants answered both survey eligibility questions (response percentage: 860/3,129 = 27.5%) and 701 were deemed eligible (98.1% of ineligible were not in clinical practice).

Dentists

Study investigators directly e-mailed a survey link to a random sample obtained from the CDA online member directory in December 2018 (N = 7,752). The sample was stratified by local dental society component, with oversampling from components with fewer members (generally, membership size is largest in urban areas). Messages were not sent to student or retired members. Reminders followed after 3, 7, and 16 d. Undeliverable were 83 messages (invalid addresses). In total, 752 participants answered both eligibility questions (response percentage: 752/7,669 = 9.8%) and 725 were deemed eligible (92.6% of ineligible were not in clinical practice).

Measurement

A literature search was conducted for existing measures of health professionals' behaviors and beliefs related to tobacco cessation; relevant identified items were

adapted for the present study (Tong et al. 2010; Prakash et al. 2013; Jannat-Khah et al. 2014). Practice characteristic items were drawn from the American Dental Association Survey of Dental Practice (American Dental Association 2019). Professional satisfaction (possible range: 0–10) was measured as reported elsewhere (Newton and Gibbons 2001). Own current tobacco/substance use was based on standard adult surveillance measures (i.e., have used a product ≥100 times and now use "every day" or "some days") (Wang et al. 2018). Perceived patient tobacco use was respondents' estimate of the percentage of patients in their practice who use tobacco (options: <5%, 5%–20%, >20%). Practice location was determined via asking participants to enter a 5-digit ZIP code, which was then categorized as urban, partially rural, or rural using Department of Housing and Urban Development crosswalk files and Rural Urban Commuting Area designations. Items were reviewed for face validity by invited leaders in dental professional organizations and were pilot tested among a convenience sample of 21 dental practitioners.

The main outcomes of interest were tobacco cessation practice behaviors, as determined based on 14 previously tested items that correspond to the Five As framework (Tong et al. 2010). Participants responded to the prompt: "How often do you do the following in your clinical practice?" (options: never, sometimes, often, always). Responses "often" and "always" were considered a positive response (Tong et al. 2010). The list of behaviors included actions related to "asking" (e.g., ask patients about tobacco use status and history), "assisting" (e.g., refer patients to a cessation program), and other components of the Five As (see Results). The survey also asked, "How often do you ask your patients about the following products?" (list: cigarettes, smokeless tobacco [dip/chew], e-cigarettes, other tobacco products [i.e., cigars, hookah, pipes], cannabis/marijuana; options: never, sometimes, most of the time, all of the time), with "most of the time" and "all of the time" later combined as a positive response.

To create a single outcome variable to represent assisting patients with tobacco cessation, dental professionals were considered to provide assistance if responding "always" to at least 1 of the 4 assisting behaviors (i.e., develop a quit plan, refer to cessation program, provide quitline information, or discuss cessation medications). To check the sensitivity of results to this operationalization, alternative specifications were also evaluated: 1) reporting at least 1 behavior often or always, 2) reporting all 4 behaviors often or always, and 3) a score based on frequency of each behavior (e.g., 4 points for "always," 1 point for "never"), dichotomized at the top quartile of assisting score.

The primary predictor variables of interest were dental professionals' confidence, willingness, and perceived barriers related to engaging in patient tobacco cessation. These concepts were measured using Likert-type responses (confidence and willingness: not at all, slightly, somewhat, very; barriers: never, sometimes, often, always) for 7 to 9 items within each concept (see Results). There was strong internal consistency (Cronbach αs): confidence (hygienists, 0.92; dentists, 0.92), willingness (hygienists, 0.90; dentists, 0.93), and barriers (hygienists, 0.79; dentists, 0.79). Scores were created for each concept based on summing responses (1 to 4 points for each item). Score distributions were reasonably normal based on visual inspection; thus, for multivariable analysis, scores were normalized (mean = 0; standard deviation = 1). See Appendix Table 1 for a complete list of measurement items.

Sample Size

The targeted sample size for each survey was 700 respondents, which would yield >99% power to detect within-group differences in a binary behavior (e.g., prevalence of asking about cigarettes vs. asking about e-cigarettes), assuming 20% of respondents performed only the first behavior, 5% performed only the second behavior, and 40% performed both ($\alpha = 0.05$). The sample would also have 90% power to detect differences in a binary behavior between groups (e.g., prevalence of providing tobacco cessation assistance among hygienists with ≥20 years' experience vs. among hygienists with <20 years' experience), assuming 30% of respondents in the more experienced group, 25% assistance prevalence in that group, and 35% assistance in the less experienced group ($\alpha = 0.05$).

Statistical Analysis

Descriptive statistics for participant and practice characteristics, self-reported behaviors, and attitudinal concepts were calculated for the entire eligible samples. To assess how respondents' characteristics, confidence, willingness, and perceived barriers were associated with providing tobacco cessation assistance, univariable and multivariable logistic regression models were fitted for the outcome tobacco cessation assistance to obtain unadjusted and adjusted odds ratios, respectively, for each covariable. Variance inflation factors did not indicate multicollinearity. Regression analysis was restricted to respondents who answered all 4 assisting items and at least half of the items in each confidence, willingness, and barriers scale (hygienists, $n = 640$; dentists, $n = 648$). Missing covariable data (0.3% of all covariable data, hygienists and dentists) were multiply imputed by chained equations using the mi command suite in Stata 15 (StataCorp). Dentist survey responses and models were weighted by the inverse of the local component-specific sampling probability and response percentage to obtain geographically representative statewide estimates using the svy command suite. Weights also accounted for years of CDA membership and e-mail domain (e.g., gmail.com) to account for variations in antispam processing that blocked delivery of some survey requests. Due to differences in response percentage and how surveys were distributed, no statistical tests were

performed to compare responses of hygienists and dentists.

Results

Both hygienists and dentists largely worked in general practice and small private practices and reported a high level of professional satisfaction (Table 1). Neither group was likely to use tobacco products currently; 3.7% of hygienists and 2.4% of dentists reported current cannabis use (Table 1). Approximately one-third of respondents reported that they believed less than 5% of the patients in their practices use tobacco. Most respondents practiced in urban locations (Table 1). Using survey weights, the geographic distribution of the dentist sample was highly similar to that of active dental licensee addresses obtained from the California Dental Board in 2018 (Appendix Table 2).

Most dental professionals reported asking their patients about tobacco use (hygienists: 66%; dentists: 72%) and documenting tobacco status (hygienists: 80%; dentists: 73%), but other behaviors to encourage patient tobacco cessation were performed less often (Table 2). Providing tangible assistance, such as referral to outside cessation services (programs, quitlines) or discussing medication options, were among the least performed behaviors (Table 2). Few respondents reported working in a practice that had a written protocol for tobacco cessation (hygienists: 12%; dentists: 6%). Most conversations about tobacco were initiated with adult patients, not youth or adolescents (Table 2).

While the majority of respondents reported asking most/all of the time about cigarettes, both hygienists and dentists asked about noncigarette products less often (Table 2). Considering the full response range (i.e., never, sometimes, most of the time, all of the time), both hygienists and dentists asked about cigarettes more often than all other products (all pairwise Friedman tests: $P < 0.001$) and asked about cannabis least often (all pairwise Friedman tests also statistically significant, except among dentists in comparison to e-cigarettes and cigar/hookah/pipe tobacco).

Half or more of respondents were not confident in their ability to assess, counsel, or refer patients on various topics related to tobacco cessation (Table 3). Approximately 40% of hygienists and 30% of dentists were at least somewhat confident in talking to patients about e-cigarettes or cannabis. In contrast, most respondents were at least somewhat willing to provide patients with material, such as a quitline number or educational brochure (Table 3). Willingness waned to perform more active cessation assistance, such as being the practice tobacco cessation leader, signing up patients with a quitline, or prescribing cessation medications. Perceived patient resistance (hygienist) and lack of training (dentists) were the most cited barriers to providing tobacco cessation (Table 3).

For hygienists (Table 4) and dentists (Table 5), greater confidence and willingness surrounding tobacco cessation activities were both positively, independently, and strongly associated with providing cessation assistance to patients. While perceived barriers were inversely associated with assisting patients in univariable models, that association vanished in multivariable models that included confidence, willingness, and participant and practice characteristics (Tables 4, 5). Other statistically significant positive correlates of assistance in multivariable models were working in specialty practice (hygienists), Asian or "other" race/ethnicity (hygienists), being female (dentists), and own history of never using tobacco or cannabis (dentists). Findings related to confidence, willingness, and barriers were largely robust to alternative specifications of the "assist" outcome variable; however, other covariables lost or gained statistical significance under some specifications (Appendix Table 3).

In an exploratory analysis of variables associated with confidence, willingness, and barriers, a high level of professional satisfaction was associated with greater confidence and fewer perceived barriers to performing patient tobacco cessation among both hygienists and dentists (Appendix Table 4). Perceived barriers and perceived prevalence of patient tobacco use were positively correlated. For hygienists, holding a bachelor's degree in dental hygiene was positively associated with confidence and willingness and was inversely associated with perceived barriers; however, more years in practice was associated with less confidence and willingness (Appendix Table 3). For dentists, general practitioners had greater confidence and willingness than specialists, but private practice was associated with more perceived barriers than public or university practice.

Discussion

California hygienists and dentists report that they are asking about and documenting patient tobacco use but are largely falling short of connecting tobacco-using patients with evidence-based cessation support. Dental providers are also more likely to ask patients about cigarettes than noncigarette products and cannabis, despite rising use. In this study, the strongest and most consistent correlates of assisting patients to quit tobacco were dental providers' own confidence and willingness to engage in such behavior, not their level of perceived barriers. This finding suggests that efforts to engage dental professionals in tobacco cessation should prioritize increasing dental providers' relevant knowledge, skills, and sense of professional responsibility.

There is a longstanding disconnect between dental providers' self-reported fealty to asking patients about cigarette smoking and their much less frequent practice of providing cessation assistance (Block et al. 1999; Watt et al. 2004; Tong et al. 2010; Albert and Ward 2012; Freeman et al. 2012; Prakash et al. 2013; Ahmed et al. 2018). Some respondent characteristics were associated with cessation assistance in the present study, including, for dentists, sex and own tobacco use history.

Table 1.
Participant and Practice Characteristics, California Dental Hygienists and Dentists.

	Hygienists ($n = 698$)[a]	Dentists ($n = 719$)[a]	
	Unweighted	Unweighted	Weighted[b]
Participant characteristics			
Age, mean (SD), y	41.6 (14.3)	49.2 (13.0)	48.2 (15.7)
Sex, female %	94.6	37.9	40.1
Race/ethnicity, %			
Asian	17.1	35.7	39.6
Hispanic/Latino	16.2	5.6	5.6
White	52.5	43.6	40.2
Other	14.2	15.0	14.7
Years in practice, %			
0–5	46.9	15.7	14.6
6–20	25.8	34.6	40.2
>20	27.4	49.7	45.2
Hygiene degree type, %			
Certificate/diploma	4.1	—[c]	—[c]
Associate's	63.5	—	—
Bachelor's	32.4	—	—
Professional satisfaction, median (IQR)	8 (7, 9)	8 (7, 9)	8 (7, 9)
Own tobacco/substance use (ever/current), %			
Cigarettes	43.6/0.6	39.7/1.1	36.5/1.3
Smokeless (spit) tobacco	5.9/0.2	11.1/0.6	10.9/0.5
Cigars	17.6/0.2	36.8/1.2	36.4/1.0
Hookah	29.0/0.3	23.0/0.6	23.4/0.8
E-cigarettes	13.3/0.6	7.5/0.3	7.5/0.4
Cannabis	48.1/3.7	38.1/2.6	34.7/2.4
Practice setting characteristics			
Days/week in practice, %			
1 or fewer	11.1	4.6	5.1
2	15.0	4.3	5.0
3	22.9	12.0	12.4
4	32.8	45.2	43.2
5 or more	18.3	33.8	34.2

(continued)

Table 1.
(continued)

	Hygienists ($n = 698$)[a]	Dentists ($n = 719$)[a]	
	Unweighted	Unweighted	Weighted[b]
Practice setting, %			
Small private	79.8	80.1	79.3
Large private	7.1	7.7	10.4
Public clinic	8.0	11.0	9.5
Other	5.1	1.1	0.8
Practice specialty, %			
General practice	81.0	77.3	76.6
Periodontology	4.5	4.0	4.8
Pediatric dentistry	1.2	6.6	5.8
Orthodontics	0.1	3.9	4.9
Endodontics	0	3.6	3.9
Oral surgery	0	2.4	2.1
Educational/training	3.6	0	0
More than 1	6.3	0	0
Other	3.3	2.2	2.0
Accepts Medicaid, %	15.8	25.7	25.7
Patient record system, %			
Entirely electronic	42.8	40.5	39.0
Mostly electronic	27.1	26.1	27.2
Mostly paper	22.7	25.5	25.6
Entirely paper	7.5	7.9	8.2
Practice location, %			
Urban	84.3	79.7	87.0
Partially rural	10.7	14.7	10.0
Rural	2.3	4.6	1.6
Out of state	2.6	1.0	1.4
Perceived patient tobacco use, %			
<5%	33.9	34.7	36.5
5%–20%	53.6	51.0	50.1
>20%	12.5	14.2	13.4

IQR, interquartile range.
[a]Sample size may be fewer for individual items due to nonresponse.
[b]Weighted for sampling, years of dental society membership, e-mail domain, and local dental society (approximates county of practice).
[c]Degree type not asked of dentists.

Table 2.
Tobacco Cessation Practice Behaviors, California Dental Hygienists and Dentists.

Characteristic	Hygienists ($n = 664$)[a]	Dentists ($n = 686$)[a,b]
Tobacco-related behaviors,[c] %		
Ask about tobacco use status and history (Ask)	66.4	71.7
Document tobacco status in chart (Ask)	79.9	73.0
Give clear, strong, personalized advice to quit (Advise)	60.3	57.4
Discuss health risks of tobacco (Advise)	65.9	59.5
Use open-ended questions (Assess)	55.9	37.2
Assess patient readiness to quit (Assess)	58.4	40.8
Motivate not ready patients to consider quitting[d]	54.9	47.6
Assist ready-to-quit patients to make a quit plan (Assist)	48.6	31.4
Refer to a cessation program (Assist)	34.8	16.4
Provide materials with quitline information (Assist)	26.7	9.5
Discuss cessation medications (Assist)	35.4	18.3
Follow up with patients trying to quit (Arrange)	39.5	18.1
Reevaluate tobacco use at follow-up visits (Arrange)	59.7	39.0
Ask about specific products,[e] %		
Cigarettes	58.0	62.3
Smokeless (spit) tobacco	43.3	47.3
E-cigarettes	36.0	34.5
Any other tobacco (cigars, hookah, pipes)	33.7	32.9
Cannabis	25.3	26.7
Other related behaviors		
Patient age to begin asking about tobacco, %		
<13	2.6	16.8
13–17	26.2	2.9
18–24	49.1	17.2
>24	11.7	47.1
Typically don't ask	10.5	15.9
Has a written protocol for tobacco cessation, %	12.3	5.9
Who provides tobacco cessation counseling,[f] %		
Dentist	38.9	43.7
Dental hygienist	54.5	21.6
Dental assistant	10.0	10.9
Office manager	2.5	2.2
Receptionist	1.7	1.5
Other	2.0	1.5
No one	38.7	52.0

[a]Sample size may be fewer for individual items due to nonresponse.
[b]Weighted for sampling, years of dental society membership, e-mail domain, and local dental society.
[c]Positive response: "often" or "always" do the following in clinical practice.
[d]Motivating patients not traditionally considered an "A" in the Five As.
[e]Positive response: "most of the time" or "all of the time" ask patients about the following products.
[f]Respondents instructed to select all that apply for their practice.

Table 3.
Tobacco Cessation Confidence, Willingness, and Perceived Barriers, California Dental Hygienists and Dentists.

Characteristic	Hygienists ($n = 648$)[a]	Dentists ($n = 663$)[a,b]
Confidence,[c] %		
Assess stage of readiness to stop using tobacco	51.2	33.9
Counsel patients on how to stop using tobacco	50.9	40.2
Refer to appropriate resource for cessation support	46.7	34.6
Assess a patient's nicotine dependence	42.9	30.9
Talk to patients about e-cigarettes	40.7	30.9
Discuss cessation medication options	40.3	29.7
Talk to patients about cannabis/marijuana	39.7	28.0
Willingness,[c] %		
Provide cards with the number of the smokers' quitline	89.0	74.5
Provide educational materials (e.g., brochures)	87.4	73.3
Be trained to help patients stop using tobacco	77.2	55.2
Follow up with patients trying to quit	71.3	56.1
Recommend cessation medications	67.2	57.2
Implement a written protocol for tobacco cessation	60.6	52.7
Be the tobacco cessation leader in your practice	58.6	55.7
Sign up patients online with the smokers' quitline	52.0	51.5
Prescribe tobacco cessation medications	—[d]	40.7
Perceived barriers,[e] %		
Patient resistance	60.9	56.6
Lack of patient education materials in my office	59.3	56.3
Amount of time required	54.7	46.7
Lack of training in tobacco cessation	48.3	57.6
Lack of referral resources	42.5	49.0
Lack of reimbursement	31.5	51.6
Concerned it's not effective	29.4	23.8
Resistance from other members of office	22.2	19.0
Not personally interested	13.0	19.9

[a]Sample size may be fewer for individual items due to nonresponse.
[b]Weighted percentages.
[c]Positive response: "somewhat" or "very" confident/willing to do the following in clinical practice.
[d]Not asked of the hygienist sample.
[e]Positive response: "often" or "always" a barrier to tobacco cessation.

Table 4.
Correlates of Assisting Patients in Tobacco Cessation, California Dental Hygienists.

Correlates	Percent Assisting[a]	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Attitudes and barriers			
Confidence (standardized)[b]		3.59 (2.87–4.50)[c]	3.06 (2.35–3.99)[c]
Willingness (standardized)[b]		2.51 (2.02–3.11)[c]	1.49 (1.15–1.94)[c]
Perceived barriers (standardized)[b]		0.71 (0.59–0.84)[c]	1.02 (0.81–1.28)
Participant characteristics			
Race/ethnicity: White (reference)	27.9	1	1
Race/ethnicity: Asian	34.9	1.39 (0.87–2.22)	2.02 (1.09–3.75)[c]
Race/ethnicity: Hispanic/Latino	34.9	1.39 (0.86–2.23)	1.34 (0.75–2.42)
Race/ethnicity: Other	42.3	1.90 (1.18–3.06)[c]	2.07 (1.14–3.78)[c]
Years in practice: 0–5 (reference)	34.6	1	1
Years in practice: 6–20	34.8	1.01 (0.67–1.51)	1.52 (0.91–2.54)
Years in practice: >20	26.0	0.66 (0.44–1.00)[c]	1.12 (0.64–1.95)
Associate's degree/certificate (reference)	30.0	1	1
Bachelor's degree	37.1	1.39 (0.98–1.97)	1.07 (0.67–1.69)
Professional satisfaction: <7 (reference)	31.3	1	1
Professional satisfaction: 7–8	25.8	0.76 (0.46–1.26)	0.62 (0.34–1.15)
Professional satisfaction: 9–10	39.3	1.42 (0.87–2.32)	1.05 (0.57–1.95)
Own tobacco use: never (reference)	32.1	1	1
Own tobacco use: ever	32.2	1.01 (0.72–1.42)	1.07 (0.70–1.64)
Practice setting characteristics			
Public or other practice (reference)	51.8	1	1
Private practice	29.3	0.38 (0.24–0.61)[c]	0.62 (0.32–1.19)
Specialty practice (reference)	46.7	1	1
General practice	28.8	0.46 (0.31–0.70)[c]	0.57 (0.34–0.97)[c]
Does not accept Medicaid (reference)	31.0	1	1
Accepts Medicaid	38.4	1.38 (0.89–2.15)	0.62 (0.34–1.14)
Charting: paper (reference)	29.9	1	1
Charting: electronic	33.2	1.16 (0.81–1.68)	1.02 (0.65–1.60)
Patient tobacco use: <5% (reference)	30.0	1	1
Patient tobacco use: 5%–20%	31.3	1.06 (0.73–1.53)	1.05 (0.66–1.65)
Patient tobacco use: >20%	42.3	1.70 (1.00–2.91)	1.18 (0.60–2.34)
Urban practice (reference)	31.7	1	1
Rural/partially rural practice	35.3	1.18 (0.73–1.90)	1.37 (0.74–2.53)

Missing covariable values multiply imputed.
OR, odds ratio.
[a]Assist = "always" performing at least 1 activity to develop a quit plan, refer to cessation program, provide quitline information, or discuss cessation medications.
[b]Standardized scale: odds ratio corresponds to 1 standard deviation increase in score.
[c]$P < 0.05$.

Table 5.
Correlates of Assisting Patients in Tobacco Cessation, California Dentists.

Correlates	Percent Assisting[a]	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Attitudes and barriers			
Confidence (standardized)[b]		3.09 (2.19–4.35)[c]	2.96 (2.04–4.30)[c]
Willingness (standardized)[b]		2.08 (1.51–2.85)[c]	1.45 (1.02–2.05)[c]
Perceived barriers (standardized)[b]		0.73 (0.54–0.99)[c]	1.00 (0.72–1.40)
Participant characteristics			
Sex: male (reference)	12.1	1	1
Sex: female	18.9	2.00 (1.12–3.56)[c]	1.95 (1.03–3.69)[c]
Race/ethnicity: White (reference)	13.1	1	1
Race/ethnicity: Asian	14.1	1.11 (0.57–2.17)	1.00 (0.47–2.12)
Race/ethnicity: Hispanic/Latino	12.1	1.06 (0.31–3.63)	0.86 (0.18–4.25)
Race/ethnicity: Other	22.4	2.30 (1.03–5.11)[c]	2.18 (0.74–6.46)
Years in practice: 0–5 (reference)	10.1	1	1
Years in practice: 6–20	13.6	1.49 (0.63–3.53)	1.39 (0.56–3.46)
Years in practice: >20	17.0	1.64 (0.73–3.69)	1.87 (0.69–5.06)
Professional satisfaction: <7 (reference)	13.6	1	1
Professional satisfaction: 7–8	11.5	1.19 (0.39–3.62)	0.61 (0.19–1.92)
Professional satisfaction: 9–10	18.7	1.66 (0.57–4.86)	0.62 (0.18–2.15)
Own tobacco use: never (reference)	20.2	1	1
Own tobacco use: ever	10.5	0.43 (0.24–0.75)[c]	0.53 (0.29–0.98)[c]
Practice setting characteristics			
Public or other practice (reference)	20.3	1	1
Private practice	14.0	0.72 (0.35–1.48)	0.99 (0.35–2.85)
Specialty practice (reference)	14.0	1	1
General practice	14.9	1.04 (0.52–2.06)	0.68 (0.30–1.56)
Does not accept Medicaid (reference)	13.7	1	1
Accepts Medicaid	17.5	1.41 (0.74–2.69)	1.47 (0.64–3.40)
Charting: paper (reference)	13.1	1	1
Charting: electronic	15.6	1.16 (0.59–2.30)	1.34 (0.62–2.87)
Patient tobacco use: <5% (reference)	18.4	1	1
Patient tobacco use: 5%–20%	12.9	0.55 (0.29–1.01)	0.55 (0.28–1.12)
Patient tobacco use: >20%	12.3	0.65 (0.27–1.54)	0.36 (0.10–1.27)
Urban practice (reference)	14.5	1	1
Rural/partially rural practice	16.4	1.21 (0.64–2.32)	1.02 (0.48–2.19)

All estimates weighted for sampling and nonresponse; missing covariable values multiply imputed.
OR, odds ratio.
[a]Assist = "always" performing at least 1 activity to develop a quit plan, refer to cessation program, provide quitline information, or discuss cessation medications.
[b]Standardized scale: odds ratio corresponds to 1 standard deviation increase in score.
[c]$P < 0.05$.

Similar variables have also been identified in some, but not all, prior studies, as recently reviewed (Lala et al. 2017).

Associations with attitudinal variables (i.e., confidence and willingness) were more robust to variable and model specifications than associations with respondent characteristics. For dental hygienists, confidence and willingness themselves were, counterintuitively, negatively associated with years in practice. Continuing education requirements for tobacco cessation may help improve the confidence and willingness of more experienced dental hygienists to provide such care. Among dentists, those working in a specialty practice were less confident and willing to provide tobacco cessation support than general dentists. This is contrary to a previous study demonstrating a significantly higher percentage of dental specialists providing tobacco-related counseling advice compared with generalists (Kujan et al. 2006). We speculate that some dental specialists in this study see their practice role as providing acute care and consider tobacco cessation part of the general dentist's role in continuity of care. Dentists working in public or university practice perceived fewer barriers overall, which may be due to the atypical access to empirical evidence and resources related to tobacco cessation education (Davis et al. 2016). Regardless of possible correlates, overall engagement in cessation assistance was poor, with relatively few providers consistently connecting patients with evidence-based support, such as tobacco quitlines or cessation medications.

Multiple studies have characterized barriers that dentists identify as constraints on their tobacco cessation engagement, not limited to perceived patient resistance and lack of time, training, and remuneration (Watt et al. 2004; Prakash et al. 2013; Kengne Talla et al. 2016). Despite the consistency with which such barriers are reported, the results of this study and others suggest that such barriers are not necessarily potent determinants of behavior. In a factorial design randomized controlled trial, providing dentists with tobacco cessation training resulted in greater frequency of assisting patients to quit, but the opportunity to receive monetary reimbursement did not affect dentists' tobacco counseling frequency (Walsh et al. 2012). In another study, nearly all dentists surveyed named patient resistance as a "strong" or "somewhat strong" barrier, despite the solid majority of patients in those same practices reporting that dental practices should offer tobacco cessation services (Campbell et al. 1999).

A review of strategies to enhance dental professionals' engagement in patient smoking cessation found that several multifaceted approaches successfully increase engagement (Rosseel et al. 2012). Among intervention components were professional education, provision of patient-focused tools and materials, and organizational approaches that incorporated the entire care delivery team (Rosseel et al. 2012). In the present study, dentists and hygienists reported providing most of the tobacco cessation counseling in their practices. Other team members, such as dental assistants, represent a potentially underused workforce whose participation could motivate further engagement. Notably, greater professional satisfaction was associated with more confidence and fewer perceived barriers to tobacco cessation. In primary care, receiving tobacco counseling is associated with greater overall patient satisfaction (Conroy et al. 2005). However, whether provider engagement in tobacco cessation enhanced or resulted from provider satisfaction cannot be deciphered in the present cross-sectional analysis.

Hygienists and dentists were more likely to report asking their patients about cigarette smoking than about any other form of tobacco or cannabis. Multiple studies have shown associations between cannabis smoking and periodontal disease (Thomson et al. 2008; Ortiz et al. 2018). E-cigarettes could also plausibly affect oral health (Chaffee 2019), but clinical studies of e-cigarettes and oral disease have so far been limited to case studies of oral-facial trauma from device explosions (Harrison and Hicklin 2016) or studies of short duration and small sample size (AL Harthi et al. 2019). Stronger evidence implicates cigar, pipe, hookah, and smokeless (spit) tobacco in oral disease (Warnakulasuriya et al. 2010). Nonetheless, less than half of the health providers in the present study assessed patient use of these products.

Beyond individual product health effects, dual and poly-use of cigarette and noncigarette products in combination is an increasingly common behavior, particularly among e-cigarette users (Sung et al. 2018). The American Dental Association does not endorse e-cigarettes for tobacco cessation or as a harm reduction alternative to smoking cigarettes (American Dental Association 2016), which differs from the stance of some medical organizations in the United Kingdom that support the viability of a harm reduction strategy (Royal College of General Practitioners 2017). Despite this favorable e-cigarette context, most UK dental professionals surveyed in 2017 were not comfortable recommending e-cigarettes to their patients who smoke (Ahmed et al. 2018).

There are open scientific, policy, and patient care debates regarding the health implications of e-cigarettes, other noncigarette tobacco, and cannabis. Dental patients currently (or considering) using such products doubtlessly have questions regarding their relative danger or safety. However, most dental professionals are less knowledgeable about these products than they are about cigarettes (Isett et al. 2018). Based on the present findings, most dental professionals are not engaging patients in this conversation, thus missing an opportunity to provide accurate information, as well as missing a substantial amount of patient substance use with implications for their oral health.

Strengths of the present study include sufficiently large samples to

accommodate analysis of multiple potential behavioral correlates. For dentists, the sampling and weighting strategy produced geographically representative statewide estimates, while multiple imputation minimized data loss. Both hygienists and dentists were featured, but future work should include other dental practice team members.

Among limitations, respondents' behaviors were assessed by self-report, which likely overestimates the actual level of engagement in actively assisting patients with tobacco cessation. The cross-sectional design excludes causal attribution to factors measured simultaneously with outcomes of interest. Response percentages, while typical of electronic surveys and likely constrained by antispam e-mail filters, reduce study generalizability, especially if individuals interested in the survey topic were more motivated to respond. Participants were members of professional societies, which may not represent all California practitioners. Finally, the tobacco landscape in California, with low smoking prevalence and liberal cannabis policies, is not representative of the overall context in the United States. That said, California remains a meaningful location to study, given its sizable total burden of tobacco use and the tendency for local tobacco policies and behavioral patterns to foreshadow future trends elsewhere.

Dental professionals are well positioned to address tobacco use among their patients, but the great majority remains resistant to embracing a role in tobacco prevention and cessation. The emergence of noncigarette products is a challenge requiring health care providers to adapt to evolving patient behaviors. This new landscape might also be an opportunity for outreach and training for dental professionals who may be receptive to learning about new products. Importantly, greater dental professional engagement in tobacco cessation will require expanding providers' self-efficacy and perceived professional scope, the latter of which will likely require widespread system change.

Author Contributions

B.W. Chaffee, contributed to conception, design, and data analysis, drafted the manuscript; J. Urata, E.T. Couch, S. Silverstein, contributed to conception and design, critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

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