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Association of Strong Smoke-Free Laws With Dentists' Advice to Quit Smoking, 2006–2007

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Abstract

Objectives—We examined the association of smoke-free laws with dentists' advice to quit smoking and referral to a quit line, among smokers who reported visiting the dentist in the past 12 months.

Methods—We used the 2006 to 2007 Tobacco Use Supplement of the Current Population Survey merged with the American Nonsmokers' Rights Foundation Local Ordinance Database of smoke-free laws. The dependent variables were advice from a dentist to quit smoking and referral to a quit line, and the independent variable of interest was 100% smoke-free law coverage. We controlled for respondent demographics and an index of state-level smoking ban attitudes (included to ensure that the effect detected was not the result of social attitudes).

Results—Smoke-free law coverage was associated with dental advice to quit smoking (odds ratio [OR] = 1.27; 95% confidence interval [CI] = 1.01, 1.59; $P = .041$), but not with referral to a quit line (OR = 1.33; 95% CI = 0.79, 2.25; $P = .283$).

Conclusions—Interventions with dentists are needed to increase referrals to quit lines and other smoking cessation efforts.

Smoking causes oral disease and dental therapy failures.^{1–8} Tobacco cessation interventions delivered by dentists during oral examination are associated with cessation.^{9–12} Although dentists can effectively promote cessation, particularly when they receive training to do so,^{13–17} such practices are not widespread.^{18–22} The US Public Health Service clinical practice guidelines promote the 5A's—ask about tobacco use, advise to quit, assess willingness to make a quit attempt, assist in the quit attempt, and arrange follow-up—as a standard tobacco use intervention.¹ Implementing just part of the 5A's, such as advising patients to quit, can affect patient behavior.^{16,17,23,24}

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Contributors

M. Gonzalez and A. Sanders-Jackson designed the initial analyses, interpreted the final analysis, and wrote the first draft of the article. M. Gonzalez coded the data and ran the analyses. All authors approved the initial analyses, helped design subsequent analyses, approved the interpretation, and revised the article.

Human Participant Protection

No protocol approval was required because the study used data from a public use data set without personal identifiers.

Several studies found that although oral health care providers are willing to implement the first 2 steps of the 5A's (ask, advise) they are reluctant to implement the last 3 (assess, assist, and arrange).^{10,16,18,23,25} A survey of dentists in California, Pennsylvania, and West Virginia found that most dentists reported asking patients about tobacco use and advising them to quit, but fewer than half the dentists who asked about smoking provided follow-up or assistance with quitting.²⁵ These low rates are similar to those of health care providers in other areas.¹⁸ As a result, some organizations advocate the 2A's+R (ask, advise, refer to a quit line) model of intervention.²⁶ A study that compared the effectiveness of the 5A's and 2A's+R models in dental settings found that a greater proportion of patients receiving the 5A's intervention quit but that the 2 groups showed no significant difference in abstinence at the 12-month follow-up.²⁶

Strong smoke-free laws are associated with changes in norms, attitudes, and behaviors surrounding tobacco use. These smoke-free laws may also encourage dental care providers to perceive smoking as denormalized or increase the salience of tobacco use for these providers, so that they are more likely to recommend a smoking cessation intervention. In the United States, implementation of 100% smoke-free laws is associated with a reduction in smoking prevalence and consumption,²⁷ decreased cardiovascular and pulmonary hospital admissions,²⁸ voluntary smoke-free home rules,²⁹ and reduced maternal smoking.^{30,31} We hypothesized that the implementation of 100% smoke-free laws would affect not only individual health-related behavior, but also health care provider behavior, particularly in an area, such as oral health, where cessation training is not yet routinely implemented. We examined the effect of 100% smoke-free laws on dentist implementation of the 2A's+R model of intervention, particularly dental advice to quit and referral to a quit line, or cessation help line.

METHODS

We linked individual-level data from the national 2006 to 2007 Tobacco Use Supplement to the Current Population Survey (TUS CPS) to the American Nonsmokers' Rights Foundation Local Ordinance Database of smoke-free laws to examine whether coverage by 100% smoke-free laws (100% smoke-free private workplace, restaurant, and bar laws) was associated with smokers' reports that a dentist advised them to quit and referred them to a smoking quit line.

Dependent Variables

The TUS CPS is a nationally representative sample of US households. We conducted 2 nested analyses. Our first analysis consisted of self-respondents aged 18 years or older, whose county of residence was specified, who identified themselves as smokers in the survey, and who had visited a dentist in the past 12 months (Figure 1, Table 1). (We did not include surrogate responses for others in the house-holds.) The survey asked smokers who had visited a dentist in the past 12 months whether their dentist had advised them to stop smoking. The dependent variable in the first analysis was a respondent's report of receiving a dentist's advice to stop smoking (1 = yes; 0 = no).

Our second analysis used a subset of the respondents in the first analysis: the respondents who reported they had been advised by their dentist to quit smoking. The survey asked smokers who reported that their dentist had advised them to quit smoking a follow-up question to determine whether their dentist had referred them to a quit line. The dependent variable in the second analysis was a respondent's report of referral by a dentist to a quit line (1 = yes; 0 = no).

We used respondents' county of residence to determine coverage by 100% smoke-free laws. The TUS CPS does not provide county identifiers for respondents living in small counties (defined by several criteria, including roughly < 100 000 population) to protect respondent identities, so our sample did not include respondents living in small counties. Our analyses incorporated the 37% of TUS CPS self-respondents living in larger counties (77% of the US population lived in counties with populations of $\geq 100\,000$ as of July 2006).³²

Independent Variables

We used county in which the respondent lived to determine coverage by smoking restrictions in 2006 and 2007. As described elsewhere,³³ we conducted 4 calculations to obtain the percentages of population covered by 100% smoke-free laws in public workplaces, private workplaces, restaurants, and bars in each US county. We took into account any state or county 100% smoke-free law covering the county and any subcounty entities that had passed 100% smoke-free laws; 63% of respondents in our samples lived in a county that had more than 1 such law somewhere in the county. Incorporating all 4 variables measuring proportions of county populations covered by 100% smoke-free laws for different venues into our analysis created collinearity problems.

To avoid collinearity, we constructed a 100% smoke-free coverage scale that accounted for both the variation in the regulated venues (whether or not each of the 4 venues was covered by a law) and the percentage of the county population covered by each of the 4 venue laws. We used factor analysis with a Varimax rotation on the 4 variables representing the percentages of population covered by a 100% smoke-free for public workplaces, private workplaces, restaurants, and bars in each US county to ensure that the 4 variables could be placed into a single scale. We ran 2 separate factor analyses, one for the percentage of the population covered by the 4 laws existing in 2006 and the other for 2007. Only 1 eigenvalue for each year was greater than 1 (2.06 in 2006; 2.08 in 2007), suggesting a single dominant factor.

We created a 100% smoke-free coverage scale by averaging the 4 variables representing the percentage of the population covered by the 4 smoke-free laws to obtain a score for overall 100% smoke-free coverage at the county level. The 100% smoke-free coverage score was continuous and ranged from zero (no 100% smoke-free coverage for anyone living in the county in any of the 4 venues) to 1.00 (full 100% coverage in all 4 venues for everyone living in the county). Larger values represented both more coverage across all 4 regulated venues and a larger percentage of the county population covered by 100% smoke-free laws in the 4 regulated venues.

We controlled for individual-level demographic characteristics (family income, employment status, race/ethnicity, nativity, education level, gender, and age). We also controlled for state-level public attitudes about smoking bans to ensure that patient reports of dentists' behavior reflected the presence of a smoke-free law and not just general smoke-free sentiment in the area. This variable also allowed us to control for the possibility that provider behavior reflected generally negative attitudes toward smoking behavior. For each state, we computed a score for state-level support for smoke-free venue restrictions, derived from 6 questions from the TUS CPS on level of agreement with whether smoking should be allowed in restaurants, indoor work areas, bars and cocktail lounges, indoor sporting events, indoor concerts, and outdoor children's playgrounds and sports fields. Response options were smoking should be allowed in all areas (score = -1), in some areas (0), or not at all (+1). We used factor analysis with a Varimax rotation to test whether the 6 variables could be placed into a single scale.³⁴ We then averaged each respondent's responses to the 6 questions, yielding a measure that ranged from -1 to 1, with -1 indicating that the respondent did not prefer any smoking restriction in any of the 6 venues and 1 indicating a preference for smoking restrictions in all 6 venues. We then averaged the individual smoke-free sentiment scores for all respondents in a given state to get a state-level measure of attitudes toward smoke-free venue restrictions.

Statistical Analysis

We used binary logistic regression with the TUS CPS self-response weights to estimate the extent to which the 100% smoke-free law coverage score predicted increased odds of smokers who visited a dentist reporting that their dentist had advised them to stop smoking and, if so, referred them to a quit line.

We checked for multicollinearity among the independent variables; the variance inflation factors were all below 3, indicating that multicollinearity was not an issue. We performed all calculations with Stata/MP 12 for Windows (StataCorp LP, College Station, TX).

RESULTS

Among self-respondents in larger counties, 16% were current smokers (smoked 100 cigarettes in their lifetime and currently smoked every day or some days). Of these smokers, 48% reported visiting a dentist in the past 12 months, and 35% of these had been advised by their dentist to stop smoking (Figure 1, Table 1). Of the individuals advised to stop smoking, 16% were referred to a quit line. Dental patients in our samples were predominantly employed, earned between \$25 000 and \$74 999 per year, had a high school diploma or attended some college, and were White (Table 2). Smoke-free laws were positively associated with dentists' advice to quit (OR = 1.27; 95% CI = 1.01, 1.59; $P = .041$; Table 3), but not with referral to a quit line (OR = 1.33; 95% CI = 0.79, 2.25; $P = .283$).

Smokers who had been to the dentist in the past 12 months were more likely than other respondents to report that their dentist advised them to quit if they were employed (OR = 1.20; 95% CI = 1.01, 1.43; $P = .037$; Table 3) or if their race/ethnicity was non-Hispanic other (OR = 1.50; 95% CI = 1.11, 2.01; $P = .008$). The odds that smokers reported that they had been advised by a dentist to quit smoking decreased slightly for each increasing year of

age (OR = 0.99; 95% CI = 0.98, 0.99; $P = .001$). Smokers who were female (OR = 0.79; 95% CI = 0.69, 0.91; $P = .001$) were less likely than other respondents to report that they had been advised by a dentist to quit smoking. Patient reports of dentists' behaviors indicated that smokers were less likely to report that their dentists advised them to quit if they lived in states with higher support for smoke-free venue restrictions as measured by the state-level attitude index (OR = 0.22; 95% CI = 0.07, 0.73; $P = .013$). No variable was a significant predictor of being referred to a quit line among respondents who identified themselves as smokers (Table 3).

DISCUSSION

The social norm change model of tobacco control focuses on actions that shift environmental norms and attitudes as a means of reducing tobacco use prevalence and consumption through population-level interventions such as smoke-free laws, increased tobacco tax, and naming the tobacco company as a vector of the disease.³⁵ This approach has significantly reduced youth and adult tobacco use prevalence and consumption,^{27,35} as well as maternal smoking,³¹ thus decreasing tobacco-related morbidity and mortality.²⁸ In addition, a growing literature documents the ways these environmental shifts are affecting more than individual-level tobacco use behaviors. Smoke-free laws are associated with increased preferences for smoke-free venues^{36,37} and implementation of voluntary home smoke-free rules.²⁹ Although the primary literature on smoking denormalization focuses on individual-level change,³⁵ we hypothesized that norm changes in the environment would also engender institutional changes in the health care system, which would then affect provider behavior.

Our model does not assess the intervening steps between institutional- and provider-level change; however, we theorized that shifts in the environment regarding tobacco norms would affect provider behavior through both institutional pathways and direct effects. We also theorized that we would see this association in provider settings, such as dental offices, where intervention behavior has not been routinized and few interventions focused on changing provider behavior have been conducted. A study of reported health care provider interventions in France documented a decrease in the percentage of smokers reporting that they had been the target of a tobacco cessation intervention from their health care providers after the implementation of smoke-free laws in France.³⁸ However, that study encompassed all health care providers, which may explain our differing results. Furthermore, the French study's confidence intervals substantially overlapped between waves.³⁸ Our study documented an association between 100% smoke-free laws and dental care provider implementation of parts of the 2A's+R cessation interventions (advise, but not refer), which points to an association between environmental-level changes and provider behavior.

We used a relatively simple, policy-based model to describe the effect of 100% smoke-free laws on dentists' behaviors. A post hoc analysis of the demographic differences that predicted the likelihood of being offered cessation services suggested that older and female smokers were less likely to be offered cessation services. Although our findings were limited to larger counties, it is clear that not all vulnerable populations are receiving cessation interventions from their providers.

Dentists are well positioned to provide brief tobacco cessation interventions to their patients.³⁹ Length of time in practice, age of the dentist, receiving previous training in tobacco cessation implementation, and completing previous steps of the 5A's process are correlated with implementing any of the 5A's.^{20,25,40} Provider surveys have found that at least 70% of dentists reported asking about smoking and advising patients who smoke to quit (the first 2 of the 5A's).^{18,25} By contrast, in our responses from dental patients, only about a third of smokers reported being advised to quit (the second of the 2A's). Provider surveys found that fewer than 10% of dentists reported arranging a follow-up for smokers (the last of the 5A's, which includes referral),^{18,25} which is generally consistent with our finding that only 16% of smoking patients who were asked about their smoking reported being referred to a quit line. Our patients' responses suggest that dentists' self-assessments overestimate how frequently they complete various steps of the 5A's and 2A's+R tobacco cessation interventions.

Barriers to care reported by dentists and oral surgeons included lack of time to implement cessation practices during a dental visit, lack of training, provider perception that patients do not desire such interventions, provider fear of upsetting patients, lack of patient motivation, and lack of insurance reimbursement for the procedures.⁴⁰⁻⁴⁴ We found that respondents living in states with high levels of positive attitudes toward smoke-free venue restrictions were less likely to report that their dentists advised them to quit. This finding may indicate that dentists practicing in areas where there are strong antismoking norms believe that discussing smoking behavior with their patients may stigmatize those patients and create noncompliance in other ways. This would fit with previous literature showing that several of the barriers to care cited by dentists are patient hostility, beliefs that their patients do not desire smoke-free services in dentist's offices, and fear of upsetting the patient.⁴¹⁻⁴³ However, dentists' concerns that patients are not interested in cessation may be unwarranted: surveys of patients show that they desire cessation interventions from their dental care providers.^{41,42}

The inverse relationship between enacted smoke-free laws and state-level attitudes may be caused by different processes underlying the effect of smoke-free attitudes and smoke-free policies in this context. It is possible that the community attitudinal effects on provider behavior are negative, whereas the policy-level effects are positively related. This may reflect differential effects of conceptually distinct normative issues. Some evidence suggests that injunctive and descriptive norms (norms about what should be done, as opposed to actual behavior), for example, may be different.^{45,46} In the case of our study, the injunctive norms about smoking behavior would be the state-level sentiment score, and the descriptive norm would be measured by the 100% smoke-free law index. As a result, we would expect different effects from communities' beliefs about smoke-free environments and putting into place rules enforcing actual behavior.

Limitations

We analyzed self-reported retrospective data, which depended on respondent recall. The survey did not assess whether dental patients had been referred to another provider or cessation program, rather than a quit line. Because the TUS CPS is designed to determine

tobacco-related behavior of respondents, no data on provider characteristics are collected. We could not determine whether laws in one venue or another were more important predictors of dentists' behavior because these laws were collinear (prompting us to develop the 100% smoke-free coverage measure) and therefore could not be included in the model simultaneously.

The TUS CPS restricts county-level geographic information such that locations for respondents from small counties are not available in the public use data set. An analysis of smokers with and without county codes attached to their records (conducted with χ^2 and Wilcoxon rank sum tests) showed that respondents in large counties were significantly different from respondents in small counties for all demographic categories except age. Comparison of respondents with and without county codes who reported being advised to stop smoking by their dentist and being referred by their dentist to a quit line showed that these subsamples were significantly different from each other in income, age, nativity, and race/ethnicity. As a result, our findings may not be generalizable to small or rural counties.

Conclusions

The social norm change manifested by smoke-free laws appeared to be associated with an atmosphere in which dentists paid more attention to their patients' smoking. However, this social norm change was not associated with increased referrals to a quit line. Public health practitioners and tobacco control advocates are increasingly focusing on providing dentists with the tools to routinely implement tobacco cessation interventions as part of their practice. Our findings suggest a possible benefit of 100% smoke-free laws in workplaces, restaurants, and bars and may provide additional justification for enacting these laws in indoor venues or for strengthening current smoke-free indoor air laws. Furthermore, interventions should be offered to dentists to encourage them to refer their smoking patients to quit lines and to implement other smoking cessation interventions.

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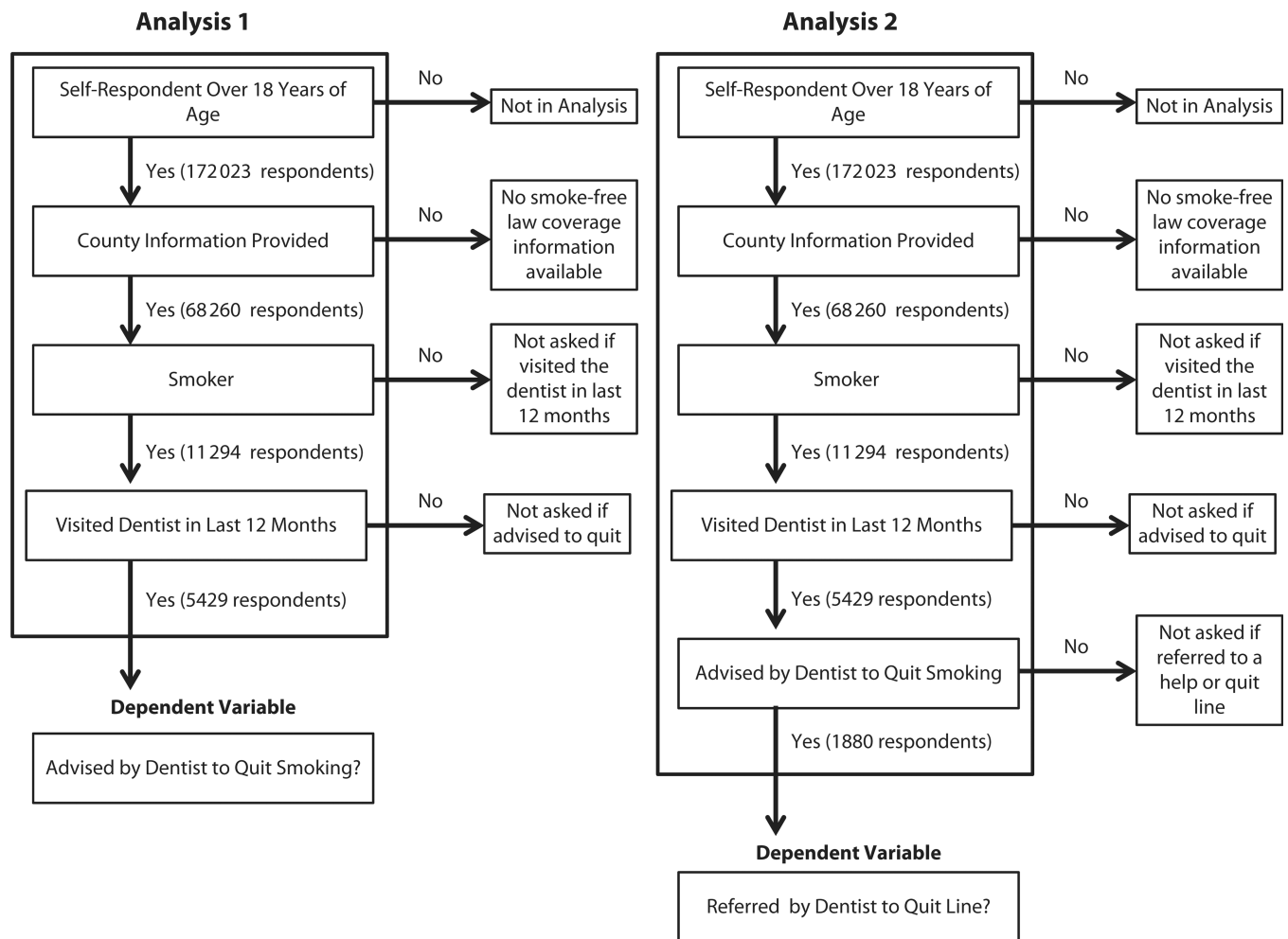


FIGURE 1. Selection process for the 2 samples examined in analysis of association of strong smoke-free laws with dentists' advice to quit: Tobacco Use Supplement to the Current Population Survey, United States, 2006–2007.

TABLE 1

Current Smokers' Responses Regarding Dentists' Advice to Quit Smoking: Tobacco Use Supplement to the Current Population Survey, United States, 2006–2007

Survey Question	Yes, No. (%)	No, No. (%)	Refused/Don't Know/Other, No. (%)
In the past year, have you seen a dentist?	5429 (48)	5475 (48)	390 (3)
During the past year, did any dentist advise you to stop smoking [asked if responded yes to previous question]?	1880 (35)	3518 (65)	31 (1)
In the past year, did a dentist who advised you to stop smoking also suggest that you call or use a telephone quit or help line [asked if responded yes to previous question]?	299 (16)	1567 (83)	14 (1)

Note. Because of rounding, percentages do not add to 100.

TABLE 2

Demographic Characteristics of Current Smokers in Analyses of Association Between Dentists' Advice to Quit Smoking and Smoke-Free Laws: Tobacco Use Supplement to the Current Population Survey, United States, 2006–2007

Characteristic	Current Smokers Who Saw a Dentist in Past Year, No. (%) or Mean (SD)	Current Smokers Who Saw a Dentist and Were Advised to Quit, No. (%) or Mean (SD)
Total	5429	1880
Employed	3913 (72)	1400 (74)
Married	2568 (47)	854 (45)
Female	2973 (55)	956 (51)
Income, \$		
< 10 000	333 (6)	126 (7)
10 000–24 999	752 (14)	245 (13)
25 000–49 999	1479 (27)	535 (28)
50 000–74 999	1682 (31)	597 (32)
≥ 75 000	725 (13)	228 (12)
Age, y	43.79 ±13.989	42.08 ±13.243
Education		
< high school	574 (11)	219 (12)
High school diploma/GED	1905 (35)	678 (36)
Some college	1854 (34)	639 (34)
≥ college degree	1096 (20)	344 (18)
US native	4897 (90)	1686 (90)
Race/ethnicity		
Hispanic	427 (8)	156 (8)
Non-Hispanic White	4150 (76)	1399 (74)
Non-Hispanic Black	480 (9)	167 (9)
Non-Hispanic Other	372 (7)	158 (8)
State-level support for smoke-free venue restrictions scale ^a	0.66 ±0.075	0.66 ±0.075
100% Smoke-free law coverage ^b	0.47 ±0.395	0.47 ±0.394

Note. GED = general equivalency diploma.

^aFor each state, we computed a score for state-level support for smoke-free venue restrictions, derived from 6 survey questions on level of agreement with whether smoking should be allowed in various venues that were asked of each respondent. We averaged each respondent's responses to the 6 questions (−1 = smoking should be allowed in all areas, 0 = smoking should be allowed in some areas, 1 = smoking should not be allowed at all). We then averaged the individual smoke-free sentiment scores for all respondents in a given state to get a state-level measure of attitudes toward smoke-free venues (state scores range = 0.46–0.78).

^bAscertained by averaging the percentage of the population covered by the 4 100% smoke-free law variables to obtain a score for overall 100% smoke-free coverage at the county level. The 100% smoke-free coverage score was continuous and ranged from zero (no 100% smoke-free coverage for anyone living in the county in any of the 4 venues) to 1 (full 100% coverage in all 4 venues for everyone living in the county).

TABLE 3

Effect of 100% Smoke-Free Laws on Dentists' Behavior: Tobacco Use Supplement to the Current Population Survey, United States, 2006–2007

Variable	Patients Advised by Dentist to Quit Smoking (n = 4949), OR (95% CI)	P	Patients Referred to Cessation Quit Line by Dentist (n = 1718), OR (95% CI)	P
100% Smoke-free law coverage ^a	1.27 (1.01, 1.59)	.041	1.33 (0.79, 2.25)	.283
Employed	1.20 (1.01, 1.43)	.037	0.96 (0.64, 1.46)	.867
Married	0.96 (0.83, 1.11)	.604	1.04 (0.73, 1.48)	.833
Female	0.79 (0.69, 0.91)	.001	1.00 (0.73, 1.39)	.993
Income, \$				
< 10 000	1.27 (0.89, 1.82)	.193	1.30 (0.58, 2.91)	.518
10 000–24 999	0.99 (0.75, 1.31)	.951	1.53 (0.81, 2.89)	.19
25 000–49 999	1.10 (0.87, 1.39)	.414	1.61 (0.96, 2.72)	.073
50 000–74 999	1.09 (0.88, 1.36)	.437	1.17 (0.69, 2.00)	.552
≥ 75 000 (Ref)	1.00		1.00	
Age, y	0.99 (0.98, 0.99)	.001	1.00 (0.98, 1.01)	.597
Education				
< high school	1.49 (1.14, 1.96)	.004	0.90 (0.5, 1.78)	.844
High school diploma/GED	1.14 (0.93, 1.39)	.218	1.40 (0.87, 2.26)	.165
Some college	1.19 (0.97, 1.45)	.094	1.16 (0.72, 1.86)	.545
≥ college degree (Ref)	1.00		1.00	
US native	1.06 (0.82, 1.37)	.669	0.69 (0.41, 1.15)	.158
Race/ethnicity				
Hispanic	1.09 (0.83, 1.41)	.542	1.08 (0.62, 1.86)	.789
Non-Hispanic White (Ref)	1.00		1.00	
Non-Hispanic Black	0.97 (0.74, 1.28)	.834	1.65 (0.94, 2.91)	.083
Non-Hispanic Other	1.50 (1.11, 2.01)	.008	1.15 (0.62, 2.14)	.665
State-level support for smoke-free venue restrictions scale ^b	0.22 (0.07, 0.73)	.013	4.00 (0.2, 81.52)	.367
Constant	1.54 (0.64, 3.73)	.337	0.06 (0.01, 0.59)	.016

Note. CI = confidence interval; GED = general equivalency diploma; OR = odds ratio.

^a For each state, we computed a score for state-level support for smoke-free venue restrictions, derived from 6 survey questions on level of agreement with whether smoking should be allowed in various venues that were asked of each respondent. We averaged each respondent's responses to the 6 questions (−1 = smoking should be allowed in all areas, 0 = smoking should be allowed in some areas, 1 = smoking should not be allowed at all). We then averaged the individual smoke-free sentiment scores for all respondents in a given state to get a state-level measure of attitudes toward smoke-free venues (state scores range = 0.46–0.78).

^b Ascertained by averaging the percentage of the population covered by the 4 100% smoke-free law variables to obtain a score for overall 100% smoke-free coverage at the county level. The 100% smoke-free coverage score was continuous and ranged from zero (no 100% smoke-free coverage for anyone living in the county in any of the 4 venues) to 1 (full 100% coverage in all 4 venues for everyone living in the county).