

Original article

Association Between National Smoking Prevention Campaigns and Perceived Smoking Prevalence Among Youth in the United States

Kevin C. Davis, M.A.*, James M. Nonnemaker, Ph.D., and Matthew C. Farrelly, Ph.D.

RTI International, Research Triangle Park, NC 27709

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Abstract

Purpose: To understand the potential effects of anti-smoking media campaigns on perceived peer smoking prevalence, a noted predictor of smoking initiation and prevalence among youth.

Methods: We used cross-sectional time series data from the Legacy Media Tracking Surveys (LMTS), a nationally representative telephone survey of approximately 35,000 12- to 17-year-olds in the United States. Exposure to the truth campaign and the “Think. Don’t Smoke” (TDS) campaign was measured with a series of questions on self-reported recall of the campaigns in general and of specific ads from each campaign. Perceived smoking prevalence was the primary outcome variable, measured using the LMTS question: “Out of every 10 people your age, how many do you think smoke?” We estimated a series of multivariable models to assess the association between perceived smoking prevalence and exposure to the truth and TDS campaigns in the United States.

Results: Findings indicate that exposure to the truth campaign was negatively and significantly associated with perceived smoking prevalence, whereas the TDS campaign was not associated with perceived smoking prevalence. These findings were consistent across several different measures of exposure to the campaigns.

Conclusions: This study highlights the potential impact of anti-smoking media campaigns on precursors to smoking and suggests that the truth campaign may have an impact on youth’s perceptions of smoking prevalence. Given the documented relationship between perceived smoking prevalence and smoking initiation, the findings highlight the need for further examination of perceived smoking prevalence as a mediating factor through which media campaigns may affect smoking behaviors. © 2007 Society for Adolescent Medicine. All rights reserved.

Keywords: Perceived smoking prevalence; Youth smoking prevention; Smoking perceptions; Anti-smoking media campaigns

Research has shown that adolescents, regardless of smoking status, overestimate actual smoking rates among their peers [1–6]. This phenomenon is commonly described as a “false consensus” or “pluralistic ignorance” about adolescent smoking behavior [7–9]. Perceived peer smoking prevalence has been shown to be predictive of future smoking behavior among adolescents in both longitudinal and

cross-sectional studies [10–12]. Links between misperceptions and downstream behaviors have also been well documented for alcohol, drug use, and other health and problem behaviors, such as eating disorders in adolescents and young adults [13–18]. This evidence suggests that perceived smoking prevalence can be an important precursor to behavior change and thus is a salient risk factor upon which to intervene.

Recent anti-smoking campaigns have used message strategies tailored to creating realistic perceptions of smoking prevalence. For example, the Vermont Tobacco Control Program’s media campaign, targeted to 10- to 13-year-olds, has used the message that “8 out of 10” teens do not smoke

RTI International is a registered trade name of Research Triangle Institute.

*Address correspondence to: Kevin C. Davis, RTI International, 3040 Cornwallis Road, Research Triangle Park, NC 27709.

E-mail address: kcDavis@rti.org

[19]. Other campaigns have used less directive messages to denormalize tobacco. For example, the original Florida TRUTH campaign, Minnesota's "Target Market" campaign, and the American Legacy Foundation's (Legacy's) "truth" campaign attempted to challenge perceptions that rebelliousness and smoking are synonymous. These campaigns instead portrayed "risk taking" youth as being independent of tobacco industry marketing [20].

Although perceived smoking prevalence has been a messaging platform in prior campaigns and perceived smoking has been shown to predict initiation, surprisingly few studies have investigated the impact of anti-smoking campaigns on perceived smoking prevalence. Siegel and Biener [21] found, in a sample of Massachusetts youth, that those exposed to anti-smoking advertisements at a baseline time period were more likely to report lower perceived smoking prevalence 4 years later, after baseline smoking status and other factors were controlled for. This study further suggested that perceived smoking prevalence may mediate the effects of media campaigns on smoking behaviors.

Recent evaluation data on the truth campaign provide an opportunity to explore the relationship between anti-smoking campaigns and tobacco-related social norms in greater detail under a national setting. At the time of its launch in 2000, the campaign differed from other national campaigns in that it was marketed as a youth brand, delivering facts and messages about the tobacco industry through a variety of television advertisements that feature risk-taking teens. These ads were designed to avoid directive statements that tell youth not to smoke. This approach is consistent with persuasion techniques cited in social norms theory, suggesting that to create desired norm corrections, messages must convey information without using directives that tell youth what to do [22]. Studies by Farrelly et al. [20, 23] have shown the truth campaign to be associated with anti-tobacco industry attitudes, lower intentions to smoke, and lower smoking prevalence among youth in the United States.

Other national campaigns, such as Philip Morris' "Think. Don't Smoke" (TDS), took dramatically different approaches. The TDS campaign, which aired nationally between 1998 and 2002, featured role model youth who state their reasons for not smoking, such as "my mind" and "my body" and are committed to not smoking [20]. Prior studies suggest that messages used in tobacco industry-sponsored campaigns have been carefully chosen to minimize their impact on youth smoking [24]. Although we cannot speculate on the design process of tobacco industry-sponsored campaigns, our data allow us to examine the association between the TDS campaign and perceived smoking prevalence.

We use a national survey of youths to estimate the association between exposure to the truth and TDS campaigns and perceived smoking prevalence. Given prior longitudinal evidence on the link between perceived smoking and smoking initiation, and evidence on the truth cam-

aign's effects on smoking behavior [23], our findings shed light on the role of perceived smoking prevalence as an important intermediate outcome to consider when assessing the effectiveness of anti-smoking campaigns.

Methods

This study used data from eight cross-sectional waves of the Legacy Media Tracking Surveys (LMTS) conducted via telephone between winter 1999 and fall 2003. LMTS was created to monitor youth awareness of the truth campaign and changes in tobacco-related outcomes. LMTS also assessed awareness of other national campaigns, including the TDS campaign. LMTS contains nationally representative samples of youth aged 12–17 years and young adults aged 18–24 years. Because adolescents are the target audience of the truth and TDS campaigns, we limited our analysis to 12- to 17-year-olds ($N = 35,074$). The eight waves of LMTS had overall response rates of 52.5%, 52.3%, 60.4%, 46.7%, 51.7%, 53.1%, 42.5%, and 30.1% [25]. To increase representation of Hispanic ($N = 6,293$), African-American ($N = 5,174$), and Asian ($N = 2,885$) youth, LMTS oversampled telephone exchanges in areas with high proportions of households with these groups. Additional oversampling of Hispanic and Asian youth was accomplished using household lists with Hispanic and Asian surnames. All analyses were conducted with sampling weights to correct for oversampling and nonresponse. Standard errors were adjusted for the stratified design of LMTS using Stata's "svy" estimators [26].

Perceived smoking prevalence

Perceived smoking prevalence was measured using an LMTS question that asked youth, "Out of every 10 people your age, how many do you think smoke?" Responses to this question ranged from 0 to 10. This measure is similar to that used in other studies, such as Sussman et al. [4], which measured the same construct with alternative denominator references (e.g., "Out of every 100 students . . .").

Exposure to anti-smoking media campaigns

Exposure to the truth and TDS campaigns was assessed using three self-reported measures from LMTS, including confirmed awareness of specific campaign advertisements and prompted and unprompted recall of campaign brands. We also used gross ratings points (GRPs) data to create an additional market-level measure of truth campaign exposure, allowing us to assess the robustness of campaign effects across multiple measures of exposure. These measures are described in detail below.

Confirmed awareness of specific smoking prevention ads

Awareness of specific television advertisements from the truth and TDS campaigns was measured using a construct identical to that in Farrelly et al. [20]. LMTS asks youth

whether they have “recently seen an anti-smoking or anti-tobacco ad on TV that shows . . .” followed by a brief description of the beginning of the ad. These questions provide enough information for respondents who have seen the ad to recognize which ad the question is referring to, but not enough information to falsely indicate awareness [20,27,28]. To confirm that a respondent saw the ad, those who indicated initial recognition were asked to report further details about what happens in the ad. Respondents who accurately described the ad were considered to have “confirmed awareness.” A dichotomous indicator of campaign awareness was then defined as having confirmed awareness of one or more advertisements from each campaign respectively. LMTS included questions about ads that aired within approximately 6 weeks preceding the survey or were currently airing during the survey period.

Unprompted and prompted recall of campaign brands

Our measures of unprompted recall for each campaign assessed whether or not youth were able to recall specific campaigns off the top of their mind without the aid of mentions of the campaign brand names. Unprompted recall was constructed from a two-part question that first asked, “Are you aware of any advertising or campaigns against smoking or against cigarette companies that are now taking place?” Youth who answered “yes” were then asked “What are the themes/slogans of this advertising or campaigns?” Participants were allowed to provide multiple answers to the second question. Respondents who answered “yes” to the first question and then specifically mentioned the truth campaign in the follow up question were defined as having unprompted recall of the truth campaign. Unprompted recall of the TDS campaign was similarly defined.

Although some youth may not remember specific campaigns from the top of their mind, their recall may be triggered by cues or mentions of specific campaign brand names. Prompted campaign recall was constructed using a question that asked “Have you seen or heard any anti-smoking advertising or campaigns with the following themes or slogans?” The truth and TDS campaign brand names were then read to each participant and they were asked to indicate whether or not they recalled these campaigns. Youth who indicated “yes” to the truth campaign were defined as having prompted recall of the truth campaign. Prompted recall of the TDS campaign was defined in the same way.

Market-level exposure to the truth campaign

Market-level exposure to the truth campaign was measured with quarterly GRP data compiled by the campaign’s media contractor. GRPs, based on youth television ratings for programs that aired campaign ads, measure the relative campaign “dose” in each of 210 media markets in the United States. Following methods used in Farrelly et al.

[23], we assigned truth GRP values to youth in LMTS based on the survey year, quarter, and media market in which participants resided. Each respondent’s market-level exposure was then defined as the total number of truth GRPs delivered to their media market from the beginning of the campaign until the time of their survey. Because the campaign launched in February 2000, market-level exposure equaled zero for participants in the fall/winter 1999 LMTS.

As expected, truth GRPs were correlated with self-reported measures of exposure to the truth campaign. Using a five-level categorization of truth GRPs, with 1 representing the lowest dose markets and 5 representing the highest dose markets, we found that 52.8% of youth in the lowest dose markets had confirmed awareness of truth compared to 67.6% confirmed awareness among youth in the highest dose markets, a statistically significant difference. GRPs vary considerably across media markets, providing an opportunity to estimate perceived smoking prevalence as a function of an exogenous measure of market-level differences in GRPs. Because GRPs are exogenous they should be uncorrelated with pre-existing levels of perceived smoking prevalence, implying that GRPs are not subject to selective attention bias and can be used as a valid alternative measure of campaign exposure. This also allows triangulation of findings derived from self-reported measures of campaign recall.

Potential confounders

Our analyses follow the principles of the socio-ecological model [29], which acknowledges that there are multiple influences on perceptions that occur at many levels within one’s social and physical environment. We therefore control for an extensive set of potential confounding influences at the individual, media market, and state levels. These measures are described below.

Individual level

Our models included control variables for age, gender, race/ethnicity, weekly spending money, and religiosity. We created indicator variables for race/ethnicity (African American, Hispanic, Asian, and other race, with white as the reference). Weekly spending money was measured using two LMTS questions that assessed how much money youths earned per week from a job and other sources such as allowances. Religiosity was measured as an indicator for whether the youth attended religious services often. We also included indicator variables for whether the participant lived in a two-parent household, the presence of a smoker in the home, and whether smoking was permitted everywhere in the home. In addition, we included a measure for the average number of hours spent watching television per day. We also included an indicator variable for whether the respondent had smoked in the past 30 days and a variable for the number of the respondent’s four closest friends who smoked.

We controlled for exposure to images of smoking in movies and television. Previous studies suggest that youth with greater exposure to images of smoking in movies are more likely to initiate smoking [30–35]. This was measured by an indicator variable for having often or sometimes, during the past week, viewed television shows or movies in which someone was smoking.

Our models also controlled for whether the interviewer believed someone else was listening on the telephone during the survey, to account for the possibility of respondents giving socially desirable answers. We also included a time-trend variable measuring the number of months elapsed between the launch of the truth campaign and the interview date. This variable allowed us to capture the length of time that the campaign had been on air and to control for national trends in perceived smoking prevalence.

Media market level

Given that truth GRPs vary across markets in the U.S., it is important to control for factors that may be correlated with both the dose of the truth campaign and pre-existing levels of perceived peer smoking in a media market. For example, low-exposure media markets tend to be more rural, to have lower income, and to be less well educated—all factors that are associated with smoking and that are potentially associated with perceived smoking prevalence. To account for these factors, we included separate variables for two aggregate media market characteristics: (1) median household income, and (2) percentage of the media market that are college graduates.

State level

To account for state level influences that are fixed over time, we included state-specific dummy variables. These variables adjust for the possible effects of unmeasured, time-invariant state characteristics that are associated with perceived smoking prevalence. For example, Utah and North Carolina have differing smoking prevalence, which likely results in different levels of perceived smoking prevalence. State-specific indicator variables control for these types of fixed differences across states, reducing the chance that those differences confound our estimates of truth campaign effects on perceived smoking prevalence.

Multivariable analysis

We estimated a series of multivariable regression models, via ordinary least squares (OLS) that assessed how exposure to the truth and TDS campaigns is associated with perceived smoking prevalence. To aid in the interpretation of model coefficients, the dependent variable was scaled so that the media exposure coefficients are interpreted as the percentage point difference in perceived smoking prevalence between those with and without exposure. Because the dependent variable is a discrete count ranging from 0 to 10, we estimated an alternative set of count-data models using negative binomial regressions [36]. Results from these mod-

els were similar to the OLS results and did not indicate significant differences in the estimation strategy.

We estimated four separate models using each of the exposure measures described previously: (a) confirmed awareness, (b) unprompted campaign brand recall, (c) prompted campaign brand recall, and (d) market-level GRPs. In specification (d), GRPs were scaled so that model coefficients represent the change in perceived smoking prevalence given an increase of 10,000 GRPs. We also included a quadratic term for GRPs (GRPs squared) to account for diminishing campaign effects at higher levels of exposure. Inclusion of quadratic GRPs is based on both the practical consideration of campaign “wear out” and prior literature [23] that suggests higher levels of exposure will not infinitely generate changes in smoking-related outcomes. Because GRP data were not available for the TDS campaign, we controlled for awareness of TDS in this model by including an indicator variable for confirmed awareness of at least one TDS ad. This model was estimated using Stata’s “cluster” option to account for the likelihood of within-market correlations.

Results

National trend

The LMTS data suggest that perceived smoking prevalence declined nationally during a 3-year period, from early 2000 to late 2003 (Table 1). Perceived smoking prevalence among 12- to 17-year-olds decreased from 45.4% to 37.5% between winter 1999/2000 and fall 2003, a decrease of 17.4% ($p < .05$). However, this decline slowed by the fall 2002 and 2003 surveys. To compare this decline with trends in actual smoking, we included trend data on the prevalence of self-reported current smoking from LMTS. Current smoking was defined as having smoked on at least 1 day in the past 30 days. Trend data on actual smoking prevalence exhibit a similar decline from 12.7% to 7.6% between the first and last LMTS waves. Linear trend tests indicated that both trends summarized in Table 1 were statistically significant ($p < .05$).

Table 1
Perceived and actual smoking prevalence among 12- to 17-year-olds

LMTS wave	Actual smoking prevalence (%)	Perceived smoking prevalence (%)
Winter 1999/2000 (n = 3,428)	12.7 (10.6, 14.7)	45.4 (43.9, 46.9)
Fall 2000 (n = 6,219)	11.7 (10.1, 13.2)	42.1 (40.9, 43.2)
Spring 2001 (n = 6,760)	12.7 (9.9, 15.5)	40.3 (38.4, 42.1)
Spring 2002 (n = 7,327)	9.4 (7.0, 11.7)	39.0 (37.5, 40.9)
Summer 2002 (n = 941)	8.9 (6.0, 11.9)	38.3 (35.7, 40.4)
Fall 2002 (n = 3,495)	7.4 (5.6, 9.2)	38.9 (37.1, 40.7)
Spring 2003 (n = 3,426)	10.8 (7.7, 12.7)	38.5 (36.5, 40.5)
Fall 2003 (n = 3,433)	7.6 (6.1, 9.0)	37.5 (36.1, 38.9)

Data in parentheses are 95% confidence intervals unless otherwise noted.
LMTS = Legacy Media Tracking Survey.

Table 2
Ordinary least squares regression coefficients showing the association between exposure to anti-smoking campaigns and perceived smoking prevalence

Explanatory variable	Specification			
	a	b	c	d
Exposure to “truth”	−1.37*	−1.67*	−1.58*	−5.50**
Exposure to “Think. Don’t Smoke”	−.73	.08	−.51	−.45
Aware of smoking in movies/television	3.24**	3.51**	2.99**	3.13**
Months since “truth” launch	−.11**	−.10**	−.04	−.08*
Age	1.92**	1.70**	1.98**	1.89**
Male	−3.77**	−2.70**	−3.60**	−3.80**
African-American	7.85**	7.76**	7.34**	7.83**
Hispanic	4.69**	5.26**	4.02**	4.64**
Asian	−.39	.40	.08	−.37
Other race	3.05*	2.12	2.49	3.09*
Current smoker	.68	1.04	−.26	.70
Lives with both parents	−3.11**	−2.52*	−3.05**	−3.02**
Attends religious services often	.54	1.33	.90	.62
Smoker lives in household	3.42**	3.43**	3.04**	3.38**
No rules against smoking in home	.19	.92	.62	.23
Daily hours of television	.36**	.57**	.35**	.35**
Weekly income	.80**	.61	.73*	.82**
Number of four closest friends who smoke	8.01**	8.22**	8.47**	8.01**
Median media market income	.03	.09	.02	.04
Percentage of media market population with college education	−2.04	−2.86	−2.18	−1.92

All models include state indicator variables, which were jointly statistically significant in each model ($p < .005$). Antismoking media exposure specifications are (a) confirmed awareness of at least one ad, (b) unprompted recall of specific campaign, (c) prompted recall of specific campaign, and (d) market-level gross rating points for “truth” and confirmed awareness of “Think. Don’t Smoke.”

* Significant at $p < .05$.

** Significant at $p < .01$.

Association with anti-smoking campaigns

Findings on the association between exposure to anti-smoking media campaigns and perceived smoking prevalence from the OLS models are presented in Table 2. Columns a, b, and c in Table 2 show regression coefficients from models using the three different specifications of self-reported campaign exposure (confirmed awareness, unprompted recall, and prompted recall, respectively), whereas column d shows results from our model using truth GRPs to measure market-level exposure to the truth campaign.

All self-reported measures of exposure to the truth campaign were associated with lower perceived smoking prevalence. Youth who indicated confirmed awareness of the truth campaign were estimated to have a 1.4–percentage point lower perceived smoking prevalence compared with youth who did not indicate confirmed awareness ($p < .02$) (column a). Similar associations were found for self-reported unprompted and prompted recall of the campaign brand. Youth who recalled the truth campaign without the aid of references (i.e., unprompted recall) indicated perceived smoking rates that were 1.7 percentage points lower than those reported by youth who did not indicate unprompted recall of the campaign ($p < .04$) (column b). When directly prompted, youth who indicated awareness of

the truth campaign reported perceived smoking rates 1.6 percentage points lower than youth who did not indicate prompted recall ($p < .03$) (column c).

Our model using market-level truth campaign GRP data to measure campaign exposure yielded similar results, suggesting that higher market-level doses of the campaign was associated with lower perceived smoking prevalence ($p < .01$) (column d). This finding mirrors the reported association between truth GRPs and youth smoking in Farrelly et al. [23]. Although this model provides further evidence of truth campaign effects on perceived youth smoking prevalence, it also validates our results on self-reported measures of truth exposure.

We did not find evidence of an association between the TDS campaign and perceived smoking prevalence. All model coefficients for the relationship between TDS and perceived smoking prevalence were small and statistically nonsignificant.

Discussion

Our findings suggest that the truth campaign may be effective in correcting norms regarding youth smoking. Realistic norms may be implicitly reinforced by the cam-

paig'n's strategy to associate images of rebelliousness (attributes usually associated with smoking) with independence from the tobacco industry, offering a model of alternative perceptions. This approach is consistent with social norms theory, which holds that norms corrections are generated by providing information without using directive messages that tell youth what to do [13]. Rebelliousness is also often looked upon favorably by youth. Youth portrayed in truth ads are never shown to smoke, which may reinforce the notion that youth who resemble those in truth ads do not necessarily smoke.

These findings might also be understood under cognitive dissonance theory, which outlines the determinants of perceptions and what happens when perceptions are challenged. According to Festinger [37], cognitive dissonance is an uncomfortable feeling that arises when persons find themselves engaging in behaviors or holding opinions that contradict reality. This feeling then motivates a change in prior misperceptions for purposes of lessening dissonance. By portraying risk-taking youth, the truth campaign may create a moderate level of dissonance among its viewers in associating images of rebelliousness with independence from the tobacco industry. By associating these images with tobacco industry independence, the campaign may challenge the misperception that risk-taking youth smoke at high rates.

We did not find significant associations between exposure to the TDS campaign and perceived youth smoking prevalence. Youth portrayed in TDS advertisements are typically "role model" teenagers who discuss their reasons for not smoking and appear to have a commitment not to smoke. This portrayal is consistent with the expectation that low-sensation seeking youth are less likely to smoke, which is in line with common perceptions about the prevalence of smoking among these youth. Therefore, it is possible that the TDS campaign generated comparatively lower levels of dissonance in regard to social norms about youth smoking, resulting in little association with perceived smoking prevalence.

As noted earlier, perceived smoking prevalence has been shown to be predictive of smoking in both longitudinal and cross-sectional studies [10–12]. Siegel and Biener [21] suggested that the effects of a Massachusetts smoking prevention campaign on smoking initiation among youth may have been partially mediated by the campaign's effects on perceived smoking prevalence. Given recent findings on the association between the truth campaign and smoking behaviors [23], our results are consistent with this interpretation. Because telephone surveys are ill-suited for measuring smoking prevalence, due to underreporting, we could not test this hypothesis with more complex analytic techniques, such as structural equation modeling.

Our study is limited by the cross-sectional design with self-reported measures of awareness, which are susceptible

to selective attention bias, whereby respondents who have pre-existing lower levels of perceived smoking prevalence may be more likely to recall the campaign. Results from our models using market-level GRP data, however, suggest that our findings are not biased by selective attention. Unlike self-reported measures of exposure, market-level GRPs are exogenous to individual-level characteristics and therefore are uncorrelated with pre-existing perceived smoking.

A second potential caveat to our findings is modest effect sizes. There are a number of factors that make modest effect sizes expected in this study. The LMTS sample included significant oversampling of underrepresented racial/ethnic groups. This leads to higher design effects and lower effective sample sizes. Our models also include an extensive set of covariates to control for as many confounding influences as possible, including state fixed effects, which may further reduce estimated effect sizes.

Another limitation is the potential for endogeneity among model covariates, which could lead to biased estimates of truth campaign effects. To assess the potential for endogeneity bias, we estimated a model using truth GRPs as the campaign exposure variable and included only covariates for exogenous factors—age, race, gender, media market income and education, and state dummy variables. All potentially endogenous variables were excluded from this model. Findings from this model were not significantly different from those reported under specification (d) in Table 2, suggesting that the estimated campaign effects are not sensitive to the inclusion/exclusion of potentially endogenous independent variables.

Finally, declining response rates over time are a potential concern. Although declining response rates are well documented for telephone data collection, we do not believe this biases our results. With the exception of the last two waves of LMTS, each survey achieved near or above 50% response rates. Furthermore, the unweighted sample characteristics are virtually identical across all survey waves, suggesting the sample has not changed over time. Finally, our main analytic findings are unchanged when our models are estimated using only the first six waves of data, excluding the last two waves with lower response rates.

In summary, our study provides evidence of the potential impact of anti-smoking campaigns on perceived peer smoking prevalence, and highlights their value as potentially effective interventions. These findings suggest the need for further analysis of perceived smoking prevalence as a possible mediator through which anti-smoking campaigns may work. More generally, our study highlights the importance of considering perceived smoking as part of a message strategy for creating realistic perceptions about smoking, as well as prudence in measuring perceived smoking prevalence as an intermediate evaluation outcome.

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