SRNT

OXFORD

Original investigation

Tobacco Advertisement Liking, Vulnerability Factors, and Tobacco Use Among Young Adults

Brianna A. Lienemann PhD[1], **Shyanika W. Rose PhD[2], Jennifer B. Unger PhD[1], Helen I. Meissner PhD[3], M. Justin Byron PhD[4], Lourdes Baezconde-Garbanati PhD[1], Li-Ling Huang PhD[4,5], Tess Boley Cruz PhD[1]**

[1]Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, CA; [2]Truth Initiative Schroeder Institute, Washington, DC; [3]Tobacco Regulatory Science Program, Office of Disease Prevention, National Institutes of Health, Bethesda, MD; [4]Lineberger Comprehensive Cancer Center, University of North Carolina at Chapel Hill, Chapel Hill, NC; [5]Master Program in Global Health and Development, Taipei Medical University, Taipei, Taiwan

Corresponding Author: Brianna A. Lienemann, University of Southern California, Keck School of Medicine, Institute for Prevention Research, 2001 N. Soto Street, Los Angeles, CA 90032, USA. Telephone: (310)924-1711, E-mail: blienema@usc.edu

Abstract

Introduction: Young adulthood (aged 18–24) is a crucial period in the development of long-term tobacco use patterns. Tobacco advertising and promotion lead to the initiation and continuation of smoking among young adults. We examined whether vulnerability factors moderated the association between tobacco advertisement liking and tobacco use in the United States.

Methods: Analyses were conducted among 9109 US young adults in the nationally representative Population Assessment of Tobacco and Health (PATH) Study wave 1 (2013–14). Participants viewed 20 randomly selected sets of tobacco advertisements (five each for cigarettes, e-cigarettes, cigars, and smokeless tobacco) and indicated whether they liked each ad. The outcome variables were past 30-day cigarette, e-cigarette, cigar, and smokeless tobacco use. Covariates included tobacco advertisement liking, age, sex, race or ethnicity, sexual orientation, education, poverty level, military service, and internalizing and externalizing mental health symptoms.

Results: Liking tobacco advertisements was associated with tobacco use, and this association was particularly strong among those with lower educational attainment (cigarettes, cigars) and living below the poverty level (e-cigarettes, smokeless tobacco).

Conclusions: The association between tobacco advertisement liking and tobacco use was stronger among young adults with lower educational attainment and those living below the poverty level. Policies that restrict advertising exposure and promote counter-marketing messages in this population could reduce their risk.

Implications: This study shows that liking tobacco advertisements is associated with current tobacco use among young adults, with stronger associations for vulnerable young adults (ie, lower education levels and living below the poverty level). Findings suggest a need for counter-marketing messages, policies that restrict advertising exposure, and educational interventions such as health and media literacy interventions to address the negative influences of tobacco advertisements, especially among young adults with a high school education or less and those living below the poverty level.

Introduction

Most daily smokers (88%) in the United States try their first cigarette by age 18, and nearly, all (99%) start by age 26.[1] During the 2000s, the rate of smoking onset was actually greater among young adults (aged 18–25; 6.3%) than adolescents (aged 12–17; 1.9%).[2] Almost one-third (31%) of US adult daily smokers began smoking daily in young adulthood (19–26), while only 4% transitioned to daily smoking after age 26.[1] Young adulthood is a critical period for determining if intermittent smoking will become a long-term addiction.[3] Young adults (18–24) have the highest prevalence of 30-day use of all tobacco products compared with other age groups.[4] Among young adults, the most popular tobacco products (30-day use) are cigarettes (28.8%), e-cigarettes (12.5%), cigarillos (12.4%), and hookah (10.7%).[4]

Among young adults, tobacco use is highest among certain vulnerable populations including American Indians or Alaska Natives and Whites,[5–7] lesbian, gay, bisexual, and transgender (LGBT) individuals,[8] low income,[6,8] low educational attainment,[6,8–10] military personnel,[11] and individuals with mental health symptoms.[12] There has also been a call to action for a greater focus on women's tobacco use and a consideration of gender in tobacco prevention and control activities.[13] While young adult males smoke cigarettes more than females, the gender gap has decreased.[14]

Many of these populations have been the focus of tobacco industry marketing tailored for cultural, racial or ethnic, and low socioeconomic groups.[15,16] Targeted advertising could contribute to these groups being particularly vulnerable to tobacco marketing and promotion, thus being more receptive to liking tobacco advertisements.

Tobacco Marketing

Exposure to tobacco advertising is associated with increased likelihood of initiation and continuation of smoking among young adults.[1] A partial explanation for the effectiveness of tobacco advertising is the extent to which viewers like an advertisement.[17,18] Advertising liking has been shown to be one of the strongest factors associated with persuasion and sales.[19] Smit et al.[20] proposed several reasons for this association. First, people are more likely to pay attention to advertisements they like, which can lead to greater message processing. Second, advertising is considered an extension of the brand, so advertisement liking could lead to buying the product. Third, likable advertisements may influence information processing by stimulating positive arousal and activation, improving information recall, and leading to positive judgments of the message and product. Fourth, positive emotions in advertisements arouse positive attitudes toward the advertisement, which transfers to the likability of the brand and may lead to an amplification of benefits and reduced perceived risk.[20,21]

Previous research on tobacco advertising liking among adolescents demonstrates positive associations between tobacco advertising liking and tobacco susceptibility and use.[22,23] Research on young adults is less common but shows a similar association of tobacco advertising liking and use.[3,24–26] However, these studies have not examined differences in the association between tobacco advertisement liking and use based on vulnerability factors. Tobacco companies have historically developed global marketing strategies (eg, lifestyle magazines) targeted to young adults, including advertising at universities, colleges, bars, and clubs, which have been associated with tobacco use among young adults.[3,10,27–29] The widespread efforts of the tobacco industry in advertising to young adults likely have contributed to advertising liking and tobacco use.

The current study examines whether vulnerability factors strengthen the association between tobacco advertisement liking and use. Vulnerability factors indicate groups that have high tobacco use prevalence and have been the focus of targeted tobacco industry marketing. We hypothesize that tobacco advertisement liking and vulnerability factors (ie, male, White, lesbian, gay, bisexual, something else [LGB], low income, low educational attainment, mental health symptoms, military personnel) will be associated with 30-day tobacco use and that the association between tobacco advertisement liking and use will be stronger among individuals with vulnerability characteristics.

Method

Data Source

The nationally representative sample consisted of US young adults aged 18–24 (*N* = 9112) from the US National Institutes of Health and US Food and Drug Administration's Population Assessment of Tobacco and Health (PATH) wave 1 dataset. An address-based, area-probability sampling method identified participant households.[30] The study oversampled tobacco users, young adults (18–24 years old), and African Americans. Data collection of wave 1 was conducted from September 12, 2013 to December 15, 2014 by Westat using audio computer-assisted self-interviewing. The study addressed tobacco use, health outcomes, risk perceptions, and attitudes toward current and emerging tobacco products. The survey design and protocol were approved by the Westat Institutional Review Board (IRB), data collection approved by the US Office of Management and Budget, and analysis approved by the University of Southern California IRB. More information about the design and methods are available elsewhere.[31]

Measures

Demographic Characteristics

Demographic variables were age, sex (male, female), sexual orientation (straight, LGB), race or ethnicity (Hispanic, White, Black, Asian, Native Hawaian or Other Pacific Islander, American Indian or Alaska Native, multiethnic), education (less than high school or General Educational Development [GED], high school degree, some college or associate degree, bachelor's or advanced degree), poverty level based on annual household income and US Department of Health and Human Services (HHS) poverty guidelines (<100% of federal poverty level, 100%–199%, ≥200%), and military service (never served, served).

Mental Health Symptoms

Internalizing and externalizing symptoms were assessed with scales from the Global Appraisal of Individual Needs—Short Screener modified for the PATH study.[32] The four-item internalizing subscale assessed depression, sleep troubles, anxiety, and distress. The five-item externalizing subscale assessed attention deficits, hyperactivity, impulsivity, and conduct problems. Points were assigned for each item if participants indicated past 12-month incidence of the symptom and categorized as low (0), moderate (1–2), and high (3+), as recommended to identify people likely to have a current diagnosis.[32]

Tobacco Advertisement Liking

Participants indicated whether they liked 20 tobacco advertisements that were randomly sampled for each participant from a pool of 959 actual tobacco advertisements in various media (print, TV, web).

While participants did not see the same 20 advertisements, each participant was shown five cigarette, five e-cigarette, five smokeless tobacco, and five cigar advertisements. These advertisements were part of 11 stratum: (1) one Marlboro cigarette, (2) one Camel cigarette, (3) one Newport cigarette, (4) two other cigarettes, (5) two snus, (6) two oral dip, (7) one chew, (8) one large cigar, (9) four cigar or cigarillo, (10) two e-cigarette TV, and (11) three e-cigarette non-TV advertisements. Advertisements were randomly selected within each stratum during the administration of the interview. Once an ad was selected for a participant, the systematic sampling used a newly generated random number to start the selection process again. Participants were shown an advertisement and asked if they "like this ad," "have no opinion about this ad," or "dislike this ad." We created four advertisement liking variables based on the featured tobacco product: cigarettes, e-cigarettes, cigars (large cigar, non-large cigar), and smokeless (Snus, oral dip, chew). We categorized to participants who had no opinion or disliked all advertisements (did not like advertisements), liked one advertisement, and liked two to five advertisements (liked multiple advertisements). This categorical measure was used for all analysis instead of a continuous measure because the continuous measure had significant skew and kurtosis: cigarette ($M = 0.28$, SD $= 0.80$, *Skew* $= 3.21$, *Kurtosis* $= 12.33$, $\alpha = 0.57$); e-cigarette ($M = 0.30$, SD $= 0.78$, *Skew* $= 3.27$, *Kurtosis* $= 11.94$, $\alpha = 0.67$); cigar ($M = 0.28$, SD $= 0.77$, *Skew* $= 3.34$, *Kurtosis* $= 12.19$, $\alpha = 0.68$); smokeless tobacco ($M = 0.21$, SD $= 0.68$, *Skew* $= 3.98$, *kurtosis* $= 17.94$, $\alpha = 0.70$). See Supplementary Figure 1 for the percentages of each category of advertisement liking by tobacco product.

Tobacco Use

The four outcome variables were used in the past 30 days of tobacco products featured in the advertisements: cigarettes, e-cigarettes, cigars (traditional cigars, cigarillos, filtered cigars), and smokeless (smokeless tobacco, snus). Participants were categorized as "used" if they used that tobacco product in the past 30 days or "did not use" otherwise.

Statistical Analysis

PATH data are weighted to compensate for oversampling of some groups and non-response. Final adult weights as calculated by the PATH Study were used for analysis.[33] We conducted the analysis with complex samples ordinal regression (advertisement liking as outcome variables) and logistic regression (tobacco use as outcome variables) in SPSS 24. All vulnerability factors were entered into the models as covariates to control for their association with advertisement liking and tobacco use. However, because of small cell sizes, American Indians or Alaska Natives and Native Hawaiians or Pacific Islanders had to be dropped from all analyses, while Asians were dropped from smokeless tobacco analysis.

The outcome variables for advertisement liking were cigarette ads, e-cigarette ads, cigar ads, and smokeless tobacco ads. As each outcome consisted of three levels, we conducted separate ordinal regressions analyzing the main effects of the vulnerability characteristics.

For our main analyses, the outcome variables were 30-day cigarette, e-cigarette, cigar, and smokeless tobacco use. We first included only main effects. Second, we ran separate analyses for ad liking interactions with the vulnerability characteristics. Results are reported when a significant interaction suggested that vulnerability characteristics (eg, education) moderated the association (ie, changed the strength or direction) between ad liking and tobacco use. However, details are not provided when a significant interaction

suggested that ad liking moderated the association between vulnerability characteristics and tobacco use. This analysis assessed the association between variables; it does not assess causality as data were collected simultaneously. Only significant results are reported ($p < .05$).

Results

Sample Demographics

The sample was 50.3% male, 21.1 years of age on average, and predominantly non-Hispanic White (55.0%), straight (91.2%), and had never served in the military (98.5%). A plurality had completed some college or associate degree (43.2%) and were living below the poverty line (47.4%) (Table 1).

Tobacco Advertisement Liking

There were 11.0% of participants who liked one cigarette ad and 5.8% who liked multiple cigarette ads. Greater odds of liking cigarette advertisements were reported for older age, male, LGB, military service, and moderate and high levels of externalizing symptoms. Lower odds were reported for high school graduate. There were 9.4% of participants who liked one e-cigarette ad and 7.0% who liked multiple e-cigarette ads. Greater odds of liking e-cigarette advertisements were reported for LGB and moderate and high levels of internalizing and externalizing symptoms. Lower odds were reported for all levels of lower education. There were 8.1% who liked one cigar ad and 6.2% who liked multiple cigar ads. Greater odds of liking cigar advertisements were reported for male, LGB, Black, multiracial or ethnic, and moderate and high levels of internalizing and externalizing symptoms. Lower odds were reported for less education than high school or GED and high school graduate. There were 6.8% of participants who liked one smokeless tobacco ad and 5.5% who liked multiple smokeless tobacco ads. Greater odds of liking smokeless tobacco advertisements were reported for male, military service, and moderate and high levels of externalizing symptoms. Lower odds were reported for Black, less education than high school or GED, and high school graduate. Percentages of liking tobacco advertisements by vulnerability characteristics are presented in Supplementary Table 1.

30-Day Cigarette Use

Nearly, a third (28.8%) of participants used cigarettes in the past 30 days. Greater odds of cigarette use were reported for liking cigarette advertisements, older age, LGB, White, less education than high school or GED, high school graduate, some college or associate degree, below poverty level, at or near the poverty level, military service, and high levels of internalizing and externalizing symptoms (Table 1).

Ad Liking by Education Level

There was a significant ad liking interaction with education, *Wald* $F(6, 94) = 2.54$, $p = .03$. The results suggested that education level moderated the relationship between ad liking and 30-day cigarette use. Among all lower levels of education, liking one ad and liking multiple ads was associated with greater odds of 30-day cigarette use than liking no ads. However, among individuals with a bachelor's or advanced degree, liking cigarette ads did not significantly change the association with cigarette use (Table 2, Figure 1).

Table 1. Logistic Regression Predicting 30-d Tobacco Use Among US Young Adults (18–24 y)

Main effects model	Sample	Cigarettes		E-cigarettes		Cigars		Smokeless	
Variable	% or M (SD)	% or M	aOR (95% CI)	% or M	aOR (95% CI)	% or M	aOR (95% CI)	% or M	aOR (95% CI)
Ad liking									
Did not like ads		83.2%	Ref	83.7%	Ref	85.8%	Ref	87.8%	Ref
Liked one ad		11.0%	2.61 (2.19 to 3.12)	9.4%	1.78 (1.49 to 2.13)	8.1%	2.32 (1.91 to 2.82)	6.9%	2.18 (1.60 to 2.98)
Liked multiple ads		5.8%	2.75 (2.20 to 3.45)	7.0%	2.07 (1.67 to 2.58)	6.1%	3.40 (2.79 to 4.15)	5.3%	4.68 (3.43 to 6.40)
Age	21.1 (2.0)	21.3	1.20 (1.16 to 1.24)	21.1	1.07 (1.03 to 1.11)	21.0	1.02 (0.99 to 1.06)	20.9	1.01 (0.96 to 1.06)
Sex									
Female	49.7%	23.8%	Ref	9.2%	Ref	10.1%	Ref	0.7%	Ref
Male	50.3%	33.8%	1.77 (1.57 to 1.99)	15.7%	1.85 (1.63 to 2.10)	20.8%	2.57 (2.25 to 2.94)	9.9%	14.73 (10.31 to 21.04)
Sexual orientation									
Straight	91.2%	27.7%	Ref	12.0%	Ref	15.0%	Ref	5.6%	Ref
LGB	8.8%	40.8%	1.58 (1.28 to 1.94)	17.7%	1.47 (1.19 to 1.82)	20.2%	1.35 (1.10 to 1.66)	2.6%	0.73 (0.44 to 1.21)
Race/ethnicity									
White	55.0%	31.7%	Ref	14.0%	Ref	15.0%	Ref	8.2%	Ref
Hispanic	20.8%	26.5%	0.57 (0.49 to 0.66)	11.8%	0.70 (0.58 to 0.85)	15.1%	0.88 (0.73 to 1.06)	2.3%	0.20 (0.14 to 0.28)
Black	13.2%	25.7%	0.62 (0.51 to 0.75)	7.8%	0.50 (0.39 to 0.63)	22.8%	1.64 (1.34 to 2.02)	0.8%	0.07 (0.04 to 0.14)
Asian	7.2%	14.9%	0.41 (0.29 to 0.58)	9.5%	0.76 (0.55 to 1.07)	2.9%	0.20 (0.10 to 0.39)	X	X
Multi	3.4%	36.5%	1.06 (0.81 to 1.37)	15.6%	0.99 (0.72 to 1.35)	23.3%	1.55 (1.21 to 1.99)	5.1%	0.51 (0.30 to 0.87)
Education									
<HS/GED	15.4%	35.6%	5.01 (3.96 to 6.33)	7.5%	2.93 (2.03 to 4.23)	7.6%	2.41 (1.73 to 3.34)	4.0%	3.14 (1.75 to 5.66)
HS Graduate	28.2%	26.1%	2.96 (2.41 to 3.63)	6.1%	2.11 (1.51 to 2.95)	5.5%	1.89 (1.40 to 2.57)	3.9%	2.68 (1.65 to 4.34)
SC/A	43.2%	23.2%	2.07 (1.69 to 2.55)	7.6%	1.88 (1.33 to 2.68)	6.4%	1.73 (1.27 to 2.37)	3.1%	1.85 (1.12 to 3.08)
B/A	13.2%	8.6%	Ref	2.8%	Ref	3.9%	Ref	1.6%	Ref
Poverty level									
Below poverty	47.4%	36.9%	1.67 (1.43 to 1.96)	8.6%	1.30 (1.09 to 1.55)	9.7%	1.29 (1.12 to 1.49)	3.0%	1.05 (0.83 to 1.33)
Near poverty	20.8%	27.2%	1.52 (1.28 to 1.80)	7.3%	1.30 (1.06 to 1.60)	6.0%	1.26 (1.05 to 1.51)	3.3%	1.05 (0.79 to 1.40)
Twice poverty	31.8%	14.2%	Ref	4.5%	Ref	4.3%	Ref	3.1%	Ref
Military service									
Never served	98.5%	21.7%	Ref	5.9%	Ref	5.5%	Ref	2.8%	Ref
served	1.5%	20.5%	1.59 (1.12 to 2.25)	5.1%	1.46 (0.93 to 2.30)	6.8%	0.77 (0.52 to 1.16)	4.4%	1.32 (0.72 to 2.43)
Internalizing									
Low	38.5%	17.0%	Ref	4.1%	Ref	4.5%	Ref	3.0%	Ref
Moderate	29.2%	19.9%	1.06 (0.92 to 1.21)	5.3%	0.97 (0.82 to 1.16)	5.2%	0.99 (0.84 to 1.16)	2.7%	0.59 (0.46 to 0.75)
High	32.3%	36.6%	1.61 (1.38 to 1.88)	11.1%	1.41 (1.19 to 1.67)	9.4%	1.38 (1.16 to 1.64)	3.5%	0.72 (0.54 to 0.95)
Externalizing									
Low	46.9%	18.9%	Ref	4.7%	Ref	4.7%	Ref	2.8%	Ref
Moderate	35.6%	24.8%	1.02 (0.90 to 1.16)	7.2%	1.05 (0.87 to 1.27)	6.8%	1.23 (1.05 to 1.45)	2.9%	0.93 (0.73 to 1.19)
High	17.5%	39.1%	1.35 (1.14 to 1.60)	12.6%	1.51 (1.23 to 1.85)	12.1%	1.62 (1.31 to 2.00)	5.0%	1.37 (1.02 to 1.86)

Ads = advertisements, B/A = bachelor's or advanced degree, CI = confidence interval, HS = high school, LGB = lesbian, gay, bisexual, or something else, M = mean, aOR = adjusted odds ratio, Ref = reference group, SC/A = some college or associate degree, SD = standard deviation, X = dropped from analysis (small cell sizes). Weighted percentages are those within the category (eg, females) that had engaged in 30-d tobacco use. The remainder (ie, those who did not engage in 30-d tobacco use) would bring the total to 100%. Means are for individuals who engaged in 30-d tobacco use. Adjusted odds ratios have been adjusted for all covariates.

Table 2. Modification of the Effect of Advertisement Liking on 30-d Cigarette Use by Education Level Among US Young Adults (18–24 y)

Ad Liking	<HS/GED % Use	<HS/GED OR (95% CI)	HSG % Use	HSG OR (95% CI)	SC/A % Use	SC/A OR (95% CI)	B/A % Use	B/A OR (95% CI)	Interactions <HS/GED OR (95% CI)	Interactions <HS/GED Wald F	Interactions HSG Wald F	Interactions SC/A Wald F
Did not like ads	39.3	Ref	24.6	Ref	22.7	Ref	15.8		Ref	Ref	Ref	Ref
Liked one ad	65.8	2.81 (1.88 to 4.22)	53.6	3.20 (2.40 to 4.27)	45.4	2.71 (2.13 to 3.45)	27.1		1.48 (0.95 to 2.31)	4.68*	9.67**	6.05*
Liked multiple ads	69.4	3.45 (2.15 to 5.53)	63.9	4.77 (3.05 to 7.46)	43.3	2.34 (1.60 to 3.44)	21.7		1.39 (0.66 to 2.92)	3.74	6.22*	1.70

Ads = advertisements; B/A = bachelor's or advanced degree; CI = confidence interval; <HS/GED = less than high school or GED; HSG = high school graduate; OR = odds ratio; Ref = reference group; SC/A = some college or associate degree. ORs are adjusted for age, sex, sexual orientation, ethnicity, poverty level, military service, internalizing symptoms, and externalizing symptoms. Percentages are weighted. Percentages are those within each education level who used cigarettes.

*$p < .05$, **$p < .01$, ***$p < .001$.

30-Day E-Cigarette Use

Prevalence of 30-day e-cigarette use was 12.5%. Greater odds of e-cigarette use were reported for liking e-cigarette advertisements, older age, male, LGB, White, less education than high school or GED, high school graduate, some college or associate degree, below poverty level, at or near poverty level, and high levels of internalizing and externalizing symptoms (Table 1).

Ad Liking by Education

There was a significant ad liking interaction with education, *Wald F*(6, 94) = 2.62, *p* = .02. However, the results suggested that ad liking moderated the relationship between education level and e-cigarette use rather than education level moderating the relationship between ad liking and e-cigarette use.

Ad Liking by Poverty Level

There was a significant ad liking interaction with poverty level, *Wald F*(4, 96) = 3.40, *p* = .01 (Supplementary Table 2, Figure 2). The results suggested that the relationship between ad liking and 30-day e-cigarette use was moderated by poverty level. Among those living below the poverty level, liking multiple ads was associated with greater odds of e-cigarette use than liking no ads; however, among those living twice above the poverty level, liking multiple ads was not significantly different than liking no ads.

Ad Liking by Internalizing Symptoms

There was a significant ad liking interaction with internalizing symptoms, *Wald F*(4, 96) = 2.53, *p* = .045 (Supplementary Table 3, Supplementary Figure 2). The results suggested that the relationship between ad liking and 30-day e-cigarette use was moderated by internalizing symptoms. Among those with low internalizing symptoms, liking one ad was associated with greater odds of 30-day e-cigarette use than liking no ads. However, among those with moderate internalizing symptoms, there was no difference between liking one ad and liking no ads.

30-Day Cigar Use

Prevalence of 30-day cigar use was 15.5%. Greater odds of cigar use were reported for liking cigar advertisements, male, LGB, White, less education than high school or GED, high school graduate, some college or associate degree, below the poverty level, at or near the poverty level, and high levels of internalizing and externalizing symptoms (Table 1).

Ad Liking by Age

There was a significant ad liking interaction for age, *Wald F*(2, 98) = 3.32, *p* = .04. However, the results suggested that ad liking moderated the association between age and 30-day cigar use rather than age moderating the association between ad liking and cigar use.

Ad Liking by Education

There was a significant ad liking interaction for education, *Wald F*(6, 94) = 4.68, *p* < .001 (Supplementary Table 4, Supplementary Figure 3). The results suggested that the relationship between ad liking and 30-day cigar use was moderated by education level. Among high school graduates, liking one ad and liking multiple ads was associated with greater odds of cigar use than liking no ads; however, among those with a bachelor's or advanced degree, there were no differences in cigar use across levels of ad liking.
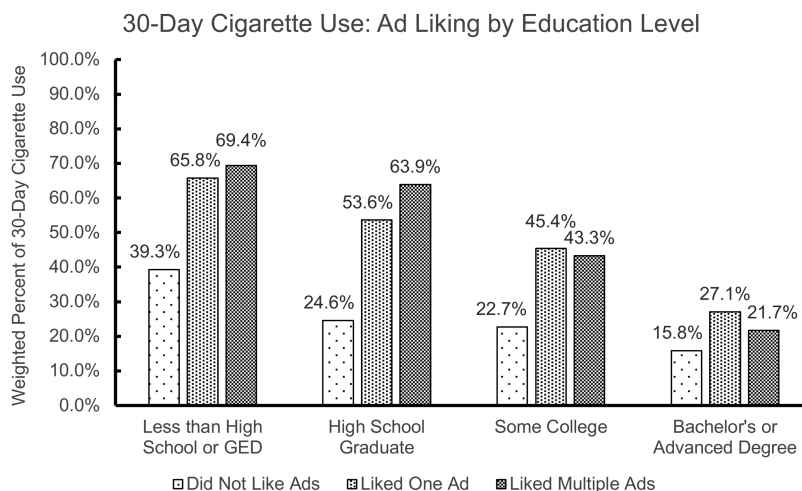
30-Day Cigarette Use: Ad Liking by Education Level

Figure 1. Percentages are weighted and represent young adults who used cigarettes in the past 30 days considering advertisement liking and education.

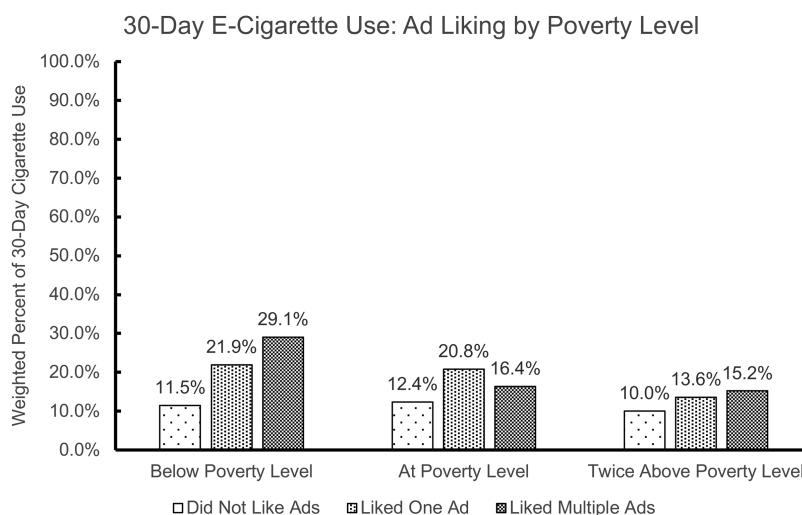## 30-Day E-Cigarette Use: Ad Liking by Poverty Level

Figure 2. Percentages are weighted and represent young adults who used e-cigarettes in the past 30 days considering advertisement liking and poverty level.

30-Day Smokeless Tobacco Use

Prevalence of 30-day smokeless tobacco use was 5.3%. Greater odds of smokeless tobacco use were reported for liking smokeless tobacco advertisements, male, White, less education than high school or GED, high school graduate, some college or associate degree, and high levels of internalizing and externalizing symptoms (Table 1).

Ad Liking by Poverty Level

There was a significant ad liking interaction for poverty level, *Wald F*(4, 96) = 3.34, *p* = .01 (Supplementary Table 5, Supplementary Figure 4). The results suggested that the relationship between ad liking and 30-day smokeless tobacco use was moderated by poverty level. Among those living below poverty level, liking one or multiple ads was associated with greater odds of smokeless tobacco use than liking no ads. However, among those living twice above poverty level, only liking multiple ads was associated with greater odds of smokeless tobacco use than liking no ads.

Ad Liking by Military Service

There was a significant ad liking interaction for military service, *Wald F*(2, 98) = 3.23, *p* = .04. However, the results suggested that ad liking moderated the association between military service and

30-day smokeless tobacco use rather than military service moderating the association between ad liking and smokeless tobacco use.

Ad Liking by Internalizing Symptoms

There was a significant ad liking interaction for internalizing symptoms, *Wald F*(4, 96) = 2.82, *p* = .03. However, the results suggested that ad liking moderated the association between internalizing symptoms and 30-day smokeless tobacco use rather than internalizing symptoms moderating the association between ad liking and smokeless tobacco use.

Ad Liking by Externalizing Symptoms

There was a significant ad liking interaction for externalizing symptoms, *Wald F*(4, 96) = 3.94, *p* = .005. However, the results suggested that ad liking moderated the association between externalizing symptoms and 30-day smokeless tobacco use rather than externalizing symptoms moderating the association between ad liking and smokeless tobacco use.

Discussion

Our results support findings discussed previously that young adult male, White, LGB, low income, low education, military personnel,

and populations with mental health symptoms have higher rates of tobacco use.[5,8,11,12] Liking tobacco advertisements was also associated with greater odds of 30-day tobacco use. This finding supports results found in a recent study of adolescents, using PATH data, in which receptivity to tobacco advertising was associated with susceptibility to cigarette smoking.[23]

Our results found that while liking tobacco advertisements was associated with tobacco use, this association was stronger among those with certain vulnerability characteristics (ie, lower education levels and living below the poverty level). The tobacco industry has identified blue-collar workers or the working class as a critical segment of the population to target with marketing efforts.[15,16] This population includes individuals with lower educational attainment and income levels.[15,34] As such, the tobacco industry has historically designed major campaigns for this population (eg, Marlboro cowboy).[15] Having major tobacco campaigns targeted specifically at individuals with low educational attainment and income levels could increase the personal relevance of the advertisements. Personal relevance may be the "most important determinant of interest and motivation to process the message."[35(p136)] Greater message processing leads to attitudes that are resistant, relatively enduring, and predictive of behavior.[36] Thus, increased personal relevance could contribute to tobacco advertisement liking having a strong association with tobacco use among individuals with lower educational attainment and income levels. Furthermore, lower income neighborhoods tend to have more tobacco marketing,[37] which could lead to increased advertisement liking via the mere exposure effect.[38]

Implications, Limitations, and Directions for Future Research

The current study analyzes cross-sectional data, so causality cannot be determined. Future randomized experiments could more directly assess causality in the relationship between ad liking and tobacco use and test a variety of policy (eg, policies to reduce point of sale advertising) or intervention approaches (eg, antitobacco campaigns to see if they may buffer this relationship), particularly for young adults with low educational attainment and those living below the poverty level. To better reach these populations, the tobacco control community could consider low income, lower levels of literacy and numeracy,[39] and environmental factors, such as exposure to advertising and promotion, that are associated with tobacco use in these populations.

The ideal solution would be a tobacco advertising ban; where that is not feasible, marketing restrictions could be imposed. For example, policies for tobacco regulations at point of sale that could potentially reduce young adult tobacco use include restricting coupon redemption, required health warnings and smoking cessation information at the point of sale, restricting the size of brand displays (eg, only displaying one package of each tobacco product), and restricting the amount of tobacco display space.[40] Additionally, targeted prevention or inoculation campaigns could be disseminated. Research suggests that antitobacco campaigns can counteract protobacco marketing.[41] For example, the US Centers for Disease Control and Prevention (CDC) developed the effective Tips From Former Smokers campaign, which has targeted at-risk populations of smokers such as military personnel.[16]

A study limitation is that it is cross-sectional, so causality could not be determined. Liking tobacco advertisements could lead to tobacco use or vice versa or there could be a reciprocal influence. It is also possible that both advertisement liking and tobacco use could be related to a third factor such as protobacco social norms. For example, a study found that tobacco advertising indirectly influenced smoking susceptibility through the perceived effect of the advertisements on the attitudes and behaviors of adolescents' peers.[42] Another limitation is that information on the specifics of the 959 tobacco advertisements (eg, visual attributes and message content) were not released by PATH, so we could not determine the features of the advertisements that may be more likeable for vulnerable populations. Because of severe skew and kurtosis, we categorized the tobacco advertisement liking variable into three categories. Furthermore, 30-day tobacco use may not distinguish between intermittent and regular tobacco use.

A strength is the large nationally representative sample, which increases US generalizability. Similar results on the association between socioeconomic status and tobacco use have also been found internationally.[43,44] Another strength is that advertisements were selected from a large database of real-world tobacco advertisements. Given limited research related to tobacco use in certain vulnerable populations, this study aids in filling a gap in the literature on whether the association between tobacco advertisement liking and tobacco use is especially strong among vulnerable young adults.

Conclusion

This study demonstrates that tobacco advertisement liking was associated with current tobacco use among young adults, and this association was stronger among those with certain vulnerability characteristics. This indicates a potential increased tobacco advertising receptivity in these groups. These findings suggest a need for tobacco control campaigns and policy interventions to offset the negative influence of tobacco advertisements among vulnerable groups.

Supplementary Material

Supplementary data are available at *Nicotine & Tobacco Research* online.

Funding

Declaration of Interests

None declared.

Acknowledgments

References

1. U.S. Department of Health and Human Services (HHS). *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2012.

2. Thompson AB, Mowery PD, Tebes JK, McKee SA. Time trends in smoking onset by sex and race/ethnicity among adolescents and young adults: findings from the 2006-2013 National Survey on Drug Use and Health. *Nicotine Tob Res*. 2018;20(3):312–320.

3. Biener L, Albers AB. Young adults: vulnerable new targets of tobacco marketing. *Am J Public Health*. 2004;94(2):326–330.

4. Kasza KA, Amrose BK, Conway KP, et al. Tobacco-product use by adults and youths in the United States in 2013 and 2014. *N Eng J Med*. 2017;37(4):342–353.

5. Evans-Polce RJ, Vasilenko SA, Lanza ST. Changes in gender and racial/ethnic disparities in rates of cigarette use, regular heavy episodic drinking, and marijuana use: ages 14 to 32. *Addict Behav*. 2015;41:218–222.

6. Lawrence D, Fagan P, Backinger CL, Gibson JT, Hartman A. Cigarette smoking patterns among young adults aged 18-24 years in the United States. *Nicotine Tob Res*. 2007;9(6):687–697.

7. Richardson A, Williams V, Rath J, Villanti AC, Vallone D. The next generation of users: prevalence and longitudinal patterns of tobacco use among US young adults. *Am J Public Health*. 2014;104(8):1429–1436.

8. Rath JM, Villanti AC, Rubenstein RA, Vallone DM. Tobacco use by sexual identity among young adults in the United States. *Nicotine Tob Res*. 2013;15(11):1822–1831.

9. Green MP, McCausland KL, Xiao H, Duke JC, Vallone DM, Healton CG. A closer look at smoking among young adults: where tobacco control should focus its attention. *Am J Public Health*. 2007;97(8):1427–1433.

10. Ling PM, Neilands TB, Glantz SA. Young adult smoking behavior: a national survey. *Am J Prev Med*. 2009;36(5):389–394.e2.

11. Bray RM, Hourani LL, Rae Olmsted KL, et al. 2005 *Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel: A Component of the Defense Lifestyle Assessment Program (DLAP)*. Research Triangle Park, NC: Department of Defense of the United States of America; 2006.

12. Lawrence D, Francis M, Zubrick SR. Smoking and mental illness: results from population surveys in Australia and the United States. *BMC Public Health*. 2009;285.

13. Amos A, Greaves L, Nichter M, Bloch M. Women and tobacco: a call for including gender in tobacco control research, policy and practice. *Tob Control*. 2012;21(2):236–243.

14. Jamal A, King BA, Neff LJ, Whitmill J, Babb SD, Graffunder CM. Current cigarette smoking among adults—United States, 2005-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65(44):1205–1211.

15. U.S. National Cancer Institute (NCI). *The Role of the Media in Promoting and Reducing Tobacco Use*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; 2008.

16. U.S. National Cancer Institute (NCI). *A Socioecological Approach to Addressing Tobacco-Related Health Disparities*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; 2017.

17. Hornik J, O'Keefe DJ. Adapting consumer advertising appeals to cultural values: a meta-analytic review of effects on persuasiveness and ad liking. *Ann Int Commun Assoc*. 2009;33(1):39–71.

18. Morgenstern M, Isensee B, Hanewinkel R. Seeing and liking cigarette advertisements: is there a 'mere exposure' effect? *Eur Addict Res*. 2013;19(1):42–46.

19. Haley RI, Baldinger AL. The ARF copy research validity project. *J Advert Res*. 1991;31:11–31.

20. Smit EG, Van Meurs L, Neijens PC. Effects of advertising likability: a 10-year perspectie. *J Advert Res*. 2006;46(1):73–83.

21. Slovic P, Finucane M, Peters E, MacGregor DG. Rational actors or rational fools: implications of the affect heuristic for behavioral economics. *J Socio Econ*. 2002;31(4):329–342.

22. Gilpin EA, White MM, Messer K, Pierce JP. Receptivity to tobacco advertising and promotions among young adolescents as a predictor of established smoking in young adulthood. *Am J Public Health*. 2007;97(8):1489–1495.

23. Pierce JP, Sargent JD, White MM, et al. Receptivity to tobacco advertising and susceptibility to tobacco products. *Pediatrics*. 2017;139(e20163353).

24. Pokhrel P, Fagan P, Herzog TA, Schmid S, Kawamoto CT, Unger JB. Comparison of measures of e-cigarette advertising exposure and receptivity. *Tob Regul Sci*. 2017;3(4):424–434.

25. Rath JM, Teplitskaya L, Williams VF, Pearson JL, Vallone DM, Villanti AC. Correlates of e-cigarette ad awareness and likeability in U.S. young adults. *Tob Induc Dis*. 2017;15:22.

26. Villanti AC, Rath JM, Williams VF, et al. Impact of exposure to electronic cigarette advertising on susceptibility and trial of electronic cigarettes and cigarettes in US young adults: a randomized controlled trial. *Nicotine Tob Res*. 2016;18(5):1331–1339.

27. Hafez N, Ling PM. How Philip Morris built Marlboro into a global brand for young adults: implications for international tobacco control. *Tob Control*. 2005;14(4):262–271.

28. Cortese DK, Lewis MJ, Ling PM. Tobacco industry lifestyle magazines targeted to young adults. *J Adolesc Health*. 2009;45(3):268–280.

29. Rigotti NA, Moran SE, Wechsler H. US college students' exposure to tobacco promotions: prevalence and association with tobacco use. *Am J Public Health*. 2005;95(1):138–144.

30. PATH Study Team. Design and methods of the Population Assessment of Tobacco and Health (PATH) Study. *Tob Control*. 2016;26:371–378.

31. Hyland A, Ambrose BK, Conway KP, et al. Design and methods of the Population Assessment of Tobacco and Health (PATH) Study. *Tob Control*. 2017;26(4):371–378.

32. Dennis ML, Feeney T, Stevens LH, Bedoya L. *Global Appraisal of Individual Needs - Short Screener (GAIN-SS): Administration and Scoring Manual for the GAIN-SS Version 2.0.1*. Bloomington, IL: Chesnut Health Systems; 2007 https://dpi.wi.gov/sites/default/files/imce/sspw/pdf/gainss-manual.pdf Accessed June 6, 2017.

33. Westat. *PATH Study Public Use Files: User Guide*. Inter-university Consortium for Political and Social Research; United States Department of Health and Human Services, National Institutes of Health, National Institute on Drug Abuse; United States Department of Health and Human Services, Food and Drug Administration, Center for Tobacco Products; 2016 http://www.icpsr.umich.edu/icpsrweb/NAHDAP/studies/36231 Accessed November 21, 2017.

34. U.S. Department of Labor Bureau of Labor Statistics. Percentage of the Labor Force by Occupation and Educational Attainment, 25 Years and Over, 2016 Annual Averages; 2016. https://www.bls.gov/spotlight/2017/educational-attainment-of-the-labor-force/home.htm Accessed April 7, 2018.

35. Petty RE, Briñol P, Priester JR. Mass media attitude change: Implications of the elaboration likelihood model of persuasion. In: Bryant J, Oliver MB, eds. *Media Effects: Advances in Theory and Research*. 3rd ed. New York, NY: Routledge; 2009:125–164.

36. Petty RE, Cacioppo JT. The elaboration likelihood model of persuasion. *Adv Soc Psychol*. 1986;19:123–162.

37. Lee JG, Henriksen L, Rose SW, Moreland-Russell S, Ribisl KM. A systematic review of neighborhood disparities in point-of-sale tobacco marketing. *Am J Public Health*. 2015;105(9):e8–e18.

38. Zajonc RB. Attitudinal effects of mere exposure. *J Pers Soc Psychol*. 1968;9(2):1–27.

39. Kutner M, Greenberg E, Jin Y, Paulsen C. *The Health Literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy (NCES 2006–483)*. Washington, DC: U.S. Department of Education; 2006.

40. Lange T, Hoefges M, Ribisl KM. Regulating tobacco product advertising and promotions in the retail environment: a roadmap for states and localities. *J Law Med Ethics*. 2015;43(4):878–896.

41. Emory KT, Messer K, Vera L, et al. Receptivity to cigarette and tobacco control messages and adolescent smoking initiation. *Tob Control*. 2015;24(3):281–284.

42. Gunther AC, Bolt D, Borzekowski DLG, Liebhart JL, Dillard JP. Presumed influence on peer norms: how mass media indirectly affect adolescent smoking. *J Commun*. 2006;56:52–68.

43. Hiscock R, Bauld L, Amos A, Fidler JA, Munafò M. Socioeconomic status and smoking: a review. *Ann N Y Acad Sci*. 2012;1248:107–123.

44. Nagelhout GE, de Korte-de Boer D, Kunst AE, et al. Trends in socioeconomic inequalities in smoking prevalence, consumption, initiation, and cessation between 2001 and 2008 in the Netherlands. Findings from a national population survey. *BMC Public Health*. 2012;12:303.