Original investigation

Tobacco Marketing and Subsequent Use of Cigarettes, E-Cigarettes, and Hookah in Adolescents

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Abstract

Introduction: Tobacco marketing has expanded from cigarettes to other tobacco products through many promotional channels. Marketing exposure is associated with use of that tobacco product. However, it is unclear if marketing for one product leads to subsequent use of other tobacco products.

Methods: This prospective cohort study assessed self-reported marketing exposure for six tobacco products across five marketing channels in 11th and 12th grade students in 2014. Approximately 16 months later, a follow-up survey was conducted online ($N = 1553$) to assess initiation of cigarettes, electronic cigarettes (e-cigarettes), and hookah.

Results: Adolescent never-smokers with frequent exposure to cigarette marketing on the Internet and in stores are more than two times as likely to begin smoking as young adults (Internet OR = 2.98 [95% CI = 1.56 to 5.66]; stores OR = 2.83 [95% CI = 1.23 to 6.50]). Never users of e-cigarettes were significantly more likely to initiate use, if exposed to Internet, store, and outdoor e-cigarette marketing. Never users of hookah were more likely to use hookah after seeing it marketed in stores. Youth exposed to marketing of e-cigarettes, hookah, cigars, smokeless tobacco, and pipe tobacco in stores were two to three times more likely to begin smoking cigarettes even though the marketed products were not cigarettes.

Conclusions: Adolescent exposure to marketing of tobacco products is associated with initiation of those products as young adults. Exposure to marketing for non-cigarette tobacco products is associated with subsequent cigarette smoking, even when the promoted products are not cigarettes. Future research and interventions should consider the influence of marketing from multiple tobacco products on adolescent tobacco use.

Implications: Adolescents grow up in a rich media environment with exposure to tobacco marketing in both their homes (eg, through the Internet and television) and their communities (eg, stores and billboards). This prospective study provides evidence that adolescents exposed to tobacco marketing for multiple tobacco products are more likely to subsequently begin using those products and to begin smoking cigarettes even when the marketing they recall is for different tobacco products. Adolescent exposure to tobacco marketing can increase likelihood of cigarette smoking, e-cigarette, and hookah use with potential lifelong health effects.

Introduction

The United States has seen a steady decline in adolescent cigarette use.^{1,2} At the same time, the use of other tobacco products such as electronic cigarettes (e-cigarettes) and hookah (tobacco waterpipes) has increased.³ In 2015, e-cigarettes were the most commonly used tobacco product among high school students (16.0%), followed by combustible cigarettes (hereafter called cigarettes) (9.3%), cigars/cigarillos/little cigars (8.6%), hookah (7.2%), smokeless tobacco (chewing tobacco, snuff, dip, snus) (6.0%), and pipe tobacco (1.0%).³ Amidst mounting evidence that e-cigarette use can contribute to youth smoking initiation,⁴⁻⁸ there is concern that we may see a reversal of the downward trend in cigarette use and renormalization of smoking among adolescents.⁹

Advertising for e-cigarettes has risen sharply across media channels in recent years from \$6.4 million spent in 2011 to \$115 million in 2014 (excluding retail advertising costs), with the highest expenditures in magazines and on television (TV).^{10,11} Youth exposure to TV e-cigarette ads increased 256% between 2011 and 2013 in a medium where the US government banned cigarette advertising more than four decades earlier.^{11,12} E-cigarette advertising is now widespread, with 88% of 18- to 21-year-olds reporting exposure to at least one advertisement in 2015.¹¹ Advertising expenditures for cigarettes through channels other than TV and radio (which do not permit cigarette ads) are high, reaching \$8.24 billion in 2015 (eg, ranging from relatively small categories such as outdoor signage on stores and other outdoor locations at <.1% of total, company Web sites at .3%, magazines at .3%, and discount coupons at 4.1%; and large categories such as the retail environment, which includes point-of-sale advertisements at .4%, retail and wholesale price discounts at 84.3%, and promotional allowances at 6.9% of the total).^{13,14}

There is strong evidence that cigarette marketing contributes to cigarette use among adolescents and adults.¹⁵⁻¹⁷ Cross-sectional investigations have demonstrated links between smoking and exposure to cigarette marketing through TV and movies, promotional items, direct mail, magazines, and retail marketing.^{15,18-20} Prospective studies have shown increased odds of cigarette smoking among adolescents with high media receptivity,^{21,22} among students in a school-based study exposed to images of cigarette ads,²³ in adolescents who visited convenience stores,²⁴ and among youth who watched movies with smoking.²⁵

The evidence regarding the effects of e-cigarette and other types of tobacco marketing is less conclusive, based largely on cross-sectional analysis. E-cigarette use has been associated with e-cigarette marketing via the Internet, newspapers/magazines, the retail environment, and TV.²⁶⁻³⁰ A controlled e-cigarette trial found that adolescents previously exposed to e-cigarettes ads had greater curiosity and greater odds of e-cigarette initiation though not cigarette initiation.³¹ An analysis of Wave 1 of the nationally representative PATH (Population Assessment of Tobacco and Health) study found that adolescent nontobacco users who recall ads for cigarettes, e-cigarettes, and smokeless tobacco are more susceptible to smoking cigarettes.³² A cohort study of adolescents found that recall of e-cigarette marketing in stores and on the Internet was associated with two to three times greater likelihood of initiating e-cigarettes and susceptibility at 6-month follow-up.³³

Although this body of research indicates that exposure to cigarette marketing contributes to smoking, exposure to e-cigarette marketing contributes to e-cigarette use, and receptivity to non-cigarette tobacco products is associated with cigarette susceptibility, it is not clear if marketing for non-cigarette tobacco products

will subsequently lead to cigarette smoking. This question is critical given the recent leveling of historic declines in adolescent smoking³ and increases in marketing for emerging products. It is also important given the potential of marketing in stores, on the Internet, and in movies to reach adolescents with overlapping positive messages about multiple tobacco products. Research on the effects of tobacco product marketing in this new media landscape is urgent to inform counter-marketing communications and policies for the prevention of tobacco use. The current study analyzes whether adolescent exposure to promotions of six different tobacco products through five media channels is associated with initiation of cigarettes, hookah, and e-cigarettes as young adults. It is the first comprehensive prospective cohort study examining multiple product promotions across multiple channels of exposure.

Methods

Study Design and Sample

The Southern California Children's Health Study (CHS) is a population-based prospective study of five cohorts of youth across 13 communities in Southern California followed since kindergarten or first grade.³⁴⁻³⁶ In spring 2014, a total of 2097 11th and 12th grade participants in 12 CHS communities completed paper and pencil questionnaires in classrooms (referred to in this study as the baseline survey) under study staff supervision. Follow-up data were collected from 1553 of these participants (response rate 74.1%), from February 2016 to July 2016 via online survey. All participants were 18 years of age or older at follow-up.³⁴

Ethics Statement

The study was approved by the University of Southern California Institutional Review Board. Participants age 18 or older provided written informed consent. Written parental informed consent and student assent were obtained for all participants prior to data collection in 2014.

Measures

Cigarette and Alternative Tobacco Product Use

In 2014 and at follow-up during 2015–2016, participants were asked if they had ever tried cigarettes, e-cigarettes, hookah or waterpipe, cigars or little cigars or cigarillos, smokeless tobacco, and pipe tobacco. For each product, they were asked age of first use and the number of days it was used in the past 30 days. Participants were classified as “never users” of a tobacco product at baseline if they had never used the product, “not even one or two puffs.”³² “Initiators” were baseline never users of a tobacco product who reported ever use or past 30-day use at follow-up in 2016.

Marketing Exposure

Self-reported exposure to tobacco promotion at baseline was assessed separately for each of six tobacco products and each of five marketing media channels. The six tobacco products were (1) cigarettes, (2) e-cigarettes, (3) hookah or waterpipe, (4) cigars or cigarillos or little cigars, (5) smokeless tobacco, and (6) pipe tobacco. The five marketing channels were assessed using the following questions: (1) When using the Internet, how often do you see ads for (each of six tobacco products)? (2) When you read newspapers or magazines, how often do you see ads for (product)? (3) When you go to a convenience store, supermarket, or gas station, how often do you see

ads for (product)? (4) During the past 30 days, how often did you see an ad for (product) outdoors on a billboard or outside a store? (5) When you watch TV or go to the movies, how often do you see actors using (product)? For each question, the response options for marketing exposure were never, rarely, sometimes, most of the time, always, or an indication they do not use that channel. For analysis, response options were combined into two categories at each end of the spectrum (eg, high exposure included “most of the time” and “always” whereas low exposure included “never” or “no access” to that marketing channel; responses in the middle were not included to reduce uncertainty that marketing exposure did or did not occur).

Sociodemographic Factors

Gender, ethnicity (Hispanic white, non-Hispanic white, other), and highest parental education of either parent (<12th grade, high school or general education diploma (GED), some college, college degree, some graduate school, or higher) were available from self-administered questionnaires completed by parents of participants at the first wave of the cohort study in kindergarten.³⁵

Statistical Analysis

Mixed effects logistic regression models were used to evaluate the association between perceived exposure to marketing of tobacco products in 11th or 12th grade and subsequent initiation of tobacco products at follow-up approximately 16 months later (ie, transitioning from a never user in 11th or 12th grade to someone who had used tobacco after high school by reporting either current user or prior use in the follow-up survey). Separate models were used (1) to analyze exposure to marketing of a single tobacco product through one marketing channel “most of the time or always” compared to never at baseline with subsequent initiation of that same product (eg, exposure to e-cigarette advertising through the Internet in 11th or 12th grade and subsequent e-cigarette initiation); (2) to evaluate the association between exposure to marketing of each tobacco product (eg, exposure to hookah marketing) through each of five marketing channels (ie, Internet, newspaper/magazine, outdoor, store, and TV/movies) “most of the time/always” for each of the five channels and subsequent initiation of that same tobacco product; (3) to evaluate the association between marketing exposure for six tobacco products combined (ie, cigarette, e-cigarette, hookah, cigar/little cigar/cigarillo, smokeless tobacco, and pipe tobacco) through single marketing channels (eg, the Internet) and subsequent initiation of cigarettes, e-cigarettes and hookah; and (4) to evaluate the association between exposure to marketing for each of six tobacco products by marketing channel and subsequent onset of cigarette smoking. Models analyzing initiation of a tobacco product at follow-up in 2016 were restricted to respondents who were “never users” of that specific tobacco product (eg, use of cigarettes at follow-up was analyzed among participants who reported at baseline that they never used cigarettes) in 2014, with adjustment for sex, ethnicity, highest parental education, and use of other tobacco products at baseline (eg, in analyses evaluating odds of cigarette initiation, models were adjusted for never, past or current use of e-cigarettes, hookah, smokeless, cigar, or pipe). Each model treated community as a random effect ($N = 12$ communities) with a random effect for clustering by community. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were used to estimate the odds of cigarette, e-cigarette, or hookah initiation, among young adults at follow-up who had not used these products at baseline. All analyses were performed using SAS v. 9.4 (SAS Institute Inc, Cary, NC).

Results

Study Sample

Our sample at baseline was 2097 11th and 12th grade students of which 1553 completed the follow-up survey (retention rate = 74.1%). Participants who were never users of specific tobacco products at baseline were analyzed for subsequent initiation of those products, described in Table 1. Most of these participants had never used the three tobacco products of interest at baseline. Between the two waves, 16.4% initiated cigarettes, 28.1% tried e-cigarettes, and 17.9% used a hookah.

Exposure to Tobacco Product Marketing

Exposure to tobacco marketing and promotions at baseline varied by the type of marketing channel and product (Figure 1). Students in 11th and 12th grade reported they saw ads most of the time or always in stores (58.7% reported this exposure for cigarettes, 43.1% for e-cigarettes, and 25.3% for hookah), followed by reports of exposure most of the time or always to cigarette smoking portrayals in movies and TV (27%). Frequent exposure to outdoor tobacco product ads on large billboards and smaller signage outside stores was reported more often for cigarettes (18.4%) and e-cigarette products (13.6%) than for hookah (6.6%). The Internet was reported as offering more exposure to marketing for e-cigarettes (10.1%) than for hookah (6.1%) or cigarettes (5.7%). For almost all channels of exposure, hookah marketing was reported less often compared to cigarettes and e-cigarettes.

Exposure to the Marketing of a Product and Subsequent Use of That Product

Several channels of marketing exposure were assessed in high school students to determine whether exposure to tobacco product marketing through each channel was associated with subsequent use of that product as young adults (Table 2). Participants who had never used cigarettes at baseline were more likely to report using them by the follow-up survey if they had been exposed to cigarette marketing on the Internet (OR = 2.98 [95% CI = 1.56 to 5.66]) or in stores (OR = 2.83 [95% CI = 1.23 to 6.50]). They were more likely to start using e-cigarettes following exposure to e-cigarette marketing through the Internet, inside stores, and outdoors (outside stores and on billboards). Hookah marketing exposure through stores was associated with greater risk of hookah initiation at follow-up (OR = 1.95 [95% CI = 1.27 to 3.00]).

Exposure to Marketing of Multiple Tobacco Products and Subsequent Use of Cigarettes, E-Cigarettes, and Hookah

When high school students were frequently exposed to marketing for six types of tobacco products (cigarette, e-cigarette, hookah, cigar/little cigar/cigarillo, smokeless tobacco, and pipe tobacco, combined) on the Internet, they were three to four times more likely to begin using cigarettes and e-cigarettes as young adults (Table 3) compared to youth with no exposure (cigarette OR = 3.05 [95% CI = 1.10 to 8.40]; e-cigarette OR = 4.52 [95% CI = 1.81 to 11.29]). Exposure to advertising of these six products inside stores increased the likelihood of starting to smoke cigarettes more than threefold (cigarette OR = 3.59 [95% CI = 1.42 to 9.12]).

Exposure to Channels of Marketing for Non-Cigarette Tobacco Products and Subsequent Cigarette Smoking

If participants in high school recall exposure to frequent marketing for non-cigarette tobacco products in stores, then they were

Table 1. Demographic Characteristics and Tobacco Use of 11th and 12th Grade Participants at Baseline and Follow-up

	Total at follow-up	Never users of cigarettes at baseline	Never users of e-cigarettes at baseline	Never users of hookah at baseline
Total	1553 (100)	1293 (83.3)	1197 (77.1)	1145 (73.7)
Demographic	N (col %)	N (col %)	N (col %)	N (col %)
Sex				
Female	801 (51.6)	675 (52.2)	582 (50.8)	582 (50.8)
Male	752 (48.4)	618 (47.8)	563 (49.2)	563 (49.2)
Race/ethnicity				
Hispanic white	758 (48.8)	618 (47.8)	581 (50.7)	581 (50.7)
Non-Hispanic white	592 (38.1)	497 (38.4)	397 (34.7)	397 (34.7)
Other	203 (13.1)	178 (13.8)	167 (14.6)	167 (14.6)
Parental education				
High school or general education diploma or lower	462 (29.7)	381 (29.5)	359 (31.4)	359 (31.4)
Some college	548 (35.3)	445 (34.4)	390 (34.1)	390 (34.1)
College degree or higher	446 (28.7)	390 (30.2)	327 (28.6)	327 (28.6)
Missing	97 (6.2)	77 (6.0)	69 (6.0)	69 (6.0)
Tobacco use at follow-up				
Cigarette initiation		208 (16.4) ^a		
E-cigarette initiation			327 (28.1) ^a	
Hookah initiation				201 (17.9) ^a
Poly tobacco use (N, % of 2097 at baseline)				
0 products at baseline		1527 (90.0)	1480 (93.4)	1457 (95.9)
1 product at baseline		116 (6.8)	97 (6.1)	51 (3.4)
2 products at baseline		44 (2.6)	6 (0.4)	9 (0.6)
3 products at baseline		10 (0.6)	2 (0.1)	2 (0.1)

Respondents could be included in more than one “Never User” column.

^aThe percentages for initiation of a product at follow-up vary slightly from the never users of this product at baseline because of missing data in product use at both baseline and follow-up.

Figure 1. Marketing exposure among students at baseline by tobacco product and marketing channel

approximately two to three times more likely to start smoking cigarettes as young adults (Table 4) (eg, they initiated cigarette smoking at follow-up after exposure to e-cigarette ads in stores [OR: 3.16; 95% CI = 1.64 to 6.06], hookah ads in stores [OR: 2.00; 95% CI = 1.28 to 3.14], and cigar/cigarillo, smokeless tobacco, and pipe tobacco ads in stores). We also assessed exposure to a combination of five marketing channels (versus none) for each tobacco product to assess the subsequent likelihood of smoking cigarettes, but these combined forms of marketing were not significant. Marketing exposure through the Internet for cigars, smokeless tobacco, and pipe tobacco were each significantly associated with subsequent cigarette smoking.

Discussion

This prospective analysis provides evidence that marketing exposure to diverse tobacco products across varied channels increases likelihood of subsequently initiating these products. There were two central findings from this analysis. First, when adolescents who do not use a tobacco product report exposure to frequent marketing for that product, including cigarettes, e-cigarettes, and hookah, then they are more likely to initiate that product by early adulthood. Second, when these adolescents report the exposure is for five non-cigarette tobacco products in stores, or for Internet marketing of three tobacco products, then they are more likely to start smoking

Table 2. Association of Perceived Marketing Exposure for a Tobacco Product by Channel at Baseline with Subsequent Initiation of That Product

Marketing channels ^{a,b}	Cigarette use, N (1252–1260) ^c	E-cigarette use, N (1150–1158) ^c	Hookah use, N (1108–1113) ^c
Internet	2.98 (1.56, 5.66)*	2.39 (1.46, 3.89)*	1.61 (0.85, 3.06)
Newspaper/magazine	1.36 (0.78, 2.39)	1.69 (1.00, 2.86)	1.50 (0.61, 3.67)
Outdoor	1.40 (0.89, 2.22)	1.92 (1.27, 2.90)*	1.66 (0.88, 3.14)
Store	2.83 (1.23, 6.50)*	1.86 (1.19, 2.92)*	1.95 (1.27, 3.00)*
Television/movie	1.34 (0.67, 2.68)	1.45 (0.87, 2.40)	1.72 (0.96, 3.07)

^aMarketing channels assess exposure to marketing of a tobacco product through a single channel most of the time or always compared to never.

^bCell entries are adjusted odds ratios (ORs) and 95% confidence intervals. All models are adjusted for gender, ethnicity, parents' education, other tobacco product use (cigarette, e-cigarette, hookah, smokeless, cigar, and pipe; never, past or current use) and community random effect at baseline.

^cThe N for each model varies slightly because of missing values, so a range is given for each tobacco outcome.

*OR significant at $p < .05$.

Table 3. Association of Perceived Marketing Exposure for Six Combined Tobacco Products at Baseline With Subsequent Initiation of Cigarettes, E-Cigarettes and Hookah, by Channel

Marketing channels ^{a,b}	Cigarette use, N (1246–1258) ^c	E-cigarette use, N (1145–1157) ^c	Hookah use, N (1103–1111) ^c
Internet	3.05 (1.10, 8.40)*	4.52 (1.81, 11.29)*	2.17 (0.77, 6.07)
Newspaper/magazine	0.84 (0.17, 4.19)	2.11 (0.65, 6.84)	0.94 (0.20, 4.40)
Outdoor	1.68 (0.76, 3.73)	1.45 (0.73, 2.88)	1.94 (0.90, 4.19)
Store	3.59 (1.42, 9.12)*	1.91 (0.95, 3.85)	2.08 (0.91, 4.73)
Television/movie	0.94 (0.31, 2.83)	2.00 (0.79, 5.07)	1.67 (0.64, 4.39)

^aAdjusted odds ratio (OR) for initiation of a tobacco product at follow-up if reported exposure to all six tobacco products most of the time/always at baseline, through a specific marketing channel.

^bCell entries are adjusted odds ratios (ORs) and 95% confidence intervals. All models are adjusted for gender, ethnicity, parents' education, other tobacco product use (cigarette, e-cigarette, hookah, smokeless, cigar, and pipe; never, past, or current use) and community random effect at baseline.

^cThe N for each model varies slightly because of missing values, so a range is given for each tobacco outcome.

*OR significant at $p < .05$.

Table 4. Association of Perceived Marketing Exposure for Five Individual Tobacco Products at Baseline With Subsequent Initiation of Cigarette Smoking, by Channel

Marketing channels ^{a,b}	E-cigarette ads, N (1252–1260) ^c	Hookah ads, N (1252–1260) ^c	Cigar/cigarillo ads, N (1251–1260) ^c	Smokeless ads, N (1251–1260) ^c	Pipe ads, N (1253–1260) ^c
Internet	1.70 (0.99, 2.90)	1.33 (0.70, 2.52)	2.65 (1.30, 5.40)*	2.31 (1.11, 4.80)*	2.51 (1.13, 5.54)*
Newspaper/magazine	1.16 (0.64, 2.10)	0.88 (0.32, 2.45)	1.31 (0.62, 2.78)	2.22 (1.03, 4.79)*	0.86 (0.27, 2.76)
Outdoor	1.33 (0.82, 2.15)	1.81 (0.99, 3.33)	1.56 (0.92, 2.64)	1.57 (0.89, 2.80)	1.85 (0.93, 3.70)
Store	3.16 (1.65, 6.06)*	2.01 (1.28, 3.14)*	2.50 (1.41, 4.42)*	2.34 (1.46, 3.74)*	1.72 (1.13, 2.60)*
Television/movie	0.85 (0.45, 1.62)	1.29 (0.69, 2.41)	1.20 (0.70, 2.07)	1.28 (0.71, 2.30)	1.05 (0.57, 1.92)

^aMarketing channels assess exposure to marketing of that product through that channel most of the time or always compared to never.

^bCell entries are adjusted odds ratios (ORs) and 95% confidence intervals. All models are adjusted for gender, ethnicity, parents' education, other tobacco product use (cigarette, e-cigarette, hookah, smokeless, cigar, and pipe; never, past or current use) and community random effect at baseline.

*OR significant at $p < .05$.

cigarettes as young adults. Cigarette initiation is more likely among young adults exposed as adolescents to tobacco marketing in stores, regardless of the type of tobacco product being marketed.

Our study supports previous cross-sectional analyses linking exposure to marketing of a specific tobacco product with use of that product among adolescents. It complements a limited number of longitudinal studies that have associated exposure to cigarette ads²³ with initiation of smoking, and exposure to e-cigarette ads³¹ with later use of e-cigarettes. It is consistent with results from Henriksen et al.³⁴ study of cigarette marketing through stores and subsequent smoking.

Novel associations not previously examined include results suggesting that marketing for hookah in stores may lead to hookah initiation, and that exposure to marketing of poly-tobacco products via the Internet contributes to initiation of cigarettes and e-cigarettes.

This study provides new evidence that adolescents using the Internet recall frequent marketing of multiple tobacco products, and this exposure can lead to initiation of these various products as well as to cigarette smoking.

Although this study does not test causality, it addresses several components for establishing causal links to tobacco initiation:³⁷ adolescents reported exposure to cigarette, e-cigarette, and hookah marketing before they started using those products; there was evidence of increased risk if exposed to marketing of multiple tobacco products in stores (for cigarette initiation) and on the Internet (for cigarette and e-cigarette initiation), and to marketing for a specific product most of the time or always compared to no exposure for that product, after controlling for other factors including gender, ethnicity, parental education, and other tobacco product use.

There are some limitations to this study that suggest directions for future research. First, this study did not rule out the possibility that adolescents who were at risk for tobacco use (eg, contemplating use) may have been more likely to notice and remember tobacco marketing. In addition, although the models adjusted for parental education, gender, ethnicity, and community, there may have been other confounders that were not accounted for in the models, for example, peer and parental tobacco use. Some of these measures (eg, parental education), assessed when the youth joined the study in kindergarten, may have changed over time. In addition, attrition bias was not assessed and could be related to tobacco use. Because we assessed exposure to marketing by self-report, actual levels of exposure to marketing were not available. However, perceived marketing exposure may be as or more influential on behavior than the actual prevalence of marketing through each channel because it measures what participants noticed. We limited exposure to store marketing to reported marketing inside stores, whereas another measure, outdoor/billboard marketing, captured signage outside stores and at other outdoor locations that youth might see when traveling through an area. It is a conservative measure of store marketing that none the less was significant in predicting cigarette, e-cigarette, and hookah initiation. An additional limitation is that the baseline and follow-up surveys used identical measures of marketing exposure and tobacco use but different methods of administration at the two waves: the first wave was in school and the second wave was online. Marketing exposures for different types of tobacco products were correlated enough that we could not test whether exposure to marketing for one type of tobacco (eg, e-cigarettes) was related to use of other products (eg, cigarettes) at follow-up among those who did not use the type of tobacco (eg, e-cigarettes) being marketed. Finally, the study population is drawn from California, a state with a mature tobacco-control program, low rates of adolescent tobacco product use, and enactment of a law in the last 2 months of this study that limited tobacco sales to age 21, so findings may not be generalizable to other regions with different tobacco prevention environments.

The current analysis expands our understanding of a media environment that can reach adolescents in both their homes (eg, through the Internet and TV) and their communities (eg, stores and billboards) with few restrictions from current tobacco-control regulations. It also moves beyond a focus on cigarettes and e-cigarettes to include the potential effect of exposure to marketing for multiple tobacco products such as smokeless tobacco, hookah, and cigars. In the currently expanding tobacco marketplace, analysis of total exposure to tobacco product marketing is needed to more fully understand the effects on adolescent initiation of tobacco.

Regulation of cigarette and smokeless tobacco marketing to youth has been a limited but important feature of tobacco control over the past two decades, including the US Master Settlement Agreement of 1998, the 2009 Family Smoking Prevention and Tobacco Control Act, and the World Health Organization Framework Convention on Tobacco Control.^{15,38} The Master Settlement Agreement limits billboard advertising for major cigarette and smokeless tobacco companies but permits it for other tobacco products and for smaller billboards on stores that sell tobacco. More recently, the Food and Drug Administration has expanded the Tobacco Control Act to cover e-cigarettes, cigars, pipes, and hookah.³⁹ However, these restrictions are limited to certain types of message claims, distribution of free samples, and tobacco-branded events and promotional items. Marketing for e-cigarettes can reach large numbers of youth with positive imagery through stores and TV.^{12,40} At the same time,

the Internet provides almost unlimited opportunities for exposure and reach of cigarette, hookah, and other tobacco product messages through social media accounts, videos, and message sharing.^{41–43} With exposure to marketing of multiple tobacco products through multiple channels, cigarette smoking may face a future reversal of its downward trend.^{3,9}

Our results raise concern that widespread marketing of e-cigarettes, hookah, and small cigars may contribute to rising use of those products as well as a rise in cigarette smoking. E-cigarette ads have appeared on TV after decades without cigarette ads. The public health impact of multiple forms of tobacco marketing should be considered in future tobacco prevention strategies. There is evidence that comprehensive rather than partial restrictions on cigarette advertising have reduced youth smoking in the past.^{16,44–46} If e-cigarette and other tobacco product use by youth is to be reduced in our increasingly diverse media and tobacco product environment, it may be necessary to develop preventive messages and to restrict protobacco marketing across media channels to which adolescents are easily exposed.

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Declaration of Interests

None declared.

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