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*Corresponding author: Anna V Wilkinson, Epidemiology, Human Genetics & Environmental Science, UTHHealth School of Public Health in Austin, USA
E-mail: Anna.V.Wilkinson@uth.tmc.edu

Reviewing editor:
Andrew Kiyu, Department of Community Medicine and Public Health, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Malaysia

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PUBLIC HEALTH & PRIMARY CARE | RESEARCH ARTICLE

Exposure to e-cigarette marketing and product use among Mexican American young adults on the US-Mexico border: A pilot study

Ana L Herrera¹, Anna V Wilkinson^{2*}, Elizabeth A Cohn³, Cheryl L Perry² and Susan P Fisher-Hoch³

Abstract: Historically, the tobacco industry has marketed directly to minority groups, which is associated with increased product use; the advent of e-cigarettes poses a new risk. The purpose of this study is to examine associations between exposure to tobacco marketing via traditional and digital marketing channels and ever use of e-cigarettes among Mexican-American young adults. Ninety-two Mexican-American young adults between 18 and 29 years of age (61% female) were recruited from the Cameron County Hispanic Cohort, a well-characterized population-based cohort on the U.S.–Mexico border. Participants reported their use of e-cigarettes and exposure to pro- and anti-media messages about these products in traditional and digital venues. Nearly one third reported ever using e-cigarettes and exposure to media overall was low. However, exposure to pro e-cigarette messages via digital sources was associated with increased odds of ever using e-cigarettes (OR: 2.86; 95% CI: 1.11–7.38). Results suggest that regulations on e-cigarette digital media may help to reduce e-cigarette use.

Subjects: Health Communication; Public Health Policy and Practice; Epidemiology; Health Education and Promotion

ABOUT THE AUTHORS

Ana L Herrera is a graduate research assistant and Anna Victoria Wilkinson is faculty with the Texas Tobacco Center of Regulatory Science (TX TCORS) on Youth and Young Adults. As young adult use of non-cigarette alternative tobacco products continues to increase in the United States, it also is important to examine the changes and patterns of use across time, and the impact of tobacco marketing on young adults' use of non-cigarette products. Thus, a shared research interest of theirs focuses on tobacco marketing disparities and alternative tobacco use among young adults and college students. The current pilot study focuses on e-cigarette marketing exposure and its influence on e-cigarette use among a two-fold targeted group, Hispanic young adults. It was found that those who reported more exposure to online pro e-cigarette messages also were more likely to use e-cigarettes. Our findings contribute to the growing body of literature that supports the regulation of e-cigarette advertising to reduce e-cigarette use.

PUBLIC INTEREST STATEMENT

Electronic cigarettes, also known as e-cigarettes, are now being used more than traditional cigarettes, causing a major public health concern. Current federal regulation allows tobacco companies to spend millions of dollars each year to advertise e-cigarettes on television, radio, and internet. These advertising methods have been effective in promoting tobacco use, especially among minority groups who tend to use tobacco more than the public. E-cigarette companies use company websites, retailer websites, and social media sites like Twitter, YouTube, and Instagram to reach the rapidly growing Hispanic, particularly Mexican heritage population. This pilot study examined whether exposure to pro-tobacco internet advertising influenced e-cigarette use among a group of Mexican-American young adults (18–29 years old). It was found that those who reported more exposure to online pro e-cigarette messages were also more likely to use e-cigarettes. Clearly, it is important to also regulate online e-cigarette advertising to reduce e-cigarette use.

| **Keywords: e-cigarettes; marketing; Mexican-American**

Electronic cigarettes (e-cigarettes) are devices that contain a battery-powered heating component used to aerosolize a liquid, typically containing concentrated nicotine and flavor additives (U.S. Department of Health and Human Services (USDHHS), Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2012). Although the health impact of e-cigarettes remains uncertain (Chen & Husten, 2014), concerns have been raised regarding the use of these products including their potential to promote use of combustible tobacco products among current non-users, long-term dual use (i.e. use of e-cigarettes with combustibles), and smoking relapse in former smokers (USDHHS, 2014). State-level and national studies including the National Youth Tobacco Survey and Monitoring the Future Study indicate that e-cigarettes have surpassed the use of conventional cigarettes (Arrazola et al., 2015; Barrington-Trimis et al., 2016; Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2015). The inclusion of potentially harmful ingredients (Chen & Husten, 2014; Goniewicz et al., 2014) and the presence of nicotine, an addictive substance with negative health consequences (U. S. Department of Health and Human Services (USDHHS), Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office of the Associate Director for Communications, 2014), underscores these concerns. Unsurprisingly, both awareness and use of e-cigarettes among U.S. adults has increased over time (King, Patel, Nguyen, & Dube, 2014), with young adults aged 18–24 years reporting the highest prevalence rates of e-cigarette use among all age groups (Schoenborn & Gindi, 2015).

Evidence underscoring the powerful influence that cigarette advertising and promotions exert on smoking initiation (U.S. Department of Health and Human Services (USDHHS), Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2012; Gilpin, White, Messer, & Pierce, 2007) led to the establishment of restrictions in the U.S. set forth by the Master Settlement Agreement of 1998 (National Association of Attorneys General, 1998) and the Family Smoking Prevention and Tobacco Control, Public Law 111-31 (2009). In August 2016, the Food and Drug Administration formally imposed regulations on e-cigarettes (Backinger, Meissner, & Ashley, 2016); however, there were minimal regulations placed on e-cigarette advertising. Despite recent studies demonstrating that exposure to e-cigarette advertising elicits favorable attitudes toward the product (Pokhrel et al., 2016) and increases interest in trying an e-cigarette in the future (Farrelly et al., 2015), the current level of federal regulations enables e-cigarette manufacturers to market their products by and through any means, as well as target and sell to all populations, including minors and minority groups.

The rapid growth of e-cigarette use and awareness coincided with major increases in e-cigarette advertising. Between 2010 and 2014, e-cigarette manufacturers in the U.S. have dramatically increased spending on advertising from \$5.6 million to \$115.3 million (Campaign for Tobacco-Free Kids, n.d.). During the second quarter of 2013 alone, spending on advertising reached \$28 million. Spending breakdowns indicate that the majority of advertising dollars were spent on print ads (upwards of \$26 million during the first two quarters of 2013), followed by television ads (around \$13 million during the first two quarters of 2013), and then radio ads (around \$3 million during Q1 and Q2 of 2013) (Kornfield, Huang, Vera, & Emery, 2015), yet spending on e-cigarette internet advertising consistently remained under \$1 million (Kornfield et al., 2015; Richardson, Ganz, & Vallone, 2015).

Despite having a relatively small budget for internet advertising, it can provide e-cigarette companies with an inexpensive way to reach large amounts of people. E-cigarettes are heavily advertised through various online media channels, including company websites, retailer websites, and social media platforms such as Twitter, YouTube, and Instagram (Freeman, 2012; Huang, Kornfield, Szczypka, & Emery, 2014; Laestadius, Wahl, & Cho, 2016; Ritter, 2015; Sears, Walker, Hart, Lee, & Smith, 2017;). While there are bans on certain forms of advertising on social media,

e-cigarette companies often find ways to circumvent these restrictions with direct and indirect marketing tactics (World Health Organization, 2009). With internet and social media becoming increasingly popular, e-cigarette companies are aware of the vast marketing potential of the internet and social media.

E-cigarette advertising is of particular concern for racial and ethnic minority populations in the U.S. because cigarette manufacturers have specifically targeted these groups in the past (U.S. Department of Health and Human Services (USDHHS), Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2012). The current rapid growth of the Hispanic population in the U.S. in general (Colby & Ortman, 2015), and the Mexican heritage population in particular (Flores, 2017), with a young median age of 26 years (Lopez, 2015), makes young adult Mexican-Americans a particularly attractive target of e-cigarette marketing. Furthermore, internet use among Hispanics continues to grow at a faster rate than non-Hispanic whites and African-American/Blacks in the U.S., particularly for social media sites as 68% of Hispanic internet users use a social media site such as Facebook, Twitter, or Instagram, compared to 58% of all U.S. internet users (Brown, Lopez, & Lopez, 2016). Therefore, e-cigarette companies may try to capitalize on this and develop targeted messages for this population.

Evidence suggests that marketing and media exposure influences cigarette use among Mexican-American youth (Wilkinson, Vandewater, Carey, & Spitz, 2014), but to date, no studies have examined the association between marketing exposure and e-cigarette use among Mexican-American young adults. Moreover, with the vast majority (93%) of Hispanic individuals aged 18–29 years reporting use of the internet, and rates of internet access via smartphones and use of social networking sites equaling—and in some cases surpassing—those of other Americans, it is important to examine whether marketing, particularly through internet and social media advertisements, influences the use of e-cigarettes among this demographic group (Lopez, Gonzalez-Barrera, & Patten, 2013). The purpose of this pilot study is to examine associations between exposures to pro-tobacco marketing in different venues and ever use of e-cigarettes among Mexican-American young adults.

1. Methods

1.1. Study sample and population

The participants in this study were recruited from the ongoing Cameron County Hispanic Cohort (CCHC), a well-characterized population-based cohort maintained and developed by The University of Texas School of Public Health (Fisher-Hoch et al., 2010). Eligibility criteria for this study included (1) being between 18 and 29 years of age; (2) a resident of Cameron County, Texas; (3) of Mexican heritage, defined as being born in Mexico, having a parent, or at least one grandparent born in Mexico; and (4) able to speak English or Spanish. Given this was a pilot study, we conducted a priori power calculations, which demonstrated that a sample size of 100 would be adequate to detect an overall association between tobacco user status and self-reported exposure to pro-tobacco marketing. We used quota sampling to ensure equal numbers of tobacco users and non-users were recruited. We identified roughly 450 individuals from the CCHC database who met the study criteria.

1.2. Procedure

Demographic information, personal and family health histories, and behavioral risk data, including smoking status, was collected at time of enrollment into the CCHC (Fisher-Hoch et al., 2010), and therefore, individuals from the cohort who met eligibility criteria were contacted via telephone to determine interest in participating in the study. Those who expressed interest met with a bilingual data collector to provide written informed consent and completed an interviewer-assisted structured interview, either in English or Spanish, in which the interviewer recorded the responses. Recruitment and data collection started in June 2014 and ended in August 2015, during which

time 104 individuals who met the inclusion criteria were approached, of whom 92 agreed to participate, resulting in an 88% response rate. Those who participated received a \$20 gift card as an incentive. The Institutional Review Board at the University of Texas Health Science Center approved all aspects of this study.

Many of the measures included in the survey have been used extensively in previous research with Mexican heritage youth and adults, (e.g. Murray, Prokhorov, & Harty, 1994; Operario, Adler, & Williams, 2004). Items probing knowledge and use of e-cigarettes underwent extensive cognitive testing and revision prior to use (Hinds et al., 2016). All responses to questions in the interview were self-reported.

1.3. Measures

1.3.1. Ever e-cigarette use

The main outcome of interest was based on participants' response to the question, "Have you ever tried an electronic cigarette or e-cigarette, even a puff?" Responses of "yes" were coded as "1," and those of "no" as "0." Participants were provided with a brief explanation, as well as pictures depicting a variety of examples of e-cigarettes to ensure product recognition (Hinds et al., 2016).

1.3.2. E-cigarette marketing exposure

Exposure to pro e-cigarette messages from eight media sources (television, radio, billboards or posters, newspapers, magazines, text, internet, and Facebook) was assessed through the following item (Murray et al., 1994): "During the last month have you seen or heard messages that are FOR E-CIGARETTES?". Responses of "yes" were coded as "1," and summed to create two distinct sources of marketing exposure. Traditional media included television, radio, billboards or posters, newspapers, and magazines, while digital media included ads seen via the internet and Facebook and received via text. Exposure to traditional media could range between 0 and 5 sources. Exposure to digital media could range between 0 and 3 sources.

Exposure to anti e-cigarette (prevention materials) messages from the same eight media sources was assessed through the following item (Murray et al., 1994): "During the last month have you seen or heard messages that are AGAINST E-CIGARETTES?". Responses of "yes" were coded as 1, and summed to create a single exposure measure which could range between 0 and 8 sources.

Given the study location, the media sources reported as either pro- or anti-e-cigarette messages could have originated from either the U.S. or Mexico.

Susceptibility to Advertising was assessed using a measure adapted from Barr and Kellaris (2007). This four-item measure captures the degree to which the individual believes advertising provides useful information. Participants respond on a scale of 1–5, and the four items are averaged to create a total score; higher scores reflect higher beliefs about the usefulness of advertising. Cronbach's alpha based on the current study is acceptable ($\alpha = 0.77$).

1.3.3. Demographic variables

We controlled for demographic variables associated with smoking behavior, including gender (female served as the reference category) and age, examined as a continuous variable. We further controlled for subjective social status using the MacArthur Scale of Subjective Status, which reflects the respondents' subjective views of where they lie in the social hierarchy relative to other people in the U.S. (Operario et al., 2004). This 10-point scale is constructed in the shape of a "social ladder." Participants were instructed: "Think of a ladder with 10 steps representing where people stand in the United States. At the top of the ladder (step 10) are the people who are the best off—those who have the most money, the most education, and the most respected jobs. At the bottom of the ladder (step 1) are the people who are worst off—those who have the least money, least education, and the least respected jobs or no job. Where would you place

Table 1. Demographic characteristics, advertising covariates, and e-cigarette use (n = 92)

	N (%)
Gender	
Male	36 (39.1)
Female	56 (60.9)
Ever e-cigarette use (yes)	30 (32.6)
	Mean (SD)
Mean age in years (range 18–29)	22.11 (2.83)
Subjective social status (range 1–10)	5.61 (2.13)
Susceptibility to advertising (range 1–5)	2.95 (0.99)
Marketing exposure	
Digital pro e-cig messages	0.28 (0.60)
Traditional pro e-cig messages	0.62 (0.97)
Anti e-cig messages	0.37 (0.69)

yourself on this ladder?”. Subjective social status was entered as a continuous variable in the multivariable regression analyses.

1.4. Statistical analysis

First, descriptive statistics were calculated; frequencies and percentages are presented for categorical variables and means and standard deviations for continuous variables in Table 1. Second, to examine the association between ever use of e-cigarettes and exposure to pro e-cigarette advertising, we completed an unconditional logistic regression. The model included both traditional and digital media and controlled for three demographic covariates, exposure to prevention materials and susceptibility to advertising. All analyses were completed using SPSS version 23 (IBM Corp, 2015).

2. Results

As seen in Table 1, roughly 61% of the participants were women, the overall mean age was 22.11 years (SD = 2.83 years), and on average, participants placed themselves on the sixth of 10 rungs on the subjective social status ladder. Nearly one third (32.6%) reported ever using e-cigarettes. On average, participants reported limited exposure to pro-tobacco media: 0.6 (range 0–4) sources of traditional media and 0.3 (range 0–2) sources of digital media. Overall, 46% reported some exposure to digital media sources compared to 22% reporting exposure to traditional sources (data not shown). Overall, 24% reported exposure to prevention materials, with an average exposure of 0.4 (range 0–3) to sources of anti-e-cigarette messages. Finally, the average for susceptibility advertising was 2.95, suggesting a slight overall disagreement that advertising is useful and does not affect their purchasing behavior.

Table 2. Multivariate logistic regression of ever use of e-cigarettes and exposure to pro e-cigarette messages in traditional and digital venues (n = 92)

	Adjusted OR (95% CI)
Gender (female)	2.79 (1.07–7.30)*
Age	1.01 (0.85–1.21)
Subjective social status	1.04 (0.82–1.30)
Susceptibility to Advertising	1.06 (0.65–1.74)
Marketing exposure	2.86 (1.11–7.38)*
Digital pro e-cig messages	0.85 (0.48–1.52)
Traditional pro e-cig messages	0.88 (0.40–1.98)
Anti e-cig messages	

Notes: Female served as the reference category for gender; * significant at $p < 0.05$.

As seen in Table 2, exposure to digital pro e-cigarette advertising was significantly associated with ever use of e-cigarettes, after adjusting for exposure to pro e-cigarette advertising via traditional media sources and all types of anti-e-cigarette advertisements, responsiveness to advertising, gender, age, and subjective social status. For participants exposed to digital pro e-cigarette messages via the internet or Facebook, the odds of ever using e-cigarettes increased by 2.86 (95% CI: 1.11–7.38) for each source of message viewed. In contrast, exposure to pro e-cigarette advertising via traditional sources was not significant. The odds of ever use of e-cigarettes also varied by gender; the odds of use among males was almost three times higher than among females (OR = 2.79; 95% CI: 1.07–7.30). The Hosmer and Lemeshow test revealed an adequate model fit for the data (chi-square = 9.45 (df = 8), $p = 0.306$).

3. Discussion

Previous studies have found a positive association between exposure to marketing and e-cigarette use among youth (Mantey, Cooper, Clendennen, Pasch, & Perry, 2016; Singh et al., 2016); however, there is limited information on this relationship among young adults and, in particular, those of Mexican heritage. The results from this study demonstrate an association between pro-e-cigarette marketing via the internet and Facebook and e-cigarette use among Mexican Americans aged 18–29 years. Surprisingly, however, no association was observed between e-cigarette use and e-cigarette marketing exposure via traditional media sources, including television ads, television shows, radio ads, radio programs, billboards, posters, newspaper or magazine ads, or other advertisements. However, the Elaboration Likelihood Model posits that attitudes result from persuasive influences processed via either central or peripheral routes (Cacioppo, Harking, & Petty, 1981; Cacioppo & Petty, 1979). Information processed via the central route requires high-level cognitive processes such as evaluation, recall, critical judgment, and inferential judgment and is more likely to result in higher persuasion (Petty & Cacioppo, 1986; Petty & Krosnick, 1995; Petty & Wegener, 1998). However, persuasion for attitude formation can also occur even via messages processed peripherally. Therefore, while we did not observe an association between traditional media sources and e-cigarette use in our sample, it does not necessarily mean that advertising messages are not being processed as it remains possible that messaging is still being processed via the peripheral route.

Recent studies have indicated that the increase in spending on advertising is correlated with increases in people's exposure to e-cigarette ads. In just two years, between 2011 and 2013, young adults' exposure to e-cigarette advertising via television ads increased by 321% (Duke et al., 2014). The effectiveness of advertising via digital sources, such as on the internet or through social media, however, is an avenue that is extremely attractive for e-cigarette companies from a business perspective, and therefore deserves to be followed with caution in years to come. Social media sources, like Twitter, are important to consider because of the frequency in which people share (or re-tweet) posts, allowing for messages to reach people at an exponential rate. For example, researchers followed tweets that originated from the e-cigarette company, Blu, and found that within three months, a tweet originally sent to 214 followers ended up reaching 2,600 individuals by means of retweeting (Chu et al., 2015). Furthermore, in a fashion similar to re-tweeting on Twitter, internet marketing can be particularly effective because of the potential for ads to be copied and shared on a variety of social media sites, and thus reach an expansive number of individuals from a variety of social networks, at no additional charge to the company.

Around the globe, the use of digital advertising has grown rapidly and is expected to continue rising in years to come (Zenith Optimedia Group, 2016). The shift from traditional to digital sources can be attributed to the economic efficiency of online advertisements, as well as the decline in use of printed materials such as newspapers and magazines (Evans, 2009). The internet allows for companies to tailor messages to target audiences in order to make advertisements more appealing to users based on their interests and demographics (Evans, 2009). Despite reports of minimal e-cigarette advertising on the internet (Richardson et al., 2015), evidence indicates that it serves as one of the major sources from which youth and young adults are exposed to information about e-cigarettes (Cavallo et al., 2014; USDHHS, 2016). Moreover, many youth and young adults may not realize that they are being exposed to pro-tobacco/e-cigarette advertising via indirect marketing strategies such as product reviews (Liang,

Zheng, Zeng, Leischow, & Chung, 2015), tobacco-related scenes (Liang et al., 2015), and even user-generated videos (Dunlop, Freeman, & Jones, 2016). Similar to the tactics utilized by the tobacco industry for cigarette marketing, the e-cigarette industry has targeted minority groups with their internet advertising, particularly on websites frequented often by Hispanics (Richardson et al., 2015).

When considering Facebook alone, people spend an average of 50 minutes on the site per day (Facebook, 2016), falling just under the daily average time people spend eating and drinking (1.07 hours), and accounting for more time spent on a single activity per day except for sleeping, working, and watching TV/movies (US Department of Labor Statistics, 2015). More time spent on Facebook correlates with increased engagement on the site, both of which allows Facebook to gather information about users' habits and interests, to in turn better target its advertisements (Calder, Malthouse, & Schaedel, 2009). Among internet users, young adults aged 18–29 years (87%) and Hispanics (73%) utilize Facebook most compared to other age groups and racial/ethnic populations, respectively (Duggan, Ellison, Lampe, Lenhart, & Madden, 2015). The combination of easily accessible, targeted, and tailored messages that are created and disseminated with little investment from e-cigarette companies makes the digital realm an ideal source from which the e-cigarette industry can market their product, yet simultaneously raises a public health concern.

Exposure to e-cigarette advertisements is associated with an increased curiosity about and likelihood of trying an e-cigarette among young adult never users (Villanti et al., 2016). Positive perceptions of e-cigarettes, such as their perceived effectiveness to aid in smoking cessation among all young adults, regardless of prior usage are also associated with exposure (Villanti et al., 2016). Indeed, young adults who believe e-cigarettes help people quit smoking are more likely to experiment with e-cigarettes (Choi & Forster, 2014); making the implications of exposure to e-cigarette advertising a public health concern. Given the known risks and potential impact e-cigarette use can have on individual and population health, and the influence advertising can have on individuals' behavior, this study suggests that regulations on e-cigarette marketing on the internet and social media may help in reducing e-cigarette use. Moreover, further research examining internet and social media messages is warranted as public health officials and policy makers could use this information to identify emerging products and understand how these products are being marketed in order to develop new regulations.

Like all, our study has some limitations. As a pilot study, there was a limited sample size; however, participants were part of a population-based cohort, and thus are representative of the target population. Importantly, our results generalize back to the population of young Mexican Americans who reside near the border between the United States and Mexico. The limited sample size might lead to a spurious association; however, the model fit was adequate, lending support to our findings. E-cigarette behavior was assessed via self-report and not verified using chemical validation, which could lead to reporting bias. Furthermore, this was a cross-sectional study, and therefore it is not possible to infer causality between e-cigarette use and exposure to advertising. Lastly, we only distinguished between Facebook and the internet. We did not ask about any other sources of social media such as Twitter and Instagram, both of which are popular among individuals of the age group included in this study population. Notwithstanding these limitations, our finding contributes to the growing body of literature examining the influence of digital media exposure on e-cigarette use among adult Mexican Americans.

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Competing Interest

The authors declare no competing interests.

Author details

Ana L Herrera¹
E-mail: anaherrera@utexas.edu
Anna V Wilkinson²
E-mail: Anna.V.Wilkinson@uth.tmc.edu
Elizabeth A Cohn³
E-mail: eac2168@gmail.com
Cheryl L Perry²
E-mail: cheryl.l.perry@uth.tmc.edu
Susan P Fisher-Hoch³
E-mail: susan.p.fisherhoch@uth.tmc.edu
¹ Department of Health Behavior and Health Education, University of Texas at Austin, Austin, Texas, USA.
² Department of Epidemiology, Human Genetics and Environmental Science, UTHealth School of Public Health in Austin, Austin, Texas, USA.
³ Department of Epidemiology, Human Genetics and Environmental Science, UTHealth School of Public Health in Brownsville, Brownsville, Texas, USA.

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