

Using anti-tobacco industry messages to prevent smoking among high-risk adolescents

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Abstract

Media campaigns to prevent adolescent tobacco use in the United States increasingly focus on the deceitful practices of the tobacco industry; however, little is known about how adolescents at elevated smoking risk respond to this strategy. This study used data from a nationally representative survey of 10 035 adolescents, ages 12–17 years, in order to test whether reactions to anti-industry advertisements (ads), the attitudes these ads target, and the relationship between these attitudes and smoking differed by social bonding and sensation-seeking risk factors. Results indicated that anti-industry ad reactions and the strength of anti-industry attitudes were comparable between high- and low-sensation seeking adolescents, whereas weakly bonded adolescents had less favorable ad reactions and weaker anti-industry attitudes than strongly bonded adolescents. Social bonding also moderated the influence of sensation seeking on anti-industry ad reactions, such that

sensation seeking had a positive influence among more strongly bonded adolescents and no influence among weakly bonded adolescents. Finally, the relationship between anti-industry attitudes and smoking appeared consistent across risk groups, whether risk was defined using social bonding, sensation seeking or the interaction between them. Overall, these results suggest that anti-industry messages are a promising strategy for preventing smoking among high- and low-risk adolescents alike.

Introduction

Some mass media campaigns aim to prevent adolescent tobacco use by fostering negative attitudes about the tobacco industry [1–5]. Little is known about the effectiveness of this approach for adolescents who are at elevated risk for smoking. This study used theories of social bonding and sensation seeking to define adolescent risk groups, with the aim of examining how these constructs influenced their (i) reactions to anti-industry advertisements (ads), (ii) attitudes about the tobacco industry and (iii) the strength of the relationship between anti-industry attitudes and smoking-related intentions and behavior. These analyses aimed to determine whether messages that target anti-industry attitudes are a viable tobacco prevention strategy for adolescents at elevated risk for smoking.

Social bonding, sensation seeking and smoking risk

Social bonding theory posits that adolescents who have weaker bonds with primary social relationships

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and conventional socializing institutions are at increased risk of engaging in deviant behavior [6, 7]. According to this theory, affective attachment to parents is a key characteristic of social bonds because greater attachment to parents implies both greater regard for parental opinion and greater concern that engaging in deviant behaviors would violate parental expectations. Another important element of social bonding is commitment to conventional socializing institutions like schools and church. Adolescents' commitment to these institutions is indicated by striving for socially sanctioned goals (e.g. graduating from high school; not sinning) that yield rewards (e.g. a well-paying, interesting job; an afterlife). Hence, social bonding theory predicts that adolescents with stronger commitments to conventional institutions will be less likely to threaten the investments they have made by engaging in deviant behavior.

Social bonding theory was originally developed to explain behaviors that are more deviant than smoking. Nevertheless, smoking is illegal among adolescents, engaged in by a minority of adolescents, and increasingly stigmatized within contemporary society [8]. Indeed, the social bonding constructs of parental attachment and regard for parental opinion are relatively consistent predictors of adolescents smoking [9–13]. Moreover, school achievement, academic aspirations, school participation and positive perceptions of the school climate appear to protect against smoking behavior [14–16]. Similarly, attendance at religious services is associated with lower levels of substance use, including tobacco use [17, 18]. In general, these results support the use of social bonding constructs to help explain adolescents smoking.

The theory of sensation seeking has also been used to understand why some adolescents smoke. This theory posits the existence of a psychological trait that increases the likelihood of seeking out and enjoying risky behavior [19]. Studies have found that high sensation-seeking adolescents are more likely to smoke, as well as engage in drug use, alcohol consumption and sexual risk taking [20–22]. Indeed, sensation seeking was among the strongest predictors of progression to regular smoking in a

cohort of teens followed up for 1 year [23]. Overall, these studies indicate that sensation seeking increases the risk of smoking among adolescents.

Countermarketing, anti-tobacco industry attitudes and smoking among high-risk adolescents

Tobacco prevention messages that focus on the deceitful practices of the tobacco industry appear to prevent adolescent smoking by fostering negative attitudes about the industry [24]. For instance, exposure to Florida's 'truth' campaign and to the national truth[®] campaign was associated with stronger anti-industry attitudes and lower levels of smoking among adolescents [1, 2, 25–27]. In the high-risk context of tobacco producing states, anti-industry messages appear to work as well as in lower-risk contexts of non-tobacco producing states [4]. Yet it is unknown whether the anti-industry campaign strategy is effective among adolescents whose elevated risk for smoking is due to other factors.

The content and execution of ads within the national truth[®] campaign were developed to appeal to high sensation seekers [28]. In the context of traditional prevention messages that focus on health outcomes, anti-industry messages contain novel information and feature complex arguments (e.g. 'the tobacco industry is exploiting you if you smoke'), message characteristics that appeal to high sensation seekers [29]. Other research suggests that vivid, fast-paced and dramatic execution of messages also appeals to high sensation seekers, generating positive ad evaluations [30], enhancing ad recall [31], engendering negative attitudes and intentions to avoid drugs [32] and reducing drug-use behavior within this high-risk group [33]. By tailoring the content and stylistic presentation of anti-industry messages, truth[®] ads may reduce the elevated risk of smoking that is associated with sensation seeking.

The content of anti-industry messages may also appeal to adolescents with weak social bonds. By focusing on how the tobacco industry manipulates people, anti-industry messages might break down the positive connotations of smoking, such as

independence and rebelliousness [34, 35], that might otherwise make smoking appeal to socially marginal, weakly bonded adolescents. Moreover, weak bonds with social institutions may translate into anti-establishment sentiment that heightens receptivity to anti-industry messages.

On the other hand, despite the possible appeal of anti-industry ads among weakly bonded adolescents, social bonding theory implies that anti-industry campaigns may be more successful among adolescents with stronger social bonds. Strongly bonded adolescents might respond favorably to anti-industry messages because these messages call attention to how the industry has violated the conventional sociomoral order to which they are strongly bonded. As a corollary, weakly bonded adolescents may be more likely to tolerate this violation, and, hence, maintain weaker anti-industry attitudes. Furthermore, social bonding theory suggests that the relationship between anti-industry attitudes and smoking would be relatively stronger among high-bonded adolescents, since they would be more concerned about maintaining consistency between their attitudes and their behavior. Adolescents at lower levels of social bonding generally would be less concerned with such contradictions, and if such concerns were to arise, they would be more likely to rationalize them away [6]. The resistance of high-risk adolescents to traditional, knowledge-based tobacco prevention efforts [36] provides some support for this proposition. Indeed, social bonding theory suggests a relatively pessimistic outlook for attempts to prevent smoking among weakly bonded adolescents with knowledge-based strategies, regardless of the content of the prevention message used.

Research questions and hypotheses

Hypotheses generated from our literature review began with confirmation of previous results. Specifically, we hypothesized that weaker social bonding, higher sensation seeking and weaker anti-tobacco industry attitudes would have independent, positive associations with smoking susceptibility and behavior. Furthermore, we hypothesized that the association between anti-industry attitudes

and smoking outcomes would be stronger among adolescents with stronger social bonds and higher sensation seeking than among adolescents with weaker social bonds and lower sensation seeking, respectively. Finally, we hypothesized that adolescents characterized by stronger social bonds and higher sensation seeking would have more favorable reactions to anti-industry ads and stronger anti-industry attitudes than their counterparts.

Methods

Data and analytic sample

Data were extracted from two cross-sectional Legacy Media Tracking Surveys (LMTS), which are nationally representative surveys that use a two-stage stratified design involving oversampling of minority adolescents (see [1]). Data for the current study were collected between 3 April 2001 and 29 August 2001 (LMTS3) and between 18 December 2001 and 30 May 2002 (LMTS5), and had response rates of 60% and 47%, respectively [37]. Surveys were telephone-administered to 12- to 24-year old adolescents ($n = 20\,856$), however, only 12- to 17-year olds were eligible for study inclusion ($n = 14\,191$) because they were the primary audience for the truth[®] campaign. Moreover, because some study variables were eliminated from the LMTS5 questionnaire halfway through its administration, data from participants interviewed after this date were excluded. The final analytic sample contained observations from 10 035 adolescents.

Measurement

Social bonding variables

Parental attachment items assessed perceived closeness to father and to mother (see Appendix 1 for wording and response formats for all items) [11, 38]. School commitment was measured with questions on school enrollment, achievement and aspirations for future education. Religious commitment was measured with frequency of attendance at religious services in the last 30 days. Although this item does not completely capture religious

commitment [39], it has been associated with numerous deviant behaviors [40].

Social bonding index

For purposes of summarizing the overall influence of social bonding and to classify observations for subgroup analyses, items were combined to create an index with higher scores indicating greater social bonding. Conceptually, social bonding is not a unidimensional attribute with a uniform influence across all the domains we assessed; rather, the extent of bonding within each domain has an incremental, cumulative contribution to the overall extent of social bonding. Because social bonding theory does not suggest that one domain of influence is stronger than another, all items were equally weighted. Two methods of index construction were pursued: (i) items were equally scaled from 1 to 5, summed and averaged and (ii) each variable was normalized (i.e. $\mu = 0$; $SD = 1$), summed and averaged. The correlation between these two indexes was strong ($r = 0.95$), suggesting that either would produce similar results. The index with equally scaled items was selected because its range was the same as half of the original bonding items and because this range was shared with other scales under consideration. The assessment of inter-item reliability is inappropriate for determining the measurement properties of an index with causal indicators [41, 42], so we did not assess the index in this manner.

Sensation seeking

The four-item 'Brief Sensation Seeking Scale-4' was used (Appendix 1), which had good reliability and construct validity in other surveys of adolescents [43, 44]. These items had moderate inter-item reliability in our sample ($\alpha = 0.64$), and were averaged, with higher scores indicating greater sensation-seeking tendencies.

Anti-industry attitudes

Six items measuring anti-tobacco industry attitudes (Appendix 1) have been shown to be associated with exposure to the national truth[®] campaign and with smoking [24]. In our analytic sample, inter-item reliability for these items was reasonable

($\alpha = 0.73$), so they were averaged with higher values corresponding to stronger attitudes.

Anti-industry ad reactions

Anti-industry ad reactions (AIAR) were assessed among study participants with confirmed awareness of at least one national truth[®] campaign ad during the 6-week period prior to the interview. Questions assessing ad exposure were designed to give respondents enough information about an ad so that they could remember it, but not enough to allow them to 'fake' awareness. To further confirm their exposure, respondents who indicated that they had seen an ad were asked to provide other details about it [1, 45]. Each ad for which a participant showed confirmed awareness was used as the referent for three questions, whose content addressed aspects of message processing and, according to theory, the likelihood of persuasion (i.e. argument credibility, argument strength and strength of attention paid to a message) [46]. For the AIAR scale, responses to each question were averaged for all ads seen. Because these questions had different response formats (Appendix 1), two items were rescaled from 1 to 5 so that they would have the same scale as the third item and, therefore, equally contribute to scale scores. This range was also comparable to the index and other scales. AIAR items showed moderate reliability ($\alpha = 0.64$) and were averaged, with higher values indicating greater likelihood of persuasion.

Smoking intentions and behavior

Smoking status data were gathered using items validated for adolescent populations (Appendix 1) [10, 47]. Among those who reported never smoking, smoking susceptibility was assessed with three questions concerning intentions to smoke. Participants were considered 'susceptible' to smoking if responses indicated anything but 'definitely not' to any of these questions [47]. Participants were classified as current smokers if they reported smoking at least one cigarette in the last month.

Control variables

Age, gender and ethnicity were assessed with standard items.

Data analysis

In all analyses, data from both waves were treated as a single sample and STATA, version 8.0, was used to adjust for design effects and sample weights. Inter-item reliabilities for multi-item constructs were assessed using Cronbach's alpha [41]. For measures of bivariate association, unadjusted logistic regression coefficients were used for dichotomous dependent variables, and unadjusted linear regression coefficients were used for continuous dependent variables. For estimates of adjusted coefficients, both multivariate logistic regression and multivariate linear regression were used.

Results

Sample population characteristics

The sample was comprised of an almost equal number of males and females ($n = 5048$ and 4997 , respectively), and 61% of the sample identified as White ($n = 6189$). About 17% ($n = 1740$) of the sample identified as Hispanic, while 12% ($n = 1195$), 5% ($n = 526$) and 3% ($n = 344$) identified as

Black, Asian or as from a different ethnic background, respectively. The mean age of the sample was 14.5 years old, with an approximately uniform distribution of adolescents across 12- to 17-year old categories (range = 1425–1900). About 57% of the sample ($n = 5705$) had never smoked and was not susceptible to smoking, whereas 17% ($n = 1737$) had never smoked but was susceptible to smoking. Eighteen percent ($n = 1775$) of the sample reported having smoked but not in the previous month, whereas 8% ($n = 818$) reported smoking in the last month. Finally, 42% ($n = 4241$) of the sample displayed confirmed awareness of at least one anti-industry ad in the 6 weeks before the interview.

Confirmatory hypotheses of smoking risk factors

Results from univariate logistic regressions indicated that all social bonding variables were inversely associated with current smoking (Table II) while only maternal closeness and school achievement were associated with smoking susceptibility (Table I). When the social bonding index was examined, stronger bonding was associated with

Table I. Smoking susceptibility regressed on sociodemographics and smoking risk factors

Sociodemographics and risk factors	Smoking susceptibility		
	Univariate Model b (SE)	Multivariate Model 1 b_{adj} (SE)	Multivariate Model 2 b_{adj} (SE)
Age	-0.046 (0.049)	-0.178 (0.054)***	-0.174 (0.052)***
Sex (male versus female)	0.235 (0.162)	0.235 (0.158)	0.207 (0.172)
Ethnicity			
Black versus White	0.244 (0.253)	0.177 (0.271)	0.249 (0.260)
Latino versus White	0.393 (0.162)*	0.423 (0.179)*	0.437 (0.178)*
Asian versus White	0.298 (0.349)	0.530 (0.334)	0.474 (0.378)
Other versus White	-0.631 (0.330)	-0.656 (0.279)	-0.639 (0.351)
Closeness to mother	-0.233 (0.101)*	-0.061 (0.111)	—
Closeness to father	-0.135 (0.075)	-0.101 (0.084)	—
Church attendance	-0.007 (0.067)	0.121 (0.075)	—
School enrollment	-0.257 (0.629)	0.332 (0.597)	—
School achievement	-0.227 (0.094)*	-0.149 (0.102)	—
School aspirations	-0.163 (0.110)	-0.090 (0.125)	—
Social bonding index	-0.394 (0.169)*	—	-0.119 (0.175)
Sensation seeking	0.313 (0.116)**	0.385 (0.128)**	0.370 (0.129)**
Anti-industry attitudes	-0.922 (0.156)***	-1.019 (0.163)***	0.998 (0.157)***

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table II. Current smoking regressed on sociodemographics and smoking risk factors

Sociodemographics and risk factors	Current smoking			
	Univariate Model b (SE)	Multivariate Model 1 b_{adj} (SE)	Multivariate Model 2 b_{adj} (SE)	Multivariate Model 3 b_{adj} (SE)
Age	0.537 (0.077)***	0.384 (0.085)***	0.357 (0.092)***	0.342 (0.091)***
Sex (male versus female)	-0.032 (0.213)	-0.462 (0.268)	-0.337 (0.257)	-0.338 (0.225)
Ethnicity Black versus White	-0.722 (0.376)	-0.602 (0.415)	-0.638 (0.419)	-0.667 (0.408)
Latino versus White	-0.618 (0.226)**	-0.569 (0.244)*	-0.556 (0.265)*	-0.556 (0.261)*
Asian versus White	-2.000 (0.414)***	-1.510 (0.473)***	-1.533 (0.429)***	-1.516 (0.415)***
Other versus White	0.083 (0.486)	0.385 (0.567)	0.253 (0.560)	0.173 (0.593)
Closeness to mother	-0.500 (0.101)***	-0.373 (0.161)*	—	—
Closeness to father	-0.352 (0.078)***	-0.062 (0.108)	—	—
Church attendance	-0.428 (0.086)***	-0.189 (0.105)	—	—
School enrollment	-1.970 (0.410)***	-1.807 (0.362)***	—	—
School achievement	-0.698 (0.147)***	-0.375 (0.165)*	—	—
School aspirations	-0.457 (0.119)***	-0.198 (0.157)	—	—
Social bonding index	-1.819 (0.199)***	—	-1.240 (0.227)***	-3.712 (1.080)***
Sensation seeking	1.118 (0.144)***	0.689 (0.177)***	0.710 (0.179)***	-2.038 (1.281)
Anti-industry attitudes	-1.704 (0.173)***	-1.229 (0.171)***	-1.227 (0.176)***	-1.245 (0.183)***
Sensation seeking × social bonding	—	—	—	0.702 (0.304)*

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

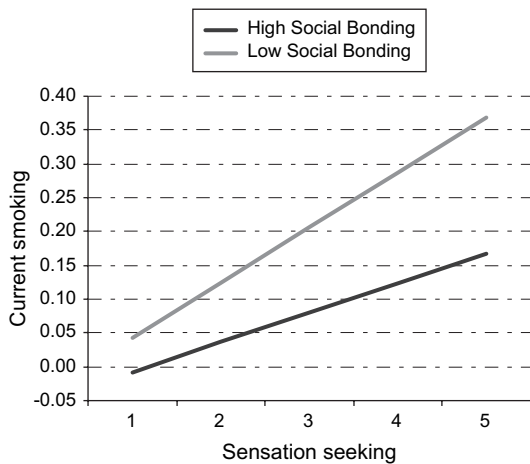


Fig. 1. Adjusted (for age, sex, ethnicity and anti-industry attitudes) predicted values of current smoking across levels of sensation seeking among high- and low-bonded adolescents.

lower likelihood of current smoking and, marginally, with lower smoking susceptibility. Higher sensation seeking and weaker anti-tobacco industry attitudes were positively associated with both smoking susceptibility and behavior.

Multivariate models were run in order to test the independence of bivariate associations with smoking outcomes and to help establish the validity of the social bonding index. In the first models for each outcome, smoking susceptibility was regressed on all social bonding variables, sensation seeking, anti-industry attitudes and control variables. The second model for each outcome was the same except that the social bonding index was substituted for the social bonding variables. When examining the social susceptibility outcome, the general pattern of results was similar across the two models (Table I, Models 1 and 2), and non-significant results were obtained for all individual social bonding variables and for the index. Comparable patterns also characterized results from the two models for current smoking (Table II, Models 1 and 2), except that not all social bonding variables were statistically significant, whereas the index was ($b_{adj} = -0.241$). Nevertheless, because the valences for coefficients associated with individual social bonding variables were in the expected direction and because the estimates for other study variables were nearly identical across

Table III. Anti-industry ad reactions regressed on sociodemographics, smoking status, social bonding and sensation seeking

Sociodemographics, smoking status and risk factors	Anti-industry ad reactions		
	Univariate Model b (SE)	Multivariate Model 1 b_{adj} (SE)	Multivariate Model 2 b_{adj} (SE)
Age	-0.025 (0.035)	0.057 (0.032)	0.045 (0.031)
Sex (male versus female)	-0.137 (0.109)	-0.126 (0.091)	-0.134 (0.087)
Ethnicity	Black versus White	0.035 (0.176)	-0.130 (0.167)
	Latino versus White	0.091 (0.109)	0.052 (0.099)
	Asian versus White	0.041 (0.140)	-0.185 (0.122)
	Other versus White	-0.190 (0.283)	-0.195 (0.213)
Smoking status	Never smoker, susceptible ^a	-0.088 (0.090)	-0.065 (0.095)
	Ever smoker, not current ^a	-0.406 (0.149)**	-0.309 (0.164)
	Current smoker ^a	-1.594 (0.296)***	-0.910 (0.224)***
Social bonding index	0.583 (0.133)***	0.363 (0.120)**	-1.435 (0.431)***
Sensation seeking	-0.172 (0.079)*	-0.079 (0.061)	-2.348 (0.611)***
Sensation seeking \times social bonding	—	—	0.537 (0.138)***

^aSmoking status variables were dummy coded with omnibus never smoker, non-susceptible adolescents as the reference group. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

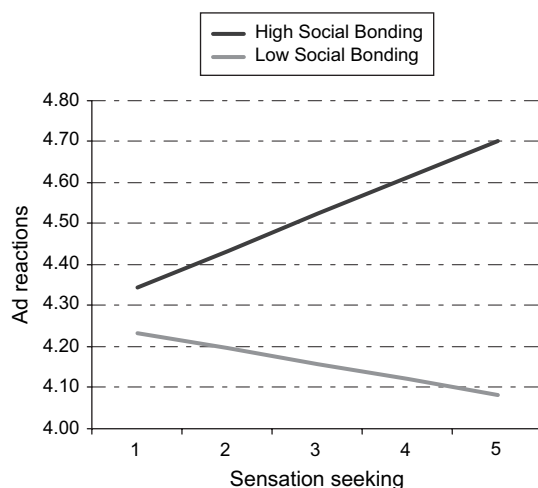


Fig. 2. Adjusted (for age, sex, ethnicity and smoking status) predicted values of anti-industry ad reactions across levels of sensation seeking among high- and low-bonded adolescents.

models, we used the index in all further analyses. In multivariate models with this index, sensation seeking and anti-industry attitudes were independent predictors of smoking susceptibility ($b_{adj} = 0.370$, $b_{adj} = -0.998$, respectively) and of current smoking ($b_{adj} = 0.710$, $b_{adj} = -1.227$, respectively).

Tests of primary hypotheses

To test hypotheses concerning different strengths of association between anti-industry attitudes and smoking outcomes among adolescents at different levels of risk, we added interaction terms to the multivariate models described above. Interactions between anti-industry attitudes and neither social bonding nor sensation seeking were statistically significant. However, an interaction between sensation seeking and social bonding was significant in predicting current smoking (Table II, Model 3). Finally, we tested a three-way interaction between social bonding, sensation seeking and anti-industry attitudes, which was not significant.

To probe the statistically significant interaction, we used the mid-point of the social bonding index to divide the sample into high- and low-bonded adolescents. Multivariate models were then rerun in order to generate the adjusted, predicted value of the independent variable (i.e. current smoking) across levels of sensation seeking. Figure 1 shows the plotted results, indicating that sensation seeking was more strongly associated with current smoking among more weakly bonded, higher risk youth.

Hypotheses concerning anti-industry ad reactions used the subsample of participants who had been

Table IV. Anti-industry attitudes regressed on sociodemographics, smoking status, social bonding and sensation seeking

Sociodemographics, smoking status and risk factors		Anti-industry attitudes		
		Univariate Model b (SE)	Multivariate Model 1 b_{adj} (SE)	Multivariate Model 2 b_{adj} (SE)
Age		-0.125 (0.014)***	-0.069 (0.013)***	-0.071 (0.013)***
Sex (male versus female)		-0.088 (0.049)	-0.058 (0.039)	-0.062 (0.038)
Ethnicity	Black versus White	-0.050 (0.078)	-0.092 (0.061)	-0.104 (0.061)
	Latino versus White	0.057 (0.044)	0.033 (0.038)	0.028 (0.038)
	Asian versus White	0.143 (0.073)*	0.012 (0.056)	0.022 (0.057)
	Other versus White	0.084 (0.131)	0.082 (0.101)	0.072 (0.104)
Smoking status	Never smoker, susceptible ^a	-0.334 (0.052)***	-0.316 (0.048)***	-0.313 (0.048)***
	Ever smoker, not current ^a	-0.392 (0.061)***	-0.211 (0.067)**	-0.204 (0.065)**
	Current smoker ^a	-1.384 (0.096)***	-0.863 (0.089)***	-0.834 (0.089)***
Social bonding index		0.380 (0.051)***	0.151 (0.051)**	-0.379 (0.202)
Sensation seeking		-0.206 (0.034)***	-0.050 (0.029)	-0.748 (0.263)**
Sensation seeking × social bonding		—	—	0.164 (0.061)**

^aSmoking status variables were dummy coded with omnibus never smoker, non-susceptible adolescents as the reference group.
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

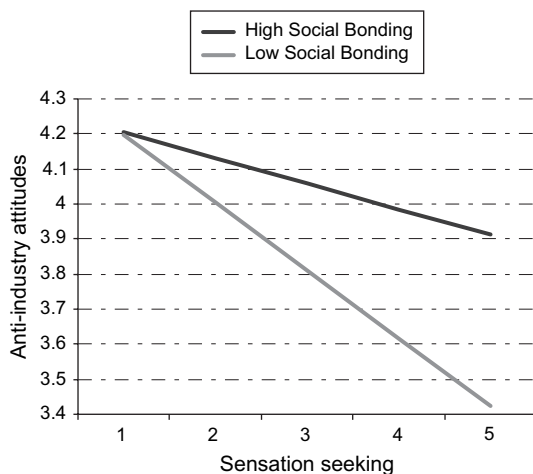


Fig. 3. Adjusted (for age, sex, ethnicity and smoking status) predicted values of anti-industry attitudes across levels of sensation seeking among high- and low-bonded adolescents.

exposed to an anti-industry ad in the previous 6 weeks ($n = 4241$). When compared with those who did not report seeing an anti-industry ad in this period, this subsample was more likely to be older, male, black, to have attended church less frequently, to have higher educational aspirations and to be

characterized by higher levels of sensation seeking. Statistically significant associations were found when regressing anti-industry ad reactions (AIAR) just on sensation seeking ($b = -0.172, P = 0.028$) and on social bonding ($b = 0.583, P < 0.001$). When adjusting for age, gender, ethnicity and smoking status (Table III, Model 1), AIAR was still positively associated with social bonding ($b_{adj} = 0.363, P = 0.003$) but unassociated with sensation seeking ($b_{adj} = -0.079, P = 0.25$). An interaction between sensation seeking and social bonding was next entered into the model (Table III, Model 2), and it was statistically significant ($b_{adj} = 0.537, P < 0.001$). Using the method described above to probe this interaction, the positive relationship between sensation seeking and ad reactions appeared to obtain among high-bonded youth, whereas there was little to no relationship among low-bonded youth (Fig. 2).

The entire analytic sample was then used to examine whether social bonding and sensation seeking were associated with the anti-industry attitudes that these ads targeted. Bivariate results (Table IV) indicated stronger anti-industry attitudes for those with stronger social bonds ($b = 0.380, P < 0.001$) and weaker sensation-seeking tendencies ($b = -0.206, P < 0.001$). However, in a multivariate model that controlled for sociodemographics and

smoking status (Table IV, Model 1), only social bonding was an independent predictor. When the interaction between social bonding and sensation seeking was added to the model, it was statistically significant (Table IV, Model 2). We probed this interaction by plotting the predicted values of anti-industry attitudes by levels of sensation seeking among high- and low-bonded groups. Figure 3 indicates that inverse association between sensation seeking and anti-industry attitudes appeared stronger among more weakly bonded, higher risk adolescents.

Discussion

Study results provided mixed support for hypotheses but suggested that fostering negative attitudes toward the tobacco industry is likely to prevent tobacco use among high- and low-risk adolescents alike. Results generally replicated previous studies showing that anti-industry attitudes, social bonding and sensation seeking appeared to influence smoking intentions and behavior. The exception was the lack of or weak association between social bonding variables and smoking susceptibility. This was not surprising given the inconsistent relationship between social bonding and smoking initiation found in other studies [48]. Given social bonding theory's focus on deviance, these weak or non-existent associations suggest that adolescents may not view as deviant being open to trying smoking for the first time. The stronger, statistically significant relationship we found between all social bonding variables and current smoking suggests that current smoking is more likely to be viewed as deviant than merely being open to smoking.

The influence of anti-industry attitudes on both smoking outcomes appeared comparable across adolescents at different levels of smoking risk, whether risk was defined by sensation seeking, social bonding or the interaction of these constructs. We also found that social bonding modified the influence of sensation seeking on current smoking, such that sensation seeking appeared more strongly associated with smoking only among adolescents

with weaker social bonds. This finding is inconsistent with other studies that have found sensation seeking to be a stronger smoking risk factor among groups who perceive smoking as less socially acceptable [22, 49]. These studies suggest that sensation seeking is more powerful risk factor under such circumstances because high sensation seekers may gain pleasure from violating social norms. Because normative constraints against smoking are presumably stronger among adolescents with stronger social bonds, these other findings suggest that there would have been a stronger relationship between sensation seeking and smoking among more strongly bonded adolescents. Our results do not support this contention.

Results concerning reactions to anti-industry messages among weakly bonded adolescents provided some support for social bonding theory's implication that adolescents with weaker bonds would be more resistant to knowledge-based appeals against smoking. Less favorable reactions to anti-industry ads and lower anti-industry attitudes among more weakly bonded adolescents supported this contention. Nevertheless, the consistent relationship between anti-industry attitudes and smoking outcomes across levels of social bonding risk suggests that once weakly bonded adolescents hold strong anti-industry attitudes, these attitudes are likely to deter smoking.

We found evidence for the appeal of anti-industry ads among high-risk adolescents when we examined sensation seeking. Sensation seeking did not have an independent association with responses to either anti-industry ads or anti-industry attitudes, indicating the relatively consistent impact of these ads among adolescents at different levels of sensation seeking. In the context of previous findings about the pro-drug attitudes of high sensation seekers [30, 33], these findings should be interpreted with optimism. Indeed, the truth[®] campaign's strategy of designing anti-industry ads to appeal to high sensation seekers may be judged successful to the extent that these ads appear to have influenced high- and low-risk adolescents alike.

When we took into account the moderating influence of social bonding, the lack of association

between sensation seeking and anti-industry ad appeal appeared confined to weakly bonded adolescents. Among adolescents with stronger social bonds, high sensation-seeking adolescents appeared more likely to be persuaded by these ads than their lower-risk counterparts. At the same time, our results suggested that the inverse association between sensation seeking and anti-industry attitudes was stronger among more weakly bonded youth. Hence, anti-industry ads appear to be more successful in reaching high sensation seekers if they have stronger social bonds. As mass media alcohol, drug and tobacco promotion campaigns increasingly develop messages to target high sensation seekers [50], it may be important to consider whether factors like social bonding modify campaign impact. Future studies should address whether weakly bonded, high sensation seekers share dispositions and preferences that are feasible to address in health promotion campaigns.

Overall, these results support the use of tobacco prevention messages that foster negative attitudes about the tobacco industry, since this strategy generally appeared to influence high- and low-risk adolescents alike. Tobacco prevention campaigns should not necessarily dispense with messages about the health effects of smoking, however, since anti-industry messages often presume awareness of these effects in casting the industry as culpable for them. Messages that focus on the tobacco industry's deceitful practices without mentioning health outcomes may not provide enough information to effectively distinguish the tobacco industry from other companies whose products adolescents can consume. Moreover, the apparent impact of anti-industry messages may have been at least partly due to their novelty. If so, once adolescents habituate to this messaging strategy, other more novel messages may be needed to appeal to adolescents. Further research should test the characteristics of tobacco prevention messages that appeal to high-risk adolescents, however risk is defined [51].

There were several limitations to this study. Because the data were cross-sectional, we were unable to adequately assess the temporal precedence of variables. This was less of a concern when

assessing the influence of relatively stable independent variables, such as social bonding and the personality trait of sensation seeking, because smoking and industry attitudes are unlikely to influence these factors. Temporality was also less disconcerting when examining the smoking susceptibility outcome because attitudinal alignment with potential behavior seemed less of an issue than with actual behaviors. Indeed, in spite of evidence indicating that anti-industry attitudes influence smoking behavior [2], these domains likely influence one another and, to the extent that feedback characterizes this relationship, our results likely overestimated the impact of attitudes on behavior.

The cross-sectional study design also limited our ability to directly assess the impact of the truth[®] campaign. An adequate determination of exposure to anti-industry ads was beyond our reach because exposure was self-reported and may have been susceptible to response bias despite precautions taken to avoid this problem. Perhaps more importantly, exposure assessment only accounted for the 6 weeks prior to the interview, and this national campaign began more than one year before the first interviews with participants in our analytic sample. Given that campaign awareness was 75% among 12- to 17-year olds just 7 months after the launch of truth[®] [1], earlier exposures may have already accounted for changes in perceptions of the industry. Hence, this study focused on truth[®] ads reactions as the best available proxy for campaign impact.

Selection bias may have also been an issue given the 60% and 47% response rates for the two surveys we examined. Adolescents at different levels of involvement with and risk for smoking may have differentially participated in the study, thereby biasing some results. However, the nationally representative nature of the sample helped ensure that the results generally apply to many, if not most American adolescents. A related study design strength concerned oversampling of minority adolescents to ensure that sample composition was comparable to the general population. Furthermore, the large sample size readily allowed subgroup analyses following from statistically significant interactions.

On the other hand, our analyses may have been overpowered for determining meaningful effect sizes.

Smoking intentions and behavior may have been underreported due to survey mode (i.e. telephone) and setting (i.e. home) effects. Precautions were taken to ensure that others present during the interview could not deduce question content based on overhearing participant responses. Some adolescents may still have been concerned that others could determine or listen in on their responses. Studies in California [52] and Massachusetts [53] indicate that self-reported 30-day smoking estimates for adolescents are substantially lower when using data from telephone-administered surveys (i.e. 9% and 12%, respectively) than from school-based surveys (i.e. 14% and 26%, respectively). However, such underreporting would likely underestimate true effects, as was found in a study comparing data from national, school-based samples with LMETS data [54].

Results from this study are important in light of previous studies indicating that high-risk adolescents are resistant to traditional educational messages that emphasize the harmful effects of smoking [36] or that aim to reduce social influences to smoke [55]. Our results suggest that anti-industry messages may do a better job preventing smoking among high-risk adolescents, particularly adolescents whose increased smoking risk is due to sensation seeking. Our insights into the apparent impact of anti-industry messages may be useful to consider when refining anti-industry campaigns as well as when developing mass media campaigns that focus on other substance use behaviors.

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Appendix I Items measuring key study constructs

Construct	Questions (response format) ^a
Parental attachment	You feel close to your mother or stepmother You feel close to your father or stepfather
School commitment	Are you currently enrolled in school? (yes; no) How well would you say you have done in school? (1 = much worse than average, 5 = much better than average) How far do you think you will go in school? (high school or less; some college or technical school; college; graduate school)
Religious commitment	How often have you attended church or religious services in the last month? (never; rarely; sometimes; often)
Anti-tobacco industry attitudes	Cigarette companies lie Cigarette companies try to get young people to start smoking I would like to see cigarette companies go out of business I would not work for a cigarette company I feel angry with cigarette companies
Sensation seeking (BSSS-4)	How do you feel about cigarette companies? (1 = like a lot, 5 = dislike a lot) I would like to explore strange places I like to do frightening things I like new and exciting experiences, even if I have to break the rules I prefer friends who are exciting and unpredictable
Anti-industry ad reactions (AIAR)	This ad is convincing Would you say that ad grabbed your attention? (yes; do not know; no) Would you say that ad gave you good reasons not to smoke? (yes; do not know; no)
Smoking behavior	Have you ever tried cigarette smoking, even 1 or 2 puffs? (yes; no)
Smoking susceptibility	During the last 30 days, on how many days did you smoke cigarettes? (1–30) Do you think you will smoke a cigarette at any time during the next year? Do you think you will smoke a cigarette soon? If one of your best friends offered you a cigarette, would you smoke it?

^aUnless otherwise indicated, the response format was a five-point Likert scale indicating extent of agreement.