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Brief Report

#FlavorsSaveLives: An Analysis of Twitter Posts Opposing Flavored E-cigarette Bans

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Abstract

Background: Starting in 2019 policies restricting the availability of flavored e-cigarette products were proposed or implemented in the United States to curb vaping by youth. People took to Twitter to voice their opposition, referencing the phrase “Flavors Save Lives.” This study documented the emerging themes pertaining to “Flavors Saves Lives” over a 12-month period.

Methods: The study period was from May 1, 2019, to May 1, 2020. A stratified sampling procedure supplied 2500 tweets for analysis. Posts were classified by one or more of the following themes: (1) Political Referendum; (2) Institutional Distrust; (3) Individual Rights; (4) Misinformation; (5) THC Vaping is the Real Problem; (6) Smoking Cessation; (7) Adult Use; and (8) Not a Bot. The temporal pattern of tweets over the year was examined.

Results: Political Referendum (76.5%) and Institutional Distrust (31.3%) were the most prominent themes, followed by Not a Bot (11.0%), Individual Rights (10.4%), Adult Use (8.0%), Smoking Cessation (6.6%), Misinformation (5.9%), and THC Vaping is the Real Problem (3.5%). Total tweet frequencies increased in September 2019 and peaked in November 2019 before returning to relatively low numbers. Political Referendum and Institutional Distrust were consistently the most prevalent themes over time.

Conclusion: Twitter posts with the phrase “Flavors Save Lives” commonly discussed voting against political incumbents and mentioned distrust of government representatives. Findings demonstrated the possibility of near real-time Twitter monitoring of public opposition to flavor bans. These data may be valuable for designing tobacco control information campaigns in the future.

Implications: (a) Starting in 2019 policies restricting the availability of flavored e-cigarette products were proposed or implemented in the United States to curb vaping by youth. (b) This study content analyzed Twitter posts with the phrase “Flavors Save Lives” from a 12-month period to understand opposition to flavor restrictions. (c) Twitter posts commonly discussed voting against political incumbents and mentioned distrust of government representatives. (d) Findings demonstrated the possibility of near real-time Twitter monitoring of public opposition to flavor bans, and contribute to a more comprehensive assessment of different sub-population’s responses to current and proposed tobacco control information policies.

Introduction

E-cigarette use, or vaping, has been on the rise for years.¹⁻³ The taste of the vapor is a commonly cited reason for use among adults and adolescents,⁴⁻⁹ and e-cigarette users have a wide selection of flavors to choose from.¹⁰ Users of flavored e-cigarettes report greater satisfaction and perceived dependence than users of non-flavored e-cigarettes,¹¹ and growing evidence suggests that adolescents who use flavored e-cigarettes—specially sweet-flavored or other non-traditional flavors (eg, candy)—are more likely to maintain vaping, increase vaping frequency, and transition to combustible cigarettes.¹²⁻¹⁵ These findings suggest that flavored e-liquids may increase the overall tobacco product-related public health burden.

In response to the increased youth uptake of e-cigarettes, several policies restricting the availability of flavored e-cigarette products have been proposed and/or implemented at the local, state, and federal levels in the United States.¹⁶ At the federal level, the Food and Drug Administration (FDA) announced in September 2019 that they would finalize policies to enforce sales restriction of cartridge-based flavored e-cigarette products (other than tobacco and menthol flavors) for non-tobacco-flavored e-cigarette products that had not received premarket authorization.¹⁷ The final guidance for industry outlining the FDA's enforcement priorities was announced in January 2020¹⁸ (and the most recent version was published in April 2020).¹⁹

Previous research demonstrates that monitoring Twitter as a surveillance system can provide valuable insights into public reaction to e-cigarette-related policies.^{20,21} For example, individual e-cigarette users, e-cigarette companies, and vendors mounted a coordinated refutation of the California Department of Public Health's "Still Blowing Smoke" campaign, by using the hashtag "Not Blowing Smoke" to extol the health benefits of e-cigarettes and to argue against government regulation of the industry.²⁰ Similarly, starting in the fall of 2019, people took to Twitter to voice their opposition, referencing the phrase "Flavors Save Lives." Conversations in direct response to potential local, state, and national bans on specifically flavored (ie, non-tobacco/non-menthol) e-cigarette products started to spread on the social media platform. This study documented the emerging themes pertaining to "Flavors Saves Lives" on Twitter over a 12-month period. Findings should provide additional support for the possibility of near real-time Twitter monitoring to contribute to a more comprehensive assessment of different sub-population's responses to current and proposed tobacco control policies, and may inform tobacco control campaigns in the future.

Methods

Posts containing the terms "Flavors Save Lives" and/or "#FlavorsSaveLives" were collected from May 1, 2019, to May 1, 2020, from Twitter's Streaming Application Programming Interface (API). There was a total of ($n = 33\ 725$) posts containing these terms during this time. Similar to previous research,²² after excluding all retweets ($n = 23\ 685$), we randomly sampled the remaining tweets ($n = 10\ 040$) proportionately by week to arrive at a sample of ($n = 2500$) unique tweets by ($n = 536$) unique users to code.²³

Two coders worked together with the first and last authors to become familiar with the data, then created a codebook and identified eight common themes, using the text of the tweet as the unit of analysis. The purpose of the approach was to condense the raw text-based data into a summary format and report the underlying themes that were evident in the data.²⁴ Identified themes were as follows:

(1) *Political Referendum*; (2) *Institutional Distrust*; (3) *Individual Rights*; (4) *Misinformation*; (5) *THC Vaping is the Real Problem*; (6) *Smoking Cessation*; (7) *Adult Use*; and (8) *Not a Bot*. Note that we did not identify any "pro-ban" themes in this sample. **Table 1** describes the coding criteria for each theme. A tweet could be classified into more than one themes. Once the codebook was finalized, the two coders analyzed a subsample of posts ($n = 500$) to establish interrater reliability, with percent agreement ranging from 93.59% to 100%, and Cohen's kappa ranging from 0.59 to 1.00. The first and last authors served as arbitrators to resolve discrepancies between the coders. Additionally, to estimate the level of reach and degree of engagement with tweets, the number of retweets and likes (as a function of a theme) was calculated in this study.

To characterize the temporal pattern of tweets in relationship to dates of regulatory activity (eg, FDA announcing a potential flavor ban in September 2019), data were plotted across the study period (from May 1, 2019 to May 1, 2020) and presented as both total frequencies and proportion of themes. All posts in this dataset were publicly available and anonymized, and all analyses adhered to the terms and conditions, terms of use, and privacy policies of Twitter, and were performed under University of Southern California Institutional Review Board approval. To further protect privacy, posts exemplifying themes are paraphrased; no tweets are reported verbatim.

Results

Approximately 89.0% of the tweets from this corpus had at least one theme. Of these, 49.2% had more than one theme (see **Table 1** for representative paraphrased tweets). Overall, the most prevalent theme was *Political Referendum* (76.5%), followed by *Institutional Distrust* (31.3%). Other themes had relatively lower prevalence in the dataset: *Not a Bot* (11.0%), *Individual Rights* (10.4%), *Adult Use* (8.0%), *Smoking Cessation* (6.6%), *Misinformation* (5.9%), and *THC Vaping is the Real Problem* (3.5%). The most common dyadic combination of themes was *Political Referendum* and *Institutional Distrust* (24.4%), *Political Referendum* and *Not a Bot* (9.9%), and *Political Referendum* and *Individual Rights* (9.3%); other theme combinations had relatively low prevalence (eg, *Misinformation* and *Not a Bot*: 0.7%). The number of likes and retweets ranged diversely by theme from none to hundreds (see **Table 1**).

Figure 1 (top panel) shows the total tweet counts as a function of month (May 1, 2019, through May 1, 2020). Few to zero posts containing the key terms were posted to Twitter from May through August 2019. The level of discussion increased in September 2019 and peaked in November 2019 before returning to relatively low numbers for the remainder of the study period. **Figure 1** (bottom panel) shows the percentage of tweets containing the most prevalent themes as a function of month. *Political Referendum* and *Institutional Distrust* were consistently the most prevalent themes over time. The proportion of tweets containing the *Not a Bot* theme was greatest during the months with the highest overall tweet counts (ie, October and November) and decreased to zero as the number of tweets decreased. Proportions of all other themes (data not shown) remained relatively stable over time.

Discussion

This study documented public reactions to e-cigarette flavor bans on Twitter using the phrase "Flavors Saves Lives" or hashtag

Table 1. Descriptive Statistics, Description of Coding Criteria, and Selected Paraphrase Tweets for Each Theme

Theme	Total count	Likes <i>Md</i> (Range)	Retweets <i>Md</i> (Range)	Coding criteria	Example Tweets
<i>Political Referendum</i>	1913	1 (0–62) ^a	0 (0–173) ^a	Mentions of removing the incumbent out of office, including governors, the president, senators, or other elected officials. Mentions of voting, including the hashtags or phrases, “we vape we vote” “I vape I vote” and “we vote we matter”	“Gov. Cuomo, I will vote for anyone that understands that vaping flavors saved my life” “POTUS will lose in 2020 if he bans flavors”
<i>Institutional Distrust</i>	782	1 (0–217) ^b	0 (0–141) ^b	Mentions of distrust of individual actors representing government, including public health organizations, and media organizations, including mentions of fake news, accusations over decreases in tax revenue from combustible tobacco sales, and references to Master Settlement Agreement	“Why did it take the CDC so long to respond to e-cigarette harm? It must be the Master Settlement Agreement blood money.” “The Surgeon General is trying to help Big Tobacco and continue receiving Master Settlement Agreement blood money.”
<i>Individual Rights</i>	261	1 (0–55) ^c	1 (0–28) ^c	Mentions of personal freedoms and liberties, restrictions on vaping are a form of oppression, flavor bans prevent people from earning a living	“Do not take away my right to vape honey nut cereal nicotine liquid” “The flavor ban will destroy the ability of thousands of small businesses to make an honest living”
<i>Misinformation</i>	148	2 (0–58) ^d	0 (0–31) ^d	Posts that include unsubstantiated health claims such as vaping is safe, harmless, health-promoting in the case of chronic diseases; posts identifies an e-cigarette or related component part and uses adjectives to describe it as safe or healthy	“Vaping is 95% safer than conventional cigarettes” “I don’t want anything FDA approved. I’ll use my 95% safer harm reducing e-liquid”
<i>THC Vaping is the Real Problem</i>	87	1 (0–37) ^e	0 (0–29) ^e	Posts that suggest black market or underground cannabis-related products are the real threat to health and not nicotine products	“e-Cigarettes are not linked to lung disease. The news said it was black market THC.” “480K death due to combustible cigarettes; 40+ deaths due to illegal black market THC; 0 deaths dues to e-cigarettes”
<i>Smoking Cessation</i>	165	2 (0–116) ^f	0 (0–44) ^f	Mentions of the use of flavored vaping products to successfully quit cigarettes	“I quit a 30-year cigarette habit with flavored e-cigarettes” “I haven’t smoked in 7 years because of vaping flavors”
<i>Adult Use</i>	199	1 (0–183) ^g	0 (0–63) ^g	Mentions that adults like flavors—this may include references to smoking cessation and draws comparisons to those under 21	“Don’t just focus on kids; adults like flavors too” “I am an adult that used Blueberry Sugar Buzz to quit smoking”
<i>Not a Bot</i>	276	1 (0–217) ^h	0 (0–141) ^h	Mentions of not being a bot (ie, automated accounts programmed to post about specific topics on social media) in any form	“I vape, I vote. #NotABot” “I quit smoking with flavored e-cigarettes and I’m not a bot”

Total number of coded tweets $N = 2500$. A tweet could be classified to more than one theme. A subset of tweets were no longer available for a post hoc analysis of Likes and Retweets, leaving the following counts for each theme: ^a $N = 1586$; ^b $N = 614$; ^c $N = 214$; ^d $N = 131$; ^e $N = 74$; ^f $N = 144$; ^g $N = 177$; ^h $N = 218$

“#FlavorsSaveLives.” Posts commonly discussed voting incumbents out of office, including governors, the president, senators, and other elected officials. Posts mentioned distrust of individual actors in government (including public health organizations, and media organizations that cover politicians), personal freedoms and liberties, and that restrictions on flavored e-cigarettes was a form of oppression.

Discussions about flavor bans peaked in the fall of 2019 around the time when the FDA announced potential restrictions on all flavors (other than tobacco and menthol),¹⁷ voters in select states were headed to the polls, and policies were debated in state legislatures (eg, several bills were being considered by the California State legislature in 2019–2020 session).²⁵ Taken all together, findings demonstrated the possibility of near real-time Twitter monitoring of opposition to flavor bans, which could be used to better understand different sub-populations’ views of current and proposed tobacco product regulations.

Themes identified in the present study included the use of flavors to help with smoking cessation and the belief that adult—not

just adolescent—vapers like flavors, and restricting products to protect adolescents may harm adults who wish to quit smoking. It is important to note that the notion that flavors are needed to aid smoking cessation is often debated.²⁶ Posts also refuted the evidence and concerns that nicotine-containing e-cigarettes may cause pulmonary problems (eg, e-cigarette, or vaping, product use associated lung injury or EVALI)^{27,28} by arguing that the black market or underground cannabis-related vaping products were the primary threat to public health. Similar to prior Twitter-based research,^{21,29} posts in this study often included misinformation, such as unsubstantiated health claims that vaping is safe and harmless, as well as health-promoting for those with select chronic diseases. Overall findings from this study suggest that arguments about the potential beneficial health effects of vaping—regardless of whether those benefits are based on empirical evidence—were part of the flavor ban opposition conversation on Twitter during the study period.

Posts revolving around “Flavors Saves Lives” included the phrase, “not a bot,” most likely to note that the backlash against

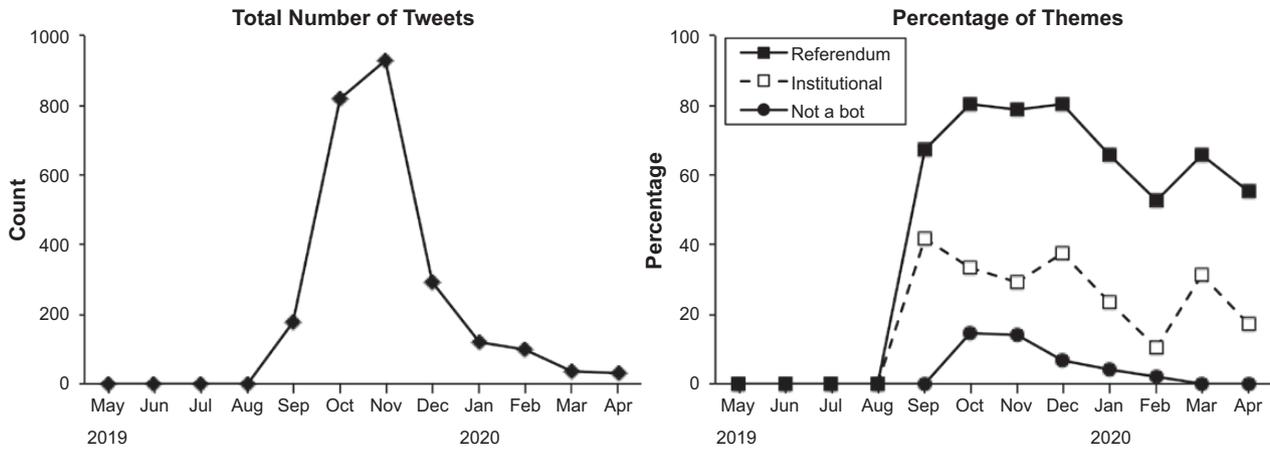


Figure 1. Left panel: Total tweet counts by month (May 1, 2019, through May 1, 2020). Right panel: The percentage of tweets containing the most prominent themes (Political Referendum, Institutional) by month and the theme that tracked total tweets by month (Not a Bot).

e-cigarette regulation is not coming from automated accounts but instead real-life people who can vote. A number of states including California along with the US Congress have investigated the role social bots play in driving online discussions about e-cigarettes.^{30,31} Previous research of e-cigarette-related discussions on Twitter has found that social bots were two times as likely as their non-bot counterparts to tout the health benefits of e-cigarettes,²⁹ and that social bots have been regularly discussed in the context of e-cigarettes, unsubstantiated health claims, and astroturfing (ie, organized social media activity to create a false impression of a widespread grassroots movement).²¹ Additionally, the use of the “not a bot” label closely tracked to the overall number of tweets, increasing in percentage as the total number of tweets increased in September/October 2019, suggesting that the phrase may have been used to counter claims that this political activism was emanating from bots.

Limitations

This study relied on the singular phrase “Flavors Save Lives” and its corresponding hashtag “#FlavorsSaveLives” in data collection. While this decision precluded us from capturing and understanding all flavor ban-related conversations on Twitter, it was informed by prior research.²⁰ Posts from this study may not reflect the attitudes of Twitter users with private accounts. This study focused on the text of Twitter posts but did not code website links or images attached to posts. Previous work shows that there is value in examining both image and text,³² and it is possible that some additional themes would have emerged had we coded images. Findings may not extend to other time periods (such as when there are no flavor-related referendums on state ballots) or other social media platforms. Additionally, geolocation was not collected, and thus it was unclear whether themes vary by location or if the majority of posts originated from one or many locations. It is important to note that engagement (likes and retweets) ranged diversely among this sample of tweets, and thus it is not clear the extent to which all Twitter users were exposed to this conversation. Future research might examine the influence of similar tobacco-related public conversations on reaching and shaping attitudes in other sub-populations.

Despite these limitations, this study demonstrated the possibility of near real-time Twitter monitoring of opposition to flavor bans among a sub-population of Twitter users. Future public health information campaigns could use this strategy to better inform effective,

targeted tobacco control campaigns. For example, the hashtag “#FlavorsSaveLives” could be used to target audiences who oppose flavor bans to provide the current scientific evidence on how flavored e-cigarette-related products are associated with combustible smoking uptake among young people while providing little benefit for smoking cessation among adults. Additionally, capitalizing on hashtags like “#FlavorsSaveLives” could help public health communication planners penetrate echo chambers that often develop on social media platforms like Twitter. Such targeting may be valuable to communication programmers designing tobacco control campaigns in the future.

Supplementary Material

A Contributorship Form detailing each author’s specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

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Author Contributions

MGK and JPA conceived the study. MGK, JPA, AD, and VR created the codebook for data analysis, and AD and VR completed data coding. MGK and JPA drafted the initial manuscript. JCC, AM, DS, TBC, and JBU revised the manuscript for important intellectual content. TBC, JBU, and JPA obtained the funding. All authors approved the final manuscript.

Declaration of Interests

The authors declare no conflicts of interest.

References

- Cullen KA, Ambrose BK, Gentzke AS, Apelberg BJ, Jamal A, King BA. Notes from the Field: use of electronic cigarettes and any tobacco product among middle and high school students - United States, 2011-2018. *MMWR Morb Mortal Wkly Rep.* 2018;67(45):1276-1277.
- Gentzke AS, Creamer M, Cullen KA, et al. Vital signs: tobacco product use among middle and high school students - United States, 2011-2018. *MMWR Morb Mortal Wkly Rep.* 2019;68(6):157-164.
- Stanton CA, Sharma E, Seaman EL, et al. Initiation of any tobacco and five tobacco products across 3 years among youth, young adults and adults in the USA: findings from the PATH Study Waves 1-3 (2013-2016). *Tob Control.* 2020;29(suppl 3):s178-s190.
- Patrick ME, Miech RA, Carlier C, O'Malley PM, Johnston LD, Schulenberg JE. Self-reported reasons for vaping among 8th, 10th, and 12th graders in the US: Nationally-representative results. *Drug Alcohol Depend.* 2016;165:275-278.
- Berg CJ. Preferred flavors and reasons for e-cigarette use and discontinued use among never, current, and former smokers. *Int J Public Health.* 2016;61(2):225-236.
- Kong G, Morean ME, Cavallo DA, Camenga DR, Krishnan-Sarin S. Reasons for electronic cigarette experimentation and discontinuation among adolescents and young adults. *Nicotine Tob Res.* 2015;17(7):847-854.
- Patel D, Davis KC, Cox S, et al. Reasons for current E-cigarette use among U.S. adults. *Prev Med.* 2016;93:14-20.
- Rutten LJ, Blake KD, Agunwamba AA, et al. Use of E-Cigarettes among current smokers: associations among reasons for use, quit intentions, and current tobacco use. *Nicotine Tob Res.* 2015;17(10):1228-1234.
- Leventhal AM, Miech R, Barrington-Trimis J, Johnston LD, O'Malley PM, Patrick ME. Flavors of e-cigarettes used by youths in the United States. *JAMA.* 2019;322(21):2132-2134.
- Zhu S-H, Sun JY, Bonnevie E, et al. Four hundred and sixty brands of e-cigarettes and counting: implications for product regulation. *Tob Control.* 2014;23(suppl 3):iii3-iii9.
- Landry RL, Groom AL, Vu TT, et al. The role of flavors in vaping initiation and satisfaction among U.S. adults. *Addict Behav.* 2019;99:106077.
- Leventhal AM, Goldenson NI, Cho J, et al. Flavored e-cigarette use and progression of vaping in adolescents. *Pediatrics.* 2019;144(5).
- Morean ME, Butler ER, Bold KW, et al. Preferring more e-cigarette flavors is associated with e-cigarette use frequency among adolescents but not adults. *PLoS One.* 2018;13(1):e0189015.
- Chen-Sankey JC, Kong G, Choi K. Perceived ease of flavored e-cigarette use and e-cigarette use progression among youth never tobacco users. *PLoS One.* 2019;14(2):e0212353.
- Cooper M, Harrell MB, Pérez A, Delk J, Perry CL. Flavorings and perceived harm and addictiveness of e-cigarettes among youth. *Tob Regul Sci.* 2016;2(3):278-289.
- Consortium TCL. *US Sales Restrictions on Flavored Tobacco Products*, 2020. Saint Paul, MN: Public Health Law Center; 2020.
- Administration UFaD. Trump Administration Combating Epidemic of Youth E-cigarette Use with Plan to Clear Market of Unauthorized, Non-Tobacco-Flavored E-cigarette Products. 2019; <https://www.fda.gov/news-events/press-announcements/trump-administration-combating-epidemic-youth-e-cigarette-use-plan-clear-market-unauthorized-non>.
- Administration UFaD. FDA Finalizes Enforcement Policy on Unauthorized Flavored Cartridge-based E-cigarettes That Appeal to Children, Including Fruit and Mint. 2020; <https://www.fda.gov/news-events/press-announcements/fda-finalizes-enforcement-policy-unauthorized-flavored-cartridge-based-e-cigarettes-appeal-children>.
- Administration UFaD. Enforcement Priorities for Electronic Nicotine Delivery System (ENDS) and Other Deemed Products on the Market Without Premarket Authorization. 2020; <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/enforcement-priorities-electronic-nicotine-delivery-system-ends-and-other-deemed-products-market>.
- Allem JP, Escobedo P, Chu KH, Soto DW, Cruz TB, Unger JB. Campaigns and counter campaigns: reactions on Twitter to e-cigarette education. *Tob Control.* 2017;26(2):226-229.
- Harris JK, Moreland-Russell S, Choucair B, Mansour R, Staub M, Simmons K. Tweeting for and against public health policy: response to the Chicago Department of Public Health's electronic cigarette Twitter campaign. *J Med Internet Res.* 2014;16(10):e238.
- Allem JP, Escobedo P, Dharmapuri L. Cannabis surveillance with Twitter data: emerging topics and social bots. *Am J Public Health.* 2020;110(3):357-362.
- Vitter JS. Random sampling with a reservoir. *ACM Trans Math Softw.* 1985;11(1):37-57.
- Bowen GA. Grounded theory and sensitizing concepts. *Int J Qual Methods.* 2006;5(3):12-23.
- Legislature CS. California Legislative Information: Bills Introduced for 2019-2020 Session. 2020; [https://leginfo.ca.gov/faces/billSearchClient.xhtml?session_year=20192020&keyword=flavor tobacco&house=Both&author=All&lawCode=All](https://leginfo.ca.gov/faces/billSearchClient.xhtml?session_year=20192020&keyword=flavor%20tobacco&house=Both&author=All&lawCode=All). Accessed July 30, 2020.
- Ward-Peterson M, Maziak W. For smoking cessation, e-cigarette flavors aren't required. *Nicotine Tob Res.* 2019;21(1):132-133.
- Kalininskiy A, Bach CT, Nacca NE, et al. E-cigarette, or vaping, product use associated lung injury (EVALI): case series and diagnostic approach. *Lancet Respir Med.* 2019;7(12):1017-1026.
- King BA, Jones CM, Baldwin GT, Briss PA. The EVALI and youth vaping epidemics - implications for public health. *N Engl J Med.* 2020;382(8):689-691.
- Allem JP, Ferrara E, Uppu SP, Cruz TB, Unger JB. E-Cigarette surveillance with social media data: social bots, emerging topics, and trends. *JMIR Public Health Surveill.* 2017;3(4):e98.
- Vergano D. A Fight Over Vaping "Bots" Is Blazing While E-Cigarette Bans Loom. 2019; <https://www.buzzfeednews.com/article/danvergano/vaping-bots-notabot>. Accessed July 30, 2020.
- McKinnon J. Congress Probes Bot-Generated Social-Media Messages About E-Cigarettes. 2019; <https://www.wsj.com/articles/congress-probes-bot-generated-social-media-messages-about-e-cigarettes-11571045405>. Accessed July 30, 2020.
- Kumar A, Garg G. Sentiment analysis of multimodal Twitter data. *Multimed Tools Appl.* 2019;78(17):24103-24119.