Original investigation

State Tobacco Policies as Predictors of Evidence-Based Cessation Method Usage: Results From a Large, Nationally Representative Dataset

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Abstract

Introduction: Evidence-based cessation methods including nicotine replacement therapy (NRT), non-NRT medications, quitlines, and behavioral treatments are underutilized by smokers attempting to quit. Although a number of studies have demonstrated a relationship between state-level tobacco policies (eg, taxation, appropriations) and cessation, whether such state-level factors influence likelihood of using an evidence-based treatment is unclear. Accordingly, the aims of the present study were: (1) to describe evidence-based cessation method utilization by state and (2) to examine the effect of state-level factors on cessation method utilization above and beyond individual-level predictors.

Methods: Data were utilized from the 2010–2011 Tobacco Use Supplement to the Current Population Survey (TUS-CPS). Participants included 9232 smokers who reported a past-year quit attempt. Data on 11 state-level predictors were collated from national datasets. Analyses were based on: (1) descriptive characterization of quit method usage, (2) logistic regression models to determine state-level factors as predictors of quit method utilization, controlling for individual-level predictors, (3) cluster analyses grouping states with similar state-level factors, and (4) examination of cluster as a predictor of cessation method.

Results: Tobacco control appropriations significantly predicted NRT, quitline, and behavioral treatment utilization. Additional state-level factors that demonstrated significant relationships included Medicaid coverage of non-NRT medications and behavioral treatment, tobacco tax rate, smoking prevalence, and percentage of population uninsured. State clustering significantly predicted quit method across all four methods.

Conclusions: State-level factors influence the likelihood of residents utilizing evidence-based quit methods. Results are discussed in terms of implications for tobacco policy at the state level.

Implications: Results from the present study highlight state tobacco control appropriations as a robust predictor of evidence-based cessation method utilization. Other significant state-level predictors of evidence-based cessation method utilization included Medicaid coverage of non-NRT medications and behavioral treatment, tobacco tax rate, smoking prevalence, and percentage of population uninsured. Moreover, state-level predictors clustered together to significantly predict

evidence-based cessation method utilization. Thus, increasing tobacco control appropriations, extending health insurance coverage, maximizing revenue from tobacco taxation and tobacco settlements, and ultimately decreasing smoking prevalence are important targets for individual states to promote utilization of evidence-based cessation methods.

Introduction

Tobacco use poses one of the greatest detriments to public health worldwide. In the United States alone, percentage of health care expenditure dedicated solely to treating tobacco-related disease ranges from 6% to 18% across states, totaling \$193 billion in direct health care expenditures and lost productivity.^{1,2} In contrast to the cost of continued tobacco use, evidence-based smoking cessation treatment is both inexpensive and cost-effective, with cost per life-year saved ranging from \$128 to \$1450 depending on the intervention.^{1,3} The most researched and widely utilized evidence-based treatments for smoking cessation include: (1) nicotine replacement therapy (NRT; eg, nicotine patch, gum, lozenge, nasal spray, inhaler), (2) non-NRT medications (eg, varenicline, bupropion), (3) behavioral interventions (eg, individual counseling, group counseling), and (4) quitlines.⁴ Each of these treatments offers significantly improved rates of quitting,⁵ though only 20%–30% of smokers who make a quit attempt employ such methods.^{6,7} Thus, promoting utilization of evidence-based quit methods nationally has the potential to increase cessation nationwide and to significantly impact public health.⁸

Promotion of evidence-based quit methods at the population level requires strong tobacco policies. Statewide tobacco control programs are one of the most effective means to reduce tobacco use. Common state tobacco control programs, policies, and indicators include: (1) state tobacco excise taxation,⁹ (2) tobacco control appropriations (ie, each state's expenditure on tobacco control and prevention program efforts),^{10,11} (3) comprehensive smoke-free air laws (eg, smoke-free workplaces, restaurants, and bars),¹² (4) tobacco-related revenue,¹³ (5) provision of free cessation medications by state quitlines,¹⁴ and (6) state Medicaid coverage of evidence-based cessation treatment (which can be separately examined as coverage of NRT, coverage of non-NRT medications, and coverage of behavioral treatment).¹⁵ Numerous studies show that state tobacco control programs independently and collectively lead to declines in cigarette consumption and in the prevalence of cigarette smoking.^{16–19} One might presume that these collective policies influence uptake of evidence-based treatment, but this has never been shown.

State-level influences of medical care may also lead to increased utilization of evidence-based cessation methods. Current guidelines from the US Department of Health and Human Services specify that clinicians should consistently identify and document tobacco use status and encourage smokers to quit utilizing evidence-based behavioral and pharmacological treatments.⁵ Therefore, access to medical care (ie, health insurance status) and utilization of routine medical care may be predictors of evidence-based smoking cessation treatment utilization. Specifically, states in which a greater proportion of the population is insured and routinely visit a physician should have higher utilization of evidence-based smoking cessation treatment, but this too is unclear.

While individual-level predictors of quit method usage are well-characterized,^{20–22} the literature is limited regarding the relationship between state-level factors (ie, state tobacco control and healthcare indicators, hereafter collectively referred to as “state-level factors”)

and utilization of evidence-based cessation treatment. A few studies highlight the effects of one or more of these factors within a single state or city.^{14,23–27} However, no studies to date have offered national, between-state comparisons of these state-level factors in aggregate and their association with use of evidence-based cessation treatment on the level of individual smokers. Accordingly, the aims of the present study were twofold: (1) to describe evidence-based cessation method utilization by state and (2) to examine the effect of state-level factors on evidence-based cessation method utilization. Particular interest was in: (1) examining the clustering of state-level predictors that best promoted usage of each quit method while (2) examining these predictors above and beyond relevant individual-level predictors (eg, demographics, smoking history). Four broad classes of evidence-based treatment were separately examined: (1) NRT, (2) non-NRT medication, (3) behavioral treatment, and (4) quitline.

Method

Data Source for Outcome Variables

Data were utilized from the 2010–2011 Tobacco Use Supplement to the Current Population Survey (TUS-CPS),²⁸ the most recent available TUS-CPS dataset. The CPS uses a multi-stage stratified sampling procedure to interview a nationally representative sample of households of non-institutionalized civilian US population aged 15 and older. The TUS is a periodic survey attached to the CPS every 4 years which includes data from US households regarding smoking, use of tobacco products, and tobacco-related norms, attitudes, and policies. For 2010–2011, TUS questions were added to the CPS surveys in May 2010, August 2010, and January 2011. The TUS-CPS is the largest national survey that queries on individual methods of quitting. Additional details regarding methodology employed by the TUS-CPS can be found by visiting the TUS-CPS website (<http://appliedresearch.cancer.gov/tus-cps/>).

The TUS-CPS asked current smokers who endorsed making a quit attempt lasting longer than 24 hours in the past 12 months the following: “Thinking back to the last time you tried to quit smoking in the past 12 months—did you use any of the following products: a nicotine patch; nicotine gum or nicotine lozenge; nicotine nasal spray or nicotine inhaler; a prescription pill called Chantix or Varenicline; a prescription pill called Zyban, Bupropion, or Wellbutrin; another prescription pill; a telephone help line or quitline; one on one counseling; a stop smoking clinic, class or support group?” Respondents indicated yes or no to each method separately. Participants were also queried regarding utilization of alternative, predominantly non-evidence based cessation methods (eg, switching tobacco products, hypnosis, books, pamphlets), which were not included in present analyses.

Analysis of each quit method (eg, patch vs. gum vs. lozenge vs. etc.) was considered but opted against, as there were too few users within each method within each state. Thus, for analyses, aggregated quit method usage was as follows: (1) NRT, inclusive of

nicotine patch, nicotine gum, nicotine lozenge, nicotine nasal spray, or nicotine inhaler, (2) non-NRT medications, inclusive of Chantix/Varenicline, Zyban/Bupropion/Wellbutrin, or another prescription pill, (3) behavioral treatments, inclusive of one-on-one counseling, a stop smoking clinic, class, or support group, and (4) quitline, defined as using a telephone help line or quitline. These groupings were selected on the basis of similarity of treatment mechanism and similarity of policy implications (eg, Medicaid coverage of NRT would similarly impact nicotine patch, gum, lozenge, nasal spray, and inhaler). For each method, quit outcomes were not explicitly assessed by the TUS-CPS. However, these questions were asked only of current smokers, thus it may be reasonable to assume that these methods did not result in sustained cessation.

Data Sources for Predictor Variables

Ten state-level variables of interest were identified a priori to examine as potential predictors of evidence-based cessation method utilization. All selected state-level variables have: (1) a face valid relationship with smoking cessation and (2) a publically available dataset quantifying the variable. These predictors and their data source are listed below. Except where noted below, all data were ascertained from 2010 sources.

State Medicaid Coverage of NRT, non-NRT Medications, and behavioral treatment

Data regarding state Medicaid coverage of NRT, non-NRT medications, and behavioral treatment (yes/no) were available via the CDC for 2008 and for 2014.²⁹ Data from 2008 were utilized for present analyses as this data was collected closest in time to the 2010–2011 TUS-CPS.

Percent of State Population Uninsured

Data on percentage of state population without health insurance coverage were available via the US Census Bureau Current Population Survey, 2008 to 2011 Annual Social and Economic Supplements.³⁰ From published Census Bureau data, a 3-year average (2008–2010) or 2-year averages (either 2007–2008 or 2009–2010) were available for use. The 3-year average between 2008 and 2010 was chosen for this study.

Provision of Free Cessation Medications by State Quitline

Data were obtained from the 2010 North American Quitline Consortium (NAQC) Annual Survey to identify whether each state provided free cessation medications.³¹ A state was considered as providing free medication if the state quitline provided at least one cessation medication. Rhode Island, Tennessee, and Minnesota did not participate in the 2010 NAQC Annual Survey, so current 2016 data were used for those states.

Percentage of State Population Who Visited a Physician for a Routine Checkup Within the Last Year

Estimated 2010 prevalence of adults aged ≥ 18 years who visited a physician for a routine checkup during the preceding 12 months for each state was available via the 2010 Behavioral Risk Factor Surveillance System.³²

State Excise Tax per Pack

State excise tax per pack data were available via the National Conference of State Legislatures.³³ 2010 state excise tax per pack data included price increases effective July 1, 2010. State tax was

divided into quartiles: $\leq \$0.79$; $> \$0.79$ to $\leq \$1.34$; $> \$1.34$ to $\leq \$1.78$; $\geq \$1.78$.

State Tobacco Revenue per Capita

State tobacco revenue data, defined as total revenue from tobacco industry settlement payments and cigarette excise taxes, were available via the CDC.³⁴ Total state tobacco revenue was divided by state population from the 2010 Census³⁵ in order to calculate state tobacco revenue per capita (in thousands of dollars/capita).

Total State and Federal Tobacco Control Appropriations

Total state and federal tobacco control appropriations data were available via the CDC.³⁴ Total state and federal control appropriations was divided by state population from the 2010 Census³⁵ in order to calculate total state and federal control appropriations per capita (in thousands of dollars/capita), which was then divided into quartiles.

State Comprehensive Smoke-Free Laws

Data on state comprehensive smoke-free laws for 2010 were available via the CDC³⁶ and were coded dichotomously (yes/no). A state was considered as having comprehensive smoke-free laws if smoking was prohibited in workplaces, restaurants, and bars.

State Smoking Prevalence

Though not considered a tobacco policy in itself, the general tobacco climate within each state (ie, smoking prevalence) is important to consider as a treatment predictor. Thus, state smoking prevalence was included as an 11th predictor. Smoking prevalence among individuals age 18 and older by state was acquired from the 2009 Behavioral Risk Factor Surveillance System.³² Current smoking in this assessment was defined as having smoked ≥ 100 cigarettes lifetime and currently smoking every day or on some days.

Participants

Participants in the present study were smokers from the 2010–2011 TUS-CPS dataset who made a quit attempt in the last year lasting longer than 24 hours. Use of each cessation method was asked of daily and some-days smokers (the latter defined as smoking on 12 or more days out of the last 30 days).

Within the 2010–2011 TUS-CPS, there were 171365 self-respondents, of whom 21971 were current daily smokers, and 5640 were current some-days smokers. Among this sample of smokers, 9232 (33.4%) reported a past-year quit attempt lasting longer than 24 hours, representing our final study sample (see Table 1 for demographics). Of these, an additional 325 respondents were excluded from subsequent logistic regression and cluster analyses (see below) due to missing data. A non-response adjustment weight, derived and provided by CPS, was used for all analyses. This adjustment accounts for households that completed the CPS but not the TUS. Because supplement data included participants from each of three time points (May 2010, August 2010, and January 2011), the non-response adjustment weight was divided by three for all participants (for additional details, see the CPS codebook <https://cps.ipums.org/cps/resources/codebooks/cpsmay10.pdf>).

Analytic Plan

Data analysis was split into four main sections: (1) descriptive analyses of evidence-based cessation method utilization by state, (2)

Table 1. Demographics

	Unweighted	Weighted
<i>n</i>	9232	8795758
Age (<i>M</i> (<i>SD</i>))	43.36 (14.61)	42.6 (0.2)
Female (%)	52.39%	50.4%
Race (%)		
White	82.7%	80.9%
Black	10.7%	13.4%
American Indian/Alaskan Native	1.8%	1.2%
Asian	1.8%	2.0%
Hawaiian or Pacific Islander	0.4%	0.3%
Multiracial	2.6%	2.3%
Ethnicity (%)		
Hispanic	6.6%	8.3%
Non-Hispanic	93.4%	91.7%
Income (%)		
<\$20k	28.7%	28.9%
\$20k to \$35k	23.1%	23.7%
\$35k to <\$60k	24.0%	23.3%
≥\$60k	24.1%	24.1%
Marital status (%)		
Married	41.4%	41.1%
No longer married	29.2%	28.3%
Never married	29.4%	30.6%
Education (%)		
Below High School Diploma/GED	14.8%	15.7%
High School Diploma or GED	39.2%	38.5%
Some college or associate's degree	34.0%	33.9%
Four-year college degree or more	12.1%	11.9%
Smoking status (%)		
Everyday	79.2%	79.3%
Some days	20.8%	20.7%
Menthol preference (%; <i>n</i> = 223 missing)		
Non-menthol preferred	69.5%	66.9%
Menthol preferred	30.5%	33.1%
Average cigarettes smoked per day (<i>M</i> (<i>SD</i>); <i>n</i> = 122 missing in unweighted sample)	10.6 (9.1)	10.5 (0.1)

Twenty participants in the unweighted sample had missing data for both menthol preference and average cigarettes smoked per day.

logistic regression models to examine state-level predictors of cessation method utilization, controlling for individual-level predictors, (3) cluster analyses grouping states with similar state-level factors, and (4) examination of cluster membership as a predictor of cessation method.

Descriptive Analyses

Descriptive statistics were used to ascertain prevalence, within each state, of utilization of (1) NRT, (2) non-NRT medication, (3) behavioral treatment, and (4) quitline. To display results graphically, states were split into tertiles, with 17 states in each third (Washington DC included separately as the 51st state). Dividing states into tertiles was solely for descriptive purposes but allowed for parsimonious, easily interpretable divisions of high, middle, and low ranges of utilization.

Logistic Regression Models

Hierarchical logistic regression models were used to examine the effects of the 11 state-level predictors, focusing on the influence of these predictors independent of individual-level predictors. Random effects were included per state to account for clustering of policy

level variables by state.³⁷ Based on prior literature, a priori identified individual-level predictors (all derived from within the TUS-CPS) included: age, family income, marital status, gender, education, race, ethnicity, smoking status (daily vs. nondaily smoking), use of menthol cigarettes, and cigarettes per day (data for each individual predictor not shown herein). Each pair of predictors was assessed for collinearity to determine if there was substantial redundancy in predictors. No pairs were found to have high associations (measured by correlations or odds ratios, depending on the nature of the predictors in each pair). As such, all of the individual-level predictors were initially included in all models, with each quit method modeled separately. Specifically, the unit of analysis was the smoker, and a logistic regression model was fit with the outcome a binary indicator for the use of the quit method (yes vs. no). Each model included all 11 state-level predictors, and predictors were sequentially removed until only statistically significant ($p < .05$) state-level predictors remained in each model. Although some state-level predictors may be related (eg, excise tax and revenue), the decision was made a priori to consider all state-level predictors in the initial models, and then retain only statistically significant predictors. Logistic regression models were performed using SAS software, Version 9.3.

Cluster Analyses

To address potential collinearity, due to the interrelatedness of state-level variables, a composite variable was derived to capture the set of state-level characteristics. All state-level variables were included in a hierarchical clustering to cluster states according to similarity across variables.^{38,39} Divisive clustering (ie, “top down”) was used, given the goal of deriving a small number of clusters as opposed to many clusters with few states within each. Euclidean distance was used for clustering states and dendrograms were created to display state clustering. Silhouette plots were examined to evaluate homogeneity of clusters and choose the height at which the dendrograms should be cut to define the clusters, resulting in seven state clusters. Dendrograms and an image plot of the variables were combined to demonstrate patterns and clusters in the data. Two clusters were comprised of single states (New Hampshire and Connecticut) due to unique state-level factors that distinguished each of these states from other clusters. Cluster analyses were performed in R (version 3.3.0) with the library “cluster.”

Cluster Predicting Cessation Method

Logistic regression models for each quit method were then used to examine cluster as a predictor of treatment utilization controlling for individual-level predictors. For each model, the reference cluster was the cluster with the highest utilization of each quit method.

Results

Descriptive Analyses

Prevalence of quit method utilization for each method was 23.8% for NRT, 14.4% for non-NRT medication, 4.0% for behavioral treatment, and 3.1% for quitline. The prevalence of evidence-based cessation method utilization was examined by state among individuals who made a quit attempt lasting longer than 24 hours in the last year (Supplementary Figure 1). Prevalence of NRT utilization ranged from 15.5% (Louisiana) to 36.7% (Vermont), with a median use of 24.5% (Delaware and Alaska). Prevalence of non-NRT medication utilization ranged from 3.9% (New Mexico) to 22.1%

(Minnesota), with a median use of 14.8% (Wisconsin) and 14.9% (Vermont). Prevalence of behavioral treatment utilization ranged from 0.0% (New Mexico) to 9.4% (Hawaii), with a median use of 4.0% (Wisconsin and Louisiana). Prevalence of quitline utilization ranged from 0.6% (Texas) to 19.8% (Montana), with a median use of 3.2% (Nebraska and Connecticut).

Logistic Regression Models

Each evidence-based quit method was influenced by a different set of state-level predictors (Table 2). For NRT, Medicaid coverage of non-NRT medications predicted decreased utilization, whereas tobacco excise tax rate and tobacco control appropriations predicted increased utilization. For non-NRT medications, Medicaid coverage of behavioral treatment and uninsurance prevalence predicted decreased utilization, whereas Medicaid coverage of non-NRT medications, smoking prevalence, and tobacco excise tax rate predicted

Table 2. Results of Multiple Logistic Regression Models Examining State-Level Factors as Predictors of Evidence-Based Quit Method Utilization Controlling for Individual-Level Variables

Predictors	OR	95% CI
NRT		
Medicaid coverage of non-NRT medications	0.73	0.60–0.89
Tax rate (highest vs. lowest quartile)	1.38	1.17–1.62
Tax rate (highest vs. second lowest quartile)	1.27	1.11–1.46
Tax rate (highest vs. second highest quartile)	1.18	1.00–1.39
Tobacco control appropriations (highest vs. lowest quartile)	1.33	1.11–1.59
Tobacco control appropriations (highest vs. second lowest quartile)	1.08	0.90–1.29
Tobacco control appropriations (highest vs. second highest quartile)	0.91	0.76–1.09
Non-NRT medications		
Medicaid coverage of non-NRT medications	1.39	1.11–1.75
Medicaid coverage of behavioral treatment	0.78	0.67–0.91
Prevalence of cigarette smoking	1.03	1.01–1.06
% Uninsured	0.98	0.96–0.996
Tax rate (highest vs. lowest quartile)	1.26	0.99–1.60
Tax rate (highest vs. second lowest quartile)	1.31	1.08–1.60
Tax rate (highest vs. second highest quartile)	1.00	0.82–1.22
Behavioral treatment		
Tobacco control appropriations (highest vs. lowest quartile)	1.77	1.18–2.64
Tobacco control appropriations (highest vs. second lowest quartile)	1.31	0.88–1.94
Tobacco control appropriations (highest vs. second highest quartile)	1.08	0.74–1.58
Quitline		
% Uninsured	0.95	0.91–0.998
Tobacco control appropriations (highest vs. lowest quartile)	3.52	2.04–6.10
Tobacco control appropriations (highest vs. second lowest quartile)	2.89	1.72–4.85
Tobacco control appropriations (highest vs. second highest quartile)	1.36	0.85–2.16

CI = confidence interval; NRT = nicotine replacement therapy; OR = odds ratio. All predictors listed above were significant at the $p < .05$ level. Nonsignificant predictors are not included in this table. All models controlled for individual-level predictors including age, family income, marital status, gender, education, race, ethnicity, smoking status (daily vs. nondaily smoking), use of menthol cigarettes, cigarettes per day, and state.

increased utilization. For behavioral treatment, tobacco control appropriations predicted increased utilization. Finally, for quitline, uninsurance prevalence predicted decreased utilization, whereas tobacco control appropriations predicted increased utilization.

Cluster Analyses

Because state policies may be related to one another, it was of interest to identify groupings (ie, clusters) of state-level factors that tended to co-occur. States clustered together in seven distinct clusters with similar state-level factors (see Supplementary Figure 2 for graphic depiction of distinct characteristics of each cluster). After identifying distinct clusters of states, these clusters were examined to see whether they predicted quit method usage. For each analysis, cluster membership was determined to be a significant predictor of quit method utilization (ps for all four quit methods $<.05$; Table 3). For NRT, with Cluster 6 as the referent with highest usage (32.6%), residents of Clusters 4, 5, and 7 were significantly less likely to utilize NRT. For non-NRT medications, with Cluster 1 as the referent with highest usage (19.5%), residents of Cluster 7 were significantly less likely to utilize non-NRT medications. For quitline, with Cluster 3 as the referent with highest usage (8.0%), residents of Clusters 1, 2, 4, 5, and 7 were significantly less likely to utilize quitlines. For behavioral treatment, with Cluster 3 as the referent with highest usage (6.4%), residents of Clusters 2, 4, 5, and 7 were significantly less likely to utilize behavioral treatment.

Discussion

A number of prominent national panels and policy guidelines highlight the need for promoting utilization of evidence-based quit methods by aligning cessation treatment with tobacco policy.^{8,40,41} This need is addressed herein by examining patterns and predictors of evidence-based cessation method utilization across states, clustered by various indicators of tobacco and healthcare policy. Consistent with prior research,^{6,7} evidence-based cessation treatments were underutilized and the majority of participants did not utilize an evidence-based quit method. Moreover, as compared to utilization of NRT and non-NRT medications, utilization of quitlines and of behavioral treatment was low. The majority of states had variable utilization across quit methods (ie, had a mix of high, medium, and low utilization across methods), although two states (Texas and Nevada) had consistently low utilization.

For each evidence-based quit method, discrete state-level factors emerged as significant predictors of quit method utilization above and beyond individual-level predictors. The most robust single predictor of quit method across states was tobacco control appropriations (ie, state-level spending on tobacco control), which significantly predicted increased utilization of NRT, behavioral treatment, and quitline. Although previous studies have documented a relationship between state spending on tobacco control programs and tobacco sales and use,^{10,42} to our knowledge this is the first study to find total state and federal tobacco control appropriations as a significant predictor of utilization of multiple evidence-based quit methods. Despite the potential public health significance of high tobacco control appropriations, currently only one state (North Dakota) meets the CDC's best practice recommendations for state funding for tobacco control.⁴³ Nearly all other states fall far below the recommended minimum funding levels and receive grades of "F" from the American Lung Association's "State of Tobacco Control 2016".⁴⁴ Thus, these results suggest that increasing tobacco control

Table 3. Cluster as a Predictor of Evidence-Based Quit Method Utilization Controlling for Individual-Level Predictors

Cluster	NRT			Non-NRT medication			Behavioral treatment			Quitline		
	% Use	OR ^a	95% CI ^a	% Use	OR ^a	95% CI ^a	% Use	OR ^a	95% CI ^a	% Use	OR ^a	95% CI ^a
1 (NH)	31.2%	0.93	0.60–1.46	19.5%	<i>Ref.</i>	<i>Ref.</i>	3.7%	0.53	0.24–1.16	0.8%	0.09	0.02–0.38
2 (UT, WA, HI, OH, MA, PA, WI, MI, MD, MN, IA, RI, NY, NJ, DC)	24.8%	0.72	0.52–1.01	16.6%	0.92	0.63–1.35	4.0%	0.54	0.38–0.78	3.4%	0.42	0.29–0.60
3 (SD, ME, VM, DE)	26.8%	0.76	0.53–1.10	16.1%	0.82	0.54–1.26	6.4%	<i>Ref.</i>	<i>Ref.</i>	8.0%	<i>Ref.</i>	<i>Ref.</i>
4 (NE, VA, NV, CA, SC, NC, LA, KS, IL, CO, AZ)	22.3%	0.63	0.45–0.88	13.1%	0.72	0.49–1.07	3.5%	0.49	0.33–0.73	2.7%	0.33	0.22–0.50
5 (OR, NM, ID, TX, FL, IN, MS, OK, AR, MT, WY, ND, AK)	22.9%	0.66	0.47–0.93	13.2%	0.72	0.49–1.07	4.7%	0.67	0.45–0.99	3.1%	0.37	0.25–0.55
6 (CT)	32.6%	<i>Ref.</i>	<i>Ref.</i>	16.4%	0.87	0.50–1.53	5.3%	0.81	0.40–1.61	3.2%	0.42	0.18–1.01
7 (WV, TN, GA, MO, KY, AL)	24.6%	0.68	0.48–0.97	12.9%	0.63	0.42–0.96	3.5%	0.42	0.26–0.68	2.4%	0.26	0.15–0.44

CI = confidence interval; NRT = nicotine replacement therapy; OR = odds ratio. Sample sizes reflect weighted samples.

^aFor ORs and CIs for each cessation method, the reference group was the cluster with highest utilization for that individual method, denoted via italics. Pairwise comparisons (vs. referent group) which were significant at $p < .05$ are bolded.

appropriations across states could significantly impact evidence-based cessation method uptake. Other state-level factors important for utilization of evidence-based methods included Medicaid coverage of non-NRT medications and behavioral treatment, tobacco excise taxation, percentage of the state population uninsured, and prevalence of current smoking.

Cluster analyses revealed several constellations of state-level factors that optimized utilization of each evidence-based quit method. These analyses showed that the clusters of state-level factors that predict uptake of quit methods vary across quit methods. Specifically, the cluster that optimized utilization of NRT tended to have low smoking prevalence, high taxation, high tobacco-related revenue, high health insurance prevalence, and a state quitline that provided free cessation medications. The cluster that optimized utilization of non-NRT medications tended to have low smoking prevalence, high health insurance prevalence, high tobacco-related revenue, and Medicaid coverage of NRT, non-NRT medications, and behavioral treatment. The cluster that optimized utilization of quitlines and behavioral treatment tended to have low smoking prevalence, high health insurance prevalence, high tobacco-related revenue, Medicaid coverage of non-NRT medications, comprehensive smoke-free laws, high appropriations, and state quitlines that provided free cessation medications. All three of these clusters had low smoking prevalence, high health insurance prevalence, and high tobacco-related revenue. Thus, in addition to maximizing tobacco control appropriations, augmenting smoking prevalence, health insurance prevalence, and tobacco-related revenue may be valuable targets for promoting utilization of cessation treatment.

Results should be interpreted with study limitations in mind. Cessation outcome (ie, successful vs. unsuccessful) was unavailable and questions regarding quit method utilization were only asked of current smokers. Future studies should consider similar examination

of state-level predictors of cessation method utilization among smokers who successfully quit. Moreover, the TUS-CPS may consider assessing cessation treatment utilization among those who quit smoking to more clearly address this question. Additionally, although state-level data from the same time period as the TUS-CPS was the ultimate goal, for some predictors 2010 data were not available.

There are a number of important future directions following from this line of research. There are likely additional factors associated with individual states (eg, tobacco-related social climates⁴⁵), which could impact tobacco policy and ultimately quit method, that merit future research. While the present study examined state-level factors for predicting cessation method utilization, making a quit attempt is likely influenced by both state-level factors as well as more granular factors, including variables at the city and community levels. For example, some municipalities have additional tobacco taxation beyond the state-level taxation (eg, New York City, Chicago, and Anchorage), and many cities and counties have unique policies related to smoke-free laws (eg, smoke-free casinos, ballparks, etc.). Moreover, neighborhood factors such as poverty and unemployment have previously been related to tobacco use and cessation.^{46,47} More granular predictors may also exist for state-level factors (eg, specific healthcare setting in which individuals visited a physician). Future studies should consider examination of these nuanced predictors that similarly may influence utilization of cessation methods.

In sum, the present study highlights a number of state-level factors that are associated with utilization of evidence-based cessation treatment above and beyond individual-level predictors. Promotion of smoking cessation on the state level is crucial as smokers have a lifespan expectancy of a decade shorter than nonsmokers, and successful smoking cessation can almost entirely reverse this shortened life expectancy.⁴⁸ Increasing tobacco control appropriations, extending health insurance coverage for state residents, maximizing

revenue from tobacco taxation and tobacco settlements, and ultimately decreasing smoking prevalence are all important targets for individual states in order to promote utilization of evidence-based cessation methods.

Supplementary Material

Supplementary data is available at *Nicotine & Tobacco Research* online.

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Declaration of Interests

None declared.

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