The Influence of the National truth® Campaign on Smoking Initiation

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Background: States and national organizations spend millions annually on antismoking campaigns aimed at youth. Much of the evidence for their effectiveness is based on cross-sectional studies. This study was designed to evaluate the effectiveness of a prominent national youth smoking-prevention campaign in the U.S. known as truth® that was launched in February 2000.

Methods: A nationally representative cohort of 8904 adolescents aged 12–17 years who were interviewed annually from 1997 to 2004 was analyzed in 2008. A quasi-experimental design was used to relate changes in smoking initiation to variable levels of exposure to antismoking messages over time and across 210 media markets in the U.S. A discrete-time hazard model was used to quantify the influence of media market delivery of TV commercials on smoking initiation, controlling for confounding influences. Based on the results of the hazard model, the number of youth nationally who were prevented from smoking from 2000 through 2004 was estimated.

Results: Exposure to the truth campaign is associated with a decreased risk of smoking initiation (relative risk=0.80, p=0.001). Through 2004, approximately 450,000 adolescents were prevented from trying smoking nationwide. Factors negatively associated with initiation include African-American race (relative risk=0.44, $p<0.001$), Hispanic ethnicity (relative risk=0.74, $p<0.001$), completing high school (relative risk=0.69, $p<0.001$), and living with both parents at baseline (OR=0.79, $p<0.001$).

Conclusions: The current study strengthens the available evidence for antismoking campaigns as a viable strategy for preventing youth smoking.

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Introduction

Controlled field experiments provide consistent evidence that antismoking media campaigns are effective in reducing youth smoking when paired with complementary school or community interventions.[1] In contrast, similar experiments that feature a media campaign alone show mixed results.[1] However, population-based studies of state and national antismoking campaigns aimed at preventing youth smoking show more consistent evidence, but much of this evidence is based on cross-sectional studies.[1–5] To attribute campaign effects, these studies should provide rigorous controls of potential confounders, demonstrate that the campaign reached a large proportion of the target audience and changed campaign-related beliefs and attitudes, and illustrate a dose–response relationship between exposure and smoking.[1,6] However, although cross-sectional studies have examined pre–post changes in population-level smoking prevalence in areas with and without a media campaign or with varying doses of a media campaign,[2–5] they cannot link an individual's campaign exposure to subsequent behavior change (e.g., initiating smoking). Population-based cohort designs provide the opportunity to test such a relationship.

To date, the only two longitudinal studies of statewide campaigns both found that youth who were exposed to a greater number of antismoking advertisements were less likely to become smokers.[7,8] Given the substantial investments that states and national organizations make in smoking-prevention campaigns, it is important to have a better understanding of their effectiveness in real-world settings and to test if they can be effective in the absence of complementary school- or community-based interventions. This knowledge is especially important because some national drug-prevention campaigns have failed to prevent cigarette and drug use among adolescents and may have even encouraged greater use.[9–11] One large national antismoking effort from the U.S. that warrants closer scrutiny is the truth®

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campaign, which spent $245 million on TV advertising from 2000 through 2004.

Building on the success of the Florida "truth" antismoking campaign,[8,12–14] the national truth campaign was launched in February 2000 and has continued to deliver TV commercials and other media to a primary audience of adolescents aged 12–17 years who are likely to experiment with smoking. Young adults aged 18–24 years are an important secondary audience. Campaign messages highlight deceptive tobacco industry marketing tactics and stark facts about the deadly nature of cigarette smoking.[15] A provocative and controversial commercial from early in the campaign showed youth piling 1200 body bags outside a major tobacco company's headquarters to graphically illustrate the daily death toll resulting from tobacco use.[16]

Previous research indicates that the national truth campaign reached approximately three fourths of those aged 12–17 years in its first year,[9] and that youth found truth commercials appealing.[17] Cross-sectional studies have shown that exposure to the campaign is associated with changes in tobacco-related beliefs, attitudes, and intentions to use[9,18–21]; perceptions of peer smoking[22]; and decreases in youth smoking.[3] However, with only one cross-sectional time–series study[3] demonstrating a negative correlation between exposure to the truth campaign and youth smoking, questions remain about the effectiveness of the campaign in reducing youth smoking.[23] Wakefield and colleagues[4] conclude that, to better understand the influence of antismoking campaigns aimed at adolescents, longitudinal studies are needed that make use of "different doses of advertising buy in media markets . . ." and use multilevel analytic approaches to account for the influence of other factors. To address this gap, a quasi-experimental design was used to examine whether exposure to truth commercials that varied considerably across 210 media markets from 2000 to 2004 influenced youth smoking initiation in a nationally representative longitudinal survey of youth aged 12–17 years, interviewed annually from 1997 to 2004.

Methods

Cohort Data

The data source for smoking initiation is the National Longitudinal Survey of Youth 1997 (NLSY97). The baseline NLSY97 is a nationally representative cross-sectional sample of 8984 adolescents aged 12–17 years during the initial survey round in January 1997.[24] The NLSY97 is designed to provide information about youth's transitions from school to the labor market and into adulthood. Members of the longitudinal cohort have been interviewed annually since 1997 and were aged 15–20 years when the truth campaign began in 2000. The survey is conducted through an in-person interview, with sensitive information collected via audio computer-assisted self-interview.[24] Data from Rounds 1–8 (1997–2004) of the NLSY97 were used in the analyses, which were conducted in 2008.

Outcome Measure

The outcome measure is the age of initiation of trying smoking based on three questions. At the baseline survey, everyone is asked: *Have you ever smoked a cigarette?,* and if yes: *How old were you when you smoked your first cigarette?* For respondents who had already tried smoking by the time of the baseline survey, the second question was used to determine the age of initiation. For subsequent surveys, respondents are asked: *Have you smoked a cigarette since the last interview . . .?* For those who say yes, the age of initiation was based on their age at the time of the survey.

Campaign Exposure

To reach the campaign's target audience, truth commercials were aired on select TV networks and TV programs popular with youth. From 2000 through 2002, the campaign aired advertisements on three broadcast TV networks with high teen viewership (i.e., FOX, UPN, WB) that were not uniformly available in all markets. Beginning in 2002, the campaign began to shift away from broadcast media to cable TV (e.g., MTV) to more efficiently reach the target audience. This targeted and evolving strategy translated into considerable variability in the quantity of TV commercials over time and across the 210 media markets in the U.S.

Potential exposure to the campaign was estimated by combining information on the specific programs on which truth commercials aired, the percentage of the target audience that watched these programs (a concept known as "reach"), and the frequency with which they aired. Ratings from TV provide estimates of reach and the frequency of exposure to each commercial. The industry standard for quantifying the reach and frequency of exposure to a campaign is known as gross rating points (GRPs). For example, if 75% of the target audience saw a commercial four times in a given quarter, this would translate into 300 GRPs (i.e., 75 × 4). Because the ratings for those aged 12–17 years represent averages for each market, this measure represents an adolescent's potential exposure to the campaign. An individual's actual exposure may be more or less than the average based on his or her particular TV viewing habits. In a large cross-sectional study, Terry-McElrath and colleagues[25] used GRPs for state antismoking campaigns and found that youth's exposure to these campaigns was associated with positive changes in attitudes and decreases in smoking.

Because it is hypothesized that it takes time to influence smoking behavior, the cumulative sum of exposure (GRPs) was calculated for each study participant for each wave of the survey based on the participant's media market of residence each year.[2,3,9] For example, if a market received 1000 GRPs per year, cumulative exposure would be 5000 GRPs by 2004 for a cohort member who lived in this market for all years. Exposure was set to zero for the pre-campaign period prior to February 2000. Note that NLSY97 does not ask about awareness of the truth campaign.

To understand how the campaign strategy led to differences in campaign exposure over the study period, cumulative exposure to truth from 2000 to 2004 was categorized and plotted into five levels of GRPs in Figure 1, which illustrates

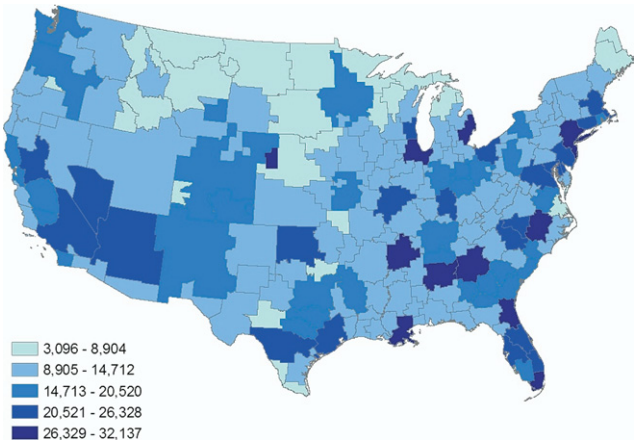

Figure 1. Cumulative exposure to the truth® campaign in GRPs, from 2000 to 2004

the considerable variability in market-level delivery of the truth campaign. This variability in potential exposure over time and across media markets creates a natural experiment that was used to examine how exposure to the campaign influences the risk of youth smoking initiation.

Confounders

Because the delivery of truth commercials was not explicitly random, it is important to account for individual, media market, and state-level influences that might confound the results.[26] Potential individual/family confounders include baseline measures for race/ethnicity, gender, total individual income, number of residents in the household, highest educational level achieved by the resident parents, living with both parents, ever being suspended from school, and perceived smoking prevalence. The last measure is based on the question: *What percentage of kids in your grade/in your grade when you were last in school smoke/smoked cigarettes?* Because the cohort begins with those aged 12–17 years, data from all waves were used to indicate whether the individual ultimately completed high school. To account for the possibility that markets that received relatively high levels of exposure to truth commercials are different from those that received lower levels of exposure, several market-level characteristics were controlled for, including average disposable family income, average high school completion rates, and percentage of the population living in rural areas. It is hypothesized that all three of these measures are correlated with smoking behaviors and exposure to truth.

Time-varying confounders include indicator variables for age for each time period, exposure to the truth campaign (cumulative GRPs), annual inflation-adjusted per capita state-level funding for tobacco control programs, and state cigarette prices. Finally, secular trends in smoking behavior were controlled for with separate indicators for year.

Statistical Analysis

To examine the impact of truth exposure on smoking initiation, the age at which each youth initiated smoking needed to be determined. The retrospective recall of the age of initiation allows the analysis to be extended for ages 5–24. As shown in Figure 2, this age range covers the period over which most initiation occurs. Respondents were excluded (n=79) from the analysis if their reported initiation age was ≤5 years. Because of missing or incomplete data, one additional respondent was excluded from the analysis, yielding a final sample size of 8904 (out of 8984).

Discrete-time survival analysis was used to assess the influence of the truth campaign on smoking initiation. The analytic approach began with all sample members who never smoked and then estimated the risk of smoking initiation as the sample of youth ages. In these models, once the "event" in question (i.e., experimenting with smoking) occurred, the sample member was dropped from subsequent time periods. This process allowed the calculation of the probability that an individual will initiate smoking for each age represented in the sample, given that they had not previously begun smoking. Specifically, a discrete-time equivalent to a continuous-time Cox proportional hazard model known as a complementary log–log model was estimated to examine the transitions from never smoking to trying smoking.[27,28]

Because potential exposure to truth was measured as a continuous variable with a large range of values from 3096 to 32,137 GRPs, exposure was scaled by 10,000 so that the hazard (or risk) ratio represented the change in the risk of smoking for an increase in 10,000 GRPs. In addition, to illustrate the influence of the campaign on smoking initiation, the actual risk of smoking by age and the risk of smoking by age in the absence of the truth campaign (i.e., if GRPs were equal to zero) were plotted. The standard errors in the hazard model are adjusted to account for the clustering of individuals within media markets—the source of variation in campaign exposure.

Results

Exposure to the truth campaign is associated with a decreased risk of smoking initiation (p=0.001; Table 1). An increase in cumulative campaign exposure of 10,000 GRPs is associated with a 20% decrease in the risk of initiation. Another way to illustrate the effect size of the truth campaign exposure is shown in Figure 2, which illustrates the proportion of the sample who initiated smoking by age, conditional on not previously initiating (the actual hazard rate), and the estimated proportion (based on the multivariable model) of the sample who would have initiated smoking in the absence of the truth campaign. The difference between the two proportions represents the difference attributable to the truth campaign. For example, 6.8% of those aged 20 years initiated smoking (among those who had not previously initiated). The model predicts that in the absence of the truth campaign, this percentage would

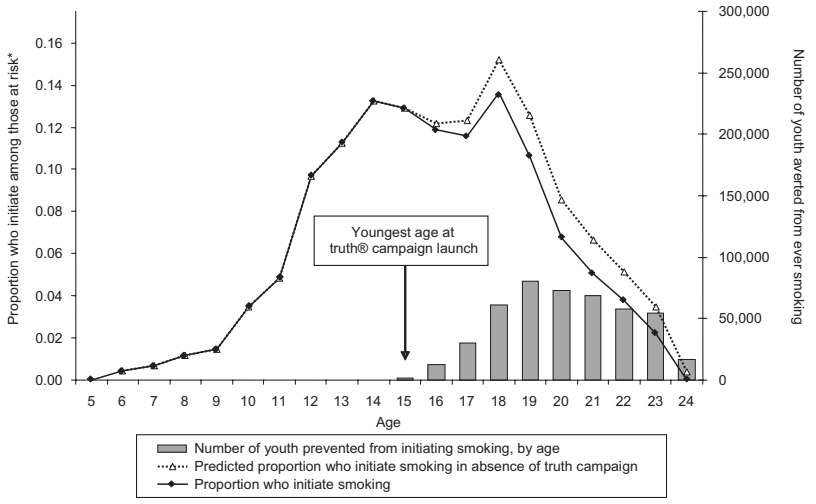

Figure 2. Initiation hazard by age—actual and estimated smoking initiation in absence of truth® campaign, NLSY97 Cohort, 1997–2004
*Proportion who initiate by age as a proportion of all who have not previously initiated

have been higher at 8.5%, or a relative risk for this comparison of 0.80 ([hazard with truth campaign]/[hazard in absence of truth campaign]=[6.8%/8.5%]=0.80). This difference translates to approximately 73,000 fewer adolescents initiating smoking nationwide. Summing these differences across ages 15–24 years, the age range of the cohort during the truth campaign (2000–2004), translates to 456,281 fewer smokers attributable to the truth campaign.

Several other factors were associated with a decreased risk of smoking initiation, including high school graduation (relative risk=0.69, $p<0.001$), African-American race (relative risk=0.44, $p<0.001$), Hispanic ethnicity (relative risk=0.74, $p<0.001$), other race (relative risk=0.78, $p=0.007$), and lived with both parents at baseline (relative risk=0.79, $p<0.001$; see Table 1). Factors associated with an increased risk of smoking initiation include perceived smoking prevalence at baseline (relative risk=1.09, $p<0.001$), ever being suspended from school at baseline (relative risk=1.77, $p<0.001$), baseline income (in $10,000s) (relative risk=1.31, $p<0.001$), and highest parental education of college graduate (relative risk=1.13, $p=0.011$).

Discussion

Exposure to the truth campaign has an independent influence on smoking initiation above and beyond multiple individual, media market, and state-level influences. These results are robust to alternative model specifications. For example, excluding respondents who reported their age of initiation retrospectively at baseline from the analysis yielded similar findings. The collection of studies on the truth campaign have demonstrated that the campaign reached a large proportion of the target audience and that exposure to the campaign is associated with changes in campaign-targeted beliefs, attitudes, perceptions, and behaviors. Although the influence of state tobacco-control program activities was accounted for, it is possible that these activities created an environment that enabled the truth campaign to have an influence on smoking. Additional analyses to test for synergies (i.e., interactions) between the truth campaign and funding for state tobacco-control programs showed no such relationship, in contrast to a previous study that showed a synergy between state and national prevention campaigns.[29] However, the measure of state tobacco-control program activities (i.e., annual per capita funding for state tobacco-control programs) is limited because it cannot distinguish between funding directed to youth versus adults or to mass media campaigns versus other interventions.

The inherent variability in campaign exposure provided a natural experiment, and the extensive control of multiple other influences lends credibility to the

Table 1. Complementary log–log model of smoking initiation, National Longitudinal Survey of Youth 1997 Cohort, 1997–2004

Explanatory variable	Hazard ratio (95% CI)	*p*-value
Cumulative truth® campaign exposure (in 10,000s of gross rating points)	0.80 (0.71, 0.91)	0.001
Race/ethnicity (ref=non-Hispanic whites)		
African American	0.44 (0.41, 0.47)	0.000
Hispanic	0.74 (0.66, 0.83)	0.000
Other race	0.78 (0.65, 0.94)	0.007
Completed high school	0.69 (0.64, 0.75)	0.000
Male	1.06 (0.995, 1.13)	0.071
Household size	0.98 (0.96, 1.000)	0.052
Total individual income	1.31 (1.17, 1.47)	0.000
Lives with both parents	0.79 (0.74, 0.85)	0.000
Highest parental education (ref≤high school)		
High school	1.02 (0.93, 1.12)	0.661
College graduate	1.13 (1.03, 1.23)	0.011
Postgraduate	0.96 (0.86, 1.08)	0.507
Perceived smoking prevalence	1.09 (1.08, 1.1)	0.000
Ever been suspended from school	1.77 (1.67, 1.88)	0.000

Note: Additional control variables include average market-level family income, average market-level high school completion rates, percentage of market population living in rural areas, missing parental education indicator, inflation-adjusted state cigarette prices, per capita funding for state tobacco control programs, year indicator variables, and age indicator variables.

observed relationship between campaign exposure and smoking initiation. These findings are bolstered by previous studies that have demonstrated the effectiveness of the truth campaign. However, despite paying careful attention to potential threats to study validity, the study has a number of limitations, including its nonrandomized design and the ability to account for potentially important confounders (e.g., parental and peer smoking, exposure to marketing of smoking-cessation aids).[30] First, the measure of exposure represents an individual's potential, not actual, exposure to the truth campaign. This measurement error will bias the observed effects toward the null.[31] However, individual self-reports of campaign recognition have their own limitations, including falsely reporting awareness and selective reporting of awareness tied to study outcomes.[31] Consequently, Slater[31] concludes that exogenous measures of campaign exposure based on TV ratings, such as the measure from the current study (GRPs), lead to stronger causal inferences than self-reported measures of campaign awareness.

Second, because the results rely on self-reported smoking behavior, the influence of the truth campaign may be overstated, which may be possible if, rather than decreasing smoking initiation, the campaign merely led to increased rates of under-reporting of smoking as a result of social desirability. In other words, if the campaign succeeded in making smoking less socially attractive, some youth may not admit to trying smoking even if they did. However, a study by Messeri and colleagues[32] found no correlation between truth exposure and under-reporting of smoking status. A final limitation is that only initiation to ever smoking was examined, not more regular daily or established smoking.

Initiation to ever smoking was examined for two reasons: (1) The primary goal of the truth campaign was to prevent initiation of smoking; and (2) The NLSY does not provide retrospective information on the age of initiation to regular smoking, only trying smoking. As a result, analyses that examine the progression to more regular smoking are limited to the subset of respondents who did not initiate smoking by the time of the baseline survey. However, analyses examining the influence of truth exposure on the progression from ever smoking to more regular smoking provide additional support for the current analyses. In addition, other studies highlight the importance of preventing adolescents from trying smoking, indicating that between one third and one half of adolescents who try smoking become regular smokers.[33]

The current study highlights the potential impact that a well-executed antismoking campaign can have on youth smoking, especially in the context of other evidence-based tobacco control interventions.[34] Findings suggest that approximately 450,000 fewer adolescents and young adults initiated smoking as a result of the truth campaign from 2000 to 2004. If the campaign was equally effective with younger adolescents aged 12–15 years who constitute a substantial fraction of the campaign's target audience of those aged 12–17 years, then the full impact of the campaign may be underestimated. These results come at a critical time in public health as funding for state and national smoking-prevention programs in the U.S. is declining.[21,35] For example, in 2008, the Ohio state legislature, with the support of the governor, de-funded the state's $230 million Tobacco Use Prevention and Control Foundation, which included a youth smoking-prevention campaign.[36]

Given the substantial lifetime health and economic burden of smoking, preventing adolescents and young adults from beginning smoking represents a wise investment in public health. The results suggest that there was one fewer adolescent initiating smoking for every $544 spent on the campaign during its first 4 years. This cost is modest compared with other health interventions.[37]

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