Nicotine & Tobacco Research, 2019, 220–226
doi:10.1093/ntr/ntx239
Original investigation
Received June 20, 2017; Editorial Decision October 22, 2017

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Placing Antismoking Graphic Warning Posters at Retail Point-of-Sale Locations Increases Some Adolescents' Susceptibility to Future Smoking

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Abstract

Objectives: This experiment tested whether introducing graphic antitobacco posters at point-of-sale (POS) had any effect on adolescents' susceptibility to future cigarette smoking and whether these effects were moderated by adolescents' baseline risk of cigarette smoking.

Methods: The study was conducted in the RAND StoreLab, a life-sized replica of a convenience store that was developed to experimentally evaluate how changing aspects of tobacco advertising displays in retail POS environments influence tobacco use risk and behavior during simulated shopping experiences. In this study, 441 adolescents were randomized to one of the four conditions in a 2 (graphic antismoking poster placed near the tobacco power wall: no, yes) × 2 (graphic antismoking poster placed near the cash register: no, yes) experimental design. The outcome of interest was susceptibility to future cigarette smoking.

Results: The addition of antismoking posters at POS led to a significant increase in future smoking susceptibility among those adolescents who already were at high risk for smoking in the future ($p < .045$). The introduction of graphic antismoking posters had no impact on committed never smokers, regardless of poster location; never smokers' susceptibility to future smoking was uniformly low across experimental conditions.

Conclusions: Introducing graphic antismoking posters at POS may have the unintended effect of further increasing cigarette smoking susceptibility among adolescents already at risk.

Introduction

Most of the tobacco industry's advertising budget is spent at point-of-sale (POS) retail locations.[1–3] The POS retail environment is awash in posters for tobacco products, signs for price promotions,[4–6] and tobacco power walls that prominently display hundreds of tobacco products.[7–9] Tobacco companies spend more on advertising at POS than any other industry,[10] virtually ensuring that positive tobacco product imagery and messages are dominant in this environment and highly visible to consumers.

Studies have indicated that most adolescents visit POS retail stores on a weekly or near weekly basis.[11] These frequent visits place them at significant risk of having repeated, highly consequential exposures to tobacco advertising: numerous studies have found a positive association between exposure to POS retail environments and positive shifts in adolescents' tobacco use susceptibility and product use.[12,13] Regulatory efforts have therefore sought to diminish the influence of the POS retail environment on adolescent tobacco use.[14]

Introducing antitobacco posters at POS has been advocated as a way to reduce the potency of this environment.[15] In theory, antitobacco posters work by providing counter-arguments to the positive tobacco messages that pervade the POS environment, which then leads to uncertainty regarding the overall positive message about tobacco that typically emerges from POS. The closer in physical

proximity the competing messages (antismoking) are to the central message (pro-tobacco), the greater the uncertainty about the central message and the more effective the counter-advertising.[16] As such, antismoking posters placed near the cashier or near the tobacco power wall—where the majority of tobacco advertising appears[7]—are likely to have the best potential to exert a disruptive influence.

The display of POS antitobacco posters has been implemented or considered in several countries, states, cities, and locales. For example, in 2009, New York City mandated that graphic cigarette warning posters (ie, posters that feature text warnings about smoking combined with gruesome images of smoking-related disease) be displayed at licensed tobacco retail environments; legal action by the tobacco industry, retailers, and trade organizations voided this regulation in 2010.[17] Despite this ruling, other cities and states in the United States have considered adopting policies requiring antismoking graphic warning posters to be displayed at POS,[18,19] and some US communities have entered into voluntary agreements with individual retailers to allow graphic antismoking posters to be displayed.[20] Countries outside the United States have also considered or implemented policies mandating that antismoking posters of one kind or another be displayed at POS.[21–23]

Few studies have attempted to document the efficacy of this particular regulatory action. Only three studies have been published, all of which focus on adult smokers. Findings from these studies are inconsistent. On the one hand, a study with Australian smokers found that a black and white text-only sign encouraging quitting and displayed near the cashier was associated with increased quit attempts,[23] and another study found that New York City's display of graphic warning posters at POS was associated with increased thoughts about the health risks of smoking and about quitting.[24] On the other hand, a study that utilized a virtual store paradigm found no effect of graphic warning posters displayed on the tobacco power wall for any smoking or quitting outcome.[25]

Although no studies have investigated the effect of antismoking posters at POS on adolescent smoking, studies germane to this topic have examined the relative influence of pro- and antismoking media on adolescents (eg, antismoking public service announcements preceding movies that feature smoking). However, these studies have also produced mixed results. On the one hand, correlational research has shown that exposure and receptivity to pro-smoking advertising are strongly associated with future smoking intentions and that exposure to antismoking advertising does little to dampen this association.[26,27] On the other hand, experimental research has shown that adolescents who are exposed to antismoking public service announcements before seeing a movie that features smoking have reduced smoking intentions compared with those who did not first see an antismoking public service announcements.[28,29] Finally, research has suggested that adolescents' responses to antismoking counter-advertising may depend on their smoking status;[30] in particular, adolescents who are committed never smokers attend more to and have their beliefs about not smoking strengthened by antismoking counter advertising compared with adolescents at risk for future smoking or adolescents who smoke.

At this point, it is unclear (1) whether display of antismoking posters at POS influences adolescent smoking, (2) whether the location of the antismoking posters at POS (eg, near the cashier and/or near the tobacco power wall) influences their efficacy, and (3) whether adolescents' experience with smoking moderates their responses to antismoking posters at POS.

To address these uncertainties, the current experiment tested whether displaying graphic antismoking posters in various locations at POS affects adolescents' susceptibility to future cigarette smoking and whether the effects of displaying graphic antismoking posters at POS depend on adolescents' baseline risk of future cigarette smoking. To approximate a real-life shopping experience, we conducted this study in the RAND StoreLab (RSL). The RSL is a life-sized replica of a convenience store that was designed to experimentally evaluate how to best regulate tobacco product advertising at POS during simulated shopping experiences.[31] In this study, we utilized a 2 (graphic antismoking poster near power wall: no, yes) × 2 (graphic antismoking poster near cash register: no, yes) randomized between-subjects experimental design to evaluate the effect of the number and placement of antismoking advertising at POS on adolescents' susceptibility to future smoking. In the condition with no graphic warning posters—the typical POS arrangement—we expected adolescents to experience elevated susceptibility to future smoking.[31] We hypothesized that adolescents in the condition that included graphic antismoking posters both near the cashier and near the tobacco power wall (ie, posters in two locations) would result in lower susceptibility to future smoking compared with the typical POS arrangement condition (ie, with no posters), and compared with the conditions where the posters were in either location alone. Finally, we expected that the effects of the graphic warning posters on smoking susceptibility would be most pronounced among committed never smokers.

Materials and Methods

Study Participants

Adolescents were recruited using newspaper, Internet, and radio advertising. The recruitment materials indicated that the study focused on teens' shopping habits at convenience stores and contained no information about smoking or tobacco. Parents of interested participants completed a brief eligibility screening over the phone.

To be included in the study, adolescents needed to be between 11 and 17 years old, have no physical or psychiatric problem that would interfere with completing the study (based on parent report), and have not previously participated in one of our RSL studies.[31] Parents provided written informed consent and adolescents provided written assent to participate. Adolescents were eligible for the study irrespective of their tobacco use. A total of 580 adolescents were screened, of whom 522 (90%) were eligible to participate. Of these eligible adolescents, 441 (84%) attended the laboratory session, were randomized, and completed the study. Participant characteristics are provided in Table 1.

Experimental Setting: The RSL

The RSL occupies 1500 square feet inside of an office building in Pittsburgh and is only open to research participants. Over 650 unique products are stocked in the RSL, and prices are consistent with those charged throughout the city of Pittsburgh. Stocked products include dairy, bakery, snack foods, beverages, tobacco, grocery, health and beauty aids, confectionery, and magazines or newspapers. Product posters are displayed on the walls, shelves, and windows of the store. A large tobacco power wall is located behind the checkout counter. About 80% of the RSL power wall displays cigarettes; the remaining sections display smokeless products and cigars (15%) and electronic cigarettes (5%). The power wall also includes (city and

Table 1. Participant Characteristics (Pre-RSL) by Experimental Condition

	Experimental condition				
	Poster near power wall: NO		Poster near power wall: YES		
	Poster near cashier: NO (n = 107)	Poster near cashier: YES (n = 112)	Poster near cashier: NO (n = 113)	Poster near cashier: YES (n = 109)	p
Demographics					
Age (M, SD)	13.04 (1.79)	13.62 (1.91)	13.42 (1.87)	13.28 (2.01)	.15
Female (%)	47.66	51.79	57.52	57.80	.37
Race (%)					
Caucasian	70.75	69.64	69.91	66.97	.89
African American	19.81	18.75	15.93	22.02	
Other race	9.43	11.61	14.16	11.01	
Tobacco use behavior (%)					
Ever smoked cigarette	2.80	4.46	6.20	4.59	.69
At risk (for smoking)	16.82	16.96	24.78	23.15	.32
Convenience store behavior (%)					
Shop there more than once/month	83.02	91.07	92.92	87.16	.10
Spend <10 min shopping	86.79	91.07	84.82	78.90	.08
Spend less than $10 shopping	76.42	80.36	76.46	67.59	.11
Seen cigarette ads in the past month	57.01	64.55	69.03	69.73	.18

state-consistent) prices for each displayed tobacco product and posters for some of the available brands of cigarettes and other tobacco products. A detailed description of the RSL (including photographs) can be found elsewhere.[31]

Study Design and Procedure

Figure 1 provides photographs of each of the four experimental conditions. The graphic antismoking poster that was selected (ie, a 13.5″ x 10.5″ close-up photograph of a diseased mouth and gums with a text warning that reads "cigarettes cause cancer") was drawn from the nine graphic warning labels that the US Food and Drug Administration had intended to implement on cigarette packages. This poster was selected for use in this study because it was rated as the most effective by adolescents in previous research.[32] Prior to the main experimental study presented in this article, we conducted a series of focus groups with adolescent participants who rated and discussed each of the nine FDA graphic warning labels. Results from these focus groups confirmed that the graphic image and warning that were viewed as most effective by adolescents in previous research[32] were in fact perceived as most effective by adolescents from our recruitment base (pilot focus group participants were excluded from participating in the experimental research described below). Placement and size of the posters were consistent with an ordinance that was passed (but challenged) in New York City.[17]

This study was approved by the Human Subjects Protection Committee at the RAND Corporation. To balance the ethical integrity and internal validity of the research, this study used an authorized deception. During informed consent, participants and their parents were told about the broad parameters of the study (eg, that the study was concerned with adolescents' shopping patterns and involved minimal risk), and that there were aspects of the study that they could not be told about up front because telling them at that point could affect the study results. They were told that they would be provided with all information about the study at the end of their participation. Their consent or assent indicated agreement to participate in the study without full knowledge of the study details.

Each participant completed the study by him or herself and completed a number of tasks. Participants first completed a pre-RSL questionnaire that contained measures related to smoking and tobacco use, convenience store shopping experiences, and susceptibility to future cigarette smoking (ie, susceptibility before shopping in the RSL). The pre-RSL questionnaire also contained filler items that were structurally similar to the smoking or tobacco measures but focused on behaviors unrelated to smoking and tobacco use (eg, consumption of soft drinks, "junk" food, and fruits and vegetables). Filler items were used to disguise the true focus of the study.

After completing the pre-RSL questionnaire, participants were randomized to one of the four experimental conditions (see Figure 1) and engaged in a simulated shopping task in the RSL. Participants were provided with $10 from a study research assistant and instructed to shop in the RSL for whatever items they wanted for as long as they wanted. They were instructed to spend at least $5 and to check-out and pay for the items as they would in any convenience store. A second research assistant (not involved in the consent or survey administration process) served as the cashier who scanned the selected items for a total price, collected money, provided change, and bagged the purchased items. No participants attempted to purchase tobacco in this study.

After exiting the RSL with their purchases, participants completed the main dependent measure, susceptibility to future cigarette smoking (ie, poster shopping susceptibility), and a set of filler items. They were next asked to guess the purpose of the study. Items that participants purchased in the RSL were returned (ie, because of food safety concerns). Participants were then debriefed and viewed a 20-min video about media literacy and cigarette advertising (available at http://www.tobaccofree.org/video.htm); they also received written smoking prevention materials. Finally, participants received a $50 gift card for completing the study, and parents were reimbursed for transportation and parking.

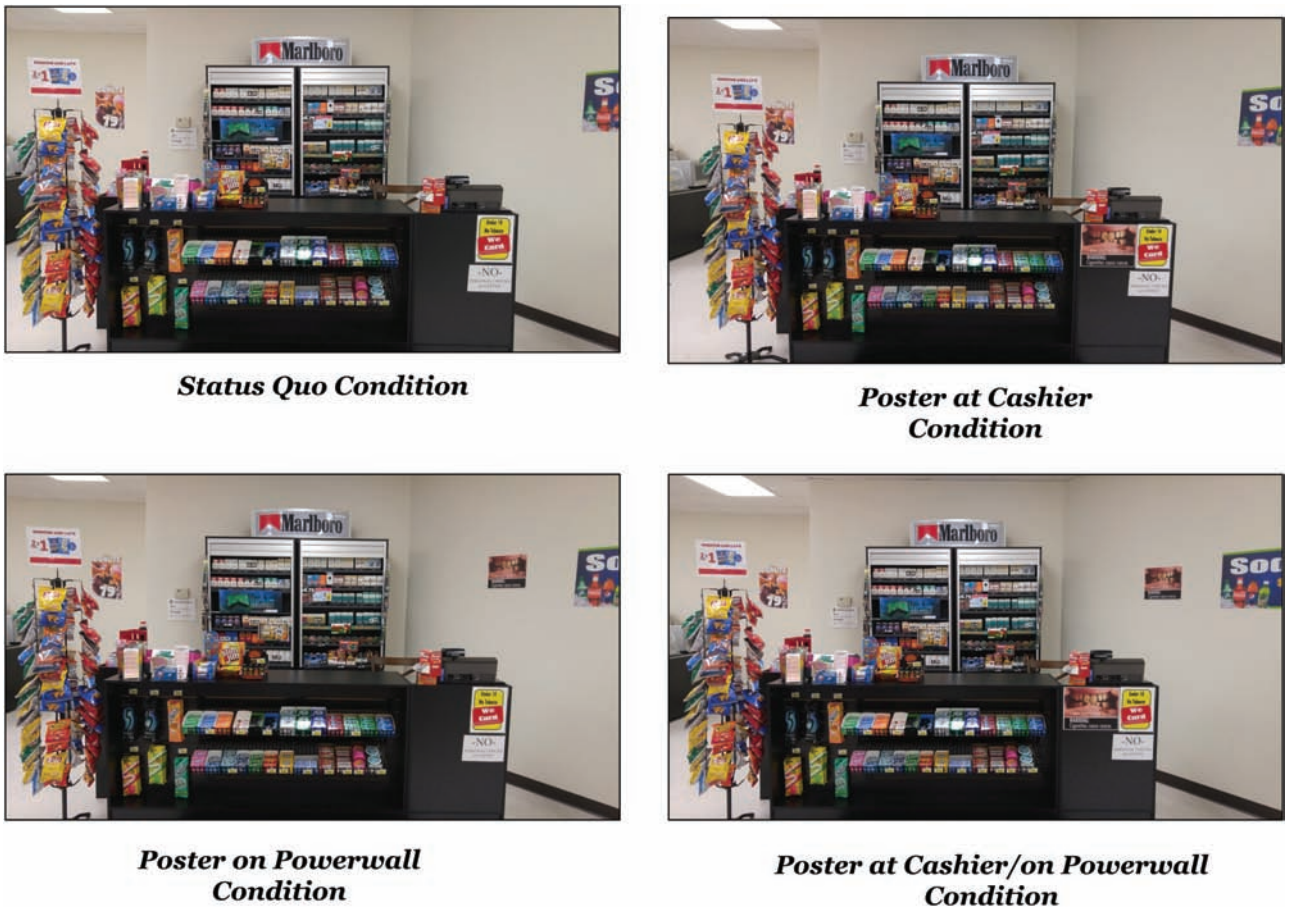

Figure 1. Photographs of the four experimental conditions that manipulate the location and/or presence of the antismoking graphic warning poster (color).

Pre-RSL Shopping Measures

Demographics

Age, gender, and race were self-reported by participants.

Convenience Store Behavior

Three items from the Convenience Customer Insights Panel survey (http://www.cstoredecisions.com/2011/05/31/targeting-convenience-store-customers/) were used to measure participants' typical convenience store shopping behavior.[31] Items asked were how frequently they shopped at convenience stores; how much time they typically spend shopping at convenience stores; and how much money they typically spend at convenience stores. They were also asked about their previous exposure to cigarette advertising in convenience stores with this item: "During the last 30 days, about how often have you seen advertisements for cigarettes in convenience stores?". Response options were never, hardly ever, some of the time, and most of the time. Responses to this item were coded as never ("0") or hardly ever, some of the time, and most of the time ("1").

Baseline Smoking Risk

Participants were categorized as being either committed never smokers or at risk of future smoking at study entry (prior to any manipulation or RSL shopping task) based on their responses to questions assessing their lifetime past use of cigarettes and susceptibility to smoke in the future.[33,34] Lifetime use of cigarettes was assessed with the question "Have you ever smoked cigarettes, even one or two puffs, in your life?", and responses were either "no or yes." Susceptibility to smoke in the future was assessed using three items: "Do you think you will try a cigarette anytime soon?", "Do you think you will smoke a cigarette anytime in the next year?", and "If one of your best friends offered you a cigarette, would you smoke it?". Responses were made on a 1 (Definitely Not) to 10 (Definitely Yes) scale and summed to produce a measure on which higher scores indicate greater susceptibility of smoking in the future (α = 0.90; range 3–30). *Committed never smokers* (n = 351) were those who never smoked in the past and also had a score of "3" (ie, the lowest score) on the susceptibility measure. *At-risk (for future smoking) adolescents* were those who never smoked in the past and who also had a score greater than "3" on the future smoking susceptibility measure (n = 70); smoked in the past and had a score of "3" on the future smoking susceptibility measure (n = 4); or smoked in the past and had a score greater than "3" on the future smoking susceptibility measure (n = 16) (total n for at-risk adolescents = 90). In the analyses, committed never smokers were assigned a value of "0," and at-risk adolescents were assigned a value of "1." Past research has shown that responses to this set of questions predict future smoking behavior among adolescents.[33,34]

Post-RSL Shopping Measures

Post-Shopping Susceptibility to Future Cigarette Smoking

The same three items that were administered as pre-RSL measure of future smoking susceptibility were administered as a post-RSL measure to assess near-term changes in cognitions predictive of future smoking.

Results

Pre-RSL descriptive information by condition is given in Table 1. Randomization was successful in ensuring parity across experimental conditions. The average age of the sample was 13.3 years. The sample was approximately half female, and a majority (>88%) was either Caucasian or African American. Across conditions, 5% of participants reported cigarette smoking in their lifetime. Twenty percent were classified as being at risk for future cigarette smoking at the pre-RSL point (ie, at study entry). A majority of the sample visited convenience stores more than once per month and spent less than $10 per visit. More than half of participants reported seeing tobacco advertising at convenience stores in the past month. Because the descriptive analysis revealed that the sample was well balanced across experimental conditions, no variables from Table 1 were included as covariates in the analytic models presented below.

Only 33% of participants across conditions correctly guessed the purpose of the study. There were no differences by condition in the likelihood of making a correct guess (p = .24), and the results presented below were generally the same regardless of whether those guessing correctly were included in or excluded from the analyses; as such, they were included.

The dependent variable, post-shopping susceptibility to future cigarette smoking, was highly skewed. Although scores ranged from 3 to 30, the mean score was 4.22 (SD = 4.06), and the median score was 3.00; the 75th percentile score was also 3.00. To address the skewness of responses to this measure, we used a generalized linear model with a log link to model the association between responses and study condition.[35] Given our hypotheses, we estimated a three-way interaction model. The model included all main effects (baseline smoking risk [0 = none, 1 = any], poster near power wall [wall: no = 0, yes = 1], poster near cashier [cashier: no = 0, yes = 1]), all two-way interactions, and the three-way interaction. The final results are presented in Table 2. There was a negative and statistically significant three-way interaction (p = .045). To facilitate interpretation, predictions in the log scale from the model were retransformed back to the original scale, and mean values for each condition at each of the two levels of baseline smoking risk were plotted (Figure 2). Although the presence of a graphic antismoking poster at POS increased the future smoking susceptibility of adolescents who were at risk for smoking upon entry to the study, these increases were strongest in the case in which a single antismoking poster was placed near the power wall.

We conducted a set of ancillary analyses that had the goal of determining whether the moderating effect of baseline smoking risk was attributable to either of the two variables from which it was comprised: lifetime past use of cigarettes and baseline susceptibility to smoke in the future. These analyses consisted of subgroup analyses in the two groups of past use of cigarette. A generalized linear model with a log link was used to model the association between post-RSL shopping responses and study condition within each subsample. Although these analyses were underpowered (ie, because of small sample sizes within each group across experimental conditions), a pattern of results like those illustrated in Figure 2 emerged. Never smokers and adolescents who had a low baseline susceptibility to smoke in the future had uniformly low susceptibility to future smoking after shopping in the RSL regardless of experimental condition; in contrast, ever smokers and adolescents with a higher baseline susceptibility to smoke in the future had elevated susceptibility to smoke in the future after shopping in the RSL in the conditions that included the graphic antismoking poster. Thus, neither past behavior (previous smoking) nor future orientation toward smoking (susceptibility) appeared to be dominant in driving the moderating effects found in the main analyses; both variables seemed to be important.

Discussion

Our results show that adding graphic antismoking posters to a POS environment has an effect on at-risk adolescents' future smoking susceptibility. The direction of that effect was, however, contrary to what we predicted. Adolescents who were committed never smokers showed low levels of future smoking susceptibility in a typical POS arrangement (ie, the no poster condition).[4–9] Although some committed never smokers later initiate smoking[33,34] and are susceptible to tobacco advertising broadly speaking,[36] they seemed to be "protected" from the effects of POS tobacco advertising in this study. Addition of a graphic antismoking poster to the POS environment had no effect on their level of future smoking susceptibility. Their level of smoking risk remained uniformly low regardless of whether an antismoking poster was added to the store and remained low regardless of the location of the poster or how many posters were added.

In contrast, the addition of graphic warning posters to the POS environment further heightened the smoking susceptibility of adolescents who entered the study already at risk for future smoking. That is, rather than disrupting the positive messages associated with POS tobacco advertising, antismoking advertisements seem to have potentiated their effects. It is possible that at-risk adolescents responded to the graphic warning posters in a defensive manner, causing them to discount or downplay health risks portrayed in the poster.[37] Studies of adolescents at risk for marijuana use have shown that they process information portrayed in antimarijuana public service announcements in a defensive manner,[38] and studies of adult smokers have suggested that antismoking advertisements engage defensive processing mechanisms among adult smokers, causing them to react in a manner opposite to what was intended by the antismoking messages.[39] It is also possible that locating the graphic warning poster near the tobacco power wall or cashier oriented at risk adolescents

Table 2. Results of Regression Model Predicting Future Cigarette Smoking Susceptibility from Experimental Condition

Predictors	*b*	*SE*	95% CI	Wald χ^2	*p*
Wall	−0.03	0.16	[−0.35, 0.29]	0.03	.853
Cashier	−0.01	0.16	[−0.32, 0.30]	0.00	.956
Baseline risk	0.64	0.17	[0.31, 0.98]	13.85	.000
Wall x cashier	0.02	0.23	[−0.43, 0.48]	0.01	.928
Wall x baseline risk	0.57	0.22	[0.14, 1.00]	6.68	.010
Cashier x baseline risk	0.35	0.23	[−0.10, 0.79]	2.36	.124
Wall x cashier x baseline risk	−0.60	0.30	[−1.19, −0.01]	4.02	.045

Wall, graphic antismoking poster placed near power wall; Cashier, graphic antismoking poster placed near cash register.

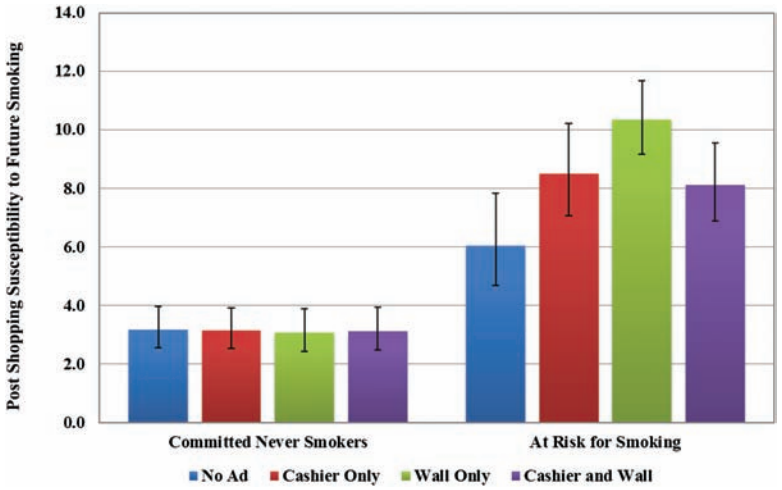

Figure 2. Plot of the estimated mean values (with vertical bars to indicate standard errors) for future smoking susceptibility for each experimental condition between committed never smokers and adolescents at risk for smoking (color).

not toward the antismoking message communicated by the poster itself *but toward* the vast array of tobacco-related stimuli on the power wall. As a result, the tobacco power wall may have functioned as a sort of smoking cue that increased future smoking susceptibility. This interpretation is supported by studies that have found that adolescent smokers (even light smokers) exhibit reactivity to smoking cues,[40] and antismoking messages may strengthen smoking cravings and weaken intentions to maintain abstinence in adult current and former smokers.[41,42] It is not possible for us to discern whether defensive processing and/or cue reactivity was responsible for the iatrogenic effects we observed in at-risk adolescents. As such, future research should seek to disentangle mechanisms responsible for these effects.

Several limitations of this study should be considered. First, we tested content from a single poster. Although our preliminary research and work elsewhere[32] showed that a poster with this warning content was perceived as effective by adolescents, other posters with different images and/or different text warnings may have produced different results. Likewise, posters of different sizes than the one we used in our study, or placed in different locations, might have produced different results. Second, although the assessment of baseline smoking risk we employed is commonly accepted,[34] there may be other ways to characterize baseline risk of smoking that could alter our conclusions (eg, via assessing sensation seeking[43]). Relatedly, it may be that our dependent measure was not sensitive to changes in risk that occurred in committed never smokers that another assessment device may have detected; an alternative dependent measure may have provided different results. Third, although our dependent measure, susceptibility to future cigarette smoking, has been shown to predict smoking in adolescents in several studies,[33,34] we did not measure actual smoking behavior in this experiment. Finally, the environment of the RSL, though closely modeled after a real convenience store, does not allow modeling of the entire process of how the POS environment influences adolescent smoking. Rather, the RSL allows us to look closely at a carefully chosen "slice" of this entire process and provides information about how altering specific features of the POS retail environment (ie, addition of a graphic antismoking poster) influences near-term changes in tobacco use risk.

Based on the results of this study as well as other research[37–42] and the potential for legal challenges,[17,18] it is difficult to recommend the display of antismoking posters at POS retail locations. Countries that currently include or that are considering the display of antismoking posters at POS may wish to reconsider this particular policy action—which could have iatrogenic effects on at-risk adolescents.

What This Article Adds

Exposure to POS cigarette advertising contributes to risk of cigarette smoking initiation in adolescents and triggers smoking in adult smokers. Dampening the potency of the POS environment by displaying antismoking counter advertising messages has been proposed as a potential regulatory solution. However, there is no evidence that this action is effective among adolescents. The current experiment provides evidence that displaying a graphic antismoking poster at POS leads to increased smoking susceptibility among adolescents already at risk for future smoking. This finding suggests that this particular regulatory action needs additional research or potentially should be abandoned in favor of other alternatives.

Funding

The work presented in this article was supported by the National Cancer Institute and FDA Center for Tobacco Products (CTP) (R01CA175209).

Declaration of Interests

None of the authors has any conflict of interest or competing interest to report.

Acknowledgments

The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration. We thank Stacey Gallaway and Angela Sicker for their assistance in the conduct of this research.

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