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Variations in State Use of Anti-Tobacco Message Themes Predict Youth Smoking Prevalence in the United States, 1999–2005

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Abstract

Objective—This study tests relationships between the volume of ads (PSAs) employed in state anti-smoking campaigns, use of different themes and stylistic features in these PSAs, and state youth smoking prevalence between 1999 and 2005.

Methods—We merged commercially available data on televised anti-smoking PSAs that aired between 1998 and 2004 with data on state tobacco control activity to test the relationship between the volume and content of youth-targeted and general/adult-targeted anti-smoking PSAs on youth smoking prevalence, controlling for other tobacco control efforts. We use content analysis and ordinary least squares (OLS) regression to assess which thematic and stylistic features employed in state anti-smoking PSAs are associated with reduced smoking prevalence.

Results—A 100-ad increase in the yearly volume of youth-targeted state anti-smoking PSAs was associated with a 0.1 percentage point decrease in state youth smoking rates in the following year. This relationship was driven by variation in state use of PSAs emphasizing health consequences to the self or others and anti-industry appeals. Controlling for appearances of these

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CONTRIBUTIONS

J Niederdeppe conceptualized the study, contributed to the interpretation of the data, and led the writing of the paper. RJ Avery contributed the time of the research assistants on this project, conceptualized the study, supervised the statistical analysis, and helped write the paper. S Byrne conceptualized the study, contributed to the interpretation of the data, and helped write the paper. Tyseer Siam conducted the statistical analysis and contributed to interpretation of the data.

COMPETING INTERESTS

The authors report no competing interests.

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themes, use of graphic imagery and personal testimonials did not predict reduced smoking prevalence. Adult/general-targeted PSAs were not associated with youth smoking prevalence.

Conclusion—Youth-targeted state anti-tobacco PSAs that emphasize the health consequences of smoking (to oneself and others) and contain anti-industry appeals are associated with reduced youth smoking rates. Future work should avoid typologies that do not account for co-occurrence of thematic and stylistic content in anti-tobacco PSAs.

Keywords

communication; policy; PSAs; advertising; youth smoking

INTRODUCTION

Cigarette smoking among U.S. high school students decreased sharply between 1997 and 2003, but the rate of decline in smoking among teenagers has since slowed considerably. The U.S. Surgeon General estimates there would be 3 million fewer American smokers today if the success in reducing youth tobacco use observed between 1997 and 2003 had been sustained. [1] There is strong evidence that comprehensive tobacco control programs were a major contributor to the observed declines in youth smoking prevalence during this time period. [2–4] Mass media campaigns are widely accepted as an integral part of these programs, [4–5] and numerous studies link campaign exposure to reduced smoking prevalence in the United States. [5–8]

A parallel body of work has sought to identify characteristics of effective anti-smoking ads (PSAs), emphasizing the importance of both thematic content and stylistic features. [9–14] Some of these studies have classified a small number of ads into mutually exclusive categories that combine information about their theme (e.g., health consequences) and style (e.g., graphic imagery; personal testimonials). [9–10] Others have sought to separate out the effects of style and theme by coding larger samples of PSAs for the presence or absence of both types of design characteristics and gauging audience responses to them [11–14] or holding ad theme constant by focusing on the effects of different stylistic factors using messages from a single campaign. [15] Most of these studies have focused on short-term (e.g., recall, perceived effectiveness, attitudes, intentions) rather than long-term outcomes (e.g., smoking behavior or prevalence). [9–13,15] In addition, many have implicitly assumed (through their use of mutually exclusive coding procedures) that different types of content do not co-exist in the same message—in other words, that PSAs focus on either a health consequences or an anti-industry message, but not both. [9–12]

Study Objectives

Understanding which PSA themes and stylistic elements are associated with declines in state youth smoking rates can contribute to the design of more effective anti-smoking messages. This study seeks to address many of the limitations of previous work on the topic. We utilize commercially available data on state-sponsored anti-tobacco television PSAs (those purchased by or airtime donated to a state tobacco control program; called “state PSAs” in the rest of the paper) between 1998 and 2004 to examine the relationship between the overall

volume of state PSAs, the use of different combinations of themes and stylistic features in these state PSAs, and state youth smoking prevalence from 1999 to 2005, while controlling for other state and national anti-smoking programs and policies. We first use content analysis to identify the degree to which discrete themes and stylistic elements co-occur in youth-targeted and adult/general-targeted state PSAs appearing between 1998 and 2004. We then use OLS regression models to test the relationship between the volume and content (both thematic and stylistic) of these state PSAs on youth smoking prevalence from 1999 to 2005, controlling for numerous potential confounders.

METHODS

PSA Appearance Data and Ad Content Coding

We first obtained a dataset of all state-sponsored anti-tobacco PSAs appearing on television between 1998 and 2004 from TNS, an affiliate of Kantar Media. TNS provided information on the media market in which the state PSA appeared, the time and channel of airing, and the digital ad to permit content coding. The dataset includes 1,320 unique state PSAs that aired a total of 218,721 times during the time period. TNS also provided ad appearance data for cigarette ads in print media (including location of distribution based on readership data), smoking cessation product advertising in print media and television, and the number of TRUTH ads appearing on television in a particular market, channel, and time.

We trained two independent coders to determine the target audience for each of the 1,320 unique state PSAs. Coders first classified the state PSAs into one of three groups: youth-targeted, adult-targeted, or general. Youth-targeted ads were judged to have been directed at youth or teens, doing one or more of the following: aiming to deter youth from initiating smoking, discussing peer pressure to smoke, describing assistance for quitting directed at teens or youth, or featuring youth discussing the tobacco industry. Coders were highly reliable in these assessments (Cohen's $\kappa = .99$; Table 1); study principal investigators resolved any discrepancies. We split ads into two categories based on coded targeting: youth-targeted PSAs ($n = 362$ unique PSAs, $n = 39,039$ PSA appearances, 18% of all state PSAs) and adult or general-targeted PSAs ($n = 958$ unique PSAs, $n = 177,889$ state PSA appearances). Most youth-targeted PSAs appeared on the networks FOX (31%), WB (13%), ABC (12%), and NBC (11%), while adult/general-targeted PSAs were relatively equally distributed largely across the four major broadcast networks ABC (20%), NBC (19%), FOX (17%), and CBS (6%). State PSAs aired more frequently over time, with the most appearances occurring in 2004 (youth $n = 5,207$; adult/general $n = 46,655$), 2002 (youth-targeted $n = 13,215$; adult/general targeted $n = 35,047$), 2003 (youth $n = 5,036$; adult/general $n = 39,638$), and 2001 (youth $n = 7,886$; adult/general $n = 29,515$), and with the fewest total appearances in 1998 (youth $n = 1,423$; adult/general $n = 9,056$), 1999 (youth $n = 2,878$; adult/general $n = 9,733$), and 2000 (youth $n = 2,302$; adult/general $n = 8,245$).

The research team next coded for the presence or absence of any reference to specific themes in state PSAs, informed by previous work. [16–17] We pre-tested these themes prior to commencement of final content coding and then trained 6 independent coders to use the pre-tested instrument and codebook to content code the state PSAs for theme appearance and two stylistic features that have been the focus of previous work and recommended in the

design of PSAs. [10–12] Single state PSAs could feature multiple themes and styles (Table 1).

The most prevalent message theme for youth-targeted PSAs were health consequences to self or others (73%), anti-industry appeals (63%), social consequences to self (44%), efficacy appeals (38%), behavioral directives (31%), and irrationality appeals (12%), with the rest of the themes appearing in less than 10% of the youth-targeted PSAs. One in five (21%) youth-targeted PSAs contained personal testimonies while 10 percent utilized graphic imagery. Adult/general-targeted PSAs often focused on health consequences to self or others (73%), efficacy appeals (62%), anti-industry appeals (30%), and irrationality appeals (23%), using either a personal testimonial (15%) or graphic imagery (16%) in about one in six state PSAs. Most state PSAs utilized multiple themes (Youth-targeted: 1 theme $n = 2,792$ appearances, 7% of state PSAs; 2 themes $n = 11,284$ appearances, 29% of PSAs; 3 themes $n = 14,477$ appearances, 37% of PSAs ; 4 themes $n = 6,275$ appearances, 16% of PSAs ; 5+ themes $n = 4,261$ appearances, 11% of PSAs) (Adult/ general-targeted: 1 theme $n = 45,496$ appearances, 25% of PSAs; 2 themes $n = 69,913$ appearances, 39% of PSAs; 3 themes $n = 44,671$ appearances, 25% of PSAs ; 4 themes $n = 13,729$ appearances, 8% of PSAs ; 5+ themes $n = 4,479$ appearances, 3% of PSAs).

Measures

The dependent variable was annual (1999–2005) state youth (12–17 years) cigarette use rates as reported by *Substance Abuse and Mental Health Services Administration (SAMHSA), Office of Applied Studies, National Household Survey on Drug Abuse (NHSDA)* and defined as the percent of youth in a state using cigarettes at least once in the past year. [18]

The independent variables for the study were the volume and content of state PSAs that, based on TNS data, appeared in media markets with majority coverage within a particular state in the preceding year (e.g., 1998 PSA volume to predict 1999 smoking rates). We used a one-year lag for all state PSA and state-level variables because reports of smoking in the NHSDA are retrospective (i.e., span the previous year; see Table 2). [5,8]

We used TNS data to account for airing of commercial tobacco and anti-tobacco ads in a state (with a 1-year lag, 1998–2004), including the total: number of print ads for tobacco products per state/year; number of television ads for smoking cessation products (patch, pills, gum, etc.) per state/year; number of print ads for smoking cessation products per state/year; and number of ads from the national TRUTH anti-smoking campaign per state/year (Table 2). [8]

We also accounted for state-level factors used to predict youth smoking rates in previous work. We obtained data on state tobacco control policies and anti-smoking expenditures from the *ImpacTeen Tobacco Control Policy and Prevalence Data*, University of Illinois at Chicago, *Institute for Health Research and Policy*. [19] These data provided information on annual: per capita tobacco control funding in the state; state excise tax per pack of cigarettes; an index (range 0–8) of the number of smoking bans in the state in that year (public school, private school, public transit, restaurant, recreational facility, health facility, childcare

facility, private worksite facility); percent of state gross domestic product from tobacco production; and the extensiveness of state tobacco control youth access laws in that state (total Alciati score; see Table 2). [20] In addition, we controlled for several state-level population factors including the percentage of the state population under 18 years of age, percentage of adult population that is Black, percentage of adult population that is Hispanic/Latino, and percentage of adult population unemployed.

Analytic Approach

We used ordinary least squares (OLS) regression to estimate the relationship between state PSA appearances (in the previous state/year) and state youth smoking rates (in the current state/year), controlling for state/year variation in other tobacco-related ad activity (previous state/year) and the state tobacco control environment (previous state/year). We ran several different regression models. In the first set of models (labeled “Model 1” in the table), we estimated the relationship between the volume of state PSA appearances and youth smoking rates, controlling for potential confounders (other smoking-related ads and state-level variables), with separate models for each state PSA theme and style. In the second model (“Model 2”), we fit a model that included two state PSA variables: the overall volume of youth-targeted PSA appearances and the overall volume of adult/ general-targeted PSA appearances, again controlling for potential confounders. In the third model (“Model 3”), we included all youth-targeted content variables (styles and themes) that were featured in at least ten percent of youth-targeted PSA appearances in the same model (controlling for potential confounders). In the fourth model (“Model 4”), we included all adult/general-targeted PSA content variables (styles and themes) that appeared in at least ten percent of state PSA appearances in the same model (controlling for potential confounders). Models 3 and 4 thus isolate the independent contributions of specific thematic and stylistic content on youth smoking prevalence by accounting for the co-occurrence of multiple themes and stylistic content in the same state PSA appearance. We tested for evidence of near-extreme multicollinearity in each model by requesting variance inflation factors (VIFs) for each variable in the model¹.

RESULTS

OLS Regression Models Predicting State-Year Youth Smoking Rates

Table 3 shows results from OLS regression models predicting state youth smoking rates by state PSA appearance volume, volume of other tobacco-related messaging, and other state-level characteristics. Models 1 and 2 reveal that a 100-ad increase in the yearly volume of state PSA appearances was associated with a 0.1 percentage point decrease in state youth smoking rates in the following year. Models also shows that use of three state PSA content features were associated with decreased smoking prevalence: Youth-targeted PSA appearances emphasizing health consequences to the self or others, those emphasizing

¹We originally created separate categories for health consequences to self and consequences to others. However, these variables were very highly correlated and introduced significant problems of near-extreme multicollinearity (VIFs > 20) into the models. We thus combined these two variables in to a single content category. We also tried including all content categories, including those found in less than 10% of ads, in Models 3 and 4; doing so also introduced multicollinearity issues (VIFs > 15) so we removed rarely-occurring PSA content from the models.

tobacco industry misdeeds, and those using normative appeals. Model 3 reveals that two of these content features, youth-targeted PSA appearances emphasizing health consequences to self and others ($B = -0.24$) and using anti-industry appeals ($B = -0.18$), remained significant in multivariable models controlling for other ad themes and styles². Youth-targeted state PSA appearances featuring explicit behavioral directives were associated with increased state youth smoking prevalence. Many of the themes and styles included in Model 3 were strongly correlated with one another (Table 4); however, none of the VIFs in Model 3 were above 7.5, indicating that the model coefficients are robust to controls for the appearance of other state PSA themes and styles. Notably, neither personal testimony nor graphic imagery was associated with reduced smoking prevalence in any of the youth-targeted state PSA models.

None of the adult/general-targeted state PSA variables, including the overall volume (in Models 1 and 2) or theme/style-specific volume (in Models 1 and 4) were significant predictors of youth smoking prevalence (all variable VIFs < 10). Furthermore, print cigarette ad volume, print cessation ad volume, televised smoking cessation ad volume, and TRUTH anti-smoking ad appearances were not associated with reduced youth smoking rates (Models 1–4).

Turning to state-level variables, each additional dollar per-pack of cigarette excise taxes was associated with a 1.93 to 1.97 percentage point decline in youth smoking rates; a one percentage point increase in state GDP from tobacco farming was linked to a 6.20 to 6.45 percentage point increase in state youth smoking prevalence. Location bans, per capita tobacco control funding, and youth access laws were not associated with declines in youth smoking rates, although several demographic factors (% youth population, % Black, % Hispanic) did predict youth smoking rate.

DISCUSSION

This study offers new evidence that state-sponsored youth-targeted anti-smoking PSAs are significantly associated with declines in youth smoking observed in the late 1990s and early 2000s in the United States. More importantly, we identify two specific thematic characteristics of youth-targeted state anti-smoking PSAs that are independently associated with reduced youth smoking rates (although they often co-occur): youth-targeted PSAs emphasizing health consequences to self and others, and youth-targeted PSAs emphasizing deceptive or unethical tobacco industry behavior. We also find some evidence that youth-targeted PSAs featuring explicit behavioral directives (“don’t smoke”) are linked to increased state smoking prevalence. We find no evidence that adult- or general-targeted PSAs are associated with youth smoking rates, nor does specific stylistic content (PSAs using personal testimonials or graphic imagery) predict youth prevalence over and above thematic content.

²We conducted a series of sensitivity analyses to assess whether the statistically coefficient for normative appeals in Models 1 was robust to model specification. In short, normative appeals were not statistically significant in multivariable models that controlled for other ad themes and styles. Since including rarely occurring content introduced multicollinearity issues (high VIFs) we did not include this variable in our final multivariable models.

This pattern of findings complicates results from previous studies which have tended to collapse ads into discrete typologies—for example, ads using graphic imagery to convey health effects versus ads describing the behavior of the tobacco industry. [9–15] We find that many of these features tend to co-occur in the same message. While studies that have used typologies have reached conclusions that are similar to those observed here (that PSAs should emphasize health consequences to self and others OR anti-industry themes) [9–15], our findings suggest there may be benefit to emphasizing both message themes in the same state PSA (since multivariable model results suggest an additive effect of each theme). This approach has been the hallmark of the TRUTH anti-smoking campaign, which previous studies have found to be effective in reducing smoking prevalence (although we did not; more on this point below). [8]

We were surprised that ads utilizing stylistic elements of personal testimonials or graphic imagery were not associated with reduced smoking prevalence. We do not suggest that campaigns should cease the use of these stylistic feature, as there is good evidence that personal testimonials and graphic images can draw attention to youth anti-smoking messages. [9–10;14–15] We do suggest, however, that ads emphasizing the health consequences of smoking or emphasizing poor tobacco industry behavior may not *require* the use of graphic images or personal testimonials to be effective at reducing smoking rates. Future work should continue to untangle the effects of anti-smoking ads with strong health consequences messages and the effects of ads with graphic images (which usually function to convey those consequences).

Findings also echo concerns raised in previous work about potential negative consequences of using explicit behavioral directives in youth-targeted anti-smoking ads. Philip Morris’ “Think, Don’t Smoke” campaign was criticized for utilizing this approach in their so-called anti-smoking campaign from the early 2000s. [21–22] Asserting independence is an important part of adolescents’ cognitive and social development, and messages that explicitly threaten their personal freedoms to choose by directing behavior (“do this, don’t do this”) are unlikely to be productive and, as suggested here, may backfire [23].

Contrary to previous work, we found no evidence that exposure to TRUTH anti-smoking ads was associated with declines in youth smoking. [8] Our study was designed to examine state-level PSA ad volume on state youth smoking prevalence, whereas the TRUTH campaign was a national effort that was not restricted or targeted by state. We suspect that limited state-level variation in TRUTH ad exposure may have reduced our chances of detecting any such effects.

Turning to state tobacco control variables, our finding that state excise taxes were associated with reduced state youth smoking prevalence echoes previous work, as does our finding that youth access laws were not associated with these declines. [2–4] Contrary to previous work, however, we found no significant association between state tobacco control funding and youth smoking rates. [2–4] At the same time, previous studies that have found evidence for effects of state funding on youth smoking have not accounted for media campaign exposure in the same model. Since media campaigns likely represent the largest expenditure in state

tobacco control programs, [24] we suspect that this finding can be explained by the fact that we measured and accounted for the effects of anti-smoking ad exposure in our study.

Study Limitations

We measured state PSA volume at the state level, but these campaigns are purchased and vary by media market, which do not strictly adhere to state boundaries. While most media markets are located within a particular state, some markets extend across state borders, meaning that our estimates of volume of PSAs aired may under- or over-represent the volume of exposure in cities that reside in a media market centered in another state. In addition, our measure of state PSA volume (number of PSAs appearing in a state) also does not account for variations in the size of audience for a particular state PSA—state PSAs airing at 3 a.m. are likely to have a smaller audience than PSAs airing at 9 p.m., yet our models treat these PSAs equivalently. At the same time, we assume that state media campaign planners sought to maximize exposure within state boundaries given resources available to them, and that the volume of these resources is highly associated with overall tobacco control funding in a state. Thus, the fact that we accounted for per capita state tobacco control expenditures is likely to account for much of the difference in resources available to generate widespread exposure to anti-smoking PSAs appearing in a state. To test this hypothesis we ran additional models interacting overall state PSA volume with per capita funding for tobacco control programs. Results indicate that the main effect of state PSA volume remains significant, although the magnitude of the marginal effect is reduced slightly. This indicates that the effect of airing additional youth-targeted state PSAs on youth smoking prevalence in highly funded states are slightly lower than the effects of additional youth-targeted PSAs in states with less funding for tobacco control programs. Although we can only speculate, this may reflect a diminished marginal return per state PSA appearance in states where there is other prominent tobacco control activity underway.

We only examined two stylistic features, personal testimonials and graphic imagery, focusing on those that have been the focus of considerable previous research. Future research should explore the potential impact of other stylistic features in shaping ad response. Finally, our study is limited to youth smoking rates, not adult prevalence or quit rates. Other themes and styles may be effective among adult audiences, and our results do not speak to these outcomes.

Conclusion

State anti-tobacco youth-targeted PSAs that emphasize health consequences to the self and others, and emphasize negative tobacco industry behavior, appear more effective at reducing youth smoking rates than those that utilize other themes. Future research should consider avoiding PSA typologies that do not adequately capture the variety of thematic and stylistic content that commonly appear in state anti-tobacco PSAs.

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WHAT THIS PAPER ADDS

Previous research has sought to identify thematic and stylistic characteristics of effective anti-smoking PSAs, but this work has often focused on short-term outcomes and has examined a limited set of combinations of style and substance. This study uses commercially available data on state-sponsored anti-smoking PSAs that aired in the United States between 1998 and 2004 to assess the independent contributions of various thematic and stylistic features that predict lower youth smoking prevalence between 1999 and 2005, controlling for the use of multiple themes and styles per PSA and other tobacco control efforts in the state. We find that state-sponsored PSAs emphasizing health consequences to the self or others, as well as those emphasizing tobacco industry misdeeds, were significantly associated with reduced youth smoking prevalence. These results lead us to recommend that researchers avoid using typologies that oversimplify the variety of thematic and stylistic content that commonly appears in youth-targeted, state-sponsored anti-tobacco PSAs.

Table 1

Themes, Stylistic Features, Inter-Coder Reliability and Frequency of Appearance

Theme	Definition	Cohen's κ	Frequency (N, %) of PSA appearance	
			Youth-targeted	Adult/General-targeted
Health Consequences to Self and Others	Themes that raise awareness of the health consequences of smoking or the health benefits of not smoking/quitting, including physical and dental health, and the prenatal effects of tobacco use, or Themes that focus on how tobacco use impacts people around you at home, in the workplace, and in public. Types of impacts may be second hand smoke and clean air health effects on children, the family, or others more generally.	.90	28,490 72.9%	112,777 62.8%
Anti-industry Appeal	Themes claiming that tobacco companies know that their product kills and is addictive, but they only care about the well-being of their company or tobacco companies manipulate their customers and use marketing techniques to keep and gain customers in any way they can; or Themes aimed at raising awareness that tobacco companies continue to sell a product that they know does harm or implying that tobacco companies are targeting customers that are not legal buyers of their product (youth).	.96	24,588 63.0%	54,269 30.2%
Social Consequences to Self	Themes that focus on the effects of tobacco on the user's physical appearance, smell, and attractiveness, and how you will be perceived and accepted by society and your friends if you smoke.	.97	17,137 43.9%	18,343 10.2%
Efficacy Appeal	Themes that focus on advice on quitting, show how to quit, give you encouragement to quit, or have an overarching theme of quitting tobacco; include a quit help line or website.	.92	15,000 38.4%	111,711 62.2%
Behavioral Directives	Themes explicitly encouraging people not to initiate smoking and/or to quit.	.92	12,150 31.1%	4,546 2.5%
Irrationality Appeals	Themes that attempt to debunk the myth that cigarettes are good for your mental health and stability; cigarettes are not needed for relaxation; claims about the addictiveness of cigarettes or nicotine.	.97	4,794 12.3%	41,459 23.1%
Normative Appeal	Themes that focus the normative (peer) pressure of others impacting smoking initiation or continuance; themes informing and reminding you that the majority of kids do not smoke, so you shouldn't either; themes highlighting when someone changes their behavior because of the others around them.	.98	2,333 6.0%	3,840 2.1%
Financial Appeal	Themes explicitly state monetary reasons why you should not smoke; focus on the expense of smoking, the other things you could do with the money you spend on cigarettes, or the accumulated amount one spends on smoking in a week/month/year/etc.	1.00	2,313 5.9%	3,538 2.0%

Theme	Definition	Cohen's κ	Frequency (N, %) of PSA appearance	
			Youth-targeted	Adult/General-targeted
Regulatory Appeal	Themes focus on the enforcement of laws in place, the addition of regulations pertaining to smoking in public, not selling tobacco to minors, and political persuasion about a tobacco bill. Also included in this theme are political persuasions or movements towards tobacco-free policies.	1.00	2,025 5.2%	17,389 9.7%
Personal Testimonial	Ads that contain visual emotional testimony to invoke feelings; a story told by a loved one of the lost; drawing to the strong emotional connection between people that is ruptured because of smoking; a monologue of somebody who's life has been severely affected by smoking.	1.00	8,346 21.4%	26,856 15.0%
Graphic Imagery	Ads that contain a visual image of graphic adverse effects due to smoking; includes visuals of x-rays, internal images, visuals of a throat with a tracheotomy, oxygen masks/tanks, etc.	.89	3,990 10.2%	28,747 16.0%

Table notes: Frequencies do not sum to the total ad appearances ($n = 39,039$ for youth-targeted; $n = 179,632$ for adult/general-targeted) because most ads used more than one theme and style.

Table 2

Descriptive Statistics on State-Year Variables Involved in the Analysis

Variable Description: Number of Youth-Targeted State PSAs from the Previous State-Year:	Mean	Standard Deviation
Overall	106.3	310.4
Health consequences to self and others	78.7	244.9
Anti-industry appeal	68.2	266.1
Social consequences to self	45.4	153.7
Efficacy appeal	41.7	184.4
Behavioral directives	33.9	160.8
Irrationality appeal	13.4	66.7
Normative appeal	6.5	37.8
Financial appeal	6.5	60.1
Regulatory appeal	5.7	41.3
Personal testimonial	23.4	148.7
Graphic imagery	10.6	55.4
Overall	498.3	1,291.5
Health consequences to self and others	311.5	812.0
Anti-industry appeal	150.8	590.9
Social consequences to self	50.6	186.1
Efficacy appeal	310.8	760.6
Behavioral directives	11.7	62.0
Irrationality appeal	114.8	415.2
Normative appeal	10.8	70.3
Financial appeal	9.9	58.6
Regulatory appeal	48.6	231.7
Personal testimonial	71.4	308.8
Graphic imagery	78.4	329.1
Number of Other Smoking-Related Ads from the Previous State-Year:		
Print cigarette ads	7.2	14.5
Print smoking cessation ads	0.1	0.7
TV smoking cessation ads	2,170.6	2,005.4
TRUTH ads	1,133.3	1,616.0
State-Level Tobacco Control Environment Variables from the Previous State-Year		
Number of location bans on cigarette use (range 0–8)	0.80	1.19
Excise tax (in dollars) per cigarette pack, excluding federal excise taxes, adjusted for inflation	0.25	0.07
Extensiveness of laws restricting youth access to tobacco	16.09	5.77
% of state GDP in a year generated from tobacco farming	0.02	0.08

Variable Description: Number of Youth-Targeted State PSAs from the Previous State-Year:	Mean	Standard Deviation
Per capita tobacco control funding (inflation adjusted)	6.82	7.25
% of state population that are less than 18 years old	27.45	2.28
% of state population that are Black	0.10	0.11
% of state population that are Hispanic/ Latino	7.96	8.86
% of state population that are unemployed	4.73	1.18

Table 3

OLS Regression Models Predicting State-Year Youth Smoking Rates

Variable	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)	Model 4 B (SE)
Number of Youth-Targeted PSA Appearances in Previous State-Year / 100:				
Overall	– 0.11 ^{**} (0.035)	– 0.11 ^{**} (0.035)	--	--
Health consequences to self and others	– 0.17 ^{**} (0.044)	--	– 0.24 [*] (0.109)	--
Anti-industry appeal	– 0.14 ^{**} (0.040)	--	– 0.18 [*] (0.083)	--
Social consequences to self	– 0.12 (0.069)	--	– 0.02 (0.102)	--
Efficacy appeal	– 0.10 (0.058)	--	0.08 (0.085)	--
Behavioral directives	– 0.07 (0.066)	--	0.30 ^{**} (0.113)	--
Irrationality appeal	– 0.18 (0.159)	--	0.24 (0.180)	--
Normative appeal	– 0.62 [*] (0.286)	--	--	--
Financial appeal	– 0.34 (0.175)	--	--	--
Regulatory appeal	0.07 (0.253)	--	--	--
Personal testimonial	– 0.11 (0.071)	--	0.22 (0.111)	--
Graphic imagery	– 0.31 (0.188)	--	– 0.31 (0.214)	--
Number of Adult/General-Targeted PSA Appearances in Previous State-Year / 100:				
Overall	– 0.02 (0.010)	– 0.01 (0.010)	--	--
Health consequences to self and others	– 0.02 (0.015)	--	--	– 0.03 (0.037)
Anti-industry appeal	– 0.03 (0.019)	--	--	– 0.03 (0.030)
Social consequences to self	– 0.09 (0.061)	--	--	– 0.09 (0.083)
Efficacy appeal	– 0.02 (0.016)	--	--	0.01 (0.029)
Behavioral directives	0.21 (0.169)	--	--	0.23 (0.175)
Irrationality appeal	– 0.02 (0.029)	--	--	– 0.02 (0.044)
Normative appeal	– 0.17 (0.155)	--	--	--
Financial appeal	– 0.04 (0.182)	--	--	--

Variable	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)	Model 4 B (SE)
Regulatory appeal	0.04 (0.046)	--	--	--
Personal testimonial	– 0.06 (0.036)	--	--	– 0.03 (0.047)
Graphic imagery	– 0.02 (0.035)	--	--	0.09 (0.073)
Number of Other Smoking-Related Ad Appearances in Previous State-Year:				
Print cigarette ads	– 0.01 (0.010)	– 0.01 (0.010)	– 0.01 (0.009)	– 0.01 (0.010)
Print smoking cessation ads	0.00 (<0.001)	0.00 (<0.001)	0.00 (<0.001)	0.00 (<0.001)
TV smoking cessation product ads / 100	0.11 (0.164)	0.11 (0.164)	0.12 (0.162)	0.09 (0.168)
# of TRUTH ads per state-year / 100	0.01 (0.011)	0.01 (0.011)	0.01 (0.011)	0.00 (0.011)
State-Level Variables, Previous State-Year				
# of location bans on cigarette use (range 0–8)	– 0.13 (0.096)	– 0.13 (0.096)	– 0.11 (0.095)	– 0.13 (0.099)
Per capita tobacco control funding (inflation adjusted)	– 0.02 (0.018)	– 0.02 (0.018)	– 0.02 (0.018)	– 0.02 (0.018)
Excise tax (dollars) per pack	– 1.93 ** (0.306)	– 1.93 ** (0.306)	– 1.94 ** (0.296)	– 1.97 ** (0.316)
Index of laws restricting youth access to tobacco	– 0.03 (0.018)	– 0.03 (0.018)	– 0.03 (0.018)	– 0.03 (0.019)
% of state GDP in a year generated from tobacco farming	6.20 ** (1.338)	6.20 ** (1.338)	6.45 ** (1.327)	6.43 ** (1.358)
% of state population that are less than 18 years old	– 0.21 ** (0.056)	– 0.21 ** (0.056)	– 0.18 ** (0.057)	– 0.22 ** (0.057)
% of state population that are Black/ African-American	– 10.14 ** (1.136)	– 10.14 ** (1.136)	– 10.09 ** (1.125)	– 9.99 ** (1.158)
% of state population that are Hispanic/ Latino	– 0.08 ** (0.014)	– 0.08 ** (0.014)	– 0.08 ** (0.014)	– 0.07 ** (0.014)
% of state population that are unemployed	– 0.07 (0.118)	– 0.07 (0.118)	– 0.06 (0.117)	– 0.08 (0.120)
Constant	25.34 ** (1.563)	25.34 ** (1.563)	24.58 ** (1.576)	25.69 ** (1.598)
Adjusted R-Squared	--	0.586	0.596	0.574
Number of Observations	357	357	357	357

Table notes

* denotes $p < .05$;

** denotes $p < .01$.

Models 1 presents coefficients for models where each state PSA variable was entered separately; in Models 2 through 4 the coefficients that are presented come from a single model. All models also include a dummy variable for each year in the observation period (except for 1998 as the omitted category).

Table 4

Correlation Matrix for State PSA Message Themes and Style Appearances

	Y Health	Y Industry	Y Social	Y Efficacy	Y Directives	Y Irrational	Y Testimony	Y Graphic
Youth (Y) Industry	0.7760	1						
Youth Social	0.5375	0.3233	1					
Youth Efficacy	0.6236	0.6995	0.3884	1				
Youth Directives	0.5601	0.6856	0.5622	0.6014	1			
Youth Irrational	0.4572	0.3354	0.2403	0.2237	0.1953	1		
Youth Testimony	0.6167	0.4092	0.0314	0.3441	0.0277	0.1761	1	
Youth Graphic	0.3300	0.2139	0.3083	0.4066	0.2433	0.2638	0.2326	1
Adult/General (A) Health	0.3488	0.2916	-0.0063	0.1732	0.0661	0.3436	0.3048	-0.0133
Adult/General Directives	0.2106	0.4337	0.0151	0.4270	0.4513	0.1165	0.0571	-0.0152
Adult/General Social	0.0891	0.1095	-0.0265	0.1033	-0.0033	0.1016	0.1107	0.0047
Adult/General Efficacy	0.2992	0.2594	0.0002	0.0572	0.0607	0.3577	0.1660	-0.0442
Adult/General Industry	0.2004	0.1840	-0.0226	0.0743	-0.0145	0.3326	0.1356	-0.0164
Adult/General Irrational	0.2755	0.1522	-0.0211	0.0475	-0.0024	0.2451	0.3141	-0.0137
Adult/General Testimony	0.3438	0.3170	-0.0223	0.1125	-0.0087	0.6531	0.1962	-0.0069
Adult/General Graphic	0.1960	0.1646	-0.0387	0.0833	0.0526	0.1616	0.2051	-0.0238
Adult/General Industry	0.7537	1						
Adult/General Social	0.6555	0.4711	1					
Adult/General Efficacy	0.8307	0.6414	0.4497	1				
Adult/General Directives	0.2101	0.0962	0.1386	0.2143	1			
Adult/General Irrational	0.7238	0.5948	0.5064	0.7259	0.1154	1		
Adult/General Testimony	0.6373	0.4468	0.4699	0.5717	0.1850	0.4666	1	
Adult/General Graphic	0.8203	0.7440	0.6461	0.6530	0.1733	0.7428	0.4173	1