

# Social Media Content Analysis of Electronic Cigarette Information: Implications for Public Health Ethics – A Brief Report

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**Abstract:** *The purpose of this study was to conduct a social media analysis on content related to electronic cigarettes, especially the validity of the information, audience engagement, and emergent ethical issues of health and related information on such a platform. Our results show a majority of the videos on social media platform analyzed were from individuals or organizations for marketing purposes, thus demonstrating a significant gap of needed public health driven content.*

*We further present unique characteristics of popular videos, such as duration, comments, and like to dislike ratios that public health program can mimic to gain acceptance for anti-tobacco initiatives. The lack of information regulation on validity further raises several ethical concerns and we provide recommendations for actions to ensure the audience of such social media platform receive experience an-unbiased view of electronic cigarettes and associated outcomes.*

**Keywords:** *E-cigarettes, social media, misinformation, ethical implications*

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## I. BACKGROUND

Each year, over 480,000 deaths in the United States are attributable to cigarette use (1). Further, even though tobacco use is the largest preventable cause of death and disease in the United States, the Centers for Disease Control and Prevention (CDC) reports that 40 million adults smoked cigarettes each year in the nation, with majority of adult smokers reporting initiation of smoking at the age of 18 years old. In addition, each day more than 3,800 youth smoke their first cigarette, and 2,100 young adults become daily smokers (1-4). Additionally, smokers are more likely to develop chronic diseases such as stroke, lung cancer, and heart disease as compared to nonsmokers (3). Such outcomes associated with cigarette smoking are often the driving factor for many smokers attempting to quit or utilize another means of tobacco product as a way of lowering cigarette use and address nicotine withdrawal. In recent years, electronic cigarettes have become popular globally as one such cigarette alternate (5).

Electronic cigarettes are devices that deliver a vapor to users by heating a solution of propylene glycol, with nicotine, and different flavoring agents (5,6). The device was invented in China in the early 2000s, and the rapid market penetration of electronic cigarettes has made them a global sensation (5, 7). Although the long-term effects and safety electronic cigarettes is not fully determined, it has been suggested that electronic cigarettes are healthier than cigarettes; because they deliver fewer toxins and carcinogens into the body (8). This is why it can function as a smoking cessation product, and as a substitute to smoking cigarettes (6). The prevalence of adults using electronic cigarettes in the U.S. has and the utilization of electronic cigarettes have also doubled among the youth (8, 9). Further, while some youth that have never smoked tobacco cigarettes before, are actually experimenting with electronic cigarettes. For example, a report noted that in 2012, 20.3% of middle school students, and 7.2% of high school students reported that they use electronic cigarettes, but have never smoked a conventional cigarette (6). Furthermore, dual use of electronic cigarettes and cigarettes has also been popular. For example, among daily adult smokers in America, 30% of them use electronic cigarettes along with conventional cigarettes daily or occasionally (8). In 2011, 61% middle school students, and 80% high school students were reported to be dual tobacco, and electronic cigarettes smokers. Despite such increasing prevalence of electronic cigarettes utilization, research is limited and thus, long-term epidemiologic studies on biological effects of electronic cigarettes are limited as well (6).

In addition, the main ingredient in electronic cigarettes which is propylene glycol can cause respiratory and eye irritation, and literature suggests that the spleen and central nervous system may be affected by prolonged inhalation of propylene glycol in industrial settings (6). It has also been demonstrated that switching from conventional cigarettes to electronic cigarettes leads to a near-normalization in toxic levels of exhaled carbon monoxide, and positive changes occur in the measure of obstruction in the peripheral airways (10).

The different e-liquid flavors that are present in electronic cigarettes have attracted this product to adolescents and teenagers (6). Without strict Food and Drug Administration (FDA) regulations on electronic cigarettes, advertising and promotion of them have been easily accessible and highly promotable, especially on the internet and social media networks. For example, YouTube has been a major outlet for millions of viewers (regardless of age) to watch reviews, opinions, and experiences of tobacco products, including electronic cigarettes (11-14). As such, the purpose of this study is to evaluate electronic cigarettes promotion on social media such as YouTube, as well as highlight the lack of regulation of content, misinformation and the ethical concerns that arise as a result. We aim for the results of this to provide the foundations for informed public health decision-making and electronic cigarettes prevention strategies.

## II. METHODS

Videos using the search terms, "vape", and "e cigarette" were retrieved from the search engine, YouTube.com. We selected the most popular videos that had over 100,000 views and Non-English videos were excluded for selection. All of the videos were categorized numerically by views, and organized into the following categories: 100k-200k, 200k-300k, 300k-400k, 400k-500k, and 500k+ views.

The information that was collected for the randomly selected videos consisted of: the name of the video, link, type of video (info/critique, health, News/promo, advertisement, tutorial, review, self-upload with electronic cigarettes product use, demonstration), duration of video, date of posting/upload, number of views/likes/dislikes, # comments, type of poster (individual, television, news cast, market, company), additional information, and search term used. A total of 216 videos were randomly selected and analyzed based on: the name of the video, link, search term used, and the number of views.

### III. RESULTS

Upon randomly selecting a video from each viewership category, a total of 51 YouTube videos were included in the study analyses. Our results demonstrate several key characteristics of the videos present and analyzed on YouTube (Table 1). The average length of the video were approximately 359 seconds while the average number of videos was 399,832 with average number of comments found to be 16.6 per 10,000 views. Rate of likes were higher (nearly 32 per 10,000 views) as compared to rate of dislikes (3 per 10,000 views). The primary source of videos on electronic cigarettes was individual posting (nearly 69%) and was for marketing and/or promotional purposes (78%).

Table 2 shows the results of bivariate analyses for continuous variables. Spearman correlation analysis showed positive length of video to be positively correlated with rate of comments ( $r_s = 0.315$ ,  $p = .031$ ) and rate of likes ( $r_s = 0.475$ ,  $p < .0001$ ). Such analysis further demonstrated a negative correlation between number of views and like to dislike rate ratio ( $r_s = -0.302$ ,  $p = .033$ ). In addition, Spearman correlation analysis also showed a positive correlation between rate of comments to that of rate of likes and dislikes, while the like to dislike rate ratio did not yield significant result.

Mann-Whitney U analysis found that rate of comments was significantly ( $p = .039$ ) higher for videos posted by individuals, as compared to those posted by non-individuals (median rate of comments = 14.11 per 10,000 vs. 4.22 per 10,000). Figure 1 further shows the difference in distribution of mean ranks of rate of comments between video sources. Kruskal-Wallis test found a significant ( $p = .027$ ) association between median rate ratio of like to dislike and video type. Highest rate ratio noted for promotional/marketing videos (median rate ratio = 10.77) and lowest for other (median rate ratio = 2.79), and with health-related videos reporting a median rate ratio of 8.56.

### IV. DISCUSSION

Electronic cigarette use is globally prevalent and has consistently seen an increase. Studies show that there remains immediate effect on health and well-being as a result of such tobacco use. Despite such negative burden, young adults continue to the use. The goal of this study was to assess whether a primary source of information for young adults, social media, played a role in information delivery. Our results have several key findings. First, we noted that majority of videos based were from individuals or organizations for marketing purposes. We also found unique characteristics of popular videos, such as duration, comments, and like to dislike ratios. As such, public health workforce aiming to create such social media content may keep such characteristics in mind when creating health literacy content on similar platforms. Similar studies on social media platform on different health topics have been conducted (11, 12). For example, another study assessing tobacco content on social media (11) found that the number of video content that promoted smoking was higher than those discussing the negative outcomes of smoking. Such results from the literature in combination with the results of our study highlight a key source of imbalance of information and more public health sources and social media content are needed instead.

Such social media-based tobacco marketing coupled with lack of validated information from public health sources, especially in popular social media platform, highlights key ethical issues in public health. As such, our study focused on the importance of social media's role in effecting user consumption of electronic cigarettes due to misinformation – such as down-playing the harms of electronic cigarettes and lack of regulation, and ethical concerns that arise due to the anticipated harm, since there is not enough information related to the harm associated with electronic cigarettes.

In the absence of conclusive evidence demonstrating the safety of electronic cigarettes on public health, ethical concerns arise whether to give consumers the perception that electronic cigarettes can be effective smoking cessation/alternative aid,

although research suggests that electronic cigarettes have been successful in helping people to quit smoking. Opponents of electronic cigarettes point out that giving people the perception that electronic cigarettes are less harmful without accurate information will only lead to an increase in non-smokers to adopt smoking and renormalize a public smoking culture that public health interventions have worked for so long to curb (13). Due to the novelty of electronic cigarettes, whose harm reduction potential is still unclear, it will be prudent to weigh benefits versus the risks associated with their availability and use (13).

Additionally, studies by Franck et al. (13) also point out that safety evaluations will require quantifying the degree of risk warranted in the face of incomplete evidence with which to inform decision-making. To justify the stand for promoting autonomy, currently the users are mostly people who are trying to quit smoking, and as such they need to be provided with information relevant to risks and benefits to make informed health decisions. However, as pointed out by Franck et al. (13), this argument in the favor for autonomy would significantly change if the demographics of smokers changed to an increase in the number of non-smokers taking up electronic cigarettes, to arguments in favor of weighing individual rights to greater public good.

The importance of regulating electronic cigarettes advertisement and marketing to broad audiences when it comes to implications of perceptions on the uptake of electronic cigarettes by both smokers and non-smokers have also been highlighted in the study mentioned above. As reflected by our study, social media portrayal of electronic cigarettes as less harmful can have implications on uptake of electronic cigarettes. Comprehensive advertising bans as suggested by Franck et al. (13), would likely minimize any perceived government endorsement of electronic cigarettes. Misinformation through inaccurate portrayal of risk is unethical and leads to the failure to provide adequate information to consumers to make informed choices, as well as deceitfully suggesting that smokers can continue smoking.

Given the lack of regulation on marketing of electronic cigarettes in the United States and the increasing exchange of electronic cigarette-related information online, it is critical to understand how electronic cigarette companies market electronic cigarettes and how the public engages with electronic cigarettes information (14). Moreover, as noted by studies (15), health information is commonly accessed online, especially through social media platforms such as Twitter, Facebook and YouTube, which allow users to generate and share content, with limited verification of accuracy. As pointed by the study, most of the content related to electronic cigarettes were either portraying electronic cigarettes as equally or more harmful or as completely harmless. Such misinformation has been suggested by studies as having influences on perception of harm and adult decision to purchasing electronic cigarettes. As Liu et al (16) and Suarez-Lledo & Alvarez-Galvez (17) point out, such misinformation can undermine public health efforts because misinformation is disseminated more quickly and widely than accurate information on the internet. They further highlight that it is difficult to categorize content on the internet as misinformation when the evidence around the health topic is inconclusive or if the way the content was communicated is unclear. Nevertheless, reducing exposure to such misinformation is challenging in both harnessing algorithms to alert users and to communicate ways to spot misinformation since this misinformation is not spread by bots only but also by human actions. There is a need for innovative health communication approaches that target misinformation and counter these using effective harm reduction and health promotion strategies. Social media companies such as Facebook, twitter and YouTube have a moral obligation to make sure users are protected, and they should increase the strategies which are already in use such as removing or blocking users with content identified as misinformation and encourage users to seek out their health information from official sources.

We agree with Thomas et al. (18) and Kozlowski and Edwards (19) that safety communications employed by tobacco companies need to uphold the components of business ethics, and provide, not just warnings about health risks, but also provide information that allows people to make decisions based on the degree of danger involved that allows for informed healthy decisions. Since electronic cigarette companies have a vested interest in maximizing the number of consumers, it then becomes the responsibility of the government to protect the public health interest and restrict the influence of industry through appropriate regulations targeting manufacturing and marketing.

## V. CONCLUSION AND RECOMMENDATIONS

Electronic cigarettes continue to be promoted on social media with limited regulation on content and source of information. We recommend interventions targeting product safety health literacy, and business ownership in tackling misinformation and urge electronic cigarette corporations to provide accurate information that is relevant to harm and the levels of harm related to their products (18). Studies have demonstrated that YouTube is an outlet that young people trust, and postings reveal a proliferation of user generated videos with misleading statements about the health consequences of various types of nontraditional tobacco use, thereby having more positive attitudes toward the featured products (20).

Although, most countries have some sort of regulations placed on internet contents to protect children from harmful contents, the US perceives restricting online interactions as violating freedom of speech and motivated by political reasons. Studies by Zheng (21) and Tan and Bigman (22) demonstrate that that social media plays a critical part in shaping risk perception of electronic cigarettes in the US. Zhang (21) emphasize the importance of regulation of online electronic cigarette advertisements, especially those that portray misinformation about the potential harm to the youth.

We agree with Albarrachin et al. (20), that social media platforms, in an effort to be the responsible businesses they are and to protect the youth and the public from potentially harmful contents, can screen the contents and restrict posts that contain misinformation. These acts can still help alleviate the misinformation generated and shared on the internet. Sidani et al. (23) note that Twitter provides an opportunity to examine misperceptions related to nicotine and addiction and their relevance to electronic cigarettes.

Novel cessation therapies that target both physiological and behavioral components of cigarette smoking can be critical in public health intervention strategies. Because electronic cigarettes look and feel similar to tobacco cigarettes is attractive to smokers, as such it is important to monitor health effects of electronic cigarettes and provide all the information that is necessary for consumers to make informed choices which include the different levels of harms associated with the various products, and this should be a step taken by electronic cigarettes and tobacco businesses as part of their business ethics, so people can trust them. Additionally, government agencies such as FDA and CDC should be known for being transparent so people can trust them and should disclose important comparative information that not only includes the risks associated with tobacco products, but also the degree of risks associated with different products such as electronic cigarettes compared to combustible cigarettes as part of public education so consumers can make informed choices (18).

**Table 1.** Description of video analyzed using YouTube

<b>Video characteristics</b>	
Length of video (seconds)	
Mean (SE)	359.41 (46.49)
Range	21-1482
Views	
Mean (SE)	399,831.45 (42,777.28)
Range	108,355-1,788,200
Comments	
Mean (SE)	529.40 (79.71)
Range	3.0-2802.0
Rate of comments, per 10,000 views (SE)	16.60 (3.76)
Likes	
Mean (SE)	1131.28 (180.23)
Range	23-6003
Rate of likes, per 10,000 views (SE)	31.97 (5.91)
Dislikes	
Mean (SE)	128.04 (22.75)
Range	1.0-`906.0
Rate of dislikes, per 10,000 views (SE)	3.00 (0.44)
Median rate ratio (like: dislike)	8.42
Video source, number (%)	
Individual	35 (68.63)
Company or other	16 (31.37)
Video type, number (%)	
Health related	7 (13.73)
Marketing/Promotional	40 (78.43)
Other	4 (7.84)

**Table 2.** Results of bivariate analyses of continuous variables

	Number of views	Rate of comments	Video length (sec.)	Rate of likes (per 10,000)	Rate of dislikes (per 10,000)	Rate ratio (like:dislike)
Number of views	1.000	-.086	-.178	-.047	.273	-.302
<i>p</i> value	.	.565	.211	.747	.052	.033
Rate of comments	-.086	1.000	.315	.565	.514	.155
<i>p</i> value	.565	.	.031	.000	.000	.298
Video length (sec)	-.178	.315	1.000	.475	.273	.261
<i>p</i> value	.211	.031	.	.000	.052	.067
Rate of likes (per 10,000)	-.047	.565	.475	1.000	.522	.622
<i>p</i> value	.747	.000	.000	.	.000	.000
Rate of dislikes (per 10,000)	.273	.514	.273	.522	1.000	-.256
<i>p</i> value	.052	.000	.052	.000	.	.073
Rate ratio (like:dislike)	-.302	.155	.261	.622	-.256	1.000
<i>p</i> value	.033	.298	.067	.000	.073	.

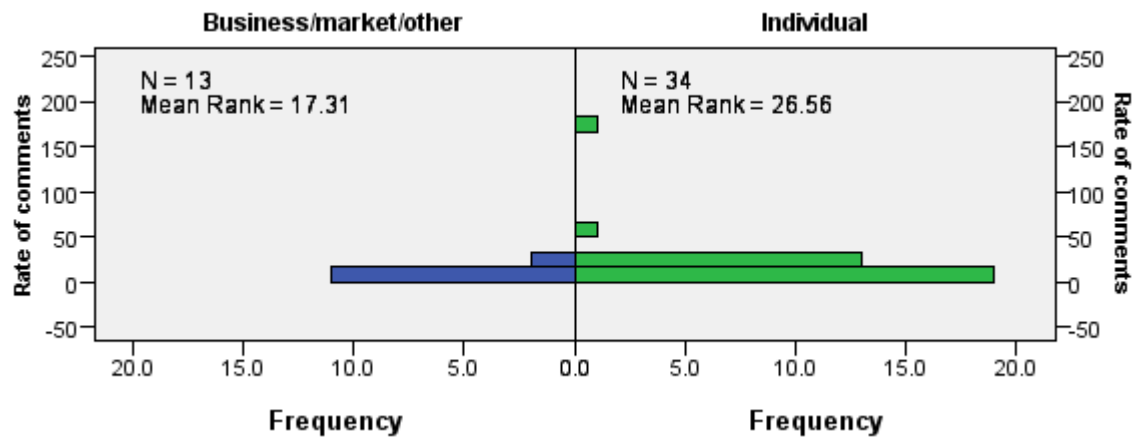


Figure 1. Distribution of mean ranks of rate of comments by video source.



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