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Pro-Tobacco Advertisement Exposure Among African American Smokers: An Ecological Momentary Assessment Study

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Abstract

Introduction—Many African Americans live in communities with a disproportionately high density of tobacco advertisements compared to Whites. Some research indicates that point-of-sale advertising is associated with impulse purchases of cigarettes and smoking. Ecological Momentary Assessment (EMA) can be used to examine associations between tobacco advertisement exposure and smoking variables in the natural environment.

Methods—Non-treatment seeking African American smokers were given a mobile device for 2 weeks ($N = 56$). They were prompted four times per day and responded to questions about recent exposure to tobacco advertisements. Participants were also asked to indicate the number of cigarettes smoked, and if they made any purchase, or an impulse purchase, since the last

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assessment. Linear mixed models (LMMs) analyzed between- and within-subject associations between exposure and outcomes.

Results—Participants reported seeing at least one advertisement on 33% of assessments. Of those assessments, they reported seeing menthol advertisements on 87% of assessments. Between-subject analyses revealed that participants who on average saw more advertisements were generally more likely to report purchasing cigarettes and to purchase cigarettes on impulse. Within-subject analyses revealed that when an individual participant reported seeing more advertisements than usual they were more likely to have reported purchasing cigarettes, making an impulse purchase and smoking more cigarettes during the same period, but not the subsequent time period.

Conclusions—Many African American smokers are frequently exposed to pro-tobacco marketing. Advertisement exposure is cross-sectionally associated with impulse purchases and smoking. Future research should assess prospective associations in more detail.

Keywords

Tobacco Advertising; Ecological Momentary Assessment; African Americans; Tobacco; Minority Health

1. Introduction

Tobacco use remains the leading cause of death and disease in the United States (Surgeon General, 2014). African American smokers suffer from tobacco-related diseases at a higher rate than White smokers (DeSantis et al., 2016). For instance, lung cancer incidence and mortality are higher among African American men compared to White men (DeSantis et al., 2016; Siegel, Miller, & Jemal, 2015). While African Americans smoke at similar rates as Whites and have a higher number of quit attempts, they are less likely to quit than White smokers (Jamal et al., 2015; Kulak, Cornelius, Fong, & Giovino, 2016). Given that quitting smoking can reduce the impact of tobacco-related diseases (Jha et al., 2013), it is important to understand factors that prompt smoking in African Americans.

Several studies indicate that many African Americans live in communities with a disproportionately high number of tobacco advertisements compared to Whites (Lee, Henriksen, Rose, Moreland-Russell, & Ribisl, 2015) (although see review in Lee et al. 2015 for null findings). For instance, one study reported that census block groups with a greater number of African Americans had more advertisements in general and more advertisements for menthol brands (Widome, Brock, Noble, & Forster, 2013). This disparity reflects marketing targeted at African Americans by tobacco companies (Anderson, 2011).

Much of tobacco advertising research focuses on the tobacco retail outlet environment, also referred to as Point of Sale (POS) (Bettigole & Farley, 2016; Richardson, Ganz, & Vallone, 2014). POS environments include gas stations/convenience stores, liquor stores, and tobacco stores (Widome et al., 2013). Advertising in convenience stores and gas stations is of concern because individuals are exposed to tobacco advertisements in locations where they may not intend to purchase tobacco.

Research on POS advertisements have used cross-sectional and longitudinal designs (Germain, McCarthy, & Wakefield, 2010; Wakefield, Germain, & Henriksen, 2008), post-purchase surveys (Carter, Mills, & Donovan, 2009; Clattenburg, Elf, & Apelberg, 2012), behavioral laboratory experiments (Kim et al., 2013; Paris et al., 2011), and diary-style surveys (Burton, Clark, & Jackson, 2012; Martino, Scharf, Setodji, & Shadel, 2012). A systematic review of 22 studies reported that there is a consistent relationship between reported exposure to POS advertisements and smoking among youth and adults (Robertson, McGee, Marsh, & Hoek, 2014). Exposure to POS cigarette advertisements is associated with craving, unplanned purchases of cigarettes and smoking (Burton et al., 2012; Paris et al., 2011; Robertson et al., 2014; Wakefield et al., 2008). Descriptive post purchase survey studies (where participants are assessed right after leaving a POS environment) reported that 11% to 22% of participants report purchasing a cigarette because they saw a POS display (Carter et al., 2009; Clattenburg et al., 2012). Additionally, a cross-sectional survey study reported that 25% of smokers purchased cigarettes because of exposure to a POS display (Wakefield et al., 2008).

Cross-sectional and post-purchase studies are limited because they do not include control groups that were not exposed to POS displays and because they could not assess the prospective association between exposure and purchases (Robertson et al., 2014). One longitudinal study did report that adult smokers with medium or high levels of sensitivity to POS displays were less likely to quit smoking (Germain et al., 2010). In addition, results from behavioral laboratory studies indicate that exposure to virtual tobacco POS advertisements is associated with greater craving and purchasing compared to virtual environments with no advertisements (Kim et al., 2013; Paris et al., 2011).

While these studies suggest a causal relationship between exposure to advertisements and purchasing/smoking, they have limited ecological validity. Recently, exposure to tobacco advertisements has been examined through daily diary assessments or Ecological Momentary Assessment (EMA) (Borzekowski & Chen, 2016; Burton et al., 2012; Shadel, Martino, Setodji, & Scharf, 2012), which involves assessing participants in the “real world.” (Shiffman, Stone, & Hufford, 2008). EMA studies have examined the frequency of reported exposure to advertisements and the associations between reported exposure and smoking intention or behaviors (Martino et al., 2012; Scharf, Martino, Setodji, Staplefoote, & Shadel, 2013). Martino and colleagues reported an average of 8 exposures in a 21 day period in college students (Martino et al., 2012). Reported exposure to tobacco advertisements among college students may also be associated with smoking intention (Shadel et al., 2012; Shadel, Martino, Setodji, & Scharf, 2013). Burton et al. (2012) reported that Australian adult smokers reported seeing tobacco displays on more than 40% of the 4-hour periods that they were outside the home. Reported exposure to tobacco displays also increased the probability of smoking. A further benefit of using EMA is that the “within-person” effect of exposure can be examined (Within individuals, does reported exposure to advertisements increase current or future risk of smoking?) as well as the “between-person” effect (Do individuals who report generally more exposure smoke more?).

To the authors’ knowledge, there are no published EMA tobacco advertising studies using U.S. adult smokers. Systematic reviews highlight the need for additional EMA research on

studies examining advertisement exposure among adult smokers. Studies of youth and nonsmokers include outcomes such as future smoking risk which do not provide information on how advertisement exposure impacts fluctuations in purchases and smoking behavior among established smokers. (Martino et al., 2012; Shadel et al., 2012). In addition, given the disparities among African American smokers noted above, it is especially important to collect data on exposure to advertising among African American smokers. The current study uses EMA to assess associations between reported tobacco advertisement exposure and behaviors related to smoking among African American smokers. The main hypothesis is that reported exposure to tobacco advertisements will be positively associated with purchases and smoking behavior.

2. Materials and Method

This is a secondary data analysis of data from 56 participants who were enrolled in a randomized controlled trial that examined the effect of attentional retraining (Robinson et al., 2017). In the parent study, 64 non-treatment seeking smokers were recruited from the Washington, D.C., area, of whom 56 provided EMA data. Participants were 18 to 65 years old; self-identified as African American; reported smoking 5 or more cigarettes per day for the past year; had a home address and telephone number and specified English as the first language. Participants were excluded if they used tobacco products other than cigarettes; used smoking cessation pharmacotherapies; were currently trying to quit smoking; had another household member enrolled in the study; color vision deficiency; breath carbon monoxide (CO) <8 ppm or were pregnant or breastfeeding. The study was approved by the Institutional Review Board of the Uniformed Services University of the Health Sciences.

2.1 Procedure

Study procedures are reported in detail in Robinson et al. (2017). Briefly, participants attended a baseline visit (Visit 1) where research staff provided a description of the study, confirmed eligibility, and obtained written informed consent. Eligible participants performed cognitive assessments, completed self-report measures, provided breath and saliva samples, and received training on the use of a personal digital assistant (PDA). Participants were also trained on how to identify and record exposures to tobacco advertisements on the PDA. Participants were informed that tobacco advertisements were any poster or graphic promoting tobacco products seen in places such as a grocery store or convenience store, a bar/restaurant, and the internet. Participants were also trained to complete assessments on the PDA and they completed a practice assessment in the laboratory.

Participants carried the PDA with them for up to two weeks in the “field” (i.e., as they went about their daily life). They were instructed to complete four PDA random assessments (RA) per day. The PDA program divided the day into four equal “periods”. An RA was scheduled at a random time during each period. Participants were also permitted to complete a participant-initiated assessment if they missed an RA. The median interval between completed PDA assessments was 3.67 hours. At each assessment, participants were instructed to report exposure to tobacco advertisements and the smoking outcomes (smoking

and purchasing) (items described later). Participants were told that they could “smoke as much or as little as they liked” throughout the study.

Participants attended up to two additional visits in the laboratory (Visits 2 and 3) and data from these assessments are reported elsewhere (Robinson et al., 2017). Participants were compensated $20 for each visit, $3 for each day in the study, and $1 for each completed RA. No compensation was provided for participant-initiated assessments.

2.2 Measures

At baseline, participants completed an author constructed demographics questionnaire. The Fagerström Test for Nicotine Dependence (FTND) was used to assess nicotine dependence (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). In this sample, Cronbach’s alpha = .60, which is consistent with prior research (Okuyemi et al., 2007).

2.2.1 Exposure to Advertisements—Exposure to cigarette advertisements was assessed using a modified version of the EMA survey by Shadel and colleagues (Shadel et al., 2012). Items included the number of advertisements, the presence of menthol advertisements, location of advertisement (e.g., convenience store/grocery store), and brand of advertisement (e.g., Newport). Participants were asked to report exposures since their last assessment. The number of advertisements item used the following scale (0 = No advertisements seen, 1 = 1 advertisements seen, 2 = 2 advertisements seen, 3 = 3 advertisements seen, 4 = 4 or more advertisements seen). Items on menthol advertisements and brands were based on tobacco marketing research and preferences among African Americans (Anderson, 2011; Glasser et al., 2016). Responses for menthol, convenience store/grocery store, bar/restaurant, internet, Newport, Kool, Marlboro were coded as dichotomous variables (yes/no) (see Supplementary Materials, Figure S1).

2.2.2 Purchasing Cigarettes—Purchasing cigarettes was assessed on the PDA using the following item: (“Since the last assessment, have you purchased any cigarettes at all?”), coded as “0” (No) or “1” (Yes). Impulse buying was assessed using the following item (“Since the last assessment, have you purchased any cigarettes “on impulse”?), coded as “0” (No) or “1” (Yes).

2.2.3 Smoking—Smoking was assessed on the PDA using the following item: “Since the last assessment, how many cigarettes have you smoked?” (response options: 0=none; 1=one cigarette; 2=two cigarettes; 3=three cigarettes; 4=four or more cigarettes). The smoking item was positively associated with heaviness of smoking in this sample as well as cotinine levels.

Baseline smoking status was verified with salivary cotinine (Ossip-Klein et al., 1986). Exhaled Carbon Monoxide levels were measured with a CO monitor (Bedfont Micro Smokerlyzer, Kent UK). At Visit 1 participants were excluded if the CO monitor indicated that a participant’s expired CO level was lower than 8 ppm, because it is unlikely that the individual actually smokes at their stated rate (Ahluwalia et al., 2006; Benowitz et al., 2002).

2.3 Mobile Device Hardware and Software

The Hewlett-Packard IPAQ Personal Digital Assistant (PDA) runs on the Windows Mobile Operating system. Application programming was done in C#.NET. Participants used the touch screen to enter responses.

2.4 Analytic Plan

Means (SD) (continuous variables) and proportions (categorical variables) were computed to describe demographic variables, smoking variables, and self-reported exposure to advertisements. Linear mixed models (LMMs) (PROC MIXED in SAS for continuous outcomes, PROC GLIMMIX for binary outcomes) (Littell, Stroup, Milliken, Wolfinger, & Schabenberger, 2006) were used to examine the association between advertisement exposure and outcomes. LMMs allow for the fact that subjects differ in the number of observations available for analysis, and take into account clustering of data by subjects. For all models using PROC MIXED, a random (subject-specific) intercept and an autoregressive model of order 1 (AR1) for the residuals within subjects was used. Treatment condition (Active vs. Control) was included as a level 2 covariate; its effect was not examined in this study (see Supplementary Materials). Day of study, time of day, and assessment type (RA vs. participant-initiated) were included as level 1 covariates.

There were three dependent variables in this study (Tables 1 and 2): Purchase (y/n coded as “1” or “0”), Impulse buying (y/n coded as “1” or “0”) and reported smoking (0–4 scale). The primary independent variables were a *Mean Exposure* score and a *Deviation Exposure* score derived from the number of advertisements item. The *Mean Exposure* score (a level 2 variable) was computed by aggregating number of advertisements responses over all available assessments for each subject. The *Deviation Exposure* score (a level 1 variable) was computed as the difference between the number of advertisements score at each assessment and the *Mean Exposure* score. *Mean Exposure* and *Deviation Exposure* scores were entered together. A significant effect for *Mean Exposure* would indicate a between-subject association (i.e., participants who report generally higher number of advertisements have higher values on the dependent variable). A significant effect for *Deviation Exposure* indicates a within-subject association, i.e., when a participant reports a higher number of advertisements than his or her average he or she also reports higher values on the dependent variable (Hedeker, Demirtas, & Mermelstein, 2009; Hedeker & Gibbons, 2006). Power to detect a within-subject association (between two level 1 variables) is generally higher than power to detect a between-subject association (between a level 2 and level 1 variable) (Snijders, 2005).

Deviation Exposure tests whether greater exposure than usual to tobacco advertisements during time period t is associated with higher values of the dependent variable during the same time period, t. In this analysis, it is not known if exposure precedes the outcome. To make the analysis prospective, *Deviation Exposure* was lagged, such that it tests whether exposure to advertisements during time period t is associated with higher values of the dependent variable during the subsequent time period, t_{+1}. This lagged analysis also included the lagged value of the dependent variable as a covariate. To limit the duration

between exposure and outcome, this analysis was restricted to assessments which occurred on the same day as the previous assessment.

3. Results

The mean age of participants (n = 56) was 43.75 (SD = 12.55) and 53.57% of participants were male. The average score on the FTND was 4.45 (SD = 2.21), indicative of low to moderate nicotine dependence (Heatherton et al., 1991). Participants reported smoking an average of 13 cigarettes per day (SD = 7.16). Mean CO at baseline was 11.95 ppm (SD = 4.31), and mean cotinine level at baseline was 377.89 ng/m (SD = 245.47).

Participants (n = 56) completed at least one item from 2,419 trainings/assessments, and provided data on advertisement exposure on 2,282 assessments. The mean number of days of PDA data was 13.09 days (SD = 3.79). Participants were scheduled to complete 56 assessments over the two-week period. On average participants completed approximately 40 assessments. Approximately 25% of assessments were participant initiated and the remaining 75% were “PDA-initiated” (random assessments). Participant attrition was due to lost PDAs and lost to follow-up (see Robinson et al. 2017 for more detail).

3.1 Frequency of Exposure and Purchasing/Smoking

Participants reported seeing 0 advertisements (since the previous assessment) on 1517 (66.47%) of PDA field assessments, 1 advertisement on 254 (11.13%) of PDA field assessments, 2 advertisements on 225 (9.90%) of PDA field assessments, 3 advertisements on 132 (5.78%), and 4+ advertisements on 154 (6.75 %) PDA field assessments (Table 1). Participants reported seeing at least one advertisement since the previous assessment on 77.01% of days on which they provided data. Participants reported seeing a menthol advertisement on 667 (29.22%) assessments. Advertisements were seen in convenience stores on 587 (25.46%) assessments, in bars or restaurants on 182 (7.75%) assessments, and on the internet in 148 (6.26%) assessments. Participants reported seeing Newport advertisements on 665 (29.06%) assessments, Kool on 419 (18.27%) assessments, and Marlboro on 444 (19.24%) assessments (Table 1).

For the dependent variables, participants reported any purchasing on 695 (30.46%) assessments, and impulse buying on 296 (12.98%) assessments. Participants reported not having smoked since the last assessment on 373 (16.36%) assessments.

3.2 Associations between Exposure and Purchasing/Smoking

Table 2 reports the association between the independent variables and the dependent variables (purchases, impulse purchases, and smoking) for the between-subject association, within subject association, and lagged analysis.

3.2.1 Number of Advertisements—There was a significant association between number of advertisements and purchasing cigarettes for the between subject association and the within subject association (Table 2*).* Participants who were generally exposed to more advertisements were more likely to purchase cigarettes (between subject association). Additionally, if an individual participant was exposed to more advertisements than his or her

average during period *t*, then she or he was more likely to purchase cigarettes during period *t* (within subject association).

Similarly, there was a significant association between number of advertisements and impulse buying for the between subject association and the within subject association (Table 2).

The effect of number of advertisements on smoking was significant in the within-subject analysis (Table 2). If an individual participant was exposed to more advertisements than during period *t*, then she or he reported smoking more cigarettes during period *t* (within-subject association) (Figure 1). This within-subject association persisted when subsetting to assessments in which participants reported no recent purchases (not shown in Table 2), $F(1, 1417) = 16.18$, $p < .001$.

There were no significant associations between exposure and any dependent variable for the lagged analyses (Table 2).

3.2.2 Menthol—For analyses with menthol advertisements as the independent variable, the within subject associations were significant for purchase, impulse, and smoking (Table 2). The between-subject association was not significant for any dependent variable. The same was true for the lagged analysis.

Associations between exposure and purchasing/smoking for the other exposure items are presented in the supplementary materials (Table S2).

4. Discussion

The aims of this study were to describe the frequency that African American smokers report being exposed to tobacco advertisements and to examine the association between exposure and cigarette purchases/smoking. The main findings were as follows. First, participants reported being exposed to at least one advertisement on about one-third of assessments. Second, participants who on average saw more advertisements were generally more likely to report purchasing cigarettes and to purchase cigarettes on impulse. Third, when an individual participant reported seeing more advertisements than usual he or she was more likely to have reported purchasing cigarettes, making an impulse purchase, and smoking more cigarettes during the same time period. Last, there was no evidence for a significant prospective association between seeing more advertisements than usual and cigarette purchases/smoking during the subsequent assessment period.

The between-subject association reveals that participants who report seeing more advertisements also report more purchases and impulse purchases. Exposure to advertisements might generally increase risk of purchasing, either in the short term or through a cumulative effect. Alternatively, participants who purchase a lot of cigarettes may report seeing a lot of advertisements through the act of purchasing. The current study cannot disambiguate these possibilities, but it does reveal that there is robust association.

For the within-subject association, it is possible that advertisement exposure causes purchases/smoking or that purchases/smoking causes advertisement exposure because the

exposure and purchasing occur in the same time period. In addition, a third unknown (level 1) variable may cause both exposure and purchases/smoking. Again, it is not possible to disambiguate these possibilities. The absence of a significant effect in the lagged analysis also makes it difficult to draw a conclusion about the direction of the association.

However, previous research provides evidence that advertisement exposure can cause purchases/smoking. As noted earlier, laboratory studies have experimentally manipulated tobacco advertisement exposure and report that advertisement exposure is associated with increased purchases compared to control cues (Kim et al., 2013; King et al., 2016; Paris et al., 2011). It is possible that the prospective association was not detected in the current study because the duration between exposure and outcome was too long. For example, exposure to tobacco advertisements may acutely provoke purchasing/smoking over the timescale of minutes, rather than hours. Moreover, if an advertisement does indeed strongly prompt purchasing (or smoking) during time period t, there may be less need to purchase cigarettes (or smoke) during time period t_{+1}. Future studies should assess exposure more intensely to better understand any prospective association between exposure and purchasing/smoking.

Results from this study add to existing laboratory, cross-sectional, and epidemiological findings on the association between advertisement exposure and smoking (Robertson et al., 2014). The study also extends the work of Burton et al. (2012), who reported that people who saw cigarettes for sale were more likely to smoke, smoked more cigarettes, and a marginally significant prospective relationship between advertisement exposure and impulse purchases. In the current study, advertisement exposure was also associated with purchases (impulse and regular purchases) and smoking. We similarly did not find a significant positive prospective association between exposure and purchases.

This study also extends previous work by examining the effect of exposure to menthol advertisements on purchasing/smoking cigarettes. Menthol cigarettes are targeted to African American smokers and 88% of African American smokers prefer menthol cigarettes (Anderson, 2011; Giovino et al., 2013). Overall, participants in this study reported seeing menthol advertisements on 30% of assessments. Furthermore, menthol advertisements were seen on 87% of assessments where at least one advertisement was reported. We also found that if a participant was exposed to a menthol advertisement he or she was more likely to purchase cigarettes, purchase on impulse, and smoke. As noted by previous researchers, menthol cigarettes may indirectly contribute to the disproportionate negative health outcomes among African American smokers (Alexander et al., 2016). The current study adds to this literature by demonstrating that menthol advertisements are associated with cigarette purchases and smoking cigarettes.

The current study has strengths. It is the first study to examine associations between exposure and purchasing/smoking in US smokers using EMA, and it extends previous work by examining between and within-subject associations. This study also had limitations. There was no control advertisement assessed (e.g. advertisements for food). Future research could assess a control advertisement in addition to tobacco advertisements to bolster confidence that the observed effects are due to tobacco advertisements as opposed to advertisements in general. Also, this study used a self-report measure of tobacco

advertisement exposure which may be limited by a participant's ability to accurately recall their exposures. Future studies should consider the development of objective measures of tobacco advertisement exposure. In addition, definitions of impulse purchases vary in the literature which may limit the ability to compare findings between studies (Siahpush et al., 2015; Wakefield et al., 2008). Future research should examine these various measures and refine the assessment of tobacco impulse purchases.

Future research should use different EMA designs. In the current study participants were required to report exposure and outcomes at each assessment. In contrast, Shadel et al. (2012) used a case controlled approach in which responses to advertising exposures assessed as events (when encountered) were contrasted with responses at control/random prompts. Replicating the findings of the current study using a case controlled would bolster confidence in the results.

Finally, as noted earlier, this was a secondary data analysis and the parent study included an intervention (Robinson et al., 2017). This inclusion limits generalizability of the findings, in that it is not known whether the data observed here would be obtained in an observational study.

5. Conclusions

Overall, this study indicates that tobacco advertisements are ubiquitous in the day to day lives of African American smokers. This study also indicates that exposure to advertisements is associated with cigarette purchases and smoking and may provoke cigarette purchases and smoking in the short term. Advertisements are a powerful environmental cue that African American smokers have limited control over. Future research may inform regulatory actions on advertising to African American smokers. Finally, this study illustrates how EMA can be used to examine cross-sectional and prospective relationships between advertisement exposure and smoking behavior.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- African American smokers reported frequent exposure to pro-tobacco marketing
- Advertisement exposure is cross-sectionally associated with impulse purchases and smoking
- There was no evidence for a significant prospective association between seeing more advertisements than usual and cigarette purchases/smoking during the subsequent assessment period

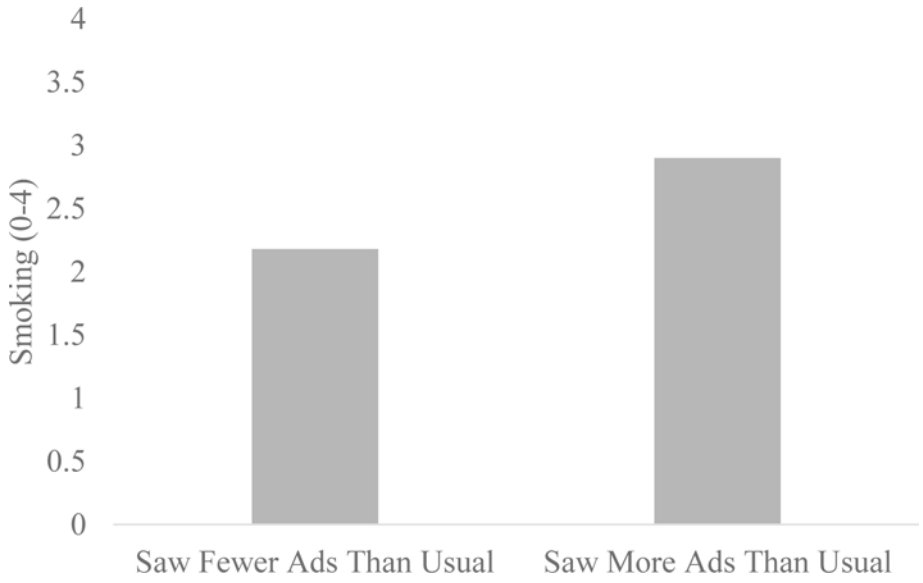

Figure 1.
Within subject association of advertisement exposure and smoking

Table 1

Descriptive Statistics for Purchasing/Smoking by Exposure

DV →			**Any Purchase**	**Impulse Purchase**	**Smoking**
Item ↓	**Response**	***n***	**% Yes**	**% Yes**	**Mean (SD)**
No. of Advertisements Seen					
	0	1517	19.12	7.98	2.15 (1.50)
	1	254	44.88	18.11	2.48 (1.41)
	2	225	52.44	23.56	2.91 (1.22)
	3	132	59.85	25.00	3.06 (1.20)
	4+	154	61.04	27.92	3.29 (1.20)
Menthol					
	Y	667	59.37	26.54	2.88 (1.34)
	N	1615	18.51	7.37	2.18 (1.49)

Table 1 Note. Any Purchase was a yes/no variable (there were 695 “yes” responses). Impulse Purchase was a yes/no variable (there were 296 “yes” responses). Smoking was assessed on a 0–4 scale (see text). Menthol was coded as yes/no (see methods and supplemental materials). Sample size (n) for the “no” response for Impulse Purchase = 1614.

Table 2

Association between Reported Exposure and Purchasing/Smoking

DV →			**Purchase**					**Impulse**					**Smoking**				
	n1	**n2**	**df_d**	**PE**	**SE**	**F**	**p**	**df_d**	**PE**	**SE**	**F**	**P**	**df_d**	**PE**	**SE**	**F**	**P**
IVs↓																	
No. of Advertisements (0–4+)	2282	56															
Between			**2111**	**.98**	**.27**	**13.33**	**.0003**	**2110**	**1.04**	**.33**	**9.66**	**.0019**	2109	.38	.21	3.31	.07
Within			**2111**	**.56**	**.05**	**157.17**	**<.0001**	**2110**	**.34**	**.05**	**38.54**	**<.0001**	**2109**	**.22**	**.02**	**110.60**	**<.0001**
Within-Lagged			1386	.04	.06	.49	.48	1384	− .03	.83	.13	.72	1381	.015	.03	.33	.56
Menthol	2282	56															
Between			2112	.74	.64	1.35	.25	2111	1.63	.84	3.81	.05	2110	.38	.53	.52	.47
Within			**2112**	**1.93**	**.13**	**218.93**	**<.0001**	**2111**	**1.35**	**.16**	**72.07**	**<.0001**	**2110**	**.49**	**.05**	**72.10**	**<.0001**
Within-Lagged			1386	−.29	.16	3.21	.07	1384	.08	.20	.19	.66	1382	− .002	.69	0.00	.96

Table 2 Note. n_1 = number of level 1 units, i.e., assessments; n_2 = number of subjects (level 2 units). n1 for between and within analyses for impulse = 2281; n1 for between and within analyses for smoking = 2280. Between = *Mean Exposure*; Within = *Deviation Exposure* (see text for details). n1 for lagged analyses: Purchase = 1553; Impulse = 1551; Smoking = 1549. df_d = denominator degrees of freedom (for all analyses, numerator df = 1)