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Exposure to Pro-Smoking Media in College Students: Does Type of Media Channel Differentially Contribute to Smoking Risk?

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Abstract

Background—There is almost no data on whether the different channels through which pro-smoking media appears (i.e., point-of-sale advertising, movie smoking) differently influences smoking.

Purpose—This study used ecological momentary assessment to examine whether differences in smoking risk were observed for exposures to different pro-smoking media channels.

Methods—College students ($n=134$) carried smartphones for 21 days, recording their exposures to pro-smoking media and the media channels for that exposure and responding to three randomly-issued control prompts per day. Participants answered questions about their future smoking risk after each pro-smoking media exposure and random prompt.

Results—Participants had elevated future smoking risk following exposure to pro-smoking media at point-of-sale ($p < 0.001$); smoking risk at times of exposure to smoking in movies did not differ from risk measured during control prompts ($p = 0.78$).

Conclusions—There is merit to examining the relative contribution of different pro-smoking media channels to smoking behavior.

Keywords

Tobacco; advertising; marketing; point-of-sale

INTRODUCTION

Exposure to pro-smoking media messages is associated with an increase in smoking in adolescent populations (1), young adult and college aged populations (2), and in established smokers (3). These pro-smoking media messages can be conveyed through a number of different types of media channels, for example as paid advertising in magazines, on billboards, and at point-of-sale retail locations (4) or via portrayals of smoking in movies (5), yet almost no research has investigated whether smoking differs as a function of exposure to pro-smoking media in different channels. Understanding of the relative potency of different media channels is important to informing the ongoing public policy debate about how pro-smoking media should be regulated and which channels deserve the most regulatory attention (6).

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Most studies of smoking-related media have taken one of two approaches in assessing pro-smoking media exposure. One class of studies has used a summary index of exposure to pro-smoking media, typically operationalized as receptivity to (7) or awareness of (8) cigarette advertising; this summary index collapses across different media channel types and exposures across time. The other class of studies has examined the association of actual exposure to individual channels of pro-smoking media and smoking behavior. For example, studies have examined whether frequency or numbers of exposures to smoking in movies (9) or at point-of-sale (10) or in magazines (11) is associated with smoking, thus providing evidence for the effects of *single* media channels on smoking behavior; this second class of studies does not compare the differential impact of different media channels on smoking. Only two studies have examined whether different channels of exposure to pro-smoking media differentially influence smoking behavior relative to one another in the same study. These studies found that exposure to movie smoking was more strongly associated with smoking initiation than was receptivity to tobacco marketing and that receptivity to tobacco marketing was more strongly associated with progression to established smoking than was exposure to movie smoking (12,13). More research is needed as to whether different smoking media channels differently influence smoking.

The current research used ecological momentary assessment (EMA (14)) to evaluate whether smoking risk differs as a function of exposure to pro-smoking media in different channels. College students carried a handheld computer for 21 days to record how much pro-smoking media they saw and through what channel. They answered questions that measured their future smoking risk immediately after each pro-smoking media exposure. They answered these same questions about future smoking risk in response to control prompts, which occurred daily at random moments when there was no exposure to pro-smoking media. Using a within-subjects design (14) this study examined whether college students' future smoking risk was higher following exposure to different specific pro-smoking media channels—specifically advertising at point-of-sale advertising, smoking in movies/on television, and exposures via other channels—than at the random control prompts. It was hypothesized that pro-smoking media at point-of-sale locations would have the strongest association with acute future smoking risk. Tobacco products are highly visible and readily available for purchase at point-of-sale locations (15) but not readily available while viewing movies or television. Visibility and availability of tobacco products may enhance their influence on smoking risk at point-of-sale locations (16, 17).

METHODS

Participants

A sample of 134 undergraduate college students participated. They were 37% male, 66% Caucasian, 24% African-American, and 10% other race; their average age was 21.0 years ($SD = 1.6$). Although 61% of the sample reported some past experience with smoking (i.e., ever smokers) less than half (37%) of these ever smokers reported smoking in the past month. Ever smokers who reported use in the past month smoked an average of 6 days in the past month ($SD = 4.4$) and an average of 2.2 ($SD = 1.3$) cigarettes on the days that they smoked. There were no daily smokers in the sample. Additional details on the sample may be found elsewhere (18).

Procedures

The study was approved by the Human Subjects Protection Committee at RAND. Data collection for the study took place between June 2010 and January 2011. Participants were recruited by advertising in university newspapers and in weekly arts and entertainment newspapers. The recruitment advertising contained no information about smoking, pro-

smoking media, or cigarette/tobacco advertising; individuals responded to an advertisement that had the generic stated goal of using “cell phones to study advertising”. Individuals who responded to the advertising completed a brief telephone screening to determine eligibility. If they met the inclusion/exclusion criteria, they were invited to attend a baseline session.

At the baseline session, participants 1) received an explanation of the study and provided written informed consent for their involvement; 2) completed a survey about their demographic characteristics and smoking history; and 3) received detailed training on using a handheld data collection device to record information about their exposures to pro-smoking media. Training consisted of a 60-minute oral presentation accompanied by electronic slides that described the data collection procedures and types of pro-smoking media to record (for this and other procedural details, see a previous publication (19)). A Palm® Treo 755p handheld device, running the Palm OS Garnet v5.4.9 and using a 312 MHz Intel PXA270 processor, was provided to each participant; Pendragon 5.1 forms application was used and programmed to collect the pro-smoking media exposure events and random event data on the handheld (<http://pendragonsoftware.com/index.html>). Participants were instructed to turn the device on when they woke up in the morning and off at night when they went to sleep, carry the device with them at all times, initiate data entry each time they encountered pro-smoking media, and respond to random prompts. Participants were provided with additional materials upon exiting the baseline session to assist with data collection and using the handheld device (e.g., small printed training manual that fit within the handheld carrying case; 24 hr help-line phone number for problems and technical support).

Participants carried the handheld devices with them for 21 days to record their exposures to pro-smoking media (i.e., what kind of media they saw and through what channel they were exposed (19)) on each of those days. At times of exposure to pro-smoking media, participants indicated the channel of exposure, choosing from a list that included the following channels (4): In a convenience store, outside or inside of a store/gas station, on the window of a store/gas station, inside of a grocery store, at a tobacco store (all point-of sale locations); on television; in a movie; in a magazine; in a bar/restaurant; on the Internet; on a billboard; direct mail/coupon; on the radio; at a sponsored event; or approached by salesperson. Participants answered questions that indexed their future smoking risk immediately after each pro-smoking media exposure entry (see below). They also answered questions about their future smoking risk in response to investigator-programmed random prompts (three per day) during the study measurement period (control prompts). The control prompts were programmed so that they would occur at random times between the hours of 10am and 10pm; none of the control prompts used in the current study occurred in proximity to pro-smoking media exposures. Participants were paid up to \$230 if they completed all aspects of the study and adhered to the study protocol.

Dependent Variable

Future smoking risk was assessed using a reliable 3-item scale adapted from items used by Choi and colleagues (20): “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 to these questions were made on a 1 (Definitely Not) to 10 (Definitely Yes) scale and averaged to produce a total future smoking risk scale score (range from 1 – 10), where higher scores indicate higher risk of future smoking (20). This set of items is a potent predictor of future smoking (20) and as such, is considered a powerful index of future smoking risk.

RESULTS

Participants responded to a total of 6,902 random prompts during the monitoring period, with a compliance rate (i.e., responding within 2 minutes of random prompts) of 83%. These data indicate a high level of compliance with the study protocol and compare favorably with other EMA studies (14).

The total number of pro-smoking media exposures across all participants and all media channel types was 1,112. The majority of exposures occurred at *point-of-sale* locations (66%) and via exposure to *smoking in movies and on television* (20%); thus, these were the primary channels of interest in our analysis. The remaining 14% of exposures occurred via a variety of other channels: in magazines (4%), in a bar/restaurant (3%), on the internet (3%), on a billboard (2%), direct mail (1%), and less than 1% combined for radio exposures, exposures at sponsored events, and being approached by a salesperson. Preliminary analyses indicated no significant association between exposure to pro-smoking media via each of these other channels and future smoking risk (likely due to low observations in these categories); as such, these eight channels were collapsed into an *other media channels* category for analysis. Thus, analyses focused on whether future smoking risk during point-of-sale exposures, via smoking in movies/television, and via other media channels differed from risk assessed at random control prompts.

To account for the nesting of observations (for different multiple exposures and random prompts each day) and to adjust for possible confounders of the association between exposure and future smoking risk, a hierarchical linear mixed model (21) was used to compare participants' future smoking risk between random prompts and exposures to pro-smoking media via the three different channels while accounting for the within-participant correlation of future smoking risk measured at different occasions. The model was specified as

$$\begin{aligned}
 \text{Smoking.Risk}_{it} &= (\beta_0 + \mu_{0i}) + \beta_1 \text{POS.Event}_{it} \\
 &+ \beta_2 \text{TV.Event}_{it} \\
 &+ \beta_3 \text{Other.Event}_{it} \\
 &+ \beta_4 \text{Avg.POS.Event}_i \\
 &+ \beta_5 \text{Avg.TV.Event}_i \\
 &+ \beta_6 \text{Avg.Other.Event}_i \\
 &+ \beta_7 X_{it} + \varepsilon_{it}
 \end{aligned}$$

where for the participant i at time t , the dummy variables POS.Event_{it} , TV.Event_{it} , Other.Event_{it} characterize whether the observation was obtained during POS, movies/television or other media channels respectively and was used to estimate the effect of the different specific media channels when compared to random prompts. The model also accounted for the proportions Avg.POS.Event_i , Avg.TV.Event_i , Avg.Other.Event_i of participant i 's total exposures that occurred via each media channel to account for the possibility that participants with a greater number of exposures overall would exhibit an acute response to exposure that was different than the response of participants with a lesser number of exposures overall (22). Other covariates in the model (represented by X_{it} in the equation) included the day of the week (weekend vs. weekdays) on which the exposure or random prompt occurred, participant demographics (gender and race), and participant smoking status. The hierarchical structure of the model assumes a random participant-level average future smoking risk (μ_{0i}), thus allowing for the estimation of the variance explained

by participants. The parameters β_1 , β_2 and β_3 estimate the average instantaneous contribution of POS, movies/television and other media channel exposure to individual smoking risk when compared to random prompts while β_4 , β_5 and β_6 estimate the average contribution of the participant level frequency of exposure to the different media channels.

Table 1 presents the results of the hierarchical linear model. Participants had higher levels of future smoking risk following exposure to pro-smoking media at point-of-sale ($p < 0.001$) and via other media channels ($p = 0.05$) than at randomly sampled (control) moments. There was no difference between future smoking risk measured after exposure to smoking in movies/on television vs. at random prompts ($p = 0.78$). Still, the overall proportion of exposures to pro-smoking media via movies/television ($p = 0.01$) and via other channels ($p = 0.01$) over the 21 days of observation were significantly related to increased future smoking risk.

DISCUSSION

This study utilized ecological momentary assessment to examine whether college students' future smoking risk was higher following exposure to pro-smoking media via specific media channels compared to randomly sampled moments. It was found that exposure to pro-smoking media at point-of sale retail locations (i.e., inside of a convenience store; outside or inside of a store/gas station, on the window of a store/gas station, inside of a grocery store, at a tobacco store) was associated with higher smoking risk compared with the risk observed at randomly sampled moments. In the past decade, there has been a substantial shift of tobacco industry advertising dollars away from traditional advertising channels (e.g., magazines, billboards) to promotion at point-of-sale retail locations (4). The tobacco rich media environment at point-of sale (e.g., tobacco power walls behind cash registers (15)) communicates and reinforces many positive messages about tobacco (23) and these exposures seem to be highly consequential: several studies have found a positive association between exposure to point-of-sale retail tobacco advertising and positive shifts in adolescents' smoking susceptibility and smoking (24). The availability of tobacco products for purchase at point-of-sale also may contribute to the acute, "in the moment" potency of point-of-sale effects on smoking risk (16).

Although acute associations between exposure to smoking in movies and on television and future smoking risk were not found, overall greater numbers of exposures to movie and television smoking were associated with increased future smoking risk. This pattern of results suggests that exposure to movie and television smoking has an impact on future smoking risk through the accumulation of exposures over time (25) as opposed to creating short-term, shifts in future smoking risk. In other words, because portrayals of smoking in movies/television are often brief and occur in environments where cigarettes are unavailable (e.g., most movie theaters) and woven into a complex multi-modal sensory fabric of a motion picture (or television program) that involves multiple characters and storylines, (sometimes) special effects, and a multi-layered soundtrack (26), their effect on smoking risk may not be as immediate. Alternatively, brief exposures to smoking in complex movie and television narrative contexts may produce rapid, pulsatile shifts in smoking risk that were not captured in the explicit questionnaire assessment that was used. Indeed, there is some evidence that exposure to smoking in movies operates subtly, putatively outside of conscious awareness, influencing positive thoughts about smoking in relatively consequential ways (27).

There was both an acute effect and overall effect of the other media exposures category on future smoking risk. The small numbers of exposures (observations) in each of these other categories (e.g., in magazines, on the internet) prohibited a clear analysis of which exposure

category or categories contributed to these effects. Indeed, these individual channels of exposure were combined into a single category because of their small size and because no significant differences were found between these individual categories and the random prompts. This significant combined effect of the other category indicates that more research with larger numbers of exposures per channel is needed to fully uncover the nature of their individual effects on smoking risk.

There are limitations to this study. First, EMA as an assessment technique has limitations (28), for example, EMA requires a technologically –savvy sample that is motivated to carry handheld data collection devices (in addition to those that they already carry). Second, this study only covered a three week period; it is not known how the changes observed in smoking risk would correspond to changes in actual smoking behavior over the long term. Relatedly, although the smoking risk assessment used in this study is a potent predictor of future smoking behavior (20, 29, 30), this study did not establish a relationship between acute changes in smoking risk in different media channels and actual smoking behavior. An accumulation of short term shifts over time would be expected to eventually reach a tipping point, after which smoking may be triggered (31). Future work should utilize prospective designs and assessments of smoking uptake and desistence as a function of acute exposures to pro-smoking media and changes in smoking risk. Third, although participants recorded a non-trivial number of exposures to pro-smoking media in roughly the proportion of media channels that might be expected given the current tobacco advertising environment (e.g., a majority of exposures were at point-of-sale locations with far fewer in magazines (4,19) and there was a high level of compliance with the study protocol, it is possible that not every encounter with pro-smoking media was recorded. Fourth, although assessment reactivity has not been found with ecological momentary assessment more generally (14), it is possible that reactivity played into this particular application of this assessment technique. Finally, this study provided information on a college-aged sample; it is not known whether similar relationships would be found with younger adolescents or older adults who have different smoking patterns and levels of exposure to pro-smoking media in different channels.

In summary, this study makes a unique contribution to understanding how different pro-smoking media channels contribute to smoking risk and suggests that there is merit to examining the relative contribution of individual pro-smoking media channels on behavior. These more detailed analyses are needed in order to inform regulatory policies aimed at limiting the public's exposure to pro-smoking media in a way that reduces smoking prevalence and downstream, minimizes the serious health consequences of cigarette smoking.

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Table 1

Results predicting future smoking risk from different pro-smoking media exposure channels.

Model Effects	<i>b</i> (SE)	<i>p</i>
Average change estimates (fixed effects)		
Intercept	2.95 (0.34)	< 0.001
Exposure via point-of-sale ^a	0.13 (0.04)	< 0.001
Exposure via movies/television ^b	-0.02 (0.06)	0.78
Exposure via other media channels ^c	0.15 (0.07)	0.05
Proportion of exposures via point-of-sale	1.60 (1.92)	0.32
Proportion of exposures via movies/television	13.01 (5.19)	0.01
Proportion of exposures via other media	10.80 (3.90)	0.01
Never smoker ^d	-2.38 (0.36)	< 0.001
Male ^e	0.09 (0.37)	0.81
Minority status ^f	-0.12 (0.37)	0.75
Weekend ^g	0.04 (0.02)	0.04
Intercept variance	3.78 (0.48)	< 0.001
Error variance	0.68 (0.01)	< 0.001

Notes. Number of observations = 7,647.

^aPoint-of-sale exposure vs. random prompt (random prompt is the reference category)^bMovie exposure vs. random prompt (random prompt is the reference category)^cOther Exposure vs. random prompt (random prompt is the reference category)^dNever smoker vs. ever smoker (ever smoker is the reference category)^eMale vs. female (female is the reference category)^fMinority vs. nonminority (nonminority is the reference category)^gWeekend (Friday, Saturday, Sunday) vs. weekday (Monday, Tuesday, Wednesday, Thursday) (Weekday is the reference category)