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Increased Attention to the Tobacco Power Wall Predicts Increased Smoking Risk Among Adolescents

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Abstract

The purpose of this correlational study was to evaluate the association between attention paid by adolescents to the tobacco power wall and their susceptibility to future smoking. The study was conducted in the RAND Store Lab (RSL), a life-sized replica of a convenience store designed to investigate how tobacco advertising displays in retail point-of-sale environments relate to tobacco use risk and behaviors. In this study, middle and high school students ($N = 80$) shopped in the RSL while their attention to the tobacco power wall was measured covertly. Before and after shopping in the RSL, participants completed a measure of susceptibility to smoking in the future. Controlling for baseline cigarette smoking susceptibility and other potential confounders, attention toward the tobacco power wall was found to be significantly associated with future smoking susceptibility, $p = 0.046$. This finding suggests that policies aimed at decreasing the prominence of power walls in retail outlets should be given careful consideration as ways to reduce the impact of point-of-sale tobacco advertising and promotion on youth smoking susceptibility.

Keywords

attention; point-of-sale tobacco advertising; smoking susceptibility; tobacco power-wall

1. Introduction

Cigarette smoking is the leading cause of preventable death in the U.S. (U.S. Department of Health and Human Services [DHHS], 2014). Given that over 80% of smokers first experiment with cigarettes and become nicotine-dependent as teenagers (U.S. DHHS, 2012), protecting adolescents from exposures that put them at risk for experimenting with smoking or progressing toward regular use, including advertising and other forms of promotion, is vital for public health.

As restrictions on tobacco advertising in traditional media have increased, the industry has become ever more reliant on the retail environment as a means of marketing its products (Cohen et al., 2008). In 2016, the U.S. tobacco industry paid over \$8 billion in incentives to retailers and wholesalers, representing more than 90% of all advertising and promotional expenditures by the tobacco industry that year (U.S. Federal Trade Commission, 2018).

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Tobacco industry documents make clear that a main objective of point-of-sale (POS) advertising is to increase the consumption of tobacco products (Lavack & Toth, 2006), and in-store pack displays are the centerpiece of this strategy. These large, prominent, and visually appealing displays of tobacco products, known as tobacco power walls (Dewhirst, 2004), are designed to attract consumers' attention—through “intrusive visibility (Pollay, 2007, p. 270)”—and encourage them to purchase tobacco products. The industry even supports retailers in installing these displays via financial contributions, providing free equipment, and awarding retailers for having fully stocked shelves and locating the displays prominently (Feighery, Ribisl, Clark, & Haladjian, 2003).

Exposure to POS tobacco displays is known to be associated with both adolescent smoking and susceptibility to future smoking (Paynter & Edwards, 2009; Robertson, McGee, Marsh, & Hoek, 2015; Shadel, Martino, Setodji, Scharf, Kusuke, Sicker, & Gong, 2016). Studies that have attempted to identify the mechanisms by which exposure to POS tobacco displays might affect young people's susceptibility for use have focused on perceptions of the attractiveness of cigarette packs, smoking-related norms, and the perceived accessibility of cigarettes (McNeill et al., 2011; Setodji, Martino, Gong, Dunbar, Kusuke, Sicker, & Shadel, 2018; Wakefield, Germain, Durkin, & Henriksen, 2006), all factors that are known to increase the likelihood of smoking (Doubeni, Li, Fouayzi, & DiFranza, 2008; Germain, Wakefield, & Durkin, 2010; Olds, Thombs, & Tomasek, 2005).

An important unanswered question concerns the role of attention in mediating the effects of exposure to the tobacco power wall. Attention is the first step in classic stimulus-response models that describe the sequence of steps that must occur for an advertisement or marketing communication to affect purchasing behavior (McGuire, 1978; Priyanka, 2013). It is thought by many—but not all (e.g., Heath & Nairn, 2005)—to be a necessary ingredient for effective advertising (Mackenzie, 1986; Teixeira, 2014; Zhang, Wedel, & Pieters, 2009). Experimental studies have demonstrated a relationship between visual attention and in-store decision-making. These studies suggest that the amount of attention that consumers pay to in-store advertising can affect sales of featured products (e.g., Chandon, Hutchinson, Bradlow, & Young, 2007; Russo & Leclerc, 1994). Attracting consumers' attention to POS displays is certainly a goal of tobacco companies. Power walls are designed to be maximally eye-catching, and tobacco companies pay large sums of money to have the power wall appear in the most prominent in-store locations (e.g., behind the cashier; often close to products intended for children; Stead et al., 2016).

In addition to theoretical considerations, clarifying the role of attention in the efficacy of tobacco power walls has important policy implications. Researchers and public health officials have proposed potential regulatory actions that are clearly aimed at reducing the salience of POS displays, such as reducing the size of the power wall and requiring plain packaging for all cigarette brands (Lange, Hoefges, & Ribisl, 2015; Smith, Kraemer, Johnson, & Mays, 2015). If it is the mere presence of a tobacco power wall that increases susceptibility to smoking (e.g., by suggesting that it is normative and that cigarettes are easily accessible) and amount of attention does not matter, then efforts to decrease the salience of in-store tobacco displays may have little impact on reducing tobacco use and

improving public health. If, on the other hand, amount of attention matters, strategies for decreasing the salience of in-store displays become very viable options to consider.

The current study examines the association between the amount of attention paid by adolescents to the tobacco power wall and susceptibility to future smoking. The setting for this study was the RAND Store Lab (RSL), a life-sized replica of a convenience store that was designed to evaluate how best to regulate tobacco product advertising at POS during simulated shopping experiences (Shadel et al., 2016). In this study, middle and high school students (90% of whom had never smoked) shopped in the RSL while their attention to the tobacco power wall was measured covertly. Susceptibility to future smoking was evaluated pre- and post-shopping so that we could evaluate the association between post-shopping susceptibility and amount of attention paid to the tobacco power wall while controlling for pre-shopping susceptibility. We hypothesized that adolescents who paid greater attention would demonstrate greater susceptibility to smoking than would adolescents who paid less attention. We measured and controlled for several characteristics of adolescents that could potentially confound the association between attention paid to the tobacco power wall and susceptibility to smoking (e.g., negative mood and prior exposure to cigarette advertising in convenience stores).

2. Methods

2.1 Overview

Participants for this study were a subset of individuals from a larger experimental study that examined whether changing the placement or visibility of the tobacco power wall influences smoking risk in adolescents (Shadel et al., 2016). The experiment was conducted in the RAND StoreLab (RSL; see description below), a true-to-life convenience store that was developed to experimentally evaluate how changing aspects of tobacco advertising at POS influences tobacco use risk and behavior. A randomized, between-subjects experimental design with three conditions that varied the location or visibility of the tobacco power wall within the RSL was used. The conditions were: 1) behind the cashier (the control condition); 2) on a side wall away from the cash register; or 3) hidden behind an opaque wall. Participants for the current study are from the control (behind the cashier) condition of the larger study. This condition was chosen because it represents the way in which the tobacco power wall is set up in the vast majority of retail settings and thus it has the most direct real-world implications. The Human Subjects Protection Committee at the authors' institution approved this research.

2.2 Participants

A convenience sample of adolescents was recruited using print, internet, and radio advertising that contained no information about smoking or tobacco to reduce potential sample biases. Parents of interested participants completed a brief screening over the phone to determine eligibility. To be eligible, participants had to be 11-17 years old, have no physical or psychiatric problem that would interfere with completing the study (based on parent report), have written parental consent, and assent to their own participation. Eighty adolescents (one-third of the total sample from the larger experimental study) were

randomly assigned to the control condition. This sub-sample had a mean age of 13.8 ($SD = 2.0$), was 57.5% female, and was mostly Caucasian (60%) and African-American (28.8%). Ten percent of the sample were ever smokers (i.e., had tried cigarettes, even a puff, at some point in the past).

2.3 Setting

The RAND StoreLab (RSL) occupies 1,500 square feet inside of an office building and is open only to research participants). It stocks over 650 unique products (e.g., beverages, dairy, grocery, health and beauty aids, magazines/newspapers, snack foods, and tobacco). We developed the RAND Store Lab using three sources of data: industry guidelines for the layout and products sold in mid-sized convenience stores; an audit of convenience stores close to the RAND Store Lab to determine layout and pricing, and focus group data gathered from children, adolescents, and adults who were asked to provide feedback on store layout, pricing, signage, and overall appearance. Products are priced to be consistent with Pittsburgh, Pennsylvania, where the research was conducted. Product posters, including those for tobacco, are displayed on the walls, shelves, and windows of the RSL. Additional details and photographs are provided in Shadel et al. (2016).

For this study, the tobacco power wall was located behind the cashier at the check-out counter; its dimensions were 63 (W) x 47 ¼ inches (H). Most of the products displayed were cigarettes, with the distribution of brands corresponding roughly to the U.S. market share for cigarettes. The remaining power wall shelves displayed smokeless tobacco products and cigars (15%) and electronic cigarettes (5%). The percentages of tobacco products displayed were consistent with percentages available in local (to Pittsburgh) convenience stores at the time the study was conducted. The power wall displayed prices for each tobacco product and posters for specific cigarette brands.

A small camera was hidden on one of the power wall shelves to record each participant's face as s/he checked out of the RSL. The camera was an AXIS M1054 stationary POE camera (1.3 × 2.3 × 3.7 inches), painted black. The camera records in h.264 and motion jpeg format with HDTV 720p image quality/1 MP resolution. Video files were captured using Media Recorder 3.0 and Observer XT 12 with a media module, loaded on a Dell Precision T3600 desktop computer.

2.4 Procedure

The study used an authorized deception to balance the internal validity and ethical integrity of the research. During the consent process, conducted by a trained research assistant, participants and their parents were told about the general parameters of the study (e.g., that it involved assessing adolescents' convenience store shopping habits and was minimal risk), and that there were aspects of the study that could not be revealed prior to participation because that knowledge could affect the study's results. They were told that they would be provided with all information about the study at the end of their participation. Their consent/assent indicated agreement to participate in the study without full knowledge of the study details.

Participants completed the study individually. Participants completed a pre-RSL questionnaire that contained measures related to smoking and tobacco use, convenience store shopping experiences, and many filler items that were similar in structure to the smoking/tobacco measures but assessed unrelated behaviors such as consumption of fruits and vegetables, soft drinks, and “junk” food (e.g., “Do you think you will eat potato chips anytime in the next year?” and “If one of your best friends offered you an apple, would you eat it?”). Filler items were included to disguise the true focus of the study.

After completing the pre-RSL questionnaire, participants were provided with \$10 from a study research assistant and instructed to enter the RSL and shop for whatever items they would like for as long as they would like. They were told to check-out and pay for the items as they would in any convenience store. A second research assistant acted as the RSL cashier, scanning purchased items, collecting money, providing change, and bagging items purchased.

No restrictions were placed on participants’ attempts to purchase tobacco products. If a participant tried to purchase a tobacco product, the assistant at the cashier counter asked for age verification and refused the participant’s request (only one participant made such an attempt).

After exiting the RSL, participants completed the dependent measure (see below) along with filler items and were then asked to guess the true purpose of the study. Any items that participants purchased in the RSL were returned (i.e., due to concerns with food safety). Participants were then debriefed and shown a 20-minute video about cigarette advertising and media literacy (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 transportation costs were reimbursed to parents.

2.5 Covariates

Asterisks below indicate measures included in the pre-RSL (baseline) questionnaire.

Susceptibility to future cigarette smoking.*—Susceptibility to future cigarette smoking was assessed using a 3-item scale developed by Pierce and colleagues and that has been shown to be predictive of future cigarette smoking in adolescent never and ever smokers (Choi, Gilpin, Farkas, & Pierce, 2001; Pierce, Farkas, Evans, & Gilpin, 1995; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996): “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 of susceptibility to future cigarette smoking on which higher scores indicate greater susceptibility to future smoking ($\alpha > .95$). Because the distribution of this measure was skewed (i.e., over 75% of participants had the lowest score possible on the scale, i.e., a ‘3’), scores on this scale were dichotomized: those who scored a ‘3’ were recoded as ‘0’ (no susceptibility) and any scores greater than ‘3’ were coded as ‘1’ (some susceptibility). This scoring convention is typically used for this assessment (Choi et al., 2001; Shadel et al., 2016).

Depressive symptoms.*—The eight-item version of the Center for Epidemiologic Studies - Depression Scale (CES-D-8; van de Velde, Bracke, Levecque, & Meuleman, 2010) was used to assess depressive symptoms. Participants reported how often they experienced eight symptoms of depression in the past week (e.g., I felt depressed) on a 4-point scale (0 = rarely or never; 3 = most or all of the time). Responses were summed to produce a scale score. Mood is related to attention (Farrin, Hull, Unwin, Wykes, & David, 2003), which is why this assessment was made.

Convenience store shopping habits.*—A single item was used to measure how frequently participants shopped at convenience stores. Responses ranged from once per month (1) to several times per day (7).

Prior exposure to cigarette advertising at convenience stores.*—Prior exposure to cigarette advertising in convenience stores was assessed with an item adapted from the 2013 National Youth Tobacco Survey (Centers for Disease Control and Prevention, 2013): “During the last 30 days, about how often have you seen advertisements for cigarettes in convenience stores?” Response options were: never (0), hardly ever (1), some of the time (2), and most of the time (3).

Time shopping in the RSL.—The total amount of time (in minutes) participants spent shopping in the RSL was measured using an automated tracking device.

Attention toward tobacco power wall.—In this study, attention was operationalized as the amount of time a participant gazed at the tobacco power wall (for information on the reliability and validity of gaze as an index of attention, see Harrigan, 2008). A detailed manual was developed by the team to code the amount of time that participants spent attending to the tobacco power wall. Attention toward the power wall was defined as any instance in which a participant’s eyes were fixed at any section of the power wall. Recommended procedures were followed to maximize the reliability of the assessment, including the use of video recording, situating a disguised camera at a short distance (approximately 4 feet) from the participant, recording only one participant at a time, changing the position of the camera to accommodate participants of different height, and having eye level lighting to reduce shadows in participants’ eye sockets (Harrigan, 2008). Three raters independently coded the video tapes for attention and interrater agreement was very high (intraclass correlation = 0.95). Participants were categorized into a low-attention group (35%), which spent less than two seconds (within-group $M = 0.91$, $SD = 0.66$, $Mdn = 0.68$) looking at the power wall, and a high-attention group (65%), which spent two or more seconds (within-group $M = 6.94$, $SD = 5.62$, $Mdn = 5.08$) looking at the power wall. A two-second threshold was chosen because it aligns with advertising industry standards regarding the minimum amount of attention needed for an advertisement to make enough of an impression on consumers that they can later recall material from the ad (Media Research Council, 2016).

2.6. Dependent measure

Susceptibility to future cigarette smoking.—The same items that were included in the pre-RSL questionnaire to measure susceptibility to future cigarette smoking were included in the post-RSL questionnaire, allowing us to assess near-term changes in susceptibility after shopping in the RSL. The post-RSL measure was scored in the same manner as the pre-RSL measure.

3. Results

Of the 80 participants, 23 (28.8%) correctly guessed that the study was about smoking or tobacco. Guessing correctly was not significantly associated with responses to the dependent measure, and including this variable in the model described below did not affect the results.

Table 1 shows descriptive statistics and bivariate correlations for all variables included in our multivariable model of susceptibility to future cigarette smoking. As the table shows, participants spent an average of 4.26 minutes shopping in the RSL ($SD = 2.66$), which is close to the average amount of time the typical adolescent spends in a convenience store (4 minutes; Mastroberte, 2005). Fourteen percent of participants exhibited some susceptibility to future cigarette smoking at baseline; post-shopping, 28% of participants exhibited some susceptibility. Logistic regression was used to predict susceptibility to future cigarette smoking from attention toward the tobacco power wall controlling for baseline cigarette smoking susceptibility, negative mood, convenience store shopping habits, prior exposure to advertising at convenience stores, and amount of time spent shopping in the RSL. Results of the logistic regression model are shown in Table 2. The likelihood of exhibiting any (vs. no) susceptibility to future cigarette smoking was greater ($p = 0.046$) among participants who spent two seconds or more attending to the tobacco power wall compared with participants who spent less than two seconds.¹

4. Discussion

The current study advances our understanding of how exposure to the tobacco power wall—in its current, minimally-regulated form—may affect adolescents' susceptibility to smoke in the future. Although prior studies had demonstrated a causal association between exposure to the tobacco power wall and adolescents' risk for smoking (Shadel et al., 2016) and established perceived smoking norms as mediator of that association (Setodji et al., 2018), it was unclear until now whether those associations depend on youth paying a minimum amount of attention to the power wall or if the mere presence of the power wall is sufficient for it to impact susceptibility. That attention to the tobacco power wall was positively associated with susceptibility to future smoking susceptibility in this study suggests that policies aimed at decreasing the salience of power walls in retail outlets, e.g., locating the power wall elsewhere in the POS environment or reducing the size or volume of displayed

¹As a sensitivity test, we ran a version of our regression analysis in which we modeled attention toward the power wall and susceptibility to future cigarette smoking as continuous variables. Doing so did not change the results. We also ran a version of our analysis in which we modeled mood, convenience store shopping habits, and prior exposure to cigarette advertising as categorical variables. This also did not change the results.

products, should be given strong consideration as strategies for mitigating the impact of in-store displays on adolescent smoking.

This study has some limitations that should be kept in mind when interpreting its results. First, the correlational design of the study prevents us from drawing causal inferences about the association between attention to the tobacco power wall and adolescents' future smoking susceptibility. It is possible that we did not measure and control for key features of adolescents that may motivate them to attend or not attend to in-store tobacco displays and potentially explain the association that we observed between attention to the power wall and susceptibility to future smoking. We did, however, control for baseline susceptibility to future smoking which is likely to account for most such unmeasured factors. It is also possible that the amount of time one's gaze is fixed on the power wall measures something other than, or in addition to, attention to the power wall, e.g., a tendency to focus one's attention in general or discomfort making eye contact with the cashier who was standing near the power wall (i.e., social anxiety). Additional research is needed to rule out these alternative explanations. Second, though the RSL is modeled after a real convenience store, shopping in the RSL only approximates a real-world shopping experience. The ways in which it does not do so perfectly (e.g., the absence of other customers) may bear on our results. Third, our relatively small sample size resulted in a wide confidence interval for our estimate of the association between attention to the tobacco power wall and susceptibility to future smoking; thus, there is considerable uncertainty about the size of the association between these two variables. Finally, the RSL power wall, though organized according to tobacco product market share and industry norms, was not set up in a way that allowed for a more precise assessment of participants' attention toward specific products or sections of the power wall that had a specific price or poster displayed. Future research could, with the use of eye-tracking technology, evaluate attention to specific products, posters, and prices on the power wall to determine how these specific features work to capture attention.

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Table 1
Descriptive Statistics and Bivariate Correlations for All Study Variables (N = 80)

Variables	1	2	3	4	5	6	7
1. Baseline smoking susceptibility ^a	--						
2. Negative mood	0.01	--					
3. Frequency of shopping at convenience stores	-0.09	0.10	--				
4. Prior exposure to cigarette advertising at convenience stores	0.11	0.09	-0.05	--			
5. Time spent in the RAND Store Lab (in minutes)	-0.14	0.28*	0.06	-0.10	--		
6. Attention toward the tobacco power wall ^b	0.22	0.10	0.08	-0.13	0.12	--	
7. Post-shopping smoking susceptibility ^a	0.56***	0.11	0.02	0.13	-0.16	0.26*	--
<i>M</i>	0.14	11.68	4.30	2.06	4.26	0.65	0.28
<i>SD</i>	0.35	3.90	1.37	1.02	2.66	0.48	0.45

^aSmoking susceptibility: 0 = no susceptibility, 1 = any susceptibility.

^bAttention toward the tobacco power wall: 0 = less than two seconds, 1 = two or more seconds

* $p < 0.05$.

*** $p < 0.001$.

Final Logistic Regression Model Predicting Cigarette Smoking Susceptibility (Post-RSL) from Attention to the Tobacco Power Wall and Other Covariates

Table 2

Predictor	<i>b</i>	<i>SE</i>	Odds ratio [95% CI]	Wald χ^2	<i>p</i>
Baseline smoking susceptibility	3.60	1.19	36.60 [3.56, 376.15]	9.16	0.002
Negative mood	0.14	0.10	1.15 [0.94, 1.41]	2.10	0.147
Frequency of shopping at convenience stores	-0.10	0.27	0.91 [0.53, 1.54]	0.13	0.714
Prior exposure to cigarette advertising at convenience stores	0.37	0.40	1.45 [0.66, 3.16]	0.85	0.357
Time spent shopping in the RSL (in minutes)	-0.18	0.15	0.84 [0.63, 1.12]	1.38	0.241
Attention toward the tobacco power wall	2.04	1.02	7.69 [1.04, 56.83]	3.99	0.046

Note. RSL = RAND Store Lab; *N* = 80