Exploring the Discursive Function of Hashtags: A Semantic Network Analysis of JUUL-Related Instagram Messages

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Abstract
This study used semantic network analysis to investigate the themes of JUUL electronic cigarette-related messages on Instagram posted by three account types (commercial, vape community, and organic users) and explore the function of hashtags in the JUUL-related discourse across these groups. Posts were collected from 1 March 2018 to 15 May 2018. We conducted network analyses for each user group, with separate analyses to examine texts with and without inclusion of hashtags. Network statistics determined which words occurred most frequently, which words co-occurred or clustered together, and what communication function hashtags perform. Analyses of message content with hashtags included revealed that the largest cluster of terms by account type was brand promotion (commercial), brand engagement (community), and youth social use of JUUL and other substances, such as marijuana (organic users). On removal of hashtags, the largest cluster for each group was online and offline retailer promotion (commercial), JUUL promotion or shares of existing promotional content (community), and youth social use (organic users). Commercial accounts used hashtags to increase brand visibility and engage with vape communities present on Instagram. Community accounts served as discursive intermediaries between commercial accounts and organic users, fostering organic user engagement with brands. Social media serve as an extension of real-life peer groups among youth and young adults. Community accounts, which likely have greater credibility among users compared to commercial accounts, may help enhance the effects of targeted promotion and normalize vaping comprehensive regulation of commercial digital tobacco marketing is necessary to reduce the amount of commercial content youth and other consumers are exposed to through overt commercial and influential community accounts.

Keywords
social media, semantic network analysis, advertising and promotion

Introduction
Electronic cigarette (e-cigarette) and vaping product vendors often employ innovative methods of “social selling,” which include native advertising, sponsored electronic word-of-mouth, and social media influencer promotion (Czaplicki, Kostygina, et al., 2020). For young people, social selling is of particular concern given that youth (i.e., children aged 12–17 years) and young adults (i.e., individuals aged 18–24 years) heavily use social media (Smith & Anderson, 2018), and are highly susceptible to social and peer influences (Brown & Anistranski, 2020). Due to the fact that social media facilitate social connections, these platforms can shape social norms around risk behaviors, such as tobacco use (Hebert et al., 2017; Jackson et al., 2018; Litt & Stock, 2011; Pokhrel et al., 2018; Salimian et al., 2014). Recent evidence suggests that youth exposure to e-cigarette-related social media content is significant and may lead to product use among both youth and young adults (Jackson et al., 2018; Kim et al., 2019; Majmundar et al., 2021; Pokhrel et al., 2018; Sawdey et al., 2017).

The limited regulatory guidance on social media promotion of tobacco and e-cigarette products in the United States...
has allowed the vaping industry to aggressively market innovative products to youth (Pokhrel et al., 2018). While the paid commercial advertising of nicotine or tobacco products may be restricted on social media and the platforms claim to self-regulate and monitor promotional content, commercial accounts and branded community accounts are present on social media and the platform-based self-regulations appear to be minimally enforced, with nicotine and tobacco-related commercial content still common on social networking sites (Czaplicki, Tulsiani, et al., 2020). In recent years, the amount of e-cigarette- and vaping-related content on social media has increased exponentially (Huang et al., 2019). This growth rate has also coincided with the rapid rise in vape product use among American youth, where current e-cigarette use increased by 78% among high school students and 48% among middle school students from 2017 to 2018 (Gentzke et al., 2019). Although the rates of use have recently declined, in 2020 one in five high school students still used an e-cigarette in the past 30 days (Gentzke et al., 2020).

One product that largely accounts for the initial increase in youth e-cigarette use is JUUL—high nicotine, U-shaped cartridge or pod-based e-cigarette (U.S. Department of Health & Human Services, 2018; U.S. Food & Drug Administration, 2018; Vallone et al., 2019). Since its launch in 2015, JUUL has dominated the e-cigarette market (Herzog Administration, 2018; Vallone et al., 2019). Since its launch in 2015, JUUL has dominated the e-cigarette market (Herzog Administration, 2018; Vallone et al., 2019) and JUUL-related content on social media is abundant (Allem, Dharmapuri, Unger, & Cruz, 2018; Huang et al., 2019; Kavuluru et al., 2019). Studies investigating JUUL-specific content found that posts or videos frequently highlighted JUUL’s appeal (e.g., sleek design, flavors), offered promotional deals (e.g., user-tagging for discounts), and reflected JUUL’s integration into youth culture (e.g., use at school, cartoons/memes), and vape-specific communities (Allem, Dharmapuri, Unger, & Cruz, 2018; Huang et al., 2019; Kavuluru et al., 2019).

Youth are exposed to JUUL and other e-cigarette-related social media content through a variety of sources. These include commercial brand and brand influencer accounts, retail vendor accounts, and vaping community or advocacy group accounts, and organic posts made by peer network members (Allem et al., 2017; Jackler et al., 2019; Pokhrel et al., 2018). Although there are several studies that investigate the type of tobacco-related content posted on social media platforms (e.g., product reviews, commercial promotions, and social posts) (Chu et al., 2016; Huang et al., 2014; Lee et al., 2017), and one study categorizing sources of a sample of posts with #eliquid and #juice references on Instagram (Laestadius et al., 2019), there has been no comprehensive research investigating similarities and differences between the amount and type of content posted by different types of social media users, including organic users. A social network analysis of the types of messages shared within and across different types of accounts—namely, commercial, community, and organic accounts—could shed light on the extent to which youth (organic accounts) interact with and are influenced by content posted by commercial accounts. This is important because, while it is impossible and undesirable to regulate content posted by regular social media users, there is strong precedent for regulating youth-targeted tobacco promotions, along with limiting promotional strategies that appeal to youth (National Association of Attorneys General, 1998).

One particularly useful type of social network analysis approach is computational semantic network analysis. Unlike traditional content analysis which depends on researcher-designed coding categories, (Krippendorff, 2018) computational semantic network analysis uses the natural language of the text to explore emerging concepts (Eddington, 2018). Software extracts clusters of highly interconnected terms and detects nodes or terms with the highest degree centrality (i.e., largest number of links with other nodes or terms in the network) (Atteveldt et al., 2008; Carley, 1997; Danowski, 1982; Diesner, 2012; Doerfel, 1998; Jang & Barnett, 1994). Semantic network analysis, therefore, differs from word-count content analysis because the meaning extracted from texts is not explicitly based on the presence of certain words but is revealed by the relationships among words (Carley, 1993).

In addition, semantic network analysis can account for how social media platforms themselves partially determine the flow of information through social sharing mechanisms, including hashtags (e.g., #juul) (Meraz & Papacharissi, 2013). A hashtag is a word or a series of words that can be used to signify a brand, concept, event, location, emotion, or phrase. They serve as content markers that allow users to tag their message as belonging to a current discussion or issue, affecting both the searchability and visibility of posts (Hodson et al., 2018; Page, 2012; Stathopoulou et al., 2017). Prior research found that hashtags are frequently used to publicize products, invite discussion, label opinions and events, mobilize action, and signify relationships (e.g., group membership, shared lifestyle interests) (Jeffares, 2014). Hashtags enable communities to emerge and form quickly in response to a particular social event or topical issue (Bruns & Burgess, 2011). As scholars have argued, hashtagging on social media platforms serves as a folksonomy, and unlike a traditional taxonomy, a folksonomy is always in the process of being created and updated by users (Highfield & Leaver, 2015; Mathes, 2004). Others identified six motives of hashtag use on Instagram: self-presentation, chronicling, inventiveness, information-seeking, venting, and etiquette (Erz et al., 2018). Hashtags are also important features in the algorithms’ social media platforms use to feature trending topics and deliver posts targeted to a user’s interests.

In the current study, we analyze the semantic networks of JUUL-related messages on Instagram, a social media platform popular among young people (Pew Research Center, 2018). This platform can provide unique, valuable insights into the promotional strategies used to popularize electronic cigarettes among youth and young adults, and engagement with this content. It is also of particular interest due to high visibility and popularity of JUUL-related Instagram accounts at the time of
the exponential growth of the brand (Czaplicki, Kostygina, et al., 2020). We assess which terms co-occur most frequently to form distinct concept clusters in posts made by three different account types (commercial, community, and organic) that could influence youth exposure to pro-tobacco content. Furthermore, we examine differences in the content posted by different user groups when hashtags are removed. Comparative analyses can help elucidate hashtag use strategies and identify patterns in how branded, commercial accounts employ unstructured conversation and message design strategies versus community and organic users. Thus, we characterize the underlying information sharing tactics that brand and retailer accounts use to communicate JUUL-related information and analyze how community and organic users engage with such content. Results can inform tobacco control strategies to regulate e-cigarette promotion on social media.

Methods

Data Collection

Hashtag-based keyword queries were used to collect JUUL-related posts from the Instagram application programming interface (API) through NUVI, Inc., a licensed syndicator of the Instagram firehose. A previously described set of 50 search terms was used to retrieve data from 1 March 2018 to 15 May 2018 (Czaplicki, Kostygina, et al., 2020). The final analytical dataset includes 14,838 JUUL-relevant posts by 5,201 unique users.

Due to API restrictions for Instagram data acquisition, commentary or replies to the primary posts were not included in the total message volume count. Search rules were constructed by identifying potentially relevant hashtags using Websta.me Instagram analytics website, prior literature, and research team expert consensus based on knowledge of JUUL-related terminology and brands. Sample hashtag search terms included #juul, #juuling, #juulvapor, #juulpod, #switchtojuul, and #juulgang. All posts by the official JUUL account (@juulvapor) and JUUL-related accounts with the highest number of followers at the time of data collection were collected (e.g., @juulcentral, @juulnation, @juul_university, @juul.girls, @juul.tv). Further information on the data collection, preparation, and cleaning process is available elsewhere (Czaplicki, Kostygina, et al., 2020).

Account Type Coding

The current study identified three account types: commercial, community, and organic users. Commercial accounts were operationalized as accounts affiliated with the retailer, promoter, or manufacturer of pod-based vaporizers, including JUUL, or attempting to sell JUUL-related products (i.e., posting branded promotional messages; URLs linking to commercial websites; hashtags indicating affiliations with commercial sites, for instance “Tag a friend that lost their JUUL this weekend. Devices on sale for only $29.99 for a limited time! #juul #gojuul #juulgang #juulnation #juulcentral #doit4juul #doit4state #kangertech #kanger #aspirebreeze #aspirebreeze2k #fire #firevape #bovaping #bovapingus #smokeshop #vapor #vaporshop #smokeshop #sorin #sorinair #sorinairdrop #bouldervape #nrsalt” by @gojuul). Community accounts were defined as accounts that advocate for JUUL use, vaping generally, or promote juuling/vaping as a lifestyle or recreational activity, are not identifiable as an individual person, but rather refer to group behavior or peer groups generally (e.g., JuulGang; doit4Juul, vapelife, etc.). The remaining accounts, including Instagram users identifiable as individuals and non-commercial entities, were labeled as “organic,” non-affiliated account users. Two members of the research team with expertise in e-cigarette-related research reviewed and manually coded 5,201 Instagram accounts for user type. Robotic accounts ("bots") or accounts posting messages automatically were not excluded from the analysis and were categorized as commercial users, as these accounts were predominantly used to promote product sales. After coding the initial overlap sample of 100 posts, the two coders discussed and resolved any discrepancies in the ratings to insure consistency. The agreement scores were calculated using Krippendorff’s alpha based on the ratings of posts by a random sample of 75 double-coded accounts drawn on completion of coding the dataset (α = .92; the agreement was 94.7%) (Krippendorff, 2011).

Semantic Network Analysis

The unit of analysis of this study was the text in the primary JUUL-related Instagram post. Each primary post on Instagram contains a visual and a textual component. While images were not included in the semantic network analysis, a qualitative analysis of the images was conducted during the data cleaning and classification stage of data preparation to inform the semantic network analysis approach, namely the images were used to help attribute the posts to commercial, organic, or community-related content and understand the messages in more detail (e.g., memes, cartoon references, cross-promotion with specific brands and products) (Czaplicki, Kostygina, et al., 2020). We used Wordij 3.0 and NodeXL Pro to conduct semantic network analyses of these texts. Network statistics were analyzed to determine which words occur most frequently and which terms co-occur across all posts (overall) and for posts within each of the three account types (commercial, community, and organic). In this study, nodes represented salient terms based on the frequency of occurrence. Links were based on co-occurrences or connection between nodes within a three-term distance. Each node was assigned a measure of centrality and degree centrality. Centrality measured a node’s position in the network, including how frequently that concept occurred within the corpus of posts (Freeman, 1977; Monge & Contractor, 2003). Centrality, therefore, denotes the power of a word in all posts by a user group (Knoke & Yang, 2008).
Degree centrality was the sum of a node’s total number of links with other nodes within the set of posts, signifying a node’s overall connectivity within the network.

Next, we used NodeXL and Gephi to conduct cluster analyses which identified the main clusters of nodes around a focal concept. Clusters are formed based on the similarity between every pair of words in the dataset. Cluster analysis grouped network nodes into subsets where the nodes were relatively similar in their position within the network (Aldenderfer & Blashfield, 1984). In this analysis, we employed hierarchical cluster analysis technique, which used multiple measures of the network’s structure to prevent biased interpretations based on the use of a single measure. To characterize the discursive functions of hashtags in commercial, community, and organic JUUL-related content on Instagram, we ran analyses with and without the inclusion of hashtags. Discrete analyses of non-tagged content allowed us to explore the themes of the more “unconnected” narrative of each post and contrast it with the relatively more rigid hashtagged content.

Gephi was used to visualize the cluster networks of the top 100 nodes with the highest degree centrality across all posts and for posts within each user group. Any nodes that ranked lower than 100 were not included in the visualization. Colors highlighted each unique cluster of terms in the network and the font size of each node increased or decreased based on the number of direct ties between that node and other nodes in the network. The width of the links—or lines between co-occurring words—was thinner or thicker based on the frequency of co-occurrence between a pair of terms. For the overall cluster analysis and analysis by account type, we present the network images (with and without hashtags).

Data from the most active account (@thebombestheadshop) were excluded from the semantic network analysis since this account posted nearly four times as many messages (794 posts over the period of data collection) as the second most active account in the dataset (@juulcentral with 202 posts over the same time period). The account, @thebombestheadshop was an outlier frequently posting a large number of repetitive commercial posts. In particular, one message (“We are known for our amazing sales and quality glass! The Bomb Head Shop has a wide selection of smoking accessories for every preference. NO OTHER SHOP IN COLORADO HAS DEALS LIKE US! #DETOX #HEADSHOP #BESTGLASSINDENVER #HATPINSHATS #BLUNTS #SMOKE #JUUL #VAPE #420onthe-block #denverciviccenter”) appeared in every post by this account. We excluded this account’s data to help avoid bias in identifying the most prominent themes, patterns of term co-occurrence, and clusters of commercial content across other commercial account.

Results

Two trained coders manually coded the Instagram accounts for user type and reached high agreement (Krippendorff’s alpha > .9). Of the 5,201 users posting JUUL-related content during the study period, 1,360 (26%) were labeled as commercial. Approximately 467 users (9%) were identified as community accounts, and the remaining 3,374 (65%) were labeled as organic users.

Table 1 presents the most active Instagram accounts posting JUUL-related content during the time of data collection. These included commercial or vape retailer accounts (e.g., @thebombestheadshop [excluded from analyses], @vaporandrew, @dashdrips, @jellyfishshdrawms), JUUL community accounts (@juulcentral, @juulbuzz, @juul.tv, @juul_gang_shit XXX[redacted]), and community accounts posting popular youth-related memes, including JUUL-related memes (e.g., @sendzone). In Supplementary Table 1, we list the top 10 co-occurring words in each cluster analysis (with and without hashtags). The three most frequently mentioned terms were similar across communities for hashtagged content, for example, #juul, #vape, and #juulvapor; thus, these hashtags were used as a common thread across account types.

| Username                | Account typea | No. of posts |
|-------------------------|---------------|--------------|
| 1 thebombestheadshop    | Commercial    | 794          |
| 2 juulcentral           | Community     | 202          |
| 3 juul.buzz             | Community     | 160          |
| 4 vaporandrew           | Commercial    | 144          |
| 5 jellyfishshdrawms     | Commercial    | 123          |
| 6 sendzone              | Community     | 121          |
| 7 juul.tv               | Community     | 120          |
| 8 uncles.sweary.balls   | Community     | 116          |
| 9 juul_gang_shit        | Community     | 114          |
| 10 dashdrips            | Commercial    | 91           |
| 11 vapersandpapers      | Commercial    | 86           |
| 12 javapeslounge        | Commercial    | 85           |
| 13 marinavape           | Commercial    | 77           |
| 14 exhale_auburnhills   | Commercial    | 75           |
| 15 zorak.meme           | Community     | 74           |
| 16 artisanvaporconoblesville | | 70           |
| 17 jillvape             | Commercial    | 70           |
| 18 eonsmoke             | Commercial    | 65           |
| 19 salt.nic             | Commercial    | 62           |
| 20 juulphase            | Community     | 59           |
| 21 myjuulwrap           | Commercial    | 57           |
| 22 bovaping_us          | Commercial    | 55           |
| 23 duuljuul             | Community     | 55           |
| 24 uptowntech_deming    | Commercial    | 54           |
| 25 juulskins            | Commercial    | 49           |
| 26 juulvapor            | Commercial    | 47           |
| 27 vape_life_videos     | Community     | 47           |

*Commercial accounts were defined as accounts affiliated with the retailer, promoter, or manufacturer of pod-based vaporizers, including JUUL, or attempting to sell JUUL-related products. Community accounts were defined as accounts that advocate for JUUL use, vaping generally, or promote juuling/vaping as a lifestyle or recreational activity and refer to group behavior or peer groups generally.
Several meta-themes emerged across account types: brand promotion (including JUUL brand promotion, JUUL brand engagement, JUUL brand memes—highlighted in orange color across groups), vape community-related content (blue color), youth-related content (green color), and salt nicotine and flavor promotion (pink color). However, these meta-themes were expressed differently within groups; distinct topics emerged as well.

Overall Networks

Figure 1 presents the network analysis of all JUUL-related content across accounts. The cluster analysis of hashtagged content identified three major semantic clusters. Cluster I (network nodes and ties highlighted in green) depicted youth- and general tobacco and marijuana-related content, where terms, such as “memes,” “CBD” (e.g., justcbd), and other “mods” or vape products (e.g., #phix) were central. Specifically, messages referencing “memes” often contained cartoon references and references to youth-related settings, such as “school” (e.g., schoolidol, collegeparty), Cluster II (orange color) focused on the JUUL brand and JUUL-specific communities, and terminology related to product characteristics (e.g., juulpod, juulgang, juulvapor, juulnation, kit, and saltnic). Cluster III (highlighted in blue) centered around general vape communities (e.g., vapelife, vapenation). In the network map of hashtagged content, the vape community terms in Cluster III served as discursive intermediaries between the youth-related content (Cluster I) and commercial content (Cluster II).

In the analysis of non-tagged content, the largest cluster (Cluster IIA, orange color) related to JUUL-specific promotion and engagement, followed by online or offline retailer promotion (Cluster IIA, lavender color), a cluster related to JUUL accessories (Cluster IIIA, mauve nodes and ties), and smaller clusters on nicotine (Cluster IVA, highlighted in pink), and flavors (Cluster VA, teal color). The list of top terms by semantic cluster and corresponding degree centrality scores (with and without hashtags) across all accounts are presented in Supplementary Table 2.

Semantic Analysis of JUUL-Related Content by Account Type

Content With Hashtags. Figure 2 displays the semantic network analysis of JUUL-related content with hashtags included for commercial, community, and organic accounts. In the analysis of commercial account content with hashtags, the largest cluster of terms was related to JUUL brand promotion (Cluster C-I, orange color), followed by cross-promotion of JUUL to users of other tobacco products and marijuana (Cluster C-II, highlighted in red), general vape community engagement (Cluster C-III, blue color), and language referencing giveaways and links to retailers (Cluster C-IV, not visualized). In the analysis of hashtagged community account content, brand engagement, which included brand-related terms and calls to “follow,” was the largest semantic cluster (Cluster CMTY-I, orange color), followed by a cluster of terms related to salt nicotine and youth (Cluster CMTY-II, pink color), general terms related to vape communities (Cluster CMTY-III, highlighted in blue), and vaping in-crowd/encouragement of overconsumption (Cluster CMTY IV, khaki color). In the analysis of organic content with hashtags, the largest cluster was use of JUUL by youth in social contexts and co-mentions of use with other substances, such as marijuana and alcohol (Cluster O-I, green color), followed by vape communities and lifestyle
(Cluster O-II, blue color), memes (Cluster O-III, highlighted in orange), and user engagement and “other” product-related terms (e.g., marijuana, other JUUL-compatible vape products; Cluster O-IV, olive).

Figure 3 depicts the analysis excluding hashtags for each of the three account groups. On removal of hashtags, the largest cluster for commercial posts was related to online and offline retailer promotion (Cluster C-I, navy color), followed by nicotine and flavor-related promotion (Cluster C-II, highlighted in pink), JUUL accessories (Cluster C-III, orange color), and physical/offline retailer locations (Cluster C-IVA, not visualized). The largest cluster for community accounts with hashtagged content removed was JUUL sales and promotion (Cluster CMTY-I, navy color) followed by brand user engagement (e.g., follow, tag, post; Cluster CMTY-II, highlighted in orange), and other salt-based nicotine vaporizer brands, such as Suorin (Cluster CMTY-III, pink color). Without hashtags content, three meaningful clusters emerged among the organic accounts: promotion and youth social use (e.g., happy hour, flavors, Cluster O-I, purple color), brand engagement (e.g., follow, post, repost; Cluster O-II, dark gray color), and flavors and nicotine (Cluster O-III, pink color).

The list of top terms by semantic cluster (with and without hashtags) for commercial, community, and organic accounts are presented in Table 2. While some of the hashtags that emerged in the top clusters across groups were the same, their discursive function appeared to be different within each group. For instance, #juulgang hashtag clustered with brand promotion-related terms in the posts by commercial accounts (Cluster C-I); with new brand engagement/follower recruitment terms in the posts by community accounts (Cluster CMTY-I); and with JUUL meme-related terms in the messages by organic accounts (O-III) (Table 2). The centrality scores for the terms used by commercial, community, and organic accounts (with and without hashtags) are presented in the Appendix (Supplementary Tables 3–5, respectively).

Discussion

Our cluster analyses revealed distinct differences in the most prominent concepts discussed based on whether posts were made by commercial, community, or organic accounts and whether hashtags were included in the analysis. When analyses included hashtags, the largest cluster of terms for commercial accounts related to brand promotion, while brand
engagement was more prominent for community accounts. For organic users, social use of JUUL alone or with marijuana and alcohol was the most dominant concept cluster. On removal of hashtags, the predominant clusters across account types remained similar signifying the importance of these respective topic areas for each user group.

While previous research has documented the importance of hashtags to publicize retail products, invite discussion, or signify group membership (Jeffares, 2014), our findings document how hashtags amplify JUUL- and vape-related commercial brand engagement among organic users. In this study, we found that commercial accounts primarily used JUUL-related hashtags to increase brand visibility and integrate or engage with vape communities on Instagram (e.g., juulnation). At the same time, organic accounts used JUUL-related hashtags to denote belonging to a vape lifestyle community (e.g., vapelife) or social group (e.g., juulnation), which is consistent with prior research (Allem, Dharmapuri, Leventhal, et al., 2018). Community accounts (e.g., juulcentral), which may be viewed as more authoritative and credible sources of information versus direct commercial accounts (Lin et al., 2016), served as intermediaries between commercial accounts and organic users and used hashtags to foster organic user engagement with the brands while promoting lifestyle- and group-based affiliations.

While we found that the dominant concepts discussed across all account types related to promotional content, another prominent semantic category was youth and vape lifestyle-related content, (e.g., vaping lifestyle communities). This finding aligns with a prior analysis of JUUL-related Instagram content during the same study time period using a content analysis approach (Czaplicki, Kostygina, et al., 2020).

The prominence of community-generated promotion of JUUL products on Instagram highlighted in this study suggests that commercial accounts have developed successful
mechanisms to integrate promotional vape-related content with non-commercial accounts. Importantly, such integration could engage and recruit new organic users, particularly through incentivized friend-tagging and repost requests. Studies have documented the use of friend-tagging to receive a product discount or engage with other users around vape-related behavior, suggesting this is a powerful mechanism to connect individuals to vape-related content (Allem, Dharmapuri, Unger, & Cruz, 2018; Czaplicki, Kostygina, et al., 2020). Comprehensive regulation of commercial tobacco-related content, including restrictions on commercial friend-tagging, could reduce electronic word-of-mouth and subsequently reduce community- and organic user-generated promotion of nicotine and tobacco products on social networking sites.

Limitations

There are several limitations to this study. Although comprehensive, this list of search terms used to capture JUUL-related posts may not have captured the full universe of JUUL-related content on Instagram during this time period. In addition, Instagram no longer provides data on the number of followers and level of influence at the account level and we were limited in our ability to quantify the reach of cluster content across account type. This study also conservatively defined commercial accounts and did not categorize the presence of paid social influencer accounts, limiting our ability to categorize the dominant content discussed among influencers and how it related to other account types. Finally, we conducted a cross-sectional analysis of the semantic networks of JUUL-related content across account types. Results may not generalize beyond the period of 1 March to 15 May 2018.

Overall, findings from this study provide further evidence of the importance of Instagram for e-cigarette and other nicotine product promotion and offer insight into the marketing strategies used by commercial entities to reach and engage with organic users. This study makes an important contribution to the understanding of the social media discourse during the exponential growth of JUUL brand, coinciding with the rapid increase in vaping prevalence among youth. Although JUUL no longer maintains an official Instagram account (Scutti, 2018) and stopped advertisements targeting individuals aged below 21 years in states, such as North Carolina (Robertson, 2021)—in part due to research documenting how their social media activity could be attractive to young people and in part due to lawsuits alleging youth targeting through social media advertisements (Becerra, 2019; Brnovich, 2020; Ferguson, 2020; Healey, 2020; James, 2019; Miller, 2019; Racine, 2019; Raoul, 2019; Shapiro, 2020; Stein, 2019)—what we learn from the JUUL phenomenon during this time period may inform future intervention and regulation strategies to help prevent tobacco and nicotine marketing exposure among young people.

In addition, vaping communities analyzed in the study and their communication strategies are likely not unique to JUUL, and the study findings are likely generalizable to other brands. The strategies that were used to promote JUUL transformed the social media and tobacco use landscape in the United States and globally. Findings from this study can inform surveillance and regulatory efforts and can be applicable to promotion and normalization of other tobacco or nicotine products or harmful substances. Overall, this study helps understand the role of communities in propagating and popularizing vaping-related content. Intermediary community accounts likely have greater credibility among the target audience versus overt promotional messages posted by brands or vendors. Without branded content, however, the role of the intermediaries may be less effective. Comprehensive regulation of commercial digital tobacco marketing is necessary to reduce the amount of commercial content youth, and other consumers are exposed to through overt commercial and influential community accounts.

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Supplemental Material

Supplemental material for this article is available online.

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Barbara Schillo, PhD, is a Senior Vice President, Schroeder Institute at Truth Initiative in Washington DC, where she provides leadership for research that examines the impact of tobacco-related policies on youth and young adults. Her research interests focus on research that advances tobacco control policy and practice, including tobacco taxes and local and state point of sale restrictions.