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Perceptions of Secondhand E-Cigarette Aerosol Among Twitter Users

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Abstract

Objectives—There is considerable debate among the public health community about the health risks of secondhand exposure to the aerosol from electronic cigarettes (e-cigarettes). Despite mounting scientific evidence on the chemical content of e-cigarette aerosol, public perceptions of the relative safety of secondhand e-cigarette aerosol have not been well characterized.

Method—This study collected tweets, or messages sent using Twitter, about exposure to secondhand e-cigarette aerosol over a 6-week period in 2015. Tweets were coded on sentiment about e-cigarettes (pro-, anti-, or neutral/unknown) and topic (health, social, advertisement, or unknown).

Results—The 1519 tweets included 531 pro-e-cigarette tweets, 392 anti-e-cigarette tweets, and 596 neutral tweets. Social tweets far outnumbered health tweets (747 vs. 182, respectively). Social-focused tweets were predominantly pro-e-cigarette, whereas health-focused tweets were predominantly anti-e-cigarette.

Discussion—Twitter discussions about secondhand vaping are dominated by pro-e-cigarette social tweets, although there is a presence of anti-e-cigarette social tweets and tweets about negative and positive health effects. Public health and regulatory agencies could use social media

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Human Subjects Statement

This study was approved by the University of Southern California Institutional Review Board.

Conflict of Interest Statement

The authors report no conflicts of interest.

and traditional media to disseminate the message that e-cigarette aerosol contains potentially harmful chemicals and could be perceived as offensive. This study identifies the prevalent topics and opinions that could be incorporated into health education messages.

Keywords

e-cigarettes; Twitter; secondhand vapor

INTRODUCTION

The popularity of electronic cigarettes (e-cigarettes) has increased rapidly over the past decade. In 2013, 36.5% of all current smokers in the United States, and 8.5% of all U.S. adults, had tried e-cigarettes.¹ E-cigarettes have been marketed as a safer alternative to combustible cigarettes, as a smoking cessation aid, and as a way to protect nonsmokers from cigarette smoke, although evidence is lacking that they are actually effective for these purposes.¹ Smokers who switched from combustible cigarettes to e-cigarettes typically report that their decision was based, in part, on an intention to protect their family and friends from secondhand smoke.^{2,3}

There has been significant debate in the scientific literature about the risks of the aerosol from e-cigarettes for nonsmokers. The tobacco industry has claimed that e-cigarette aerosol is 99.9% water and contains negligible amounts of hazardous chemicals.⁴ Studies by tobacco industry researchers⁵ and non-industry researchers^{6,7} have concluded that e-cigarette aerosol contains significantly lower levels of carcinogens, polycyclic aromatic hydrocarbons, and other toxins than does secondhand tobacco smoke.

However, although the aerosol produced by e-cigarettes might be less toxic than the smoke produced by combustible cigarettes, there is considerable evidence that it is not benign and in fact contains numerous chemicals that could be harmful to nearby nonsmokers. Analyses of e-cigarette aerosols have found potentially harmful levels of nicotine,⁸ oxidants,⁹ cytotoxic metals such as copper,⁹ nickel,⁷ and silver,⁷ and carcinogenic carbonyl compounds such as formaldehyde and acetaldehyde.¹⁰ The amounts may vary by type of solution, heating device and how the solutions are mixed. Nonsmokers who live with e-cigarette smokers have higher levels of saliva and urine cotinine than do nonsmokers living in nonsmoking households, and the air in households with e-cigarette users contains more nicotine than the air of nonsmoking households.¹¹ Inhalation of this nicotine could cause side effects among nonsmokers such as increased heart rate, increased blood pressure, asthma symptoms, lightheadedness, and reduced uterine blood flow among pregnant women. Thirdhand exposure to nicotine may also occur when nicotine from e-cigarette aerosol adsorbs onto surfaces such as furniture and carpets, where it could be absorbed transdermally or ingested by children.^{12,13}

Despite the mounting evidence of hazardous chemicals in e-cigarette aerosol, as of November 2014 only three U.S. states (New Jersey, North Dakota, and Utah) had passed laws prohibiting e-cigarette use in private worksites, restaurants, and bars.¹⁴ Understanding of the hazardous nature of e-cigarette aerosol among the general public and workers appears to be lagging behind the mounting evidence in the scientific literature. Surveys have

indicated that support for bans on indoor e-cigarette use is significantly lower than support for bans on indoor smoking of combustible cigarettes.^{15,16} In a recent nationwide survey of U.S. adults, only 37% believed that e-cigarettes should be banned in smoke-free public places.¹⁶ Other surveys have shown that people consider that e-cigarettes are safer than combustible cigarettes for pregnant women, leading to concern that pregnant women may switch to e-cigarettes instead of quitting nicotine-delivering products entirely.¹⁷ The proliferation of e-cigarette advertisements through multiple media channels may have contributed to the public perception that e-cigarette aerosol is not harmful. A 2011 content analysis of e-cigarette websites found that 76% claimed that e-cigarettes do not produce secondhand smoke, which could imply that they are safe to bystanders,¹⁸ and a 2013 survey of U.S. adults found that exposure to e-cigarette advertising was associated with less support for bans on e-cigarette use in public places.¹⁹

To design relevant and effective health communication messages to educate the public about the potential dangers of e-cigarette aerosol, it is important to understand the public's current perceptions. This study analyzed the content of Twitter tweets related to secondhand e-cigarette aerosol.

METHOD

The NCapture program was used to conduct Twitter searches from February 23 to April 9, 2015. We used the following search terms: “secondhand vape” OR “secondhand vaping” OR “second-hand vape” OR “second-hand vaping” OR “vape smoke” OR “ecig smoke” OR “e-cig smoke” OR “e-cigarette smoke” OR “vape shs” OR “ecig shs” OR “vape secondhand smoke” OR “vape second-hand smoke” OR “esmoke” OR “e-smoke”. NCapture uses the Twitter Search application programming interface (API), which approximates the results that a Twitter user would obtain by performing the same keyword search from within Twitter. The Search API does not provide 100% of all tweets from the Twitter Firehose, but its results are typically representative of those obtained from the Firehose.²⁰ NCapture saves all recent tweets matching the search criteria to a dataset (with “recent” being defined by Twitter's internal algorithms); therefore the search was repeated every day over the 6-week period and duplicate tweets were deleted so that each tweet appears only once in the dataset. The tweets were imported into the NVivo qualitative data analysis program and were content coded by two human coders independently (Cohen's kappa=0.84, indicating strong agreement). After an initial examination of 100 randomly-selected tweets and discussions among the research team about the most meaningful categories to organize the tweets and inform the field of tobacco regulatory science, the tweets were coded on the following dimensions:

Sentiment was coded as pro (positive attitude toward e-cigarettes and/or their aerosol, eg, “*cant waste any vape smoke always gotta reinhale it after u blow it out*”), anti (negative attitude toward e-cigarettes and/or their aerosol, eg, “*Sitting beside someone who keeps blowing their God damn vape smoke in my face*”), or neutral (eg, “*I walked into a cloud of vape smoke that smelled like pancakes*”).

Topic was coded as health (eg, “*all this vape smoke makin' my head hurt*”), social (eg, “*I wanna kiss you like I did the night at the car meet, with Vape smoke*”).

between our lips”), advertisement (eg, “*Paradise Vape’s Premium E-Juice Proudly Made in the USA Ask for it at a vape, smoke or gift shop*”), or unknown (eg, “*lol my cat is afraid of ecig smoke*”). Every topic could potentially be pro, anti, or neutral.

Cross-tabulations of sentiment X topic tweets were evaluated with a χ^2 test, and representative tweets from each sentiment X topic combination were extracted as examples.

RESULTS

A total of 3557 tweets meeting the search terms were captured between February 23 and April 9, 2015. Of these tweets, 1519 were original tweets and 2038 were retweets. This analysis focused on the original tweets because the retweets duplicate the content of the original tweets. The 1519 original tweets were generated by 1321 authors, who each generated between 1 and 18 tweets (mean=1.15 tweets per author, SD=1.05). The authors of the 1519 original tweets had a median of 348 Twitter followers who would potentially view the tweets on their own Twitter feeds (range = 0 to 211,843, mean=1431, SD=8343).

Coding by sentiment revealed that there were 531 pro-e-cigarette tweets, 392 anti-e-cigarette tweets, and 596 neutral tweets. Social tweets far outnumbered health tweets (747 vs. 182, respectively). A cross-tabulation of sentiment by topic (Figure 1) revealed that the social tweets were predominantly pro-e-cigarette (57%), whereas the health tweets were predominantly anti-e-cigarette (70%) ($\chi^2 = 35.38$, $p < .001$). Some illustrative samples of tweets are shown below.

Pro-e-cigarette social

Pro-e-cigarette social tweets included numerous links to videos of people performing tricks with their vape smoke, as well as descriptions of the posters’ smoke tricks:

Check out my sick vape smoke tricks <http://t.co/rSYsR111GL>

Thats it im dropping out to pursue my career in vape smoke tricks

Just blown my first (vape) smoke ring. Biggest achievement since graduation.

PROMPOSAL TIP: Use your cool vape to blow the word “PROM” in vape smoke!

I’ll only say yes to prom if you spell out prom with vape smoke

Other pro-e-cigarette social tweets emphasized the freedom and social benefits of vaping:

“i’m here to take ur daughter on a date” *blows vape smoke into his face* “is that blueberry yum yum” “duh” “this guys a keeper”

can’t see the haters thru my vape smoke

Anti-e-cigarette social

The anti-e-cigarette social tweets contained two main themes. The first theme was that blowing e-cigarette aerosol at other people is obnoxious or annoying:

Some 13 year old dweeb just blew his vape smoke directly in my face and I was 2 seconds away from attacking him

There is nothing more disgusting than walking through someone's e-cig smoke.

If we're indoors and you blow vape smoke in my face, I'm going to punch you in the chest so hard you'll do a smoke trick.

The other main theme was that people who vape, especially those who attempt to blow large clouds of smoke, do tricks with their smoke, and/or post pictures of their smoke on social media are juvenile or uncool:

if your snapchat revolves around vape smoke you need to stop

Why do "kids" these days think it's cool just to blow a big cloud of vape smoke
Make some Os, do a ghost...hell cloud out your nose FFS

It cracks me up when 8th graders pretend to smoke weed and put pics on their story but really it's vape smoke

If you're ever feeling like a loser, just remember that there are people out there who make vape/smoke trick videos. You could be much worse

Many of the anti-e-cigarette social tweets were sarcastic and reinforced the theme of disapproval of blowing e-cigarette aerosol on other people:

wow you're so cool with your vape pen please post more Snapchat selfies of you blowin o's with your fancy fuckin vape smoke

my fav is when these kids roll up to the window at mcdonalds and their car is hotboxed full of vape smoke and they try looking so cool lmao

Pro-e-cigarette health

Pro-e-cigarette health tweets emphasized the use of e-cigarettes to quit smoking, the relative safety of e-cigarette aerosol, or enjoyment of e-cigarette aerosol:

Guess there's no such thing as secondhand vape

nicotine isn't toxic in the kinds of doses you vape/smoke

"secondhand vape" poses no health risk to bystanders.

Dr. Chris Nichols [a chemistry professor who was interviewed on a radio show] speaks about the safety of vaping: «?Second-hand vape has zero things to worry about,?... <http://t.co/uYWCGqbsH1#ecig>

this secondhand vape got me buzzed fam

Anti-e-cigarette health

The anti-e-cigarette health tweets mentioned short-term and long-term health effects of exposure to e-cigarette aerosol (eg, headache, eye irritation, nausea, lung disease):

not to mention I fucking hate Vape smoke, It gives me a headache everytime. I can respect it over Cigarettes but what the fuck

Ecig smoke makes my head hurt

Is it possible to second hand vape bc i think it's happening and i think im going to pass out lol

holy fuck vape smoke just got in my eyes and burned like fuck

Your secondhand e-cig smoke is giving me lung cancer

After last night, I'm starting to think I'm allergic to secondhand vape.

Anti-e-cigarette health tweets also criticized people who subjected children and pets to secondhand e-cigarette aerosol:

Really uncool to vape (smoke an e-cig) with your dog in the car. Just sayin'...

Lady in traffic with me; windows all up, child in the back seat.. Smoking an E-Cigarette.. Smoke all in the back seat. SMFH

Neutral health

Although the neutral health tweets were rare ($N = 27$), they revealed questions about the danger of secondhand e-cigarette aerosol, suggesting that the public has a need for more information:

Is second hand vape a thing?

Does anyone know how e-cig smoke compares to cig smoke in terms of how quickly it precipitates? I want to know how long it stays in the air.

Can vape smoke really fuck w/someones pregnancy?.....

"Is second-hand vaping dangerous?"

What can you tell about second hand vaping? I'm getting second hand vaped.

Neutral unknown

A sizable proportion (30%) of the tweets were coded as neutral sentiment and unknown topic:

its not actually cloudy outside its really all the built up vape smoke bc everyone in this town has a modified vape

lol my cat is afraid of ecig smoke

DISCUSSION

In this analysis of Twitter tweets gathered in the Spring of 2015, social themes far outnumbered health themes. The social tweets confirmed that e-cigarette use is a social activity, as evidenced by numerous references to performing or watching vape smoke tricks and using e-cigarettes to impress romantic partners. The social nature of e-cigarette use has the potential to expose many nonsmokers to secondhand e-cigarette aerosol, and more aerosol may be produced with vape tricks than routine vaping. Some social tweets revealed negative attitudes toward people who expose bystanders to secondhand e-cigarette aerosol.

These people were generally described as rude, annoying, and juvenile. Health-related tweets also revealed negative attitudes toward people who expose their children or pets to e-cigarette aerosol. Although it is impossible to verify the ages of the authors of these tweets, it is important to note that several of the tweets mentioned themes that could be indicative of underage use of e-cigarettes, such as prom, taking a daughter on a date, and 8th graders.

Anti-e-cigarette health communications could educate the public that many people dislike being exposed to e-cigarette aerosol, regardless of its relative toxicity. A growing social norm against secondhand exposure to e-cigarette aerosol could help convince legislators to extend existing smoking bans to cover e-cigarettes. Local bans on e-cigarette smoking in public places, in turn, could reinforce the social norm that exposing others to secondhand e-cigarette aerosol is unacceptable and could reduce public perceptions of high prevalence of e-cigarette use, similar to the phenomena observed with bans on combustible cigarette smoking in public places.²¹

These results also indicate that the public needs more accurate information about the chemical composition and potential health effects of inhaling e-cigarette aerosol for nonsmokers. Some Twitter users reported personal short-term health effects such as headaches, eye irritation, and allergies, providing additional evidence that nonsmokers should have the right to be protected against involuntary exposure to e-cigarette aerosol, as for secondhand tobacco smoke exposure. There was a general lack of knowledge about the long-term health effects, mirroring the lack of knowledge about long-term effects in the scientific community. Even if e-cigarettes are shown to be a less harmful alternative to combustible cigarettes for the smoker, it remains important to protect nonsmokers from inhalation of any potentially harmful substances in e-cigarette aerosol, to the extent possible.

Limitations

These results are based on a limited number of tweets gathered in the spring of 2015. Public debate about e-cigarettes is changing rapidly, and longitudinal studies are needed to detect trends in public opinions about e-cigarette aerosol. People who post their opinions about e-cigarettes on Twitter represent a small proportion of those who use or are affected by e-cigarettes. Other sources of public opinion such as surveys are also needed to corroborate the findings of this study. The NCapture software did not allow us to determine how many times each tweet was retweeted, which would have been another source of information about the reach and influence of the tweets.

IMPLICATIONS FOR TOBACCO REGULATION

Despite these limitations, this analysis of Twitter data indicates that additional efforts are needed to educate the public about the potential negative health and social consequences of secondhand e-cigarette aerosol. Longitudinal studies will someday determine whether exposure to secondhand e-cigarette aerosol increases the risk of morbidity or mortality and which groups may be most affected, but it is already known that e-cigarette aerosol contains chemicals that could potentially have adverse health effects.

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References

1. King BA, Patel R, Nguyen KH, Dube SR. Trends in awareness and use of electronic cigarettes among US adults, 2010–2013. *Nicotine Tob Res.* 2015; 17(2):219–227. [PubMed: 25239961]
2. Farsalinos KE, Romagna G, Tsiapras D, et al. Characteristics, perceived side effects and benefits of electronic cigarette use: a worldwide survey of more than 19,000 consumers. *Int J Environ Res Public Health.* 2014; 11(4):4356–4373. [PubMed: 24758891]
3. Farsalinos KE, Romagna G, Voudris V. Factors associated with dual use of tobacco and electronic cigarettes: A case control study. *Int J Drug Policy.* 2015; pii: S0955-3959(15)00009-2. [Epub ahead of print]. doi: 10.1016/j.drugpo.2015.01.006
4. Long GA. Comparison of select analytes in exhaled aerosol from e-cigarettes with exhaled smoke from a conventional cigarette and exhaled breaths. *Int J Environ Res Public Health.* 2014; 11(11): 11177–11191. [PubMed: 25350011]
5. Tayyarah R, Long GA. Comparison of select analytes in aerosol from e-cigarettes with smoke from conventional cigarettes and with ambient air. *Regul Toxicol Pharmacol.* 2014; 70(3):704–710. [PubMed: 25444997]
6. Oh AY, Kacker A. Do electronic cigarettes impart a lower potential disease burden than conventional tobacco cigarettes? Review on E-cigarette vapor versus tobacco smoke. *Laryngoscope.* 2014; 124(12):2702–2706. [PubMed: 25302452]
7. Saffari A, Daher N, Ruprecht A, et al. Particulate metals and organic compounds from electronic and tobacco-containing cigarettes: comparison of emission rates and secondhand exposure. *Environ Sci Process Impacts.* 2014; 16(10):2259–2267. [PubMed: 25180481]
8. Martinez RE, Dhawan S, Sumner W, Williams BJ. On-line chemical composition analysis of refillable electronic cigarette aerosol-measurement of nicotine and nicotyrine. *Nicotine Tob Res.* 2014 pii: ntu334. [Epub ahead of print].
9. Lerner CA, Sundar IK, Watson RM, et al. Environmental health hazards of e-cigarettes and their components: Oxidants and copper in e-cigarette aerosols. *Environ Pollut.* 2015; 198:100–107. [PubMed: 25577651]
10. Kosmider L, Sobczak A, Fik M, et al. Carbonyl compounds in electronic cigarette vapors: effects of nicotine solvent and battery output voltage. *Nicotine Tob Res.* 2014; 16(10):1319–1326. [PubMed: 24832759]
11. Ballbè M, Martínez-Sánchez JM, Sureda X, et al. Cigarettes vs. e-cigarettes: Passive exposure at home measured by means of airborne marker and biomarkers. *Environ Res.* 2014; 135:76–80. [PubMed: 25262078]
12. Czogala J, Goniewicz ML, Fidelus B, et al. Secondhand exposure to vapors from electronic cigarettes. *Nicotine Tob Res.* 2014; 16(6):655–662. [PubMed: 24336346]
13. Goniewicz ML, Lee L. Electronic cigarettes are a source of thirdhand exposure to nicotine. *Nicotine Tob Res.* 2015; 17(2):256–258. [PubMed: 25173774]
14. Marynak K, Holmes CB, King BA, et al. State laws prohibiting sales to minors and indoor use of electronic nicotine delivery systems--United States, November 2014. *MMWR Morb Mortal Wkly Rep.* 2014; 63(49):1145–1150. [PubMed: 25503916]
15. Kolar SK, Rogers BG, Hooper MW. Support for indoor bans on electronic cigarettes among current and former smokers. *Int J Environ Res Public Health.* 2014; 11(12):12174–12189. [PubMed: 25429684]
16. Majeed BA, Dube SR, Sterling K, et al. Opinions about electronic cigarette use in smoke-free areas among U.S. adults, 2012. *Nicotine Tob Res.* 2014 pii: ntu235. [Epub ahead of print].
17. Baeza-Loya S, Viswanath H, Carter A, et al. Perceptions about e-cigarette safety may lead to e-smoking during pregnancy. *Bull Menninger Clin.* 2014; 78(3):243–252. [PubMed: 25247743]

18. Grana RA, Ling PM. "Smoking revolution": a content analysis of electronic cigarette retail websites. *Am J Prev Med.* 2014; 46(4):395–403. [PubMed: 24650842]
19. Tan AS, Bigman CA, Sanders-Jackson A. Sociodemographic correlates of self-reported exposure to e-cigarette communications and its association with public support for smoke-free and vape-free policies: results from a national survey of US adults. *Tob Control.* 2014; pii: tobaccocontrol-2014-051685. [Epub ahead of print]. doi: 10.1136/tobaccocontrol-2014-051685
20. Joseph, K.; Landwehr, PM.; Carley, KM. Two 1%'s don't make a whole: comparing simultaneous samples from Twitter's streaming API. *Social Computing, Behavioral-Cultural Modeling and Prediction - 7th International Conference, {SBP}*; Washington, DC, USA. April 1–4, 2014; 2014. p. 75-83.
21. Hamilton WL, Biener L, Brennan RT. Do local tobacco regulations influence perceived smoking norms? Evidence from adult and youth surveys in Massachusetts. *Health Educ Res.* 2008; 23(4): 709–722. [PubMed: 17947246]

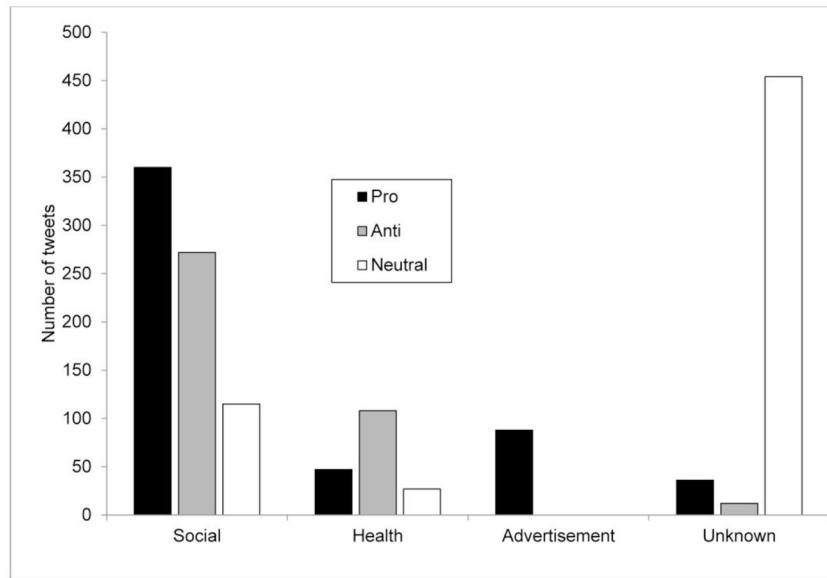


Figure 1.
Number of tweets by sentiment and topic

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