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Tobacco control policies discussed on social media: a scoping review

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ABSTRACT

Objective To describe the scope of published literature about tobacco-related policy discussions from social media data and discuss implications for tobacco control policy and future research.

Data sources PubMed, Medline, CINAHL and Web of Science were searched on 20 November 2023, using search terms for social media, tobacco, and policy. The search was limited from 2005 to 2023.

Study selection After removing duplicates, 2 authors reviewed 1118 articles. Those found to be irrelevant based on title (1078) and abstract (18) review were removed.

Data extraction Data included study descriptions (eg, policy discussed, social media platform and number of posts), study characteristics (eg, methodology, sentiment analysis (propolicy, antipolicy, neutral policy and unclear policy)), and major and additional findings.

Data synthesis Of the 22 articles, most examined discussions about USA (n=18) federal regulations (n=17) via human annotation (n=18), using Twitter (X; n=20). Of the 14 papers that discussed sentiment, 4 collected data at different time points; frequency of positive posts typically decreased after policy announcements. Policies discussed in articles included flavour restrictions; USA ban of Puff Bar; Tobacco 21; tobacco taxes; e-cigarette regulation; UK's standardised packaging; product authorisation; regulating e-cigarettes as a medical product; WHO Framework Convention on Tobacco Control regulatory actions; Australia's import restrictions on vaping products and smoke-free and tobacco-free college campus policies.

Conclusions Social media data can be leveraged to examine timely discourse regarding tobacco control policies. Identified methods of circumventing proposed tobacco control laws and enforcement challenges should be considered by regulatory agencies to close policy loopholes and inform implementation practices.

INTRODUCTION

Public perceptions about tobacco control policies are important to development and implementation, providing unique insights about community readiness, potential loopholes and enforcement challenges.^{1–4} Sentiment on social media about tobacco policy legislation can provide near real-time insights before,⁵ during⁶ and after policy enactment^{7,8} or implementation⁹ to understand the viability or efficacy of the law in its current form. This information can help policy-makers amend legislation to improve health outcomes or close loopholes exploited by the tobacco industry. Further, it can also help explain why policy advocacy was or was not successful in attempts to

influence public vote about a ballot issue pertaining to tobacco.¹⁰ While social media has been used as a viable health communication strategy for policy advocacy,^{11,12} the breath of literature about organic discussions on social media (eg, comments and posts)¹³ about tobacco control policies remains unknown.

To date, most social media research about tobacco has focused on marketing. The influence of tobacco product marketing—including traditional tobacco products and newer products such as electronic cigarettes (e-cigarettes)—on social media, and its detrimental impact on youth and young adult usage, is well documented in scholarly literature.^{12,14–19} Further, the tobacco industry uses multiple channels, including social media platforms, to influence public perceptions about corporate image, tobacco products and regulations.^{12,20–24} Alternatively, those seeking to reduce tobacco use also use social media to advocate for tobacco control laws.^{5,12} This includes understanding people's reactions to policy announcements^{25–27} and implementation²⁶ to assess impact and potential pitfalls.^{7,8} Understanding sentiment towards and discourse about tobacco regulatory policies, such as the government's approaches to regulate the import of e-cigarettes or miscommunication about minimum legal sales age laws, on social media platforms can help provide evidence to policy-makers or educate the public via platforms where they seek trusted information.^{17,18}

While most social media research assesses tobacco promotion and exposure,^{18,19} little is known about content related to tobacco policy discourse. Such data can provide regulatory agencies with evidence of policy loopholes to improve implementation and enforcement. Given the range of tobacco control policies discussed on social media platforms, there is a need to synthesise this evidence to understand what policies are being discussed and what methods are being used to examine tobacco control policy discourse on social. While several social media studies have examined sentiment toward tobacco control policies,^{4,28–30} no single study has examined such sentiment across different policies. Moreover, social media research methodological approaches range in different data collection strategies and analytic approaches. However, it is currently unknown what methodological approaches have been conducted with tobacco policy-related social media studies. Thus, we sought to describe the literature on social media discussions about tobacco policies to determine: (1) the scope of tobacco-related policy topics, (2) lay audiences' sentiment towards tobacco control laws described on social media platforms and (3) research gaps and recommendations.



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METHODS

Search strategy

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)³¹ guidelines. An initial protocol was developed for the search and was registered at Open Science Framework (<https://doi.org/10.17605/OSF.IO/P96YT>). Search terms were identified via previous tobacco and social media-related systematic reviews.^{16 18 19} Tobacco-related terms included 42 keywords, including: “hookah”, “cigarette*”, “cigar*”, “electronic cigarette*”, “vape*”, “vaping”, “e-cigarette”, “e-cig”, “ecig”, “ENDS”. Social media terms based on prior research¹⁹ consisted of 24 keywords, including “social media”, “Twitter”, “Youtube”, “Reddit”, “Snapchat”, “Instagram”, “Tiktok”, “Tumblr”, “Facebook”, “Vine”, “Pinterest”, “Google Plus”, “Twitch”, “Discord”, “Thread” and “X”. Policy-related terms included three keywords: “policy”, “law” and “regulation.” A Boolean search string was entered into PubMed, Medline, CINAHL and Web of Science in November 2023, along with a review of articles from two tobacco-related journals, Tobacco Control and Nicotine & Tobacco Research. When developing the search screen, the lead author consulted with a research librarian to determine MESH terms on PubMed and determine terms for translation to other databases. See online supplemental eTable 1 for a complete search strategy.

Eligibility criteria

Literature was limited in scope to peer-reviewed articles ahead of print or published in English between 2005 and 2023, given that Facebook (one of the first social media platforms) launched in 2004. To be included in the current analysis, each study was required to use public discourse data (defined as public comments)³² from a social media platform (including organic text and image posts) that discussed a preidentified tobacco control regulation (not a review of content where a policy theme emerged). The purpose of this was to avoid literature that primarily discussed non-policy-related topics.

Studies were excluded from analysis if they (1) used alternative methods to capture content about social media such as qualitative interviews or surveys; (2) used other media sources besides social media posts (eg, newspaper and television advertisements); (3) analysed content about cannabis or alcohol laws; (4) were opinion pieces, editorials, other systematic or scoping reviews; (5) were not related to a specific tobacco control law/regulation; (6) only included posts from protobacco and anti-tobacco advocacy accounts (not general public discussion) or (7) reviewed compliance with a policy using social media data. Although some articles discussed industry opposition to tobacco control policies on social media, they were excluded if the article did not include a discussion about a specific policy or if the data were segmented to only collect posts made by antitobacco advocacy accounts³³ or industry/protobacco advocacy accounts or community groups (eg, Facebook groups).^{34–38} The reason for this exclusion was that we sought to examine public discussion about tobacco control policies instead of targeted messages from advocacy groups.

Study selection

Identified studies were imported into Mendeley, a reference management software. After duplicates were removed, all articles were imported into Rayyan, a free cloud-based software created for screening and review of articles. Two reviewers (PD and KL) independently coded articles for relevance during the

first round of review (review of titles). Articles were coded as ‘included, maybe or excluded’ using the online programme. Of the original 1118 articles included in the title review, 30 were originally coded by both coders to be included, 11 were coded ‘maybe’ by at least one coder and there was a conflict (ie, included and excluded) for 13 articles. After coders met for discussion, four of the articles with conflicts and six of the articles coded as ‘maybe’ were included in the next round of review. Next, the 40 articles identified for the second round of review were imported into Rayyan for review of abstracts. During this round, the reviewers had a conflict on two articles, which were included in the review after discussion. Lastly, both authors conducted a full-text review to validate that all remaining articles met the inclusion and exclusion criteria. See [figure 1](#) for an illustration of the full search strategy.

Data extraction

Extracted data from the articles were input into a data display matrix. Study descriptions were provided by extracting data including authors, year published, country, tobacco control law discussed, policy level (reported as local, state, federal or international), social media platforms, number of posts examined and date of social media data collection. Next, methodology (sampling method, data extraction strategies, coding (ie, human, machine learning) and analysis) and sentiment findings were extracted. Study design was not reported given that all studies were observational. When reported within the article, overall sentiment of policy discussion was categorised as pro (support policy), anti (oppose policy), neutral (neither support or oppose policy) and unclear (unknown if policy discussion was supportive or opposed to policy). Lastly, major findings and other emergent themes about tobacco policy discussion on social media were reported.

RESULTS

Description of the included studies

Of 22 articles included in this scoping review, most (n=17) addressed USA federal regulations.^{2–4 25 26 29 30 39–48} One focused on the WHO’s eighth Meeting of the Conference of Parties—a gathering intended to promote the implementation or adoption of the Framework Convention for Tobacco Control (FCTC).⁴⁹ Two articles addressed state laws (California’s tobacco tax increase and New York state’s policy restricting flavoured e-cigarette products),^{10 27} and two focused on local policies (ie, Chicago’s ordinance in 2014 to regulate e-cigarettes as a tobacco product and sentiment toward tobacco products on California college campuses with and without smoke-free and tobacco-free policies).^{6 7} Besides the one paper focused on the WHO FCTC,⁴⁹ most (n=18) were about USA policies^{2 4 6 7 10 26 27 29 30 39–46 48}; three articles focused on the UK,²⁵ Australia⁴⁷ and a comparison of tweets from the UK and Australia about regulating e-cigarettes as a medical product.³ See [table 1](#) for descriptive variables.

Platforms and policy discussions regarding tobacco regulations

Across 3 platforms used to examine a total of 1461644 posts about tobacco control discussions, Twitter (n=20) was the most commonly used platform^{2–4 6 7 10 25–27 29 30 39–42 44 45 47–49}; one article used Reddit⁴⁶ and one used Instagram.⁴³ The article that used Instagram posts used both human coding to rate the visual and language components of the post and machine learning methods were employed to identify language pertaining to flavoured e-cigarettes. Across studies, data collection periods

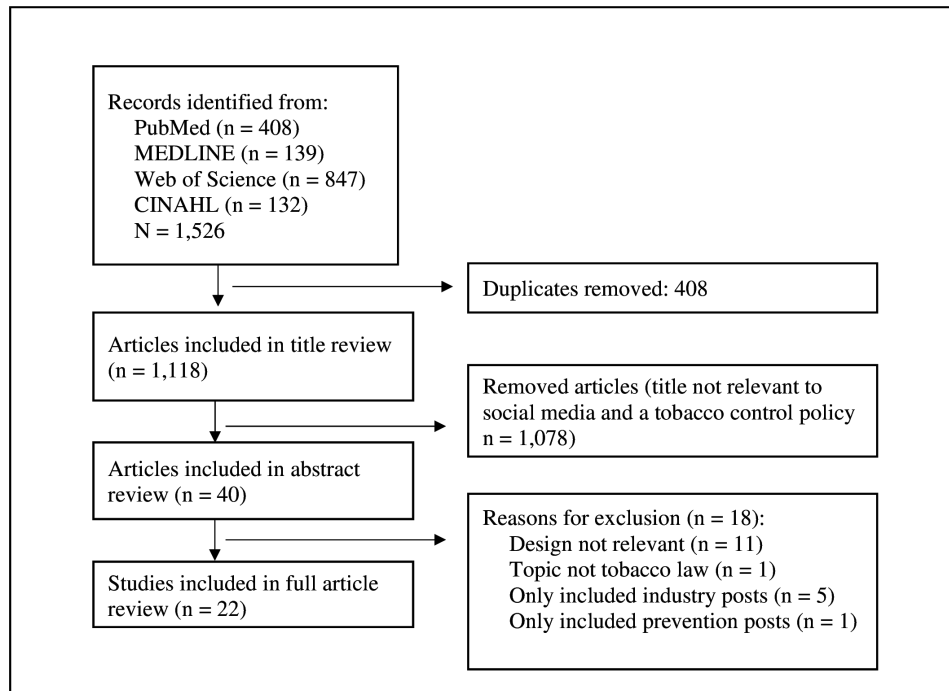


Figure 1 Study selection process.

ranged from 1 January 2012 to 27 May 2022; 16 articles collected data since 2017. Tobacco control topics were flavour restrictions including menthol (n=8),^{4 26 27 30 42 43 46 48} the USA Food and Drug Administration (FDA) market ban of Puff Bar (n=1),² Tobacco 21 (n=3),^{29 39 40} tobacco taxes (n=1),¹⁰ e-cigarette regulation (n=2),^{6 44} standardised packaging (n=1),²⁵ FDA premarket approval and product authorisation of heat-not-burn products (n=2),^{41 45} regulating e-cigarettes as a medical product (n=1),³ WHO FCTC (n=1),⁴⁹ import restrictions on vaping products (n=1)⁴⁷ and smoke-free and tobacco-free policies on college campuses (n=1).⁷

Study characteristics

Overall, eight studies used a purposive sampling method only,^{6 7 26 27 44 45 48 49} eight used a random sample only,^{2 10 25 29 30 39 40 47} five used both a purposive and random sample,^{3 4 41 46 47} and one used a stratified sample.⁴² Purposive sampling was determined when the entire sample was included instead of a random or stratified subsample. Random samples were often used when collecting a large sample of data and randomly selecting a subsample of data used for human annotation. Some random samples were also stratified by posts per day to account for fluctuations in conversations.^{29 39 40} The majority of studies (n=15) used humans to annotate data.^{2 4 6 7 10 25 29 30 39–42 45 47 49} Three performed human annotation and machine learning,^{3 43 46} and four used only machine learning to examine the content and sentiment of posts.^{26 27 44 48} Data extraction strategies most often (n=11) reported the use of application programming interface (API) networks, including Twitter's API^{3 4 7 25–27 30 42 44 45 48}; however, others included Real-time Inveillance of Twitter Health Messages software framework (RITHM),^{2 29 39 40} Twitter's Firehose,¹⁰ twitterR package for R,⁶ Crimson Hexagon,⁴¹ NCapture⁴⁹ and GetOldTweets API.⁴⁷ For the study that used Instagram, they collected data using CrowdTangle,⁴³ and the study that used Reddit data used Pushshift.io API.⁴⁶ While all articles examined the content of the social media posts, some also examined temporal patterns,^{6 29 42 46} network analysis^{6 49}

and characteristics of the posts' author.^{44 48} See [table 2](#) for full details about the study characteristics of the 22 included articles.

Sentiment analyses

Overall, 14 papers reported sentiment about a tobacco control law or potential regulation.^{3 4 6 10 25–27 29 40–42 45 47 49} Of these, 1.4% (Australia's import restriction law) to 65.7% (UK's standardised packaging law before a vote was announced) of posts were identified as propolicy sentiment.^{25 47} Posts identified as antipolicy sentiment ranged from 0.2% (critical tweets of the WHO FCTC during its 8th meeting of the Conference of Parties) to 89.2% (posts from a Twitter bomb about Chicago City Council's vote to regulate e-cigarettes in 2014).^{6 49} One article used a hashtag (ie, #flavorsavelives) that only pulled tweets that opposed a flavour restriction; thus, 100% of tweets in this paper were antipolicy.⁴² Additionally, 2.9%–55.2% of posts were identified as neutral-policy sentiment, ranging from a few informative tweets about the WHO FCTC to the majority of neutral posts regarding the FDA's authorisation of heated tobacco products, respectively.^{41 49} Three papers coded sentiment as unclear, ranging from 3.4% to 15.4%. Four papers included data from multiple time points (ie, before and after policy announcement^{25 27}; before the announcement, between announcement and implementation,^{26 48} and after implementation).^{26 48} One of these papers did not measure sentiment.⁴⁸ In two papers that captured policy discussion before proposed regulations were officially announced, the frequency of propolicy sentiment decreased and antipolicy sentiment increased after the UK announced Parliament would vote on standardised packaging and New York would ban flavoured e-cigarettes^{25 27}; however, one study found the frequency of propolicy sentiment about the FDA's flavour restriction of cartridge-based e-cigarettes increased significantly from announcement to implementation, and anti-policy sentiment decreased significantly over this timeline.²⁶ In these

few studies that examined data at multiple time points,^{3 25 27} data from 1 to 2 months increments were captured to represent sentiment before and after important policy time frames.

Table 1 Description of the selected articles about tobacco control policies discussed on social media published by November 2023

Author/s name/s, year of publication	Country	Tobacco control law/regulation	Policy level	Platform	# Posts	Data collection date/s
Allem <i>et al</i> , 2023 ³⁶	USA	FDA menthol flavour restriction	Federal	Twitter	1041	21 April 2022 – 5 May 2022
Chu <i>et al</i> , 2022 ²	USA	FDA market ban of Puff Bar	Federal	Twitter	2123	13 July 2020 – 13 August 2020
Dobbs <i>et al</i> , 2022 ³⁸	USA	Federal tobacco 21	Federal	Twitter	955	1 September 2019 – 31 December 2019
Dobbs <i>et al</i> , 2023a ³⁷	USA	Federal tobacco 21	Federal	Twitter	1109	1 September 2019 – 31 December 2019
Dobbs <i>et al</i> , 2023b ³⁹	USA	Federal tobacco 21	Federal	Twitter	1113	1 September 2019 – 31 December 2019
Feng <i>et al</i> , 2017 ¹⁰	USA	Increase California tobacco tax	State	Twitter	17 099	1 January 2012 – 5 May 2012
Harris <i>et al</i> , 2014 ⁶	USA	Chicago City Council vote to regulate e-cigarettes as tobacco products	Local	Twitter	683	8 January 2014 – 15 January 2014
Hatchard <i>et al</i> , 2019 ²⁵	UK	UK Parliamentary vote to standardised tobacco packaging	Federal	Twitter	513 525	27 October 2014 – 25 November 2014 21 January 2015 – 18 February 2015
Jun, 2020 ⁴⁰	USA	FDA authorisation of heated tobacco product	Federal	Twitter	574	28 April 2019 – 1 July 2019
Kirkpatrick <i>et al</i> , 2021 ⁴¹	USA	Flavoured e-cigarette restrictions	Federal	Twitter	2500	1 May 2019 – 1 May 2020
Kostygina <i>et al</i> , 2022 ⁴²	USA	Flavour restriction laws	Federal	Instagram	113 393	1 January 2019 – 31 December 2021
Lazard <i>et al</i> , 2017 ⁴³	USA	FDA regulatory authority of e-cigarettes	Federal	Twitter	4629	1 May 2016 – 17 May 2016
Lou <i>et al</i> , 2023 ³	Australia and UK	Policy on e-cigarettes as a medical product	Federal	Twitter	9368	20 September 20 21 – 31 December 2021
Lu <i>et al</i> , 2022 ²⁶	USA	E-Cigarette flavour restriction policy for cartridge-based products	Federal	Twitter	190 490	13 June 2019 – 22 August 2019 2 January 2020 – 5 February 2020 6 February 2020 – 30 March 2020
Robertson <i>et al</i> , 2022 ⁴⁸		WHO Framework Convention on Tobacco Control eighth Meeting of the Conference of Parties	International	Twitter	9089	1 October 2018 – 9 October 2018
Silver <i>et al</i> , 2022 ⁴⁵	USA	FDA sales restriction of flavoured cartilage e-cigarette products	Federal	Reddit	7429	01 May 2019 – 31 May 2020
Silver <i>et al</i> , 2023 ⁴⁴	USA	FDA premarket tobacco authorisation act deadline	Federal	Twitter	52	1 July 2020 – 30 November 2021
Sun <i>et al</i> , 2022 ²⁷	USA	New York State policy on flavoured e-cigarettes	State	Twitter	68 318	13 June 2019 – 22 August 2019 1 October 2019 – 31 December 2019
Sun <i>et al</i> , 2021 ⁴⁶	Australia	Proposed import restriction on nicotine vaping products	Federal	Twitter	1168	19 June 2020 – 26 June 2020
Xie <i>et al</i> , 2022 ⁴⁷	USA	FDA flavour restriction policy	Federal	Twitter	1 027 136	13 June 2019 – 31 July 2019 1 January 2020 – 5 February 2020 6 February 2020 – 12 October 2020
Yang <i>et al</i> , 2021 ⁷	USA	California public universities smoke-free and tobacco-free policies	Local	Twitter	396	2015
Zhou <i>et al</i> , 2023 ⁴	USA	FDA proposed rule prohibiting menthol cigarettes	Federal	Twitter	1941	28 April 2022 – 27 May 2022

FDA, US Food and Drug Administration.

Another paper measured sentiment towards tobacco products, finding more positive sentiments on college campuses without a smoke-free and tobacco-free policy than on campuses with such policies.⁷

Major themes about tobacco policy discussions

Emergent themes from studies that used social media data to examine tobacco control policies included perceived policy

Table 2 Methodology and sentiment of social media and tobacco control policy literature published by November 2023

Author/s name/s, year of publication	Methodology				Policy sentiment (%)			
	Sampling method	Data extraction strategies	Coding	Analysis	Pro	Anti	Neutral	Unclear
Allem <i>et al</i> , 2023 ³⁶	Random sample	Twitter API	Human annotation	Content	n/a	n/a	n/a	n/a
Chu <i>et al</i> , 2022 ²	Random sample	RITHM	Human annotation	Content	n/a	n/a	n/a	n/a
Dobbs <i>et al</i> , 2022 ³⁸	Random sample	RITHM	Human annotation	Content	15	42.4	42.6	n/a
Dobbs <i>et al</i> , 2023a ³⁷	Random sample	RITHM	Human annotation	Content	n/a	n/a	n/a	n/a
Dobbs <i>et al</i> , 2023b ³⁹	Random sample	RITHM	Human annotation	Content, temporal patterns	15	38.8	46.2	n/a
Feng <i>et al</i> , 2017 ¹⁰	Random sample	Twitter's Firehose	Human annotation	Content	53	27	20	
Harris <i>et al</i> , 2014 ⁶	Purposive	TwitterR package for R	Human annotation	Content, temporal patterns, network analysis	7.5	89.2	n/a	3.4
Hatchard <i>et al</i> , 2019 ²⁵	Random sample	Twitter API	Human annotation	Content, χ^2				
Before announcement					65.7	13.6	7.4	13.3
After announcement					32.6	25	27	15.4
Jun, 2020 ⁴⁰	Purposive, random sample	Crimson Hexagon	Human annotation	Content, text mining	16.4	28.4	55.2	n/a
Kirkpatrick <i>et al</i> , 2021 ⁴¹	Stratified sample	Twitter API	Human annotation	Content, temporal patterns	n/a	n/a	n/a	n/a
Kostygina <i>et al</i> , 2022 ⁴²	Purposive, random sample	CrowdTangle	Human annotation and machine learning	Content	n/a	n/a	n/a	n/a
Lazard <i>et al</i> , 2017 ⁴³	Purposive	NUVI and Twitter API	Machine learning	Content, text mining, influencer characteristic	n/a	n/a	n/a	n/a
Lou <i>et al</i> , 2023 ³	Purposive, Random sample	Twitter API	Human annotation and machine learning	Content				
UK					19.4	43.4	37.2	n/a
Australia					10.9	50.1	39	n/a
Lu <i>et al</i> , 2022 ²⁶	Purposive	Twitter API	Machine learning	Content, topic modelling				
Before announcement					22.8	64.8	12.4	n/a
Announcement – implementation					24.5	63.7	11.8	n/a
After implementation					26.2	62.2	11.6	n/a
Robertson <i>et al</i> , 2022* ⁴⁸	Purposive	NCapture	Human annotation	Content and network analysis	n/a	0.2	2.9	n/a
Silver <i>et al</i> , 2022 ⁴⁵	Purposive and random sample	Pushshift.io API	Human annotation and machine learning	Content, temporal patterns	n/a	n/a	n/a	n/a
Silver <i>et al</i> , 2023 ⁴⁴	Purposive	Twitter API	Human annotation	Content; negative binomial regression	22.1	77.9	n/a	n/a
Sun <i>et al</i> , 2022 ²⁷	Purposive	Twitter API	Machine learning	Content, topic modelling				
Before NY flavour policy					39	34.1	26.9	n/a
After policy					32.9	44.6	22.5	n/a
Sun <i>et al</i> , 2021 ⁴⁶	Random sample	GetOldTweets API	Human annotation	Content	1.4	87.4	11.2	n/a
Xie <i>et al</i> , 2022 ⁴⁷	Purposive	Twitter API and deepFace API	Machine learning	Content via frequent itemset mining, deepFace	n/a	n/a	n/a	n/a
Yang <i>et al</i> , 2021† ⁷	Purposive	Twitter API and Amazon Web Services	Human annotation	Content				
With campus STF policy					66.4	33.6	n/a	n/a
Without policy					76.7	23.3	n/a	n/a
Zhou <i>et al</i> , 2023 ⁴	Purposive, random sample	Twitter API	Human annotation	Content	27.6	22.8	49.6	n/a

Sentiment values represent % of total relevant responses.

*Sentiment about a tobacco control policy reported informative/neutral as neutral and critical as anti.

†Sentiment towards tobacco products rather than towards the campus smoke-free and tobacco-free law.

API, Application Programming Interface; n/a, not applicable; NY, New York; RITHM, Real-time Infoveillance of Twitter Health Messages software framework; STF, Smoke and Tobacco Free policy.

benefits, reasons for opposition, methods of circumventing the law, populations affected by law, flavour, addiction, cessation, misinformation, references to COVID and others. Policy benefits discussed among social media users included protection for youth, health benefits (including preventing disease), preventing nicotine addiction and safety.^{4 25 26 29 40 41} For example, Twitter responses indicated that age restriction laws, flavour (including menthol) restriction laws and standardised packaging regulations would prevent nicotine naïve audiences from initiating use with tweets such as, 'This is an important step for preventing children from smoking' (p.9).²⁵ Other support suggested that such

policies would help people quitting smoking and vaping.^{26 27 48} For example, females and young adults (18–35 years) were found to be more likely to report intention to quit vaping after the FDA announced and implemented the cartridge-based flavoured e-cigarette law.⁴⁸ Further, tweets about a menthol flavour policy explained that such law would reduce smoking rates among black and African American populations that have disproportionate rates of menthol cigarette use when compared with other racial and ethnic groups.⁴

Reasons for opposition to tobacco control laws included limited health benefits, individual freedoms, government distrust,

industry threatened or negatively impacted, policy not useful, negative economic effect, other regulatory needs, hindering adult use and potential enforcement problems.^{3 4 7 25 30 42 44} Antisentiment about e-cigarette-related policies often claimed these devices served as smoking cessation aids and restricting access to them would lead to relapse.^{3 41 42} For example, sentiment that opposed flavour restrictions argued that adults use flavoured e-cigarettes to quit smoking cigarettes, and sentiment against regulating e-cigarettes as a medical product suggested that such a law would make e-cigarettes less accessible.^{3 42} See [table 3](#) for summary findings from all included articles.

Methods of circumventing federal flavour, age and import restriction laws included illicit markets, buying online, flavour alternatives, disposable or refillable substitutes, product availability in particular areas, getting from friends/family, importing from abroad, stockpiling (bulk buying or panic buying), counterfeit brands and modifying unflavoured pods.^{2 39 46 47} For example, social media users encouraged others to circumvent such laws by buying flavoured e-cigarettes online or through vendors that mailed products.⁴⁶ Discussions about populations affected by the law included youth and young adults, preventing tobacco initiation among never users of tobacco, and disproportionate use among minorities (in relation to the menthol ban).^{4 26 29 40 41} Discussions about e-cigarettes or flavour restriction laws in the USA called for a flavour ban due to lung disease (referring to the e-cigarette and vaping-related lung injury (EVALI) outbreak in fall 2019).^{2 6 26 27 43}

A few studies referenced misinformation about the law,^{3 42} perceptions among general practitioners³ or portrayed by posts about the law.³⁹ For example, the US federal Tobacco 21 law raised the minimum legal sales age; however, most content generated on Twitter misstated the law as a minimum purchase age that penalises underage purchasers rather than a sales law that penalises non-compliant tobacco retailers.³⁹ Further, tweets about regulating e-cigarettes as a medical product found some users feared that few practitioners were familiar with prescribing regulations for e-cigarettes and would not provide accurate guidance for using e-cigarettes for the purpose of smoking cessation.³ Some tweets also mentioned the health risks of vaping and smoking risk associated with COVID-19.^{2 26 30} Other thematic topics included types of products discussed,^{2 4 40} political references^{29 42 44} and recommendations for other regulatory approaches.^{3 40 49}

DISCUSSION

Findings from this study provide a scoping review of the literature about tobacco-related policy discussions from social media data and implications for tobacco control policy research. Our findings suggest social media can be leveraged to examine important discourse regarding tobacco control policies. As tobacco products and marketing strategies have become more innovative, policies intended to reduce use often chase a moving target and do not keep up with public support for stricter policies.^{50 51} Sentiment, identified in 14 of the overall 22 papers, mirrors traditional surveillance methodologies that indicate opinions toward policies become less favourable after the policy is announced but improve after implementation.⁵² While these findings can provide support to policy-makers, broader implications include the nuanced topics that emerged from policy discourse including policy loopholes and enforcement challenges. Such data can also identify misinformation that can be addressed during messaging campaigns or methods used to circumvent the law, which can inform and improve implementation strategies

that seek to maximise the intended health benefits of tobacco control policies.

Policy discussions on social media discussed the potential for illegal markets and methods of circumventing flavour and age-restriction laws.^{29 46} Recent studies have found novel nicotine and tobacco products are being promoted and sold on social media platforms with a high volume of underage users, such as TikTok.^{53–57} Social media users describe methods such as buying products in bulk, buying and selling internationally, and flavour alternatives.^{39 46} While each social media platform has different policies about the promotion and sale of tobacco on their respective sites,⁵⁸ universal standards are needed to create uniform expectations for social media platforms. While the international reach of social media platforms creates policy challenges, groups such as the Conference of Parties to the WHO FCTC could review recommendations for federal policies about the sale and distribution of tobacco and nicotine products sold online.

Among the articles in our study, we identified eight that examined policy discourse about flavour restriction laws. Among these, six studies examined discussions about laws that restricted e-cigarette flavours,^{26 27 42 43 46 48} a topic that largely emerged from the FDA's cartridge-based e-cigarette flavour restriction law, implemented on 6 February 2020. The partial flavour restriction implemented by the FDA has since been criticised for loopholes it created for disposable products.² After the FDA issued warning letters for the sale of disposable products that had not received premarket approval, companies that owned these products claimed they used synthetic nicotine; thus, they were not subject to regulatory authority of the FDA. Although the FDA has since been provided authority for synthetic nicotine products and has established that most disposable e-cigarettes sold at retail locations have not received premarket approval,⁵⁹ policy discussions suggest that enforcement challenges persist as young audiences continue to gain access to flavoured e-cigarettes in the USA.^{60 61}

The two other studies regarding flavour restrictions focused on discussions that applied to the FDA's proposed policy standard to eliminate menthol cigarettes and flavoured cigarettes.^{4 30} On 28 April 2022, the FDA announced a proposed rule on product standards that would eliminate the sale of menthol cigarettes and flavoured cigars. Our findings were consistent with news media messages that suggested this proposed administrative policy would cause social injustices for black and African American communities that have higher rates of menthol cigarette use than their white counterparts.⁶² It has been well documented that menthol cigarettes were marketed for decades to black and African American communities,⁶³ taking advantage of segregation laws to create targeted advertisements for menthol products in black neighbourhoods.⁶⁴ The tobacco industry was one of the first organisations to develop political relationships with black organisations, where they hosted black and African American attended events, such as the 'Kool Jazz Festival'.^{64 65} Articles in our scoping review highlight the need for health communication campaigns to counter these social justice messages by explaining the intentional net harm the tobacco industry has caused the black and African American Communities⁶⁶ and the reduced health disparities that would result from eliminating menthol cigarettes.^{66–68} Based on our findings, we can see that the social injustice narrative is proliferating on Twitter.^{4 30} More research is needed to determine if this sentiment is identified on other platforms and if narratives about menthol cigarettes being the leading contributor to morbidity and mortality among black and African American communities are effective. Further, on 2 April 2024, three organisations (African American Tobacco Control

Table 3 Literature findings regarding tobacco control policy discussions on social media published by November 2023

Articles	Major findings	Additional findings
Allen <i>et al</i> , 2023 ³⁶	The US FDA ban on menthol tobacco products was described on Twitter as racially discriminatory (9.7%) and government distrust (6.4%).	
Chu <i>et al</i> , 2022 ²	Despite Puff Bar's lack of premarket approval, people continued to buy (16.8%) these products, underage use was discussed (3.4%) and preferred flavours (45.9%) were provided.	Regulations, price, other products, references to COVID-19, dependence
Dobbs <i>et al</i> , 2022 ³⁸	42.4% of tweets opposed the federal Tobacco 21 law. Anti-policy sentiment was associated with age-related comparisons including military enlistment, alcohol, legal voting age, firearm purchase, cannabis and overall adulthood.	Relation to types of products mentioned
Dobbs <i>et al</i> , 2023a ³⁷	Most tweets (54.7%) about the federal Tobacco 21 law, incorrectly described it as a purchase law instead of a sales law.	News, youth and young adults
Dobbs <i>et al</i> , 2023b ³⁹	More tweets were neutral (46.2%) about the Tobacco 21 law than antipolicy (38.8%) or propolicy (15%) posts. Most discussions were made by news sources and posted in the final days before enactment.	Sensible regulation, protection of youth, addiction, sarcasm, political
Feng <i>et al</i> , 2017 ¹⁰	Although the 'No on Proposition 29' outfunded the 'yes' campaign, 53% of tweets supported the proposition. Most (2/3) messages were from out-of-state Twitter users, and the yes campaign focused on simple health messages which may explain why the tobacco tax failed.	Type of account: commercial, influencers, organic post
Harris <i>et al</i> , 2014 ⁶	Most tweets in the Chicago 'Twitter Bomb' (89.2%) opposed the regulation but were not from Chicago. Chicago residents were more likely to support the policy.	Content themes: safety, lies/propaganda, science, flavour, regulation, issue salience
Hatchard <i>et al</i> , 2019 ²⁵	More (49%) tweets supported parliament's vote to standardise tobacco product packaging than opposed (19%). Before the vote's announcement, tweets were more likely to support the law, cite high-quality URLs and be linked to the health sector than after.	Content themes: health benefits, no-health reasons to enact policy, no health benefits, non-health reasons to reject policy, no theme, unclear
Jun, 2020 ⁴⁰	During the initial days that HTP products were authorised by the FDA, tweets were predominantly neutral or negative, except when tweeted by a tobacco industry account. Posts debated risk versus benefit of products.	
Kirkpatrick <i>et al</i> , 2021 ⁴¹	Tweets using the hashtag 'FlavorsSaveLives' discussed distrust of government organisations and officials, loss of personal freedoms and oppression caused by flavour restrictions.	Misinformation, THC vaping is the real problem, smoking cessation, adult use and not a bot
Kostygina <i>et al</i> , 2022 ⁴²	E-cigarette flavours are promoted on Instagram. Some promotional posts describe how to avoid laws through alternative products, do-it-yourself technology, international delivery and bulk orders.	
Lazard <i>et al</i> , 2017 ⁴³	Tweets about the FDA 'deeming act' announcement indicated that the industry was threatened by this regulation. Most discourses were negative or mixed reactions and included topics such as enforcement challenges, politician's role, benefits big tobacco and negative impact on manufacturers.	Other themes: Vaping advocate explanation of regulations
Lou <i>et al</i> , 2023 ³	Tweets regarding the UK regulation of e-cigarettes as a medical product were significantly more supportive than Australian tweets. UK tweets indicated policy may help people quit while Australian tweets suggested that it would prevent cessation.	General practitioner's misinformation, emotional catharsis, economic effect, personal choice, other regulatory needs, other reasons
Lu <i>et al</i> , 2022 ²⁶	Most Tweets occurred during the implementation of the policy. Public perceptions about the FDA's flavour policy for cartridge-based e-cigarettes were predominantly negative on Twitter; however, this negative sentiment decreased implementation.	Themes after implementation: vaping and smoking risks COVID-19, buy JUUL through shipping, intention to stop vaping, vaping and corona virus cause respiratory disease
Robertson <i>et al</i> , 2022 ⁴⁸	Tobacco industry and NGP representatives posted the majority of tweets advocating for NGPs or tobacco harm reduction during the WHO FCTC COP8.	
Silver <i>et al</i> , 2022 ⁴⁵	Most posts (95%) discussed circumventing flavour restriction policies via disposable or refillable substitutes, finding products in localities where the ban was in effect and buying online. In light of the EVALI outbreak, many blamed the illicit THC market for the regulations that affected JUUL.	Importing products from abroad, stockpiling or bulk buying, counterfeit brands, petitioning authorities, switching to tobacco products, obtaining from friends/family, and modifying unflavoured pods
Silver <i>et al</i> , 2023 ⁴⁴	Twitter posts by public health agencies may amplify antipolicy positions rather than creating group discussion supporting the policy.	Categorised as premarket Tobacco Authorisation
Sun <i>et al</i> , 2022 ²⁷	States that enact initial flavour policy may receive criticism on Twitter after the announcement of these laws. Emergent themes that did not support the policy included vaping leading to addiction, lung diseases linked to vaping, quitting smoking and vaping, JUUL gets good kids ill, and vaping leading to disease and hospitalisation.	Other messages: ban cigarettes, teen vaping, smoking and vaping, ban flavoured e-cigarettes, joke about JUUL is cool, flavoured e-cigarette policy
Sun <i>et al</i> , 2021 ⁴⁶	Most tweets (87.4%) opposed the Australian governments' proposal to prohibit the import of nicotine vaping products. Twitter may be used to lobby against tobacco regulations.	Other themes: smoking relapse, enforcement, illicit market, panic buying, impacts on vaping business, prescription
Xie <i>et al</i> , 2022 ⁴⁷	There was an increase in Twitter users' quitting vaping after the announcement of the FDA flavour restriction policy for pod devices, with a higher proportion of tweets coming from women and those 18–35 years.	
Yang <i>et al</i> , 2021 ⁷	A higher proportion of positive tweets from CA 4-year campuses without smoke-free or tobacco-free policies. Positive sentiment included expression of desire to smoke, reporting own smoking, intention to smoke, opposition to policy and urging others to smoke. Negative sentiment included observing smoking, smell of cigarettes, policy support and opinions against smoking.	

Continued

Table 3 Continued

Articles	Major findings	Additional findings
Zhou <i>et al</i> , 2023 ⁴	More positive attitudes towards FDA's proposed menthol cigarette rules after initial announcement of proposed regulation were reflected on Twitter. Such law could reduce disproportionate use among minorities (ie, African Americans), prevent disease and prevent youth addiction.	Other themes: ignoring alternative products, discrimination, impeding freedom, potential enforcement problems, hindering nicotine intake
Numbers reported are % of total relevant responses. FCTC, Framework Convention for Tobacco Control; FDA, Food and Drug Administration; NGP, new generation product; NY policy, New York flavour policy; STF, Smoke and Tobacco Free policy; THC, Delta-9-tetrahydrocannabinol .		

Leadership Council, Action on Smoking and Health and the National Medical Association) filed a second lawsuit (following the initial suit filed in 2020) accusing the Biden Administration of delaying the protection of black lives.⁶⁹ Messages that focus on protection of black/African American lives through policy regulation may help gain support for these policy endeavours.

Recommendation for future research

Our findings suggest recommendations for both social media-based research and tobacco regulatory science. Although Twitter was the leading platform used to examine policy discourse about tobacco control policies over the past decade (90%), as of February 2023, the platform now known as X announced it would no longer provide free access to the Twitter API, which presents an obstacle to research. Using other platforms, such as Reddit, Instagram and TikTok to understand tobacco regulatory discussions is recommended. Instagram and Reddit provided meaningful data regarding tobacco control policy discussions, particularly regarding flavour restrictions.^{43 46} Moreover, video-based social media platforms (eg, YouTube, TikTok) can provide visual and text information that displays people or businesses circumventing tobacco control policies. While most studies that use these platforms use human annotation, emerging research has begun to train artificial intelligence (AI) models to classify video data.^{70 71} Researchers are recommended to explore options of AI modelling to classify tobacco policy-related content posted on social media, which could provide evidence about policy adherence and enforcement to tobacco regulatory authorities.

Methodologically, our findings demonstrate that machine learning models and human annotation are common practices used to classify information about tobacco control policy discussions. Although few, some have classified demographic information about platform accounts to examine individual factors of the posts' author,^{44 48} similar to survey research that suggests older or female participants were more likely to support policies than their counterparts.⁷² Others have collected data 1–2 months before and after policy announcements and implementation to examine changes in community sentiment regarding tobacco control laws or changes in behaviour.^{25–27 48} Based on the array of tobacco control policy loopholes and enforcement challenges identified in social media research, we recommend such data be part of the evidence base to improve policy implementation and public health.

Limitations

It is possible that articles examining social media discourse about tobacco control policies were not identified in the four databases employed in our search or were not published in the two journals we reviewed. Although an extensive list of search terms was used, it is possible eligible articles were not identified via the search terms or search strategy employed. For example, studies may exist that do not feature the policy reviewed in the

title of the paper and were thus excluded from the review. The exclusion of such research could limit our findings and understanding of tobacco control regulations discussions on social media platforms. Further, social media discussions often capture an incited audience and are unlikely to provide a representative sample of the general population. Similarly, although papers that only included posts from protobacco and antitobacco advocacy accounts (not public discussion) were not included in the final analysis, front groups, industry allies and other antitobacco and protobacco advocates may use personal accounts to spread discourse about tobacco control law. Thus, some public discourse about tobacco control laws could be from these indistinguishable advocates.

CONCLUSIONS

Using sentiment from social media data can help researchers, practitioners and policy-makers understand support for or resistance to laws. Given the complexities that tobacco control laws can have with culture and social justice issues, these compiled data can demonstrate the need to create effective communication strategies before policies are announced and throughout all phases of implementation. Moving beyond sentiment, researchers can use social media discourse to identify emerging themes related to tobacco policies such as policy loopholes and enforcement challenges that allow people to circumvent local, state and federal laws. Capturing this information can provide timely recommendations to regulatory authorities who can close loopholes and address enforcement issues to enhance policy effectiveness. More research is needed to determine if discussions and opinions seen on social media are representative of the general population (and not the opinions of a select few) and what effect this public discourse may have on others' perceptions of tobacco policies. In sum, social media data are an important thermometer for tobacco regulatory science and should be included with the evidence base for policy implementation and enforcement research.

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