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The Marketing and Perceptions of Non-Tobacco Blunt Wraps on Twitter

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ABSTRACT

Objective: Non-tobacco blunt wraps (N-TBW), which entered the marketplace in 2017, are being promoted as an alternative to traditional TBWs (e.g., cigarillos) for blunt smoking. The lack of studies on these novel products warrants an investigation. This study was the first to explore blunt smokers' perceptions about N-TBW and the extent of product marketing on Twitter.

Methods: A corpus of tweets from Twitter, posted between January 2017 and November 2021, were identified by a Boolean search string ($N=149,343$), where 48,695 tweets were classified as relevant by a machine learning algorithm. These relevant tweets were further screened and labeled as promotional or organic based on product URLs, usernames, keywords, or hashtags. Topic modeling using Dirichlet Allocation was then employed for identifying latent patterns of words among relevant tweets. The Social Networking Potential (SNP) score was employed for identifying influential accounts.

Results: Most relevant tweets (89%) were organic, non-promotional expressions about N-TBW. Account users who only posted non-promotional tweets had a significantly higher SNP than those who only posted promotional tweets. Yet, neither of the two groups of account users consisted of known celebrities. Topic modeling revealed three broad groups of topics (7 in total) denoting the attributes of hemp N-TBW, interest in non-hemp N-TBW, and product marketing.

Conclusions: The large proportion of organic tweets is indicative of the nascency of N-TBW, which will need to be marketed more extensively if they are to replace cigar products used by blunt smokers.

KEYWORDS

Non-tobacco blunt wraps; social media; topic modeling; machine learning; harm reduction; tobacco regulation; cannabis regulation

Introduction

The co-occurring use of cannabis and tobacco, often in the form of a blunt, may pose greater health risks than the exclusive use of cannabis (Peters et al., 2012). Blunt smokers may be more vulnerable to co-use, as some “chase” their blunts with cigarettes or little cigars/cigarillos (LCCs) (Cooper & Haney, 2009; Peters et al., 2016). While it is debatable whether the nicotine in LCC wrappers is detectable and habit-forming (Mayer et al., 2020; Sifaneck et al., 2005; Timberlake, 2009; Timberlake et al., 2021), the non-tobacco blunt wrap (N-TBW) may be a viable and attractive alternative that could potentially reduce a blunt smoker's exposure to tobacco products. Cigarillos, other cigar products, and tobacco-based blunt wraps will be broadly referred to as tobacco blunt wraps (TBWs). In contrast to TBWs, the N-TBW are made with non-tobacco materials, such as hemp, palm, rose petals, and banana leaves (Custom Cones USA, 2022; Jordan, 2018). N-TBW come in a variety of flavors and are often marketed by manufacturers with terms indicating health or environmental benefits (e.g., vegan and organic). They are also marketed by

cannabis retailers in the form of a pre-rolled blunt (e.g., can-nagars and hemparillos), possibly due to states prohibiting cannabis retailers from selling tobacco products (California Code, 2017; Treasury – General, 2021). Hence, one can argue that N-TBW, which are becoming popular (California Tobacco Retail Surveillance Study, 2022; Matchboxbros, 2020; Morean et al., 2023), could break the nexus between cannabis and tobacco use.

Studies on harm perceptions of TBWs have reported that blunt smoking is viewed as less harmful than smoking an unmodified cigarillo (Koopman Gonzalez et al., 2017; Sterling et al., 2016), in part because the low-quality tobacco in a cigarillo is perceived as being cancerous. This perception, which is consistent with the long-standing notion that blunt smokers do not identify as cigar smokers (Sterling et al., 2016), could present challenges to N-TBW manufacturers who appear to be marketing their products as a less harmful alternative to TBWs (Hempire Wraps, n.d.; Jungle Blunts, n.d.). However, blunt smokers' acknowledgment of the harm of using TBWs in some form could increase their receptivity of switching to a N-TBW (Timberlake & Rhee, 2022).

Currently, it is unclear how N-TBW's are marketed in social media. Prior research has found that most tweets regarding e-cigarettes were overtly commercial, revealing Twitter to be an important marketing medium for promoting novel substances (Huang et al., 2014). In contrast, celebrities were used to promote TBW's and blunt smoking on Twitter, in lieu of commercial tweets which were negligible (1% of all tweets) (Kostygina et al., 2016). Brands frequently utilize celebrities (e.g., hip-hop artists) in social media platforms to promote their product to increase their audience's awareness of unfamiliar or novel brands (Wood & Burkhalter, 2014), and circumvent marketing and promotion regulations for substances, such as tobacco (Jackson et al., 2018) and alcohol (Burton et al., 2013). Substances are also frequently promoted *via* user-created content, sometimes ignited by influencers (i.e., popular social media personalities). For example, flavors for TBW's are often central discussion points among users in Instagram (Kim et al., 2021). Moreover, the cigar industry has been shown to endorse influencers to promote their branded products (Navarro et al., 2021).

Twitter is a social media platform that is accessible to researchers and popular among youth and racial/ethnic minorities (Brown et al., 2014), particularly African Americans (Cantrell et al., 2013). It has been used as a health research tool for examining content as it applies to conventional and emerging tobacco products (Lienemann et al., 2017; Myslin et al., 2013; Sinnenberg et al., 2017). Through the utilization of retweets, mentions, and hashtags, users can directly connect with their followers and users they follow (Haustein, 2019; Siegert et al., 2020). For example, the ability of retweeting tweets in Twitter increases the visibility of tweets to others outside one's direct network, and allows persistent and fluid discussion on the content of the tweet (Siegert et al., 2020). These affordances enable Twitter to be a viable resource for surveying emergent health patterns that are hard to detect by using other traditional methods, such as surveys (Eysenbach, 2009; Myslin et al., 2013).

There is no shortage of tweets on blunts as ~3.6 million tweets pertaining to TBW's and cannabis were found over a three-month period in 2014 and 2015 (Kostygina et al., 2016). There is no published literature, to our knowledge, that examines the marketing or user's perceptions of N-TBW's. Unlike a prior study that reported only 9.4% of tweets discussing the characteristics of Swisher-branded TBW's (Allem et al., 2019), this investigation anticipates a higher percentage of such tweets due to the novelty of N-TBW's. This novelty begs the question of whether the promotion of N-TBW's is primarily occurring through overt promotional/commercial marketing on social media, like the promotion of e-cigarettes (Huang et al., 2014), or perhaps indirectly through celebrities (Kostygina et al., 2016) or other social media influencers (Navarro et al., 2021), a familiar marketing tactic used by the tobacco industry. Hence, this exploratory study is intended to examine the content of tweets and extent of N-TBW marketing for assessing whether the new products could potentially replace TBW's for blunt smoking.

Methods

Source of tweets

A corpus of tweets and metadata (i.e., user-level information) were obtained through Twitter's Application Programming Interface (API v2) upon approval of our project by the company's Academic Research Product Track (Twitter, 2018). This academic initiative provides a maximum of 10 million real-time and historical tweets per month. Tweets were stored, edited, and analyzed through Texera (<https://github.com/Texera/texera>) (Liu et al., 2022), an application developed by Professor Chen Li and other coauthors in UC Irvine's Department of Computer Science. The tweets, which were limited to the English language, were selected from the approximate popularization of N-TBW's (January 1, 2017) (Matchboxbros, 2020) to the date when tweets were extracted from our finalized boolean search string (November 1, 2021).

Selection of tweets

The selection of tweets was guided by a multistep process that first entailed generating a comprehensive list of keywords (Kim et al., 2016), which included brand names, abbreviations, jargon, and slang (Cannabis Training University, 2023; Dickinson et al., 2016; Kostygina et al., 2016). The boolean search string specified a combination of the keywords structured by the following three defining terms: 1) hemp, the predominant material used to make N-TBW's; 2) wrap, the term for N-TBW's; and 3) blunt, the means of delivering cannabis *via* TBW's. The word hemp was combined with keywords for N-TBW brand names, TBW brand names (Dickinson et al., 2016), or variations of the word cigarillo in the following disjunctive statement: hemp (wrap OR zone OR swisher...). The word blunt was combined with keywords for the type of N-TBW material or a health descriptor in the disjunctive statement: blunt (hemp OR rose OR organic OR vegan...). Keywords for pre-rolled cones, but not rolling papers, were included in the search string because they are advertised as N-TBW's (The Green Brand, 2022). A few individual terms (e.g., hemparillo and cannagar) and hashtags (e.g., #hempwraps) that denote N-TBW's were added to the Boolean search string. Retweets (i.e., re-posted tweets) were excluded from the search string to avoid undue influence of repeated messages for topic modeling. The final Boolean search string consisted of 77 unique terms, 27 hashtags, and 21 exclusionary terms.

Manual labeling and supervised machine learning

The manual screening of each tweet for its relevance to N-TBW's was infeasible due to the large corpus of tweets identified from the initial search. Thus, a machine learning classifier was trained from a random sample of 2000 tweets coded for relevance (yes/no) by coders who were versed in cannabis lexicon. Relevant tweets pertained to any aspect of N-TBW's expressed in a comment, statement, or opinion,

excluding single words or short phrases that are analytically uninformative. Many of the non-relevant tweets exclusively referred to cannabis, or contained short phrases. Coders had a high inter-rater reliability as indicated by a Cohen's Kappa of 0.85.

A support vector machine (SVM) classifier (Lo et al., 2015), was trained using the manually coded tweets to screen all tweets obtained from the boolean search string for relevance to N-TBW. A series of SVM classifiers, based on varying levels of hyperparameters (e.g., C, Γ , and kernel type), were assessed for accuracy using 10-fold cross validation (Tripathy et al., 2015). Details on the parameters are discussed elsewhere (Pedregosa et al., 2011). Among the different combinations of parameters, the SVM classifier with the highest sum of positive predictive value (PPV) (0.833), sensitivity (0.905), and accuracy (0.900) was chosen for this study. PPV is the proportion of correctly classified relevant tweets among tweets classified as relevant by the SVM classifier, sensitivity is the proportion of correctly classified relevant tweets among all relevant tweets, and accuracy is the proportion of correctly classified relevant and non-relevant tweets among all classified tweets. A stratified random sample of 2000 tweets labeled relevant or non-relevant by the SVM classifier were reevaluated by human labeling, which yielded a PPV of 0.894, sensitivity of 0.905, and an accuracy of 0.900.

Topic modeling

For preparing the relevant tweets for topic modeling, we removed the URLs; tokenized the tweets into a list of lowercase words; removed stop words (e.g., "a", "is"), punctuation marks, numbers, and lemmatized words into their root form. Latent Dirichlet Allocation (LDA) was employed for identifying latent patterns of words (i.e., topics) from the relevant tweets, and selection of topic models was guided by a computational qualitative approach in analyzing large data (Evans, 2014; Laureate et al., 2023; Pirri et al., 2020). A total of 90 models, which were developed using the sklearn kit (Pedregosa et al., 2011), corresponded to 10 models in sequences of five topics (5–50 topics/model), where each had nine learning decay parameters (0.1–0.9). The nine parameters yielded topics that were homogeneous within each respective group (e.g., nine 5-topic models). The 90 models were evaluated based on coherence, a metric of the co-occurrence of words in each topic. All nine 5-topic models had the highest coherence scores, followed by all models with 10 and 15 topics. The models with 20+ topics did not yield novel or substantive topics beyond what was present in the former models. Thus, the 5-, 10-, and 15-topic models with the highest coherence scores (0.814, 0.801, and 0.762, respectively) were chosen as the final models for our analysis.

Identifying promotional/commercial tweets

Relevant tweets were screened and labeled as promotional/commercial if they had any of the following: 1) A homepage URL from a small third-party retailer (e.g., Hippiebutlers),

a URL from a N-TBW's manufacturer (e.g., High Hemp), or a product URL from a large third-party website (e.g., Amazon, Walmart, Etsy); 2) a username affiliated with a N-TBW manufacturer or retailer (The Green Brand, 2022); or 3) keywords and hashtags that distinctly indicate promotions (e.g., coupon and discounts). The list of small third-party retailers, manufacturers and product URLs were obtained through web-scraping the Google search engine using a list of relevant keywords (e.g., hemp wrap). The human labeling of the promotional content (yes/no) of a stratified random sample of 500 tweets, coded as promotional or non-promotional (250 each), yielded a Cohen's Kappa of 0.89. "Clean" words (e.g., natural and organic), which convey that a product is healthy, natural, or environmentally friendly (Asioli et al., 2017; Negowetti et al., 2022), were identified within relevant tweets to see whether N-TBWs are discussed or marketed using "clean" terms.

Identifying influencers

The Social Networking Potential (SNP) was chosen as our metric of influencers as the SNP reduces the bias of the mass-followers effect (Anger & Kittl, 2011), and provides a balance between content-oriented and conversation-oriented interactions (Hassan et al., 2019). The SNP is the average of the following three ratios: 1) the number of followers to the number of following (R_f); 2) the total number of retweets to the total number of tweets created by each user (R_{rt}); and 3) the total number of retweets to the number of followers of each Twitter user (R_i). All Twitter users and their respective metadata were extracted from each relevant tweet to compute SNP. The latest 6500 posts from each identified user (i.e., limit of Twitter's API) were retrieved to aggregate the total number of retweets to compute R_{rt} and R_i . Among the 32,064 unique users identified in our corpus of tweets, 1146 had missing SNP data due to deactivation of accounts. The top 50 Twitter accounts with the highest SNP were individually examined according to the posting of: 1) promotional/commercial tweets; 2) organic tweets; or 3) both promotion/commercial and organic tweets. The Kruskal–Wallis rank sum test and the Dunn Post-hoc test were used for comparing median values and rank sums of pairs of the three subgroups, respectively.

Results

Twitter account users

The Boolean search string yielded 149,343 tweets between January 1, 2017 and November 1, 2021, 48,695 (32.61%) of which were classified as relevant to N-TBWs according to the SVM. A total of 32,064 Twitter account users, who posted the relevant tweets, had posted a mean (sd; range) of 1.52 (9.27; 1–1352) relevant tweets, had an average of 3388.83 (95,755.44; 0–15,753,261) followers, and followed an average of 951.62 (8702.91; 0–1,477,735) Twitter users (see Table 1). Relevant tweets were retweeted an average of 3.08 (367.23; 0–77,292) times.

Table 1. Characteristics of Twitter account users who posted relevant tweets^a (N=32,064).

Twitter account user ^b	Total users	Total relevant tweets	Average relevant tweets per user	Average followers per user	Average following per user	Average social network potential per user
All account users	32,064	48,695	1.52 (SD = 9.27)	3388.83 (SD = 95,755.44)	951.62 (SD = 8702.91)	16,060.1 (SD = 46,419.53)
Commercial only ^c	617	1878	3.04 (SD = 14.45)	1792.06 (SD = 13,305.52)	984.71 (SD = 3403.16)	6020.50 (SD = 23,305.55)
Organic only ^d	31,072	40,695	1.31 (SD = 2.15)	3427.76 (SD = 97,246.36)	950.67 (SD = 8825.67)	16,420 (SD = 46,986.56)
Commercial and organic ^e	375	6122	16.33 (SD = 80.08)	2790.33 (SD = 10,881.32)	975.90 (SD = 1745.34)	3104.07 (SD = 11,515.19)
Kruskal–Wallis rank sum test <i>p</i> value	–	–	< 0.001	< 0.001	< 0.001	< 0.001

^aTotal of 149,343 tweets retrieved initially by the boolean search string. Among them, 48,695 relevant tweets were identified by the SVM classifier;

^bType of Twitter account users were classified based on the type of relevant tweets found in our corpus of relevant tweets;

^cusers who only posted promotional/commercial tweets;

^dusers who only posted organic tweets;

^eusers who posted both promotional/commercial and organic tweets.

Table 2. Dunn Post-hoc test of differences in rank sum between types of Twitter account users.

Types of Twitter account users		Differences in rank sum ^a			
		Relevant Tweets per user	Followers per user	Following per user	Social network potential per user
Commercial only ^b	Organic only ^c	7.90***	–13.47***	–7.73***	–21.64***
Commercial only ^b	Both ^d	–34.04***	–6.25***	–2.70*	1.95
Organic only ^c	Both ^d	–49.09***	2.66*	2.64*	19.34***

**p* < 0.05;

****p* < 0.001.

^aSignificance values for the Dunn Test adapted using the Bonferroni adjustment;

^busers who only posted promotional/commercial tweets;

^cusers who only posted organic tweets;

^dusers who posted both promotional/commercial and organic tweets.

Promotional/commercial vs. organic tweets

A total of 4917 (10.98%) relevant tweets contained commercial or promotional material posted by 992 account users. Among these, 704 (14.32%) were tweeted by usernames affiliated with manufacturers or retailers of N-TBWs; 101 (2.05%) had URLs of the homepages of small-scale retailers; 847 (17.23%) had URLs of manufacturers or brand websites; 495 (10.07%) had product URLs from large-scale retailers; and 4144 (84.28%) contained keyword(s) indicative of promotional content. Frequent tokenized terms for the promotional tweets denoted brand (e.g., High Hemp Wraps, 1.48%) and materials used in N-TBWs (e.g., hemp, 2.51%). Relevant tweets were posted by 31,072 unique account users. A small minority (1.17%) posted both promotional/commercial and organic tweets. Followed by hemp (3.94%), rose was the second most frequent tokenized term (3.89%) among the organic tweets. Account users who posted only organic tweets had significantly more followers than those who only posted promotional/commercial tweets (3427.76 vs. 1792.06, Dunn Post-hoc *p* < 0.001) (see Table 2). Lastly, among the 48,695 relevant tweets, 22.14%, 17.67%, and 62.15% of all tweets, organic tweets, and commercial tweets contained at least one clean term, respectively.

Timeline of tweets

Relevant and predominantly organic tweets (99.4%) spiked dramatically in September 2017 (*n*=4317) compared to other months, attributed by a viral video illustrating how to roll a rose blunt (see Figure 1). The tweet “Rose petal blunts are the new wave” exemplifies the sentiment expressed by many individuals at this time. For promotional/commercial tweets,

spikes were observed in April and May of 2017 (251 and 216 tweets, respectively) and in February of 2021 (331 tweets). Most tweets from these two periods were spammed messages promoting N-TBWs from the company RAW rolling papers.

Substantive topics from LDA models

Upon reviewing the 30 topics from the 5-, 10-, and 15-topic models with the highest coherence scores, seven substantive topics were identified and given a thematic label based on their top tokenized keywords (see Figure 2). The seven topics include all five topics from the 5-topic model (A1–A5), and one topic each from the 10-topic model (B1) and 15-topic model (C1).

Group #1: Attributes and potential of hemp wraps (A1 and B1)

The thematic label for topic A1, Potential of the Hemp Wrap as a Non-Tobacco Alternative, stems from words (e.g., organic and vegan) implying health advantages of using hemp compared to tobacco. One tweet read “I’m just looking for that healthy alternative. I still haven’t tried the hemp cyclone blunts yet. I’ve heard great things”. Some acknowledged the appeal of the hemp wrap, but expressed that tobacco is a critical component of blunts, “I liked the organic hemp wraps but it wasn’t the same high... Tobacco blunts just hit right for me still and I’m not ready to give it up”. Topic B1, labeled Other Positive Attributes of Hemp Wraps, implies other favorable attributes such as novelty, availability and flavors; the latter is expressed paradoxically by the tweet “I don’t even like flavors but I just got some mango hemp wraps”.

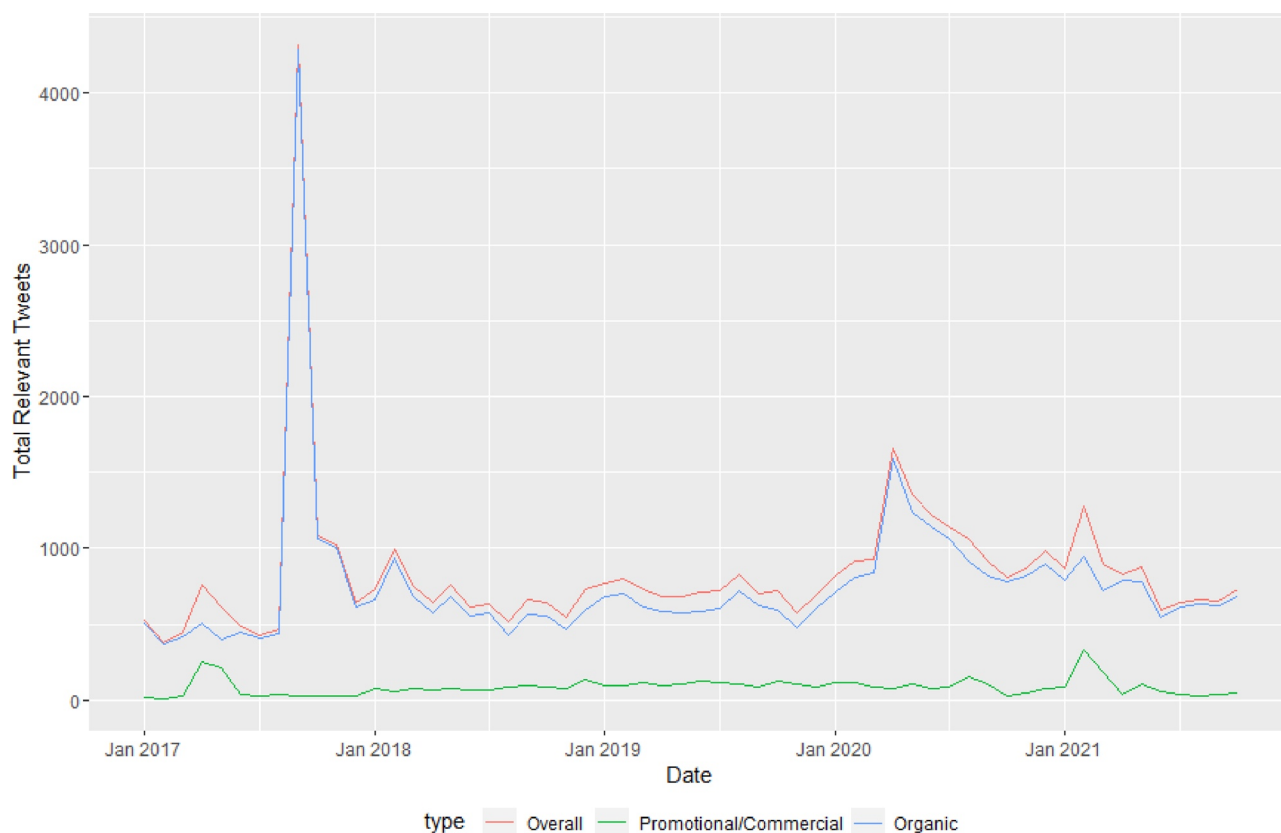


Figure 1. Frequency of relevant tweets by type* from January 2017 through October 2021. *The orange line is the frequency of all relevant tweets, green for promotional/commercial tweets, and blue for the frequency of non-promotional or organic tweets over time.



Figure 2. Word clouds of top terms within the seven substantive topics, where font size reflects weights of the terms and same colors denote equally weighted terms. *From top left to bottom right, word cloud for A1 – Potential of the Hemp Wrap as a NonTobacco Alternative, A2 – Characteristics of Rose Blunts, A3 – Wanting to Smoke Non-Hemp Blunts, A4 – Promotional/Commercial Tweets for Various Products, A5 – Online Promotion of an Emerging Cannabis Blunt, B1 – Other Positive Attributes of Hemp Wraps, and C1 – Promotion of Popular Brands, such as King Palm and High Hemp.

Group #2: characteristics and desire for non-hemp materials (A2 and A3)

The thematic label for topic A3, Wanting to Smoke Non-Hemp Blunts, stems from words that imply the desire (e.g., want, need, and love) to smoke N-TBW made from non-hemp alternatives (e.g., rose petals). Some tweets also mentioned the venue for purchasing them, *"I wanna try the King Palm blunt wraps, and they got em on amazon lol"*. The topic A2, Characteristics of Rose Blunts, stems from words that imply the occasion (e.g., Valentine's Day), the consumer (e.g., Supergirl), and properties of rose petals that were expressed in both negative and positive terms (e.g., pesticides and additives). The former is exemplified by the tweet *"If u do decide to smoke a rose blunt only smoke organic roses or u will be smoking pesticides"*.

Group #3: Promotional tweets, emerging products, and brand promotions (A4, A5, and C1)

Topic A4, Promotional Tweets for Various Products, had hashtags for different products, such as *"...#glass #vape #rawpapers #hookah #vape #cbd #highhempwraps"*. Topic A5, Online Promotion of an Emerging Cannabis Blunt, stems from the word for cannabis cigars (i.e., cannagar), other cannabis references (e.g., weed), and words for online venues (e.g., YouTube). One tweet read *"Happy Tuesday friends, live smoke sesh smoking beautiful cannagar..., enter in a baked box giveaway"*. Topic C1, Promotion of Popular Brands, derives from the two most popular brands of N-TBWs (i.e., High Hemp and King Palm), online venues (e.g., YouTube), and other suggestive words, such as review and video. Topic C1 is exemplified by the tweet *"King Palm, best slow burning natural leaf ... Made from 100% real palm leaf... completely tobacco and chemical free"*.

Role of influencers

Account users who only posted organic tweets had a significantly higher SNP than those who only posted promotional tweets (16,420 vs. 6020.50, Dunn Post-hoc $p < 0.001$). Among accounts with high SNP (i.e., the "influencers"), the majority who posted organic and/or promotional tweets had no affiliation with tobacco or cannabis groups. Recent organic tweets posted by influencers were related to entertainment, sports, politics, and celebrity-related news.

Fandom accounts, which are dedicated to following a particular celebrity, were identified among the influencers who posted tweets about N-TBWs; actual celebrities, however, were not. Examples of influencers who posted promotional tweets were smoke shops and a King Palm ambassador who marketed the brand with promotional codes (e.g., 15% off).

Discussion

This study's primary finding is that most relevant tweets (89%) were intended for non-promotional purposes. The

organic nature of these tweets is best exemplified by the ~4300 postings that originated from a viral video demonstrating how to roll a rose blunt. One of the three categories of topics was the interest and desire for non-hemp-based N-TBWs (i.e., rose petals and palm leaves). The minority of promotional tweets begs the question of what businesses are vested in N-TBWs. Our results indicate that manufacturers and large-scale retailers were the predominant sources of N-TBW promotion. Yet, it is plausible that cannabis retailers, who were prohibited from advertising on Twitter in the time period corresponding to our study (Twitter, 2023), would have advertised N-TBWs because of their interest in capturing some of the blunt market. This may be especially true given cannabis retailers' inability to sell tobacco products in many states (California Code, 2017; Treasury – General, 2021).

In contrast to N-TBWs, 90% of tweets pertaining to e-cigarettes in the year 2012 were commercial (Huang et al., 2014). Most of these tweets contained links to websites, whereas only 1.7% of relevant tweets in our study had URLs of a manufacturer or brand website. Huang et al. (2014) speculated that the rapid rise in popularity of e-cigarettes may be attributed to marketing on Twitter, which does not appear to be the case for N-TBWs. Yet, organic conversations online may help manufacturers develop personal relationships with consumers, a strategy used by tobacco companies (Hafez & Ling, 2006; Keller, 2009; Kostygina et al., 2016; Kozinets et al., 2010). A related finding was the absence of influential celebrities, which differs from the well-known hip-hop artists who were promoting TBWs on Twitter in 2014 (Kostygina et al., 2016). Although celebrities have not been marketing N-TBWs, noncelebrities may be effective in promoting the products. Marketing studies on e-cigarettes reported that viewers are likely to trust peers and develop positive attitudes toward the promoted product to a greater extent than celebrity endorsements (Phua et al., 2018). It is possible that N-TBWs are being indirectly marketed by non-celebrities, which differs from traditional tobacco marketing that utilizes celebrities and music-themed promotions (Hafez & Ling, 2006). In fact, a King Palm ambassador was identified as a non-celebrity "influencer", a strategy also used in promoting smokeless tobacco in the United States (Rhee et al., 2021). Moreover, videos may also play a large role in increasing awareness or promoting N-TBWs as found by this study. Social engagement via videos is strongly associated with higher engagement (Kim et al., 2017), and is frequently used by content creators and media companies to engage with their audience on Twitter (Sundstrom & Levenshush, 2017). Brands may be inclined to utilize videos in Twitter to increase brand awareness, as Twitter is optimized in sharing brand-central content (Smith et al., 2012).

The identified topics denoting the positive and negative aspects of N-TBWs were expected due to the novelty of the product, as well as a higher percentage of clean terms of commercial (62%) versus organic tweets (18%). Prospective users may be discussing these purported benefits with others as a function of N-TBW brands or retailers marketing their products with the clean terms. The purported benefits,

which may be misleading (Allard et al., 2023; Hoepfer et al., 2022; Popova et al., 2017), is a growing concern among public health professionals who advocate for regulating cannabis advertisements.

Flavors of N-TBW, in contrast, were not a common topic in the present investigation, unlike the frequent discussions about Swisher Sweet flavors on Twitter in another study (Kostygina et al., 2016). The lower-than-expected number of tweets about N-TBW flavors in our study might be attributed to a lack of awareness, but may change in the coming years as local, state, and federal government agencies prohibit the sales of flavored TBWs, including cigarillos.

Strengths and limitations

This study was the first to explore the prevalence of marketing and content of N-TBW discussions on a popular social media platform. The study was strengthened by examining a census of relevant tweets that were posted between the popularization of the hemp wrap (January 2017) through the end of 2021. Further, our study builds on an expanding body of research utilizing a computational qualitative approach to investigate health trends in social media (Cavazos-Rehg et al., 2015; Cranwell et al., 2015; Huang et al., 2016; Kostygina et al., 2016). Yet, limitations must be considered in interpreting the study's findings. First, other social media platforms may better reflect the marketing and reach of demographics typified by blunt smokers (Bakken & Harder, 2023; Kim et al., 2021; Spillane et al., 2021). Secondly, methods employed in this study cannot determine the attitudes of users, which would require a separate sentiment analysis. Next, retrieval sensitivity of the boolean search string was not estimated due to the labor-intensive task of manually coding a large sample of un-retrieved tweets for relevancy (i.e., tweets not identified by the boolean search string) (Kim et al., 2016). Lastly, despite supervised machine methods being an effective tool for binary classifications (e.g., relevant and non-relevant tweets), its black-box nature makes it often difficult to fully understand the decision process of the created model (Janiesch et al., 2021; Rudin, 2019). Others have suggested implementing post-hoc interpretability models (Rastegarpanah et al., 2021) or using more transparent models (i.e., white-box models) (Loyola-Gonzalez, 2019) alongside black-box machine learning methods to understand the decision-making processes of the model. However, this study was not focused on the SVM's decision-making processes.

Despite these limitations, the most profound implication of this study is the availability of a non-tobacco alternative that is being discussed widely by blunt smokers on a popular social media platform. Given the multitude of tweets expressing both positive and negative attributes of N-TBW, it is difficult to speculate whether the new products will replace TBWs (e.g., cigarillos) for blunt smoking. Focus groups and other qualitative methods will need to be employed for assessing product perceptions and receptivity to the N-TBW among blunt smokers. At the present time, it is unlikely that N-TBW will replace the TBWs due to the minority of tweets (~11%) that are marketing the new

products. However, recent changes in Twitter's advertising policy (March 2023), which allow the advertising of cannabis and paraphernalia (Twitter, 2023), are likely to be accompanied by an increase in tweets promoting the N-TBW. Furthermore, as more states and municipalities restrict the sales of flavored tobacco, N-TBW manufacturers and retailers will likely promote a variety of N-TBW flavors on social media. An additional implication of our study is the occurrence and ensuing challenge of regulating indirect marketing of N-TBW, which is being primarily propagated by non-celebrity influencers. The fate of the N-TBW will depend on a variety of factors ranging from policy to success in marketing the products to novice blunt smokers and established blunt smokers who may be receptive to a non-tobacco alternative.

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Declaration of interest

No conflicts are declared by the authors.

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Data availability statement

All related data used in this study are publicly available in the open-ICPSR Project Repository (project openicpsr-182001) in .csv format, doi:10.3886/E182001V1.

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