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Variations in tobacco control in National Dental PBRN practices: The role of patient and practice factors

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Abstract

We engaged dental practices enrolled in The National Dental Practice-Based Research Network to quantify tobacco screening (ASK) and advising (ADVISE); and to identify patient and practice characteristics associated with tobacco control. Dental practices (N=190) distributed patient surveys that measured ASK and ADVISE. 29% of patients were ASKED about tobacco use during visit, 20% were identified as tobacco users, and 41% reported being ADVISED. Accounting for clustering of patients within practices, younger age and male gender were positively associated with ASK and ADVISE. Adjusting for patient age and gender, a higher proportion of non-whites in the practice, preventive services and proportion on public assistance were positively associated with ASK. Proportion of tobacco users in the practice and offering other preventive services were more strongly associated with ASK and ADVISE than other practice characteristics.

Understanding variations in performance is an important step toward designing strategies for improving tobacco control in dentistry.

Keywords

Clinical trials; Public health dentistry; Oral health

Introduction

Tobacco use is the most preventable cause of morbidity and mortality in the United States¹ and the effects of tobacco use cost more than \$96 billion in direct health care costs and \$97 billion in lost productivity.² Not only does tobacco use cause heart disease, stroke, and numerous cancers³, it is also the most significant risk factor for oral and pharyngeal cancer, as well as for the development and progression of periodontal disease.^{4,5} Tobacco users also have a higher prevalence of periodontal attachment loss, gum recession and missing teeth than nonsmokers.⁵ Although Healthy People 2010 set a goal of reducing tobacco use to less than 12% by 2010, only modest improvements were made.⁶

The current tobacco control guideline suggests that multiple clinicians, including dentists, providing brief tobacco cessation interventions leads to higher rates of abstinence. The guideline recommended for providers is the 5A's (ask every patient every time, advise to quit, assess willingness to quit, assist in quit attempt, arrange follow-up), which can be completed in less than three minutes if integrated in a systems approach across all members of the health care team. This intervention uses systematic screening of every patient at every visit to capture tobacco use, which frequently changes between visits.⁷

Dental providers have a unique opportunity to incorporate the 5A's into their practice because of the effect that tobacco use has in the mouth and approximately 50% of smokers see a dentist each year.⁸ Obtaining an accurate measure of tobacco cessation activities in dental practices is challenging. For this reason we examined what predicts two of the 5 A's as markers of provider performance in basic tobacco control services- ASK and ADVISE. Dental provider self-reported rates of tobacco screening and advice vary widely.⁹⁻¹² Albert, et. al.⁹ reported 28% of the dentists in their study reported asking or recording tobacco use 41% of the time and about 50% of the dentists advised patients to quit at least 41% of the time. In a cross-sectional survey of 783 dentists, investigators assessed the dentists' knowledge, understanding, and adherence to the US Public Health Services guideline for tobacco-use cessation (including the 5As). About one-half of the respondents usually or always ask the patient about tobacco use and less than 40% usually or always ask the patients who smoke if they would be willing to quit.¹¹ In a more recent report, 90% of dental providers reported that they "ever ask if patient smokes" and 70% advised the smokers to quit.¹⁰ In a study of 1232 Florida dentists, 60% of the dentists reported asking regularly about tobacco use and 46% advised the smokers to quit.¹²

Alternately, patient reports of provider behaviors have been used in interventions similar to ours for outcome assessments. When compared to audio tapes, the gold standard for verification of doctor-patient encounters, surveys completed immediately after a patient visit have shown to be more accurate than provider reports or chart abstraction.¹³⁻¹⁷ The Health Plan Employer Data and Information Set (HEDIS), a set of standardized performance measures collected by the National Committee for Quality Assurance, set the national standard for provider tobacco cessation advice as patient-reported data.¹⁸

In order to improve tobacco control activities in dentistry, more research needs to be done to identify the factors associated with rates for screening and advising at every visit, the first two A's in the 5 A's intervention. Understanding variations in performance is an important step toward designing targeted interventions using all 5A's. Our objectives were to: 1)

assess dental practice adherence to the Tobacco Use and Dependence Guideline for tobacco screening and advising patients at every visit in dental practices using patient-reported measures; and 2) identify patient and practice characteristics that are associated with tobacco screening and advising during dental visits.

Methods

Study design

This study was a part of a randomized controlled trial directed at assessing the impact of a web-based tobacco control education intervention in dental practices.¹⁹ Baseline provider and patient data were used for the analyses. Dental practices for the randomized trial were recruited from Alabama, Florida, Georgia, and North Carolina using a simple random sample of dental licensure lists and mailing lists from a dental practice-based research network (the Dental PBRN). A letter explaining the study was sent to practices to assess their interest in and eligibility for the project. For blinding purposes, the study was framed as an oral cancer prevention project and data included preventive services, alcohol use, and fruit and vegetable intake. Eligible practices included general dental and periodontal practices that had access to the Internet and expressed an interest in participating. We enrolled 190 dental practices. Each dentist designated a contact person at the practice who assisted with data collection and interacted with the study coordinating center. Additional details about recruitment and sampling methodology have been provided in earlier publications from this study.¹⁹ The protocol was approved by the University of Alabama at Birmingham Institutional Review Board.

Dependent and independent variables

Data were collected from two sources: 1) from patients, using an exit card survey; and 2) from dental practice staff, using a practice survey. All data collection instruments are publicly available at <http://nationaldentalsbrn.org/peer-reviewed-publications.php>. The dependent variables were patient-reported dentist performance on asking and advising about tobacco use during the current visit. The independent variables reported by the patient included patient age, gender, and tobacco use. The independent variables reported by the practice were type of practice, number of dentists in the practice, number of hygienists/assistants in the practice, number of years dentist has been in the practice, patient volume, preventive services offered, estimated proportion of patient race (non-white), and patient insurance type (private vs. public assistance or free). Preventive services were defined as providing alcohol moderation and/or cessation counseling, diet counseling, and written patient education materials.

Data collection – patient level exit cards

Dental practices distributed patient exit card surveys to collect baseline measures of tobacco control service delivery. As previously reported¹⁹, the exit cards were developed using principles of ecological momentary assessment.^{20–23} EMA is frequently used in health behavior research to overcome traditional self-report assessment limitation.^{21,23,24} EMA limits recall bias by being completed close in time to the exposure (ex: the dental visit) and helps with participation rates and diffusion of the intervention by being brief and unobtrusive.

Potential questions for the exit card were selected by three investigators with expertise in tobacco control and survey design. The initial draft was reviewed by our full panel of investigators and an external consultant. We pilot tested the exit cards in our academic dental practice and revised to reflect the recommendations of patients and dental staff who participated in the pilot survey.

Practices were given written instructions to hand out exit cards to 100 consecutive adult patients at the end of the visit with a ball-point pen as a patient incentive. Surveys were deposited by patients into a sealed collection box. The data collection box was returned to our coordinating center after all surveys were completed. Practices received a \$50 gift card for distributing the cards. Response rate was assessed by counting the number of completed cards returned per practice, compared with the 100 distributed.

The patient exit cards collected patient age, gender, and tobacco use. Specific questions included, *Do you now smoke cigarettes, cigars, or use smokeless tobacco? During your dental visit today did anyone ask you if you smoke cigarettes, cigars, or use smokeless tobacco (ASK)?, and During your dental visit today did anyone advise you to quit tobacco (ADVISE)?*. To convey a broader purpose for the study as one having to do with oral cancer prevention (so as not to underscore the main intent of tobacco cessation), the exit card also contained questions about fruit and vegetable intake and alcohol consumption.

Data Collection – practice surveys

Practice surveys were completed by the dentist or contact person and included questions on type of practice, size of practice (number of dentists, hygienists, and dental assistants), number of years the dentist had practiced, patient volume per week, and a series of questions regarding delivery of the preventive services. The practice survey also reported patient characteristics, including the proportion of minority (non-white) patients seen and the type of payment (self-pay, public assistance, free care, or private insurance). Supplemental follow-up surveys also collected data on the ethnicity of the dentist, the smoking behaviors of the dentist and hygienists, and report of smoking cessation counseling knowledge. These supplemental follow-up survey data were only available for a subset of practices.

Analyses

For this analysis we used baseline, pre-randomization, cross-sectional data on provider performance of tobacco control. This cross-sectional study linked the baseline patient exit card data and baseline practice survey data. We first quantified differences in the proportion of patients reporting ASK and the proportion of tobacco users reporting ADVISE by practice and patient characteristics using chi square tests. We then used ASK and ADVISE as the dependent variable in a series of stepped models. Models were built to first assess patient characteristics and then to explore a series of practice characteristics. We first introduced patient age and gender (Model 1). We then added practice characteristics (patient volume, number of preventive services, proportion non-white, and proportion public assistance) into Model 2, and finally added the proportion of tobacco users in the practice for Model 3. For each model, we used a generalized linear mixed method to account for clustering of patients within practices. The models were implemented using the GLIMMIX procedure in SAS. Only characteristics that were significant in bivariate analyses were considered for the models. In addition to these primary models, we also conducted a sensitivity analysis. Acknowledging that the number of smokers per practice was low (less than 20) for some practices, the precision of the estimate for ADVISE was limited in these practices. Thus, we also conducted a sensitivity analysis, repeating our models for ADVISE including only practices with over 20 smokers.

Results

Of the 19,000 patient exit cards distributed to the 190 practices, 15,686 were completed and returned (response rate 83%). The mean number of cards returned per practice was 93 (SD 9). Of the patients returning cards, 61% were female, the mean age was 48 years, 29% reported being asked about tobacco use during their visit and 20% reported being tobacco

users. Of the tobacco users, 42% reported that they were advised to quit smoking by the dentist or dental staff during their visit. We found a wide range of reported tobacco control practices.

Of the 190 dental practices returning surveys, the majority were solo, general dentistry practices, had three to four hygienists/assistants, had been in practice for more than ten years, saw less than 100 patients per week, addressed two preventive services during a visit, and saw mostly white patients (Table 1). Practices reported a mean of 59% of their patients had private insurance, 32% were self-pay, and 10% were on public assistance (received free or care at a reduced cost).

Differences in ASK and ADVISE by practice characteristics

We assessed the association of practice characteristics with the patient self-report of dental provider performance of tobacco control activities. We did not find any significant differences in rates of ASK and ADVISE by practice type, number of staff in the practice, or years the dentist had been in the practice (Table 2). The patients of African-American and other minority dentists reported more frequently that they were asked and advised. Patient volume was positively associated with ASK, and the number of non-tobacco preventive services reported by the practices was associated with higher rates of ASK and ADVISE. The dental practice self-report of lack of knowledge about smoking cessation was associated with lower frequencies of patients reporting that they were asked and advised. Practices with a higher proportion of non-white, public assistance or free care, and tobacco using patients were each associated with higher proportions of patients reporting receiving ASK. The proportion of smokers among office staff was positively associated with higher rates of ASK and ADVISE. Of note, we looked at the correlation of the proportion of smoking patients in the practice, and the proportion of the dental staff that were smokers, and they were weakly associated (Cronbach's $\alpha = 0.19$, $p = 0.01$).

Differences in ASK and ADVISE by patient characteristics

Among the 15,686 patients returning exit cards, we found significantly higher screening rates (ASK) for the younger patients (19–29 year olds = 37.2%) compared with older (over 60 = 23.6%) and there was a significant trend by age group (37%, 32%, 27%, and 24% respectively for those less than 30, 30–44 years, 45–60 years, and over 60 years old). A similar trend by age group was seen for ADVISE (50%, 45%, 39%, and 35%) among the 3,155 tobacco users in the sample. Women were less likely to be asked about smoking (26%) than men (33%). There was also a 10% difference in the proportion of tobacco users advised to quit comparing women (37%) to men (47%). Using chi-square tests and chi-square test for trend as appropriate, all these associations were significant at $p < 0.001$.

Multivariable analyses

In multivariable models adjusting for clustering of patients within practices using the GLIMMIX procedure in SAS, younger age and male gender were again positively and significantly associated with ASK and ADVISE (Table 3, Model 1). Number of non-tobacco preventive services reported was also consistently positively associated with ASK and ADVISE.

After adjusting for patient age and gender (Table 3, ASK, Model 2), a higher proportion of non-whites in the practice was positively associated with being asked about smoking (odds ratio [OR] 1.49; 95% confidence interval [CI] 1.07 – 2.07), as was preventive services (OR 1.31; 95% CI 1.08–1.58) and public assistance (OR 1.61; 95% CI 1.13 – 2.29). For public assistance and preventive services, similar results were seen for ADVISE. However, once controlling for the number of tobacco users in the practice in Model 3 for ASK and

ADVISE, the proportion of non-white and public assistance were no longer significant predictors of ASK or ADVISE. Our sensitivity analysis including only practices with over 20 smokers per practice revealed similar results in terms of direction and magnitude of point estimates, although power was less due to the smaller number of practices (data not shown).

Discussion

Based on patient reports completed immediately after the dental visit from over 15,000 dental patients in 190 dental practices, we found that rates of being asked about tobacco use during the visit were low, with less than one-third of dental patients reporting being asked. Although these rates for ASK are low, our assessment was based on the Guidelines of ask every patient on every visit. We also found that less than half of tobacco users from these dental practices reported being advised to quit. The current tobacco cessation guideline recommends systematic screening of every patient at every visit because tobacco use is dynamic and thus can change between visits.⁷ Considering these two measures- ASK and ADVISE as markers of dental practice performance in basic tobacco control services- considerable improvement is needed.

To guide future improvement efforts, we sought to identify factors associated with lower performance of tobacco control. Tobacco control service delivery seems to fit within the overall culture of preventive service delivery, as variations in non-tobacco preventive service delivery predicted variations in tobacco control services. The type of practice, number of staff, and years in practice of the dentist did not predict tobacco control services. Although we found that the ethnicity of the dentist (minority) did positively predict Ask and Advise, we did not find anything in the literature to support this. Not surprisingly, dentists reporting a lack of knowledge about smoking cessation counseling negatively predicted tobacco control services. We were surprised that rates of screening for tobacco use were lower than rates of smoking cessation advice. Because this was a cross-sectional assessment of the current visit, it is also possible that the patient had been asked about tobacco use at a previous visit or when completing a new patient form, though the health record may not be the most reliable estimate.¹⁵⁻¹⁷ Also, low rates of ASK among dental providers may be a function of the oral examination itself, whereby dental professionals can readily ascertain smoking status without the need to ask. Visible signs due to tobacco use observed during the oral exam may provide an opportunity to identify tobacco users accurately that is not used in medical practices. Future research should assess the sensitivity and specificity of a dentists' oral exam for diagnosing tobacco use.

Not unexpectedly, we found that practices that see more tobacco users provide more tobacco control services. Practices that see tobacco users more frequently may have developed a culture that is more conducive to regular tobacco screening and advice. Thus, practices with fewer tobacco using patients may need targeted encouragement to improve. It was interesting that we found higher rates of smoking behavior among the dentist and hygienists predicted higher rates of smoking cessation counseling to the patients. Although we did not find any US studies related to this topic, several international studies have reported that-physician smokers counsel patients less.^{25,26,27} This finding warrants additional examination. Our finding may be the result of the dental practice staff and patients being from the same community (as the percent smoking patients in the practice was associated with the proportion of staff that was smokers).

Rates of tobacco control services delivery in dental practices are less characterized than in physician practices, but our results are consistent with prior epidemiologic surveys that have used patient report. Across all practices and after multivariable adjustment, we found consistent and concerning associations suggesting that women and older patients are

receiving lower rates of tobacco control services. The reasons for these differences are unclear. In addition to the disparities in tobacco control by gender and age, we found interesting preliminary evidence that practices with higher numbers of minority patients and those receiving public assistance were more likely to receive tobacco control services, suggesting a reverse-disparity favoring lower-income minorities. However, this association was not significant after adjustment for the proportion of tobacco users in the practice. Thus, practices with higher numbers of lower-income minorities were also likely to have higher numbers of tobacco users. Again, our findings further suggest that certain practices have developed a separate culture to manage their higher volume of tobacco users.

Our study has several limitations. Our practices were from a limited number of states and may not be generalizable. While limited in number of dental practices, our sample of 190 is larger than most prior samples. Although we did not have a validity check for our patient report of provider performance, prior research supports a strong correlation of patient self-report of tobacco control activities and gold standard audio taping. Most importantly, our analysis was limited only to the variables collected in the context of our randomized trial. Other important factors (e.g. organizational complexity and culture, provider self-efficacy for tobacco control) may play important roles in the delivery of tobacco control services but were beyond the scope of this project.

There are wide variations in delivery of tobacco control services in dental practices.^{9–12} Practice variables such as size, type, years at the practice, patient volume, and number of staff were not predictors of tobacco control, while percent of tobacco users, preventive services, and dentist ethnicity were significant practice-level predictors. Much of the variation in tobacco control services was predicted by certain patient characteristics (e.g., age and sex). Further quantitative and qualitative research is needed to define reasons for variation and create processes for improvement of tobacco control in dental practices.

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Table 1

Characteristics of dental practices (N=190) participating in the Dental Tobacco Control study

	Overall	
Characteristics of Practices	n/N	%
Practice Type		
General	176/190	92.6
Periodontists	14/190	7.4
Number of Dentists in practice		
1	146/187	78.1
>1	41/187	21.9
Number of Hygienists/Assistant		
0	6/190	3.2
1–2	50/190	26.3
3–4	85/190	44.7
>4	49/190	25.8
Years in this practice (Dentist)		
<5	30/176	17.1
5–10	31/176	17.6
>10	115/176	65.3
Dentist Race		
White	109/125	87.2
African-American	6/125	4.8
Other	10/125	8
Percent Tobacco Users Among Dental Providers (Dentists, Hygienists, Assistants)		
0%	46/92	50
1%–20%	35/92	38
Over 20%	11/92	12
Dentist reported lack of knowledge regarding smoking cessation counseling		
Yes	34/132	26
No	98/132	74
Patient Volume		
≤100 patients/week	141/190	74.2
>100 patients/week	49/190	25.8
Number of Preventive Services Provided*		
0–1	49/185	26.5
2	77/185	41.6

	Overall	
Characteristics of Practices	n/N	%
3	59/185	31.9
Non-white		
Quartiles 1–3 (0–49%)	139/186	74.7
Highest Quartile (50–99.5%)	47/186	25.3
Public or Free		
Quartiles 1–3 (0–10%)	135/173	78.0
Highest Quartile (11–100%)	38/173	22.0

Provider estimate of proportion

* Preventive services include alcohol moderation/cessation counseling, diet counseling, and patient education using written materials.

Table 2

Proportion of patients reporting being Asked about smoking and being Advised to quit smoking, compared across practice characteristics (n=190 practices).

PRACTICE CHARACTERISTICS	Patients ASKED (n=15,686 exit cards returned)		Tobacco Users ADVISED (n=3,155 tobacco users)	
	n/N	%	n/N	%
Practice Type				
General	4,239/14,399	29.4	1,231/2,837	43.4
Periodontists	340/1,240	27.4	93/260	35.8
Number of Dentists				
1	3,447/11,970	28.8	1,008/2,351	42.9
>1	1,003/3,425	29.3	269/664	40.5
Number of Hygienists/Assistant				
0	206/499	41.3	79/143	55.2
1-2	1,221/4,033	30.3	362/847	42.7
3-4	1,951/6,956	28.1	552/1,330	41.5
>4	1,201/4,151	28.9	330/777	42.5
Years in this practice (Dentist)				
<5	747/2,553	29.3	197/538	36.6
5-10	831/2,614	31.8	207/430	48.1
>10	2,573/9,366	27.5	812/1,886	43.1
Dentist Race				
White	2490/9170	27.2	745/1753	42.5
African-American	195/532	36.7	48/99	48.5
Other	397/787	50.4	134/234	57.3
Percent Tobacco Users Among Dental Providers				

PRACTICE CHARACTERISTICS	Patients ASKED (n=15,686 exit cards returned)			Tobacco Users ADVISED (n=3,155 tobacco users)		
	n/N	%	P	n/N	%	P
0%	1122/3885	28.9	0.001	297/705	42.1	0.001
1%–20%	711/2962	24.0		216/610	35.4	
Over 20%	419/909	46.1		146/250	58.4	
Dentist reported lack of knowledge regarding smoking cessation counseling						
Yes	665/2,873	23.2		197/538	36.6	0.001
No	2,653/8199	32.4	0.001	788/1661	47.4	
Patient Volume						
≤100 patients/week	3,522/11,369	31.0	0.03	1,035/2,335	44.3	0.2
>100 patients/week	1,057/4,270	24.8		288/762	37.8	
Number of Preventive Services*						
0–1	1,043/4,090	25.5	0.01	350/904	38.7	0.004
2	1,752/6,439	27.2		484/1,198	40.4	
3	1,684/4,781	35.2		451/919	49.1	
Non-White (%)						
Q1–3 (0–49%)	3,100/11,581	26.8	0.001	881/2,185	40.3	0.12
Q4 (50–99.5%)	1,439/3,743	38.5		430/863	49.8	
Public+Free (%)						
Q1–3 (0–10%)	2,966/11,060	26.8	0.001	844/2,160	39.1	0.01
Q4 (11–100%)	1,237/3,151	39.3		360/695	51.8	
Proportion Tobacco Users (%) in the Practice						
Lowest Quartile	785/3,976	19.7		290/769	37.7	
Second Quartile	946/3,935	24.0	0.001	332/792	41.9	0.001

PRACTICE CHARACTERISTICS	Patients ASKED (n=15,686 exit cards returned)		Tobacco Users ADVISED (n=3,155 tobacco users)	
	n/N	%	n/N	%
Third Quartile	1,488/4,010	37.1	321/764	42.0
Highest Quartile	1,360/3,718	36.6	380/772	49.2

* Preventive services include alcohol moderation/cessation counseling, diet counseling, and patient education using written materials. Denominators vary depending on the number of patients responding to question

Table 3
Predictors of Asking and Advising, adjusted OR (95%) from multivariable models

	Model 1		Model 2		Model 3	
	Odds Ratio	95%CI	Odds Ratio	95%CI	Odds Ratio	95%CI
ASK (N = 15,686 dental patients)						
Age	0.83	0.08–0.86	0.83	0.79–0.87	0.83	0.80–0.87
Female	0.67	0.62–0.72	0.67	0.62–0.73	0.67	0.62–0.73
Patient Volume			0.81	0.58–1.11	0.89	0.66–1.20
Preventive Services *			1.31	1.08–1.58	1.39	1.17–1.66
Non-white			1.49	1.07–2.07	1.30	0.95–1.76
Public Assistance			1.61	1.13–2.29	1.37	0.99–1.91
Percent Tobacco Users					1.04	1.03–1.05
ADVISE (N = 3,155 tobacco users)						
Age	0.83	0.76–0.91	0.83	0.76–0.91	0.83	0.76–0.91
Female	0.70	0.59–0.82	0.66	0.56–0.78	0.66	0.56–0.78
Volume of Patients Seen			0.88	0.64–1.21	0.93	0.68–1.27
Preventive Services *			1.27	1.05–1.52	1.31	1.09–1.57
Non-White			1.17	0.85–1.61	1.09	0.79–1.50
Public Assistance			1.44	1.02–2.05	1.35	0.95–1.91
Percent Tobacco Users					1.02	1.01–1.03

* Preventive services include alcohol moderation/cessation counseling, diet counseling, and patient education using written materials.
Odds ratios with $p < 0.05$ are in bold