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Talking about tobacco on Twitter is associated with tobacco product use

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Abstract

Tobacco-related content appears on social media in the form of advertising and messages by individuals. However, little is known about associations between posting social media messages and tobacco product use among adolescents and young adults. Self-reports of tobacco product use were obtained from the Children's Health Study of young adults in Southern California. Among the 1486 respondents in the most recent wave of the cohort (2016–2017), 284 provided tobacco product use data and their Twitter user names to access publicly available Twitter account data (mean age = 20.1 yrs. (SD = 0.6), 54% female, 49% Hispanic). We obtained the tweets that those respondents posted on Twitter, searched the tweets for 14 nicotine- and tobacco-related keywords, and coded these statements as positive or negative/neutral. Logistic regression analyses were conducted to determine whether respondents who posted positive tobacco-related tweets were more likely to report tobacco product use, relative to those who did not post any positive tobacco-related tweets. Respondents who posted any positive messages about tobacco had significantly higher odds of reporting past month use of cigarettes (OR = 3.15, 95% CI = 1.36, 7.30) and any tobacco product (OR = 2.41, 95% CI = 1.16, 5.01), relative to respondents who did not post about tobacco. This is the first study to establish an empirical link between adolescents' and young adults' tobacco-related Twitter activity and their tobacco product use. Health communications about the risks of tobacco use could target adolescents who post positive messages about tobacco products on Twitter.

Keywords

Tobacco; Electronic cigarettes; Cigarettes; Social media; Twitter; Adolescents; Young adults

1. Introduction

Tobacco content—messages about any product deemed as a tobacco product by the Food and Drug Administration (FDA)—is ubiquitous on social media. Social media conversations

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Conflict of interest

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about tobacco products include pro-tobacco messages (e.g., advertisements for products by companies with social media accounts; positive posts by individuals about their tobacco product use; pictures of individuals blowing clouds of aerosol or displaying their devices; “smokers’ rights” and “vapers’ rights” posts arguing against regulations) and anti-tobacco messages (e.g., messages from public health agencies about the harms of tobacco or information about cessation; posts from individuals expressing negative views of tobacco product use) (Chu et al., 2015; Dai and Hao, 2017; Grant and O’Mahoney, 2016; Jo et al., 2016; Laestadius et al., 2016; Rose et al., 2017). On social media, pro-tobacco messages vastly outnumber anti-tobacco messages about the potential harms of tobacco products (Allem et al., 2017; Huang et al., 2014a, 2014b). This could imply to social media users that tobacco product use is safe and/or normative.

Participation in conversations about tobacco products on social media could be a risk factor for experimentation with tobacco products and progression to nicotine dependence. Previous studies have documented that most adolescents who use social media have seen tobacco content on social media (Cranwell et al., 2015; Hébert et al., 2017). Studies have also found that adolescents’ self-reported exposure to tobacco content on social media is associated with increased likelihood of using tobacco products (Depue et al., 2015; Huang et al., 2014a, 2014b; Hébert et al., 2017). Adolescents’ self-reports of their engagement with tobacco on social media (e.g., responses to survey questions about whether they “like” or comment on tobacco content online, sign up for email alerts about tobacco products, visit tobacco websites, etc.) is also associated with increased likelihood of using tobacco products (Huang et al., 2017; Soneji et al., 2017, 2018).

However, previous research on associations between tobacco-related social media and tobacco product use have been limited to participants’ self-reports of their social media use, which could be inaccurate or biased. No previous studies have linked objective measures of what adolescents actually say about tobacco on social media to their tobacco product use. This study obtained the Twitter tweets of young adults and assessed associations between tweeting about tobacco and using tobacco products. We hypothesized that participants who tweeted positive messages about tobacco on their Twitter accounts would be more likely to use tobacco products, compared with those who posted negative or neutral messages about tobacco or did not post messages about tobacco on Twitter.

2. Methods

2.1. Sample

Data were obtained from the Children’s Health Study (Barrington-Trimis et al., 2015; McConnell et al., 2006), a cohort study originally developed to study the health effects of air pollution. This cohort has been followed annually since enrollment in 2002–2003, when participants were in kindergarten or first grade, from schools in 12 communities throughout Southern California. Detailed questions about tobacco product use were added when the participants were in high school. The most recent survey was administered online in 2016–2017 ($N = 1486$).

2.2. Measures

2.2.1. Tobacco use—The 2016–2017 survey assessed past month use of cigarettes, e-cigarettes, or hookah. We also created a variable representing any past-month use of any nicotine or tobacco products (i.e., whether respondents used cigarettes, e-cigarettes, or hookah in the past month). These variables were coded as 1 = use on at least one day in the past month or 0 = no use in the past month. The survey also included measures of demographic covariates including gender, race/ethnicity (non-Hispanic White, Hispanic White, African American, Asian, and other; in statistical analyses, the last three categories were collapsed into a single category due to their relatively small sample size), and parents' education (high school diploma or lower, some college, and college degree or higher).

2.2.2. Tobacco-related tweets—Participants were also asked to provide their Twitter user names. Among the 1486 respondents in the cohort, 290 respondents (20%) provided us with user names for their public Twitter accounts. This percentage is similar to the 21% of U.S. adults who reported using Twitter in 2016 (Pew Research Center, 2016). Of those 290, 284 also provided tobacco use outcome data on the 2016–2017 survey. We obtained the most recent 3200 tweets that those respondents posted on Twitter (the maximum number of tweets that can be downloaded from the Twitter API) and searched the text of each tweet for 14 tobacco-related keywords (listed in Supplemental Table 1) that were validated for precision and recall in a previous study (Lienemann et al., 2017). This produced a list of 253 tweets containing tobacco-related keywords. Two independent coders coded each tobacco-related tweet as positive (in favor of tobacco products, any positive message about any tobacco product) or negative/neutral (anti-tobacco, or no sentiment toward tobacco) ($\kappa = 0.97$), using established methods (Lienemann et al., 2017). We defined positive tweets as those that expressed favorable attitudes toward any tobacco product or about people who use them (e.g., I like vaping cherry flavor; smoking is cool). Negative tweets were those that expressed unfavorable attitudes toward any tobacco product or about people who use them (e.g., smoking is disgusting, vapers look stupid). Neutral tweets were those that expressed neither positive nor negative sentiments (e.g., someone is smoking in my apartment, do you vape?). Positive tweets were distinguished from negative or neutral tweets because we hypothesized that positive statements about tobacco products would be associated with tobacco product use, but negative or neutral statements would not. Disagreements between coders were resolved by discussion and consensus.

2.3. Statistical analysis

The analytical data set was restricted to the 284 participants who had provided information on use of at least one tobacco product and had provided a Twitter user name. Tweets were categorized to capture whether they contained either one or more positive tobacco-related tweets, negative/neutral tobacco tweets, or no tobacco tweets (referent group). We conducted logistic regression analyses, controlling for demographic covariates (gender, race/ethnicity, parental education), to evaluate the association of type of tweet using indicator variables with past-month use of cigarettes, e-cigarettes, hookah, and any tobacco product (vs. no product), in separate models.

3. Results

The mean age of respondents was 20.1 (SD = 0.6); 54% were female; 49% were Hispanic, 40% were white, 3% were Asian, 1% were African American, and 7% identified with an “other” racial or ethnic group. Of the 284 Twitter users in the current analysis, 276 (97%) had posted at least one tweet. Approximately one-third of the respondents who provided their Twitter names ($N=91$; 32%) had posted at least one tweet containing one of the tobacco-related keywords. Among those who had posted tweets with tobacco-related keywords, the mean number of tobacco-related tweets was 2.8 (SD = 3.4, median = 2). These Twitter users had authored a total of 253 tobacco-related tweets: 42% ($N=105$) containing positive messages about tobacco and 58% ($N=147$) containing negative / neutral messages about tobacco.

Among the respondents with Twitter data, 18% reported using one or more tobacco products in the past month, including 12% of the sample who had smoked cigarettes, 8% who had used e-cigarettes, 4% who had used hookah; 5% of participants had used more than one tobacco product in the past month.

Relative to respondents who did not tweet messages about tobacco, those who posted any positive messages about tobacco were significantly more likely to be past-month users of cigarettes (OR = 3.15, 95% CI = 1.36, 7.30) and any tobacco product (OR = 2.41, 95% CI = 1.16, 5.01). The association between positive tobacco tweets and past-month use of e-cigarettes was marginally significant (OR = 2.69, 95% CI = 0.97, 7.46) (see Table 1). Compared to respondents with no tobacco messaging, there were no significant associations of tobacco product use among individuals who only posted neutral/negative messages about tobacco.

4. Discussion

This is the first study to establish an empirical link between observed posts of positive messages about tobacco on social media and use of tobacco products. Previous studies have demonstrated that youth who recall seeing tobacco messages or imagery in social media (Depue et al., 2015; Huang et al., 2014a, 2014b; Hébert et al., 2017) or report engagement with social media (Soneji et al., 2017, 2018) are more likely to use tobacco. This study adds to the literature by documenting that adolescents and young adults who participate in conversations about tobacco in social media by posting positive messages about tobacco are more likely to be past-month tobacco users in young adulthood. These results also suggest that tobacco-related social media participation does not need to be extensive or frequent to predict tobacco use. Among those who posted positive tobacco-related tweets, the median number of positive tobacco-related tweets was 1, and this low level of posting was associated with greater odds of using cigarettes, e-cigarettes, or any tobacco product, relative to those who did not post positive messages about tobacco.

Posting positive messages about tobacco on social media could be a precursor and/or a consequence of experimentation with tobacco products. Due to the intervals between surveys, we were not always able to determine which occurred first: the first tobacco-related

tweet or the first experimentation with tobacco (which would be subsequently reported on the next annual survey). Both directions of causality are plausible; adolescents might begin to participate in social media conversations about tobacco products when they are thinking about trying tobacco (prior to initiation), or their experiences with tobacco might cause them to become more involved in social media conversations about tobacco, potentially leading to progression to more frequent use. Future studies with larger samples, followed prospectively, will be necessary to understand the directionality of the association between engagement in tobacco-related social media and tobacco use. Future studies with larger samples also would make it possible to determine whether these associations generalize across tobacco products or are product-specific. This analysis is limited to the participants who voluntarily reported their Twitter names on the survey. In addition to the 20% who provided their Twitter names, an additional 34% reported that they had ever visited Twitter; those participants either did not create a user name or declined to report it on the survey.

Social media might be more influential than traditional marketing because participants are actively engaged in the content they are viewing (Soneji et al., 2018). Because the messages about tobacco on social media are overwhelmingly positive (including advertisements and computer-generated bots to attract users to pro-tobacco websites (Allem et al., 2017)), and user conversations are not subject to federal regulations, public health education efforts are needed to counter these positive messages. It is encouraging that most of the tweets obtained in this study were negative or neutral. Previous findings that tobacco tweets are overwhelmingly positive are probably due to a large volume of advertising tweets. The interactivity of social media makes it possible to target tobacco education messages directly to people who are posting positive messages about tobacco through these same channels. For example, it could be possible to identify youth who appear to be at risk for tobacco experimentation and progression because they are engaging in social media conversations about tobacco, and target prevention messages directly to those social media users and their social networks. Perhaps social media companies such as Twitter could become partners in reaching youth at risk. This type of precision prevention approach, if demonstrated to be effective and cost-efficient, has the potential to leverage new technologies to reduce nicotine addiction and tobacco-related disease.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Associations of tobacco-related keywords from Twitter tweets and past-month use of tobacco products at most recent survey.

Tobacco product	Tobacco tweets	Tobacco product use		OR (95% CI) ^a
		No	Yes	
Cigarettes	None	175(91.1)	17(8.9)	Ref
	Neutral/negative	37(90.2)	4(9.8)	1.16 (0.36, 3.73)
	Positive	38(76.0)	12(24.0)	3.15 (1.36, 7.30)
E-cigarettes	None	178(93.7)	12(6.3)	Ref
	Neutral/negative	37(90.2)	4(9.8)	1.93 (0.57, 6.51)
	Positive	43(86.0)	7(14.0)	2.69 (0.97, 7.46)
Hookah	None	185(95.9)	8(4.1)	Ref
	Neutral/negative	40(97.6)	1(2.4)	0.65 (0.08, 5.43)
	Positive	46(93.9)	3(6.1)	1.64 (0.41, 6.55)
Any tobacco	None	163(84.9)	29(15.1)	Ref
	Neutral/negative	33(80.5)	8(19.5)	1.41 (0.59, 3.39)
	Positive	34(69.4)	15(30.6)	2.41 (1.16, 5.01)

^a Odds ratios adjusted for sex, ethnicity, and parental education.