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Exploring the Twitter activity around the eighth meeting of the Conference of the Parties to the WHO Framework Convention on Tobacco Control

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ABSTRACT

Background Tobacco companies' intentions to influence the WHO Framework Convention on Tobacco Control (FCTC) via the Conference of Parties (COP; the official biannual meeting where Parties review the Convention) are well documented. We aimed to analyse Twitter data to gain insights into tobacco industry tactics, arguments and allies.

Methods We retrieved 9089 tweets that included #COP8FCTC between 1 and 9 October 2018. We categorised the tweets' content and sentiment through manual coding and machine learning. We used an investigative procedure using publicly available information to categorise the most active Twitter users and investigate tobacco industry links. Network analysis was used to visualise interactions and detect communities.

Results Most tweets were about next-generation products (NGPs) or 'harm reduction' (54%) and tended to argue in support of NGPs; around one-quarter were critical of tobacco control (24%). The largest proportion of most active tweeters were NGP advocates, and slightly over half of those had either links to the Philip Morris International (PMI) funded Foundation for a Smoke-Free World (FSFW) and/or to the International Network of Nicotine Consumer Organisations, a network to whom the FSFW granted US\$ 100 300 in 2018. PMI was the most active transnational tobacco company during COP8.

Conclusions The nature of the activity on Twitter around COP8, including a substantial online presence by PMI executives and NGP advocates with links to organisations funded directly and indirectly by PMI, is highly consistent with PMI's 2014 corporate affairs strategy, which described engaging tobacco harm reduction advocates to 'amplify and leverage the debate on harm reduction' around events such as the COP.

INTRODUCTION

Twitter data can provide insights into public policy debates such as sugar taxation¹ and standardised tobacco packaging,² including the stakeholders involved, alliances between groups and the arguments and evidence put forward to support different positions. Such data can help public health advocates better understand and inform policy debates,^{1 2} and potentially also bring to light the role of self-interested parties such as corporations in shaping the discussion.

The WHO Framework Convention on Tobacco Control (FCTC) is a landmark global public health treaty that requires parties (of which there were

182 at the time of writing) to implement certain measures to reduce the demand and supply of tobacco at national level.³ Previous research has highlighted countries' challenges in implementing the WHO FCTC^{4 5} and tobacco industry (TI) attempts to obstruct its implementation.^{6 7} Indeed historically, the TI made concerted efforts to block and weaken the development of the WHO FCTC,⁸⁻¹⁰ and since its adoption, the industry has continued to try and influence WHO FCTC negotiations via the Conference of Parties (COP).¹¹ The COP is the governing body of the WHO FCTC, and Parties attend biannual sessions of the COP to review and promote implementation and adopt protocols, annexes and amendments to the Convention.¹² The first session of the COP, referred to as COP1, took place in 2006; the most recent session (at the time of writing), COP8, was held in 2018. An example of TI interference at COP sessions includes the use of a front group, the International Tobacco Growers Association,¹³ to defeat the adoption of full guidelines for Articles 9 and 10 at COP4 in 2010 in Uruguay.¹¹ Similarly, another TI front group, the International Tax and Investment Center,¹⁴ convened a meeting for finance ministers the day before COP6 where Article 6 guidelines on tobacco taxation were to be agreed, to influence tobacco tax negotiations and portray the meeting as though it was officially associated with COP6.¹⁵ Leaked internal documents from Philip Morris International (PMI) explicitly stated in 2014 that part of the company's corporate affairs strategy was to 'amplify and leverage the debate on harm reduction around global events (eg, COP6)'.¹⁶ A Reuters investigation also revealed that PMI set up an 'operations room' in a hotel near the venue of COP7 to influence delegations attending the conference.¹⁷ In the past, TI representatives have served on delegations and have reportedly accessed COP sessions by posing as members of the media and general public.¹⁸ To prevent such activities at COP8, members of the public and media were prohibited from accessing official sessions.¹⁸ Exposing examples of TI interference in tobacco control (TC) policy-making is an essential step in addressing the problem,¹⁵ and harvesting Twitter data could enhance this effort. Given that tobacco companies are active on Twitter,^{19 20} the lack of regulation for online media means they are able to easily promote their agendas to a widespread audience.

To date, no published studies have examined stakeholders' social media activity during a WHO



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FCTC COP. Analysing Twitter activity around COP would provide new and globally relevant insights about current TC campaigns, debates and arguments, and the networks and key actors of influence within those communications. We examined the main themes and sentiment of tweets about WHO FCTC COP8, identified and classified the most active tweeters, explored how people who tweeted about COP8 engaged with one another and, lastly, explored the presence of TI links among the most active tweeters.

METHODS

Twitter data collection

We used NCapture to download a dataset of tweets that included the hashtag associated with the eighth session of the WHO FCTC COP, #COP8FCTC. Tweets were downloaded on 16 October 2018 and content spanned an 8-day period from 1 to 9 October 2018 (COP8 took place 1–6 October 2018). This dataset comprised 9089 tweets, of which 1453 were original tweets from 386 unique users, and the remaining 7636 posts comprised retweets. NCapture does not necessarily collect all tweets with a particular hashtag; the number is determined by Twitter and depends on the number of Tweets available and the amount of traffic on Twitter. Foreign language tweets were included and were translated by members of the wider research team (these included 198 in Spanish, 51 tweets in French, 18 in Portuguese, 9 in German, 7 in Italian and 6 in other European languages). We excluded 90 tweets that did not have sufficient textual information to code (ie, they included only an image, a meme or an extremely brief tweet comprising only one or two words). Thus, the final sample of *original* tweets was 1363 (though for network analyses, we used the full dataset of 9089 tweets and retweets).

Coding tweet content and sentiment

We adapted a coding framework used in earlier research on standardised packaging² and coded tweets in terms of content and sentiment. For content, we coded whether each tweet related to: (1) a specific TC policy such as tobacco taxation (hereafter this variable is referred to as ‘*TC-related*’); (2) next-generation nicotine products (NGPs) (ie, vaping, e-cigarettes, other ‘reduced-risk’ nicotine products or ‘tobacco harm reduction’, hereafter labelled ‘*NGP-related*’) and (3) the WHO FCTC or TC more generally, that is, WHO FCTC ratification, governance or TC as a concept/sector (‘*FCTC-related*’). In terms of sentiment, we coded tweets as either: (1) informative/neutral, (2) argument or (3) critical (ie, derogatory or abusive). Full details of the coding definitions are provided in online supplemental file 1. A randomly selected subsample of tweets (n=200) was independently coded by LR and KE-R with inter-rater reliability (Cohen’s kappa coefficient) ranging from 0.90 to 0.98. Discrepant results were resolved through comparison and discussion, and the codebook was subsequently refined.

Using the 200 coded tweets, we trained machine learning classifiers to predict the content and sentiment of the remaining 1163 original tweets. To use Twitter text data as input data for machine learning models, they must be converted into a numerical format. This is done using a combination of data processing techniques from machine learning (Tf-Idf allowing for one-word, two-word and three-word combinations) and natural language processing (stop word removal and lemmatisation). We also incorporated numerical data about the tweets and the users (number of retweets, followers, following, mentions, hashtags, URLs, tweets by user in dataset, tweets by user overall, length of original tweet and length of processed tweet) and along with the ‘numerically

encoded’ tweets, these data formed the input for machine learning models. The final machine learning model that performed best on the testing dataset of each tweet category (ie, tweet content and sentiment) was selected to predict the classes for the unseen data (see online supplemental file 2 for details on model metrics). Lastly, we used descriptive statistics to examine and present data on tweet sentiment and content (including other hashtags and Twitter accounts mentioned) and the extent of retweets.

Categorising the most active Twitter users and investigating TI links

For each Twitter account that posted two or more original tweets using #COP8FCTC (n=152 Twitter users), we used a manual step-wise investigative procedure using publicly available information (eg, mainly sourced from the Twitter user’s landing page, LinkedIn and via Google) to categorise each Twitter account and investigate any links with the TI. We categorised and investigated only Twitter users who had written two or more tweets using #COP8FCTC because we conceived those users as having attempted to influence TC policy (as opposed to, eg, individuals who wrote only a single tweet or who only retweeted others’ content). We developed the following categories based on modified definitions used in other research^{2,21}: (1) TI actor, (2) NGP industry actor, (3) NGP advocate, (4) public health advocate, (5) member of public and (6) other (see table 3 for definitions). We recorded whether the Twitter account was anonymous or not; we defined an account as anonymous if it had a non-identifiable username, or if it had a seemingly identifiable username but otherwise no identifiable information on the account landing page (as an example, an account with the name ‘Tom Smith’ that provided no further personal information, account description, affiliations, occupational information, location or photographs was coded as anonymous). Five members of the research team conducted the investigative procedure; to ensure consistency and to pretest the protocol, we each independently coded the same five Twitter accounts, before discussing discrepancies and refining the definitions. Team members then each independently coded approximately 30 Twitter accounts. We subsequently double-coded 10 Twitter accounts from another team member’s subset of 30 accounts, and met to compare and check coding, and ensure there were no discrepancies.

Social network analysis

Social network analysis of the tweets was performed using *network-x*, and visualisation was done using Gephi. We built two kinds of networks (mentions-in and re-tweets) using the original dataset of 9089 tweets for this analysis. Re-tweet networks and mentions-in networks are directed weighted graphs where the nodes are the Twitter users and the edges are the retweet and mention relationship, respectively, where the direction of the relationship is shown by the direction of the edge. Both re-tweets and mentions-in show means of interaction in a Twitter social network, with re-tweets showing information-spreading to followers, while the mentions-in network represents actions to directly include or ‘tag’ another user in tweets.

Ethical compliance

The study received favourable ethical approval from the REACH Committee at the University of Bath (ref: EP17/18 237) and complies with Twitter’s terms of service.²²

RESULTS

Tweet content and sentiment

The largest proportion of tweets (n=622, 54%) were about NGPs or ‘tobacco harm reduction’ and most of these put

Table 1 Sentiment and content of tweets posted using #COP8FCTC, including the five most frequent cohashtags and mentions (ie, 'tagging' of other user accounts)

	Content		
	TC related, n (%)	NGP related, n (%)	FCTC related, n (%)
Tweet content and sentiment categorisation			
Sentiment			
Informative/neutral	33 (2.9)	15 (1.3)	13 (1.1)
Argument	81 (7.0)	387 (33.5)	131 (11.3)
Critical	2 (0.2)	220 (19.0)	274 (23.7)
Total	116 (10.1)	622 (53.8)	418 (36.1)
Most frequent hashtags* and mentions			
	TC related	NGP related	FCTC related
Hashtags	#UNTobaccoControl #NoTobacco #tobacco #SDGs	#vaping #UNTobaccoControl #GSTHR #FCTC	#vaping #WHO #defundWHO #publichealth
Mentions	@FCTCofficial @WHO @FCAforTC @AshOrg @*****	@FCTCofficial @WHO @vera_dacosta @INNCOrg @provapeomexico	@FCTCofficial @WHO @vera_dacosta @INNCOrg @FCAforTC

*Excluding #COP8, which was present in all content categories.

@*****, the personal account of a public health advocate whose identity we have withheld for privacy reasons; @FCAforTC, account of Framework Convention Alliance; FCTC, Framework Convention on Tobacco Control; FSW, Foundation for a Smoke-Free World; GSTHR, Global State of Tobacco Harm Reduction' that is, the title of a report launched during COP8 written by Knowledge-Action-Change, an organisation granted US\$1 051 364 from the PMI-funded FSW in 2018; @INNCOrg, account of International Network of Nicotine Consumer Organisations, a network granted US\$100 300 in 2018 by FSW; NGP, next-generation product; SDGs, sustainable development goals; TC, tobacco control; @vera_dacosta, head of WHO FCTC Secretariat at the time of COP8.

forward an argument in favour of NGPs (n=387, 62%) or were critical of people and organisations perceived as opposing NGPs (n=220, 35%) (table 1). Examples of tweets coded for sentiment are shown in table 2.

Only a small proportion of tweets (10%) were about TC measures outlined in the WHO FCTC (eg, taxation or standardised packaging). Of the 418 tweets that were FCTC related, the majority were critical towards the WHO FCTC or TC in general (n=274), and around half of those critical FCTC-related tweets were posted by NGP advocates (49%, n=133). Tweets that were NGP related were retweeted on average six times, compared with an average of five retweets for tweets that were FCTC related, and only three retweets for TC-related tweets.

Characteristics of the 'most active' Twitter users

Advocates of NGPs comprised the largest number of Twitter users who had posted twice or more with the hashtag #COP8FCTC (33%), and they also posted the largest volume of tweets (38%) (see table 3). There were almost as many public

health advocates in the group of most active Twitter users as there were NGP advocates (n=43 vs n=50), though the number of tweets posted by public health advocates was considerably lower than the number for NGP advocates (n=285 vs n=467). Almost one-fifth of the original tweets with #COP8FCTC were from TI actors (see table 3). Of the 27 TI actors, three were the official accounts for transnational tobacco companies (@JTI_global, @PMIScience and @InsidePMI), 11 were individual accounts from PMI executives and 3 accounts belonged to an individual employee of either British American Tobacco, Imperial Brands or Japan Tobacco International. Ten of the TI actors' accounts were from a foundation, think-tank or similar organisation that receives direct funding from a transnational tobacco company (or employees of such an organisation); examples included the PMI-funded Foundation for a Smoke-Free World,²³ the Consumer Choice Center (has received PMI funding and JTI (Japan Tobacco International) funding at time of writing)^{24 25} and Factasia.org (received PMI funding at time of writing).²⁶

Table 2 Examples of tweets coded as critical, an argument and informative/neutral

Critical	Argument	Informative/ neutral
How on earth can vapers 'block, weaken or delay' decisions #COP8FCTC when they are standing outside incommunicado. The only block, the only weakness, and the only delay, is on the part of @FCTCofficial.... (NGP advocate)	Here it is, our EU TPD submission. It's a good summary of the science related to our Electrically Heated Tobacco Product (EHTP) and contains links to many references. #COP8FCTC @vera_dacosta @FCTCofficial @FCAforTC (Tobacco industry actor)	Today, #COP8FCTC, the 8th Conference of the Parties to the Framework Convention on Tobacco Control, began in Geneva. We are following the event, represented by (username withheld) (Public health advocate)
Transparency #COP8FCTC style. They are so confident they kick out genuine tobacco harm reductionists & the world media (#Media should only print what @FCTCofficial instruct the media to print) (NGP advocate)	We must work toward achieving the #NCD 2030 goals set forth by the #SDG Goal 3a. Implementing the @WHO Framework Convention for Tobacco Control @FCTCofficial should be a priority for all countries. #NoTobacco #COP8FCTC (Public health advocate)	What would you like to ask the FCTC secretariat? We will be broadcasting today's press conference via Twitter at 9:30am CET. Tweet us your questions and we will pick a few to ask FCTC secretariat. #COP8FCTC #cop8 #FCTCCOP8 (Tobacco industry actor)

Table 3 Categorisation of Twitter users who posted two or more original tweets using #COP8FCTC (ie, which we refer to as the 'most active' Twitter users)

User category	Definition/inclusions	Sample of users, n (%)	Original tweets posted, n (%)	Retweets, n (%)	Anonymous users*
Tobacco industry actor	<ul style="list-style-type: none"> ▶ Official account of a tobacco product manufacturer. ▶ A current or recent employee of a tobacco manufacturer. ▶ A third-party organisation that receives direct tobacco industry funding (and is either sole or part funded by the industry) or an employee of such an organisation. 	27 (18)	226 (19)	1126 (22)	0 (/20)
NGP industry actor	<ul style="list-style-type: none"> ▶ Official account of an NGP retailer or manufacturer. ▶ Individuals writing for NGP advertising platforms and social media promoters of NGP. 	8 (5)	166 (14)	494 (10)	0 (/8)
NGP advocate	<ul style="list-style-type: none"> ▶ Individuals and organisations whose accounts are primarily and purposefully advocating the use of NGP, a liberal regulatory environment for NGP and/or tobacco harm reduction generally (but which are not promoting specific products). 	50 (33)	467 (38)	2189 (42)	21 (/41)
Public health advocate	<ul style="list-style-type: none"> ▶ Account of a public health organisation, an individual affiliated with such an organisation or an individual in a public health or civil service role who is independent of the tobacco and NGP industries. 	43 (28)	285 (23)	1030 (20)	0 (/21)
Member of public	<ul style="list-style-type: none"> ▶ An account that appears to be of a person whose profile and tweets reflect their individual thoughts and interests and whose primary post content is not about NGP. ▶ They do not appear to be an active NGP proponent, for example, their Twitter activity relating to NGP was time limited around COP8, or any posts about NGP are not typically political in nature (eg, photos of their equipment). 	14 (9)	36 (3)	193 (4)	4 (/14)
Other	Included: <ul style="list-style-type: none"> ▶ Journalist or news outlets writing without a specific health mandate† (n=3). ▶ Accounts that appeared to be 'bots' (n=3). ▶ Account suspended or deleted since posting with #COP8FCTC (n=4). 	10 (7)	39 (3)	150 (3)	2 (/5)
Total		152	1219	5182	27 (/109)

In this table, retweets indicate the extent to which the 1219 original tweets posted by the 152 'most active' Twitter users were retweeted, according to the category of the user who posted the original tweet.

*Anonymous accounts relate only to individual accounts (denominator shown in brackets), since organisational accounts were not anonymous.

†News organisations and journalists that did work within a global health or public health mandate were coded as 'Public health actor' (eg, CNS Health; www.citizen-news.org/). NGP, next-generation product.

None of the tobacco or NGP industry actors or public health advocates posted using an anonymous account, whereas around half of the 41 NGP advocates who tweeted in an individual capacity (rather than an organisational capacity) had anonymous accounts.

Investigating TI links among most active users

Since by definition, the public health advocates in our sample of Twitter users excluded individuals and organisations with TI links (table 3), the results of the investigative procedure focus on NGP advocates, members of the public and 'other' users. For the latter two categories, we found no evidence of any link between users and the TI; similarly, for 23 of the 50 NGP advocates, we found no publicly available evidence of any link with the TI.

Of the remaining 27 NGP advocates, six had financial links with the Foundation for a Smoke-Free World (FSFW), in that they were either an employee, board member (or other member of governance team) or director of an organisation that receives funding from FSFW. Those organisations included Knowledge-Action-Change (which was granted US\$1051364 from FSFW

in 2018),²⁷ the International Network of Nicotine Consumer Organisations (INNCO; received a FSFW grant of US\$100300 in 2018),²⁸ the Centre of Research Excellence on Indigenous Sovereignty granted US\$978500 by FSFW in 2018)²⁹ and the Twitter account for the 'Nicotine Science and Policy' website (produced by Knowledge-Action-Change).³⁰

Slightly over half (n=27) of the 50 NGP advocates were affiliated with INNCO (this number includes the official INNCO Twitter account); Twitter users/accounts' affiliations to INNCO comprised national vaping consumer organisations that were members of INNCO at the time of COP8 (eg, New Nicotine Alliance Australia and ProVapeo Mexico)²⁸ (n=6), individuals affiliated with those national member organisations (n=14), individuals who have been part of INNCO's governance or advisory groups (n=4) and two individuals who, in 2016, appear to have played an active role in helping to establish INNCO.²⁸ We found no evidence that the individuals affiliated with INNCO or its member organisations were themselves funded by FSFW or by the TI directly. Tweets by INNCO and its affiliates as

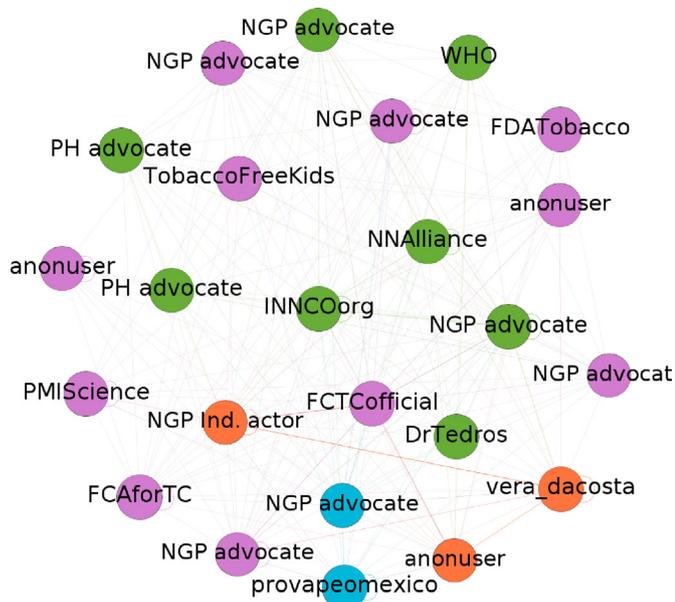


Figure 1 Graph showing most prominent nodes within mentions-in network analysis; nodes represent Twitter accounts that have been most frequently included or 'tagged' in tweets by other users. Anonuser refers to a Twitter account not categorised, as it was not a 'most active' Twitter user (name withheld for privacy reasons).

described above constituted 63% (n=296) of the tweets posted by the NGP advocates.

One organisation belonging to INNCO, ProVapeo Mexico, attempted to mobilise its members—and presumably other NGP-using members of the public—to advocate for vaping using the #COP8FCTC hashtag. An appeal on their website stated: 'Please log in to Twitter and send a message explaining how vaping has helped you and also tell COP8 that they should support vaping as an alternative for smokers who are trying to quit tobacco consumption. Hashtag #COP8FCTC send tweet to @fctcofficial @vera_dacosta copy us @provapeomexico' (see online supplemental file 3). We identified 128 tweets that mentioned @provapeomexico, consistent with ProVapeo Mexico's instructions (the vast majority of these individuals tweeted only once).

Social network analysis

Figure 1 shows the results of the *mentions-in* network. The size of the nodes are proportional to the number of times that user has received mentions, and the colours of the nodes represent belonging to the same community, as identified by Gephi. The close-up of this network diagram shows several organisations as prominent nodes: Campaign for Tobacco-Free Kids, Framework Convention Alliance, Food and Drug Administration Tobacco, WHO FCTC Official (along with Tedros Adhanom, Director General of WHO and Vera DaCosta, then Head of WHO FCTC Secretariat), INNCO, New Nicotine Alliance and PMI Science. These organisations received mentions and in turn mentioned other users most frequently.

The results for the *re-tweets* network are shown in figure 2. The size of the nodes in this figure are proportional to the number of posts retweeted by the user and nodes belonging to the same communities identified by Gephi are represented in the same colour. Figure 2 shows the nodes in the orange community contain mostly public health individuals who tend to retweet each other's tweets and that this community is relatively isolated in the COP8 dataset. The pale green community, which

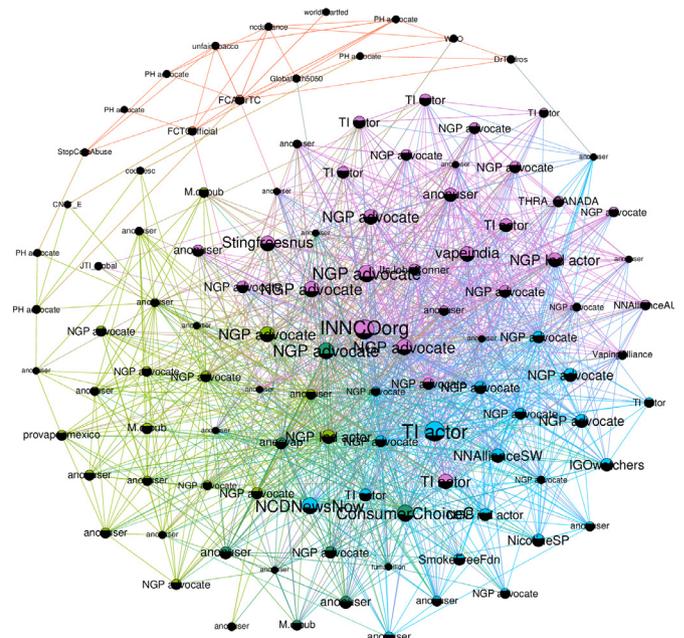


Figure 2 Graph showing results of the re-tweet network analysis; node size is proportional to the number of retweets by the user and colours indicate distinct communities as identified by Gephi.

is also relatively self-contained, features ProVapeo Mexico and the tweets and retweets generated by its campaign to mobilise members of the public. The other denser clusters indicate that users in those communities very frequently retweeted each other's tweets. TI actors appear both within the purple and blue communities of NGP advocates; the purple community includes INNCO and INNCO members such as Vape India, the Tobacco Harm Reduction Association of Canada and New Nicotine Alliance Australia, while the blue community comprises the FSFW, the 'Nicotine Science and Policy' account (a website produced by FSFW grantee Knowledge-Action-Change³⁰) and the TI-funded Consumer Choice Center. However, there was a high level of retweeting and interaction across these two (purple and blue) communities.

DISCUSSION

Most of the Twitter content regarding and during WHO FCTC COP8 advocated for NGPs or 'tobacco harm reduction' and was critical of TC. The majority of tweets were composed either by TI or NGP industry representatives or by NGP advocates; NGP advocates made up the largest group of Twitter users in our sample. They were responsible for posting the largest number of original tweets, and their tweets were retweeted to a greater extent than those written by other users. In other words, the activity generated by NGP advocates around COP8 was far greater than that generated by public health advocates.

The extensive activity by NGP advocates with links to organisations funded directly and indirectly by PMI (including factasia.org and Foundation for a Smoke-Free World,^{23 26} and Knowledge-Action-Change and INNCO,^{27 28} respectively), as well as a substantial online presence by PMI executives themselves, suggests a strategic approach by PMI to influence COP8 debates. Such an approach is highly consistent with the listed actions in the company's leaked 2014 corporate affairs strategy, which included, to: 'Establish the concept of harm reduction as legitimate public policy in tobacco regulation', 'Identify and engage non-traditional 3rd party stakeholders/allies (e-cigarette

manufacturers and retailers, adult consumers of RRP products, tobacco harm reduction advocates...' and 'Amplify and leverage the debate on harm reduction around global events (eg, COP6)'.¹⁶

The TI has a long history of using front groups and intermediaries to remove its 'fingerprints' from information and use others' voices to make its arguments appear more credible and widely supported than they actually are.^{15,31} Over many decades, the TI has repeatedly used smokers' rights groups to influence policy, groups that were organised and predominantly funded by tobacco companies themselves.³² Hence, it is perhaps unsurprising that new 'vaping consumer advocacy' groups that receive TI funding are emerging and attempting to influence the WHO FCTC.

Indeed, INNCO appears to have been set up in 2016 with assistance from members of Knowledge-Action-Change for the very purpose of influencing the WHO FCTC.²⁸ Those involved in establishing INNCO acknowledged that 'most consumers do not belong, or wish to belong, to formal organisations' yet argued the need for a new international nicotine consumer organisation as a way of 'tackling issues at an international level, in particular with the UN [United Nations] system and WHO'.²⁸ They identified the WHO FCTC COP meetings as a 'big ticket' measure that INNCO should target.²⁸ However, Parties rejected INNCO's 2018 application for WHO FCTC COP observer status.³³

Our findings have several implications. First, TC advocates and policy-makers should be aware that a key strategy of the TI appears to be engaging with and funding tobacco harm reduction consumer groups, presumably to augment pro-NGP messages and the appearance of a groundswell of independent consumer advocates. The TI's use of Twitter during COP is likely indicative of a more comprehensive strategy to influence policy for NGPs, which past evidence suggests may also involve direct lobbying, corporate social responsibility activities, and creating and disseminating misleading evidence.³¹ Our findings highlight the need for ongoing monitoring, investigation and exposure of links between tobacco companies and seemingly independent entities that promote an industry agenda,¹⁵ particularly since such links have often been deliberately obfuscated^{15,32} and are therefore not immediately apparent to policy-makers and journalists. At a national level, advocates could monitor policy submissions, reports and media articles written by tobacco harm reduction groups, investigate any links with tobacco companies and their known allies and disseminate material to expose such links via the media and to key stakeholders. In terms of Twitter activity specifically, public health advocates could consider increasing Tweet volume and communicating the need for evidence-based TC measures during WHO FCTC COP and other significant policy windows. This could help ensure messages supporting TC policies are not overshadowed by those promoting NGPs and criticising the WHO FCTC, though evaluations should be carried out to examine the effectiveness of this approach.

Our study has limitations. First, since data were collected using Twitter's public API, our dataset may not contain every tweet containing #COP8FCTC and did not include tweets from private Twitter accounts. Nonetheless, it seems very unlikely our sample of tweets differs systematically from those not captured, as the use of NCapture likely resulted in a random, rather than a biased, sample of tweets. The predictions of our machine learning models did not use any information from 'url' links or media embedded in the tweets, which means we may have lost some richness of data in terms of tweet content and sentiment. However, due to a relatively small data set, training complex models to incorporate 'images' along with text and numerical features were not feasible. Lastly, our study does not provide a

nuanced analysis of the arguments for and against various NGPs, nor does it examine qualitative differences in the tweets other than their sentiment. Future research could draw on additional data sources, such as blogs, media articles and relevant reports, to describe TI and NGP advocates' arguments and activities during COP in greater detail.

Notwithstanding these limitations, our study provides insights as to the Twitter activity during COP8 and the extent of TI involvement in shaping and amplifying harm reduction debates, both directly and indirectly through organisations it funds.

What this paper adds

What is already known on this subject

- ▶ Philip Morris International's (PMI) leaked 2014 corporate affairs strategy indicated the company was planning to influence the proceedings of the WHO Framework Convention on Tobacco Control (FCTC) Conference of Parties (COP) and planned to work with and amplify the voices of harm reduction advocates to do so.

What important gaps in knowledge exist on this topic

- ▶ To date, no published studies have explored the Twitter debates around WHO FCTC COP, nor investigated the Twitter activity of tobacco companies and their third-party allies around the WHO FCTC COP.

What this paper adds

- ▶ Most of the Twitter activity during COP8 related to 'tobacco harm reduction', yet a significant proportion of this content was created and propagated by tobacco industry actors (particularly PMI executives) and harm reduction advocates who were linked to organisations funded directly and indirectly by PMI.

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Contributors LR and KE-R conceptualised the study; all authors contributed to the refinement of the study design and methods. LR collected the data. LR and KE-R coded a subset of tweets, and AJ performed machine learning and social network analysis, with assistance from GW. LR, TL, GW, KR and KE-R conducted the investigative procedure. LR drafted the initial manuscript; all authors reviewed and contributed to subsequent drafts.

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Supplementary File 1

Table S1. Framework for coding content and sentiment of tweets

	Variable label	Tweet content	Code*	Definition
Tweet content	TC policy-related	Is the tweet about a specific tobacco control policy/ measure (excl. THR)?	Yes	– Tweet mentions specific tobacco control policies (e.g. taxation, banning tobacco advertising and promotion, smoke-free environments) and does not mention THR
			No/ Unclear	– Tweet is clearly not about tobacco control policy, or – It is unclear whether the topic of the tweet is tobacco control policy
	NGP-related	Is the tweet about next generation nicotine products (NGPs)/ tobacco harm reduction?	Yes	– Tweet is clearly about next generation nicotine products or tobacco harm reduction (i.e. vaping, e-cigarettes and other “reduced-risk” nicotine products)
			No/ Unclear	– Tweet is clearly not about NGPs or tobacco harm reduction – It is unclear whether the tweet is about NGPs or harm reduction
	FCTC-related	Is the tweet about the Framework Convention on Tobacco Control (FCTC) more generally?	Yes	– Tweet is clearly about the FCTC, its implementation, governance, or about tobacco control more generally e.g. as a sector/ community/ concept
			No/ Unclear	– Tweet is clearly not about the FCTC, its ratification, governance, or about tobacco control as a concept/ community, or – It is unclear whether the tweet is about the FCTC or tobacco control more generally
Tweet sentiment	Informative/ neutral		Yes	– Providing information without any clear intention; neutral in tone
	Making an argument		Yes	– Making an argument; promoting a campaign, position or point of view
	Critical		Yes	– Criticising alternative points of view or people/organisations in a derogatory, abusive, political or satirical way – Exposing perceived wrongdoing or malpractice

*Coding for tweet content was not mutually exclusive i.e. a tweet could be coded as THR-related and FCTC-related, for example; coding for sentiment was mutually exclusive.

N.B. TC = tobacco control; THR = tobacco harm reduction; FCTC = Framework Convention on Tobacco Control; NGP = next generation nicotine products

Supplementary File 2

We trained five different classifiers (k-nearest neighbours, random-forest, SVM, gradient boosted trees, logistic regression) for each tweet category (i.e. content and sentiment) using grid-search for parameter tuning.

Model performance metrics for classification of content and sentiment.

1. NGP-related

Classifier	precision	recall	ROC-AUC	F1
SVM	0.86	0.76	0.81	0.81
Random forest	0.90	0.72	0.81	0.80
K-NN	0.80	0.64	0.73	0.71
Logistic-regression	0.81	0.68	0.75	0.73
Xg-boost	0.80	0.68	0.75	0.73

2. FCTC-related

Classifier	precision	recall	ROC-AUC	F1
SVM	0.50	0.33	0.56	0.40
Random forest	0.66	0.26	0.59	0.38
K-NN	0.50	0.33	0.56	0.40
Logistic-regression	0.50	0.26	0.55	0.34
Xg-boost	0.66	0.53	0.68	0.60

3. TC-related

Classifier	precision	recall	ROC-AUC	F1
SVM	0.46	0.77	0.78	0.58
Random forest	0.83	0.55	0.76	0.66
K-NN	0.23	0.66	0.57	0.34
Logistic - regression	0.50	0.88	0.84	0.64
Xg-boost	0.62	0.55	0.73	0.58

4. Argument

Classifier	precision	recall	ROC-AUC	F1
SVM	0.57	0.50	0.61	0.53
Random forest	0.64	0.45	0.64	0.53
K-NN	0.42	0.25	0.50	0.31
Logistic-regression	0.68	0.54	0.68	0.60
Xg-boost	0.57	0.66	0.65	0.61

5. Critical

Classifier	precision	recall	ROC-AUC	F1
SVM	0.81	0.68	0.80	0.74
Random forest	0.82	0.73	0.82	0.77
K-NN	0.34	0.42	0.51	0.38
Logistic-regression	0.50	0.36	0.59	0.42
Xg-boost	0.46	0.36	0.58	0.41

6. Informative/Neutral

Classifier	precision	recall	ROC-AUC	F1
SVM	0.38	0.62	0.71	0.62
Random forest	0.83	0.62	0.80	0.71
K-NN	0.25	0.75	0.65	0.37
Logistic-regression	0.35	0.75	0.73	0.48
Xg-boost	0.60	0.37	0.66	0.46

Supplementary File 3. Appeals made by ProVapeo Mexico during FCTC COP8 to mobilise vapers to advocate for NGPs

AVISOS DESDE LA COP8
AYUDA AL VAPEO

El futuro del vapeo se está discutiendo del 1 al 6 de en la "Octava Conferencia de las Partes" del Convenio Marco para el Control del Tabaco de la OMS (COP8) y las cosas NO PINTAN BIEN

TODOS PODEMOS AYUDAR

Por favor entra a Twitter y escribe un mensaje donde expliques cómo te ha ayudado el vapeo. También dile a la COP que deben apoyar al vapeo como una alternativa para que los fumadores puedan abandonar el consumo de tabaco.

Hashtag: #COP8FCTC

Enviar tweet a: @FCTCofficial @vera_dacosta

Cópianos: @provapeomexico

¡NOS TIENEN QUE ESCUCHAR!

www.provapeo.org.mx

Translation

The future of vaping is being discussed from 1-6 during the 8th Conference of the Parts of the FCTC (COP8) and things are NOT looking good. Everyone can help! Please log in to Twitter and send a message explaining how vaping has helped you and also tell COP8 that they should support vaping as an alternative for smokers who are trying to quit tobacco consumption.

Hashtag: #COP8FCTC
Send tweet to: @fctcofficial @vera_dacosta
Copy us: @provapeomexico

THEY HAVE TO HEAR US!