



Vaping in the News: The Influence of News Exposure on Perceived e-Cigarette Use Norms

Hue Trong Duong  and Jiaying Liu

University of Georgia

ABSTRACT

Background: Research has documented the impact of descriptive norms on tobacco use, but few studies have investigated how media exposure shapes e-cigarette use norms.

Purpose: The purpose of this study was to examine how exposure to e-cigarette-related news articles shapes individuals' descriptive norm perceptions about real-world e-cigarette use.

Method: The study implemented an experiment with a 2 normative direction (high vs low prevalence) \times 2 exposure dosage (single vs double dose) between-subjects factorial design ($N = 298$). Analysis of variance and thematic analysis were conducted.

Results: Normative direction and exposure dosage of prevalence information contained in the news articles interacted to influence perceived descriptive norms. Increasing the dosage of prevalence information enhanced descriptive norm perceptions in low-prevalence conditions only. Participants relied on institutional signals and behavioral cues to infer descriptive norms when prevalence information was absent in the news.

Discussion: The study investigates the underlying mechanism of how news articles may influence normative perceptions.

Translation to Health Educational Practice: Given that news media may inadvertently form social norms that are conducive to e-cigarette use behavior, Health Educators should pay attention to descriptive norms emanated from the news media environment. They should also consider norm debiasing strategies and the integration of dosage of low-prevalence information into social norm messages.

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Background

Electronic cigarettes (e-cigarettes) are battery-powered devices that produce an aerosol by heating a liquid that usually contains nicotine and other chemicals. The behavior of e-cigarette use is referred to as vaping because e-cigarette users (or “vapers”) inhale and exhale aerosol or vapor instead of cigarette smoke. E-cigarettes are now the most commonly used tobacco product by youth in the United States.¹ Aggressive marketing strategies by tobacco companies on the Internet and social media promote e-cigarettes as a “harmless” and “cool” product replacement for conventional cigarettes, which is appealing to the younger population.^{2–4} Because of the inconclusive scientific evidence related to the impact of e-cigarette use on health risks,⁵ e-cigarette use has seen a heated debate among the scientific community and policymakers about how to regulate this new product.⁶ The controversy has triggered much media attention in recent years.⁷ The sheer number of media focusing on the e-cigarette debate may

inadvertently have a significant effect on media users through “social exposure”—a concept that describes the various ways in which people come in contact with a particular behavior that shapes their norm perceptions.⁸ Despite the assumption that mass media play a role in producing normative perceptions, research has so far mostly examined how interpersonal influences affect norm perceptions. Social norm researchers noted that other significant sources for the development of norms, including the mass media environment, have not sufficiently been researched, which undermines the understanding of the link between an individual's environment and the formation of social norms about a health behavior.⁸

The present research investigates how exposure to news articles about the controversy surrounding e-cigarette use may shape individuals' perceived prevalence of the behavior, namely, perceived descriptive norms.⁹ In particular, we examine this question among a sample of college students, who are increasingly using e-cigarettes.¹⁰ Scholars have

CONTACT Hue Trong Duong  hue.duong25@uga.edu  Department of Communication Studies, University of Georgia, 513 Caldwell Hall, Athens, GA 30602.

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called for considering college students as a distinct priority population due to their developmental context, needs, and community.^{11,12} According to the theory of normative social behavior (TNSB), perceived descriptive norms influence behavior.¹³ Accumulating studies have empirically documented the powerful impact of descriptive norms across behavioral domains and cultural contexts.^{14–17} Many social norms campaigns in the United States aim to promote positive behavior changes through readjusting individuals' biased descriptive norms related to the target behavior.¹⁸ Public health campaign messages utilizing normative appeals often craft messages by incorporating normative information that indicates either a low prevalence of an undesired behavior or the high prevalence of a desired behavior to encourage behavior changes through conformity to perceived norms in society.¹⁹

News articles often contain behavior prevalence statements with the goal of informing the public. In addition, because news is the product of a social institution, it may carry potential heuristic cues to normative perceptions.²⁰ However, compared to sophisticatedly crafted behavior change campaign messages with a clear intent to persuade, normative information in a news article is only part of its news content. Though effects of normative messages have been studied extensively in the context of persuasive communication,^{21,22} no study has examined how normative statements embedded in news articles, which are considered routine information sources, may influence individuals' normative perceptions. When examining the underlying mechanisms of normative formation, scholars focused heavily on the influence of movies and television rather than that of news.⁸ Moreover, there is also a lack of knowledge on the cues or sources that people rely on to infer descriptive norms in the general population in the absence of explicit prevalence information in news content. To address this gap, the present study aims to examine (a) whether news articles containing behavior prevalence information would affect readers' overall descriptive norm perceptions and (b) how perceived descriptive norms can be inferred from news articles that do not explicitly contain prevalence information. Because the link between perceived descriptive norms and behavioral intentions has been consistently established in the literature, the focus of the present study is on normative perception formation to contribute to norm-building theory. Despite the extant research on social norms theory, the sources of norm formation are insufficiently studied.⁸

Theory of normative social behavior

Social norms are broadly defined as social codes to guide a course of action that would be perceived as most beneficial, or what ought to be done, and typical

for individuals, or the prevalence of the behavior.⁹ Theorists distinguish these two types of norms as injunctive and descriptive norms. Injunctive and descriptive norms share similarities in that they are informational in nature and that they exist at both social and individual levels. At the individual level, social norms are perceived by individuals based on various social and behavioral cues. The conceptual distinction between the two types of norms is that injunctive norms involve social sanction, whereas descriptive norms do not.¹³

The TNSB theorizes the association between descriptive norms and behaviors with a focus on factors that influence this association.²³ Cognitive mechanisms, such as outcome expectations, group identity, impression management, self-efficacy, psychological involvement, and injunctive norms, have been studied as moderators in TNSB research. Researchers found the interaction effects between these variables with descriptive norms to influence various health behaviors.^{16,17,24,25} When controlling for these moderators, researchers found that the main effects of descriptive norms remain substantial for food consumption, drinking alcohol, and recycling.¹⁶ When the two types of norms are in conflict, researchers found that descriptive norms can outweigh injunctive norms to assert more influence on some risk behaviors.²⁶ Perceived descriptive norms were also found to positively correlate with the use of e-cigarettes among the college student population.¹² Clearly, the link between descriptive norms and behavior has been well established, which contributes to resolving the mixed results of social marketing campaigns that utilize the social norms approach on American campuses.²⁷

Critiques of TNSB research have been raised, including the methodological approach that is overly dependent on cross-sectional surveys and the lack of attention to norm-building processes.^{16,17,28} Simultaneously, researchers have suggested extending the theory by examining constructs accounting for how or where descriptive norms develop and change.²⁸ This extension adds depth to understanding normative influence, particularly regarding the relationship between communication variables and norm formation.⁸ The body of research on the social norms approach has indicated that descriptive norms are perceived upon the reception of information from interpersonal communication and mass media that convey unhealthy behaviors, such as drinking, smoking, and substance use.²⁹ However, the sources of social norms, particularly those related to the mediated environment, are insufficiently documented.⁸ In this study, therefore, we focused our investigation on the norm formation process, rather than on the well-documented link between norms and behavior.

The e-cigarette debate and media coverage

e-Cigarette use is currently one of the most divisive topics among the public health community.⁵ Proponents of e-cigarettes extol the product as an alternative technology with “harm reduction” in comparison to cigarettes.⁷ Specifically, promoters of e-cigarettes posit that e-cigarettes aid in smoking cessation and are less harmful. These arguments are broadly advertised in e-cigarette marketing.³⁰ Opponents, however, are skeptical of the long-term health consequences of vaping and are concerned that e-cigarettes may encourage smoking initiation by increasing nonsmokers’ chance of getting addicted to nicotine, particularly among young adults.³¹ Recent research found that vaping e-cigarettes may be positively associated with smoking,^{32,33} and the depiction of vaping in commercials increases the temptation to smoke.³⁴ Exposure to vicarious vaping behavior was found to be associated with potential renormalization of smoking among ever and potential smokers,¹⁰ which in turn leads to smoking-related chronic diseases. Moreover, recent research suggested that vaping may directly disable key immune cells in the lung and boost inflammation.³⁵

The debate about e-cigarettes, therefore, has spurred journalistic coverage at both the national and global levels. Inconsistent legal frameworks regarding e-cigarette use in different states in the United States, as well as among different countries, contributes to the salience of the e-cigarette debate in the news.^{36,37} Content analysis in UK and Scottish newspapers indicated a significant annual rise in news reporting about e-cigarettes.^{7,38} The findings revealed the divisive nature of the topic, largely due to inconsistent scientific evidence. Research in South Korea also showed a similar trend in e-cigarette news coverage.⁶ In the United States, researchers found that the majority of news articles about e-cigarettes were published in recent years, with 85% of the articles reporting e-cigarettes as neither favorable nor unfavorable.³⁹

The inundation of e-cigarette-related news in media has been found to predict news consumers’ attitudes and behaviors. For example, a recent study showed that information seeking in the media environment leads to a greater likelihood of e-cigarette experimentation among youth.⁴⁰ The results were attributed to the prevailing pro-e-cigarette information in the media environment and the discussion about comparative health risks between smoking and vaping. However, limited research has examined the influence of e-cigarette use prevalence information, which is frequently reported or depicted in news articles, on readers’ beliefs and perceptions. In addition, given the growing evidence of the overestimation of tobacco product-related descriptive norms and the association between perceived descriptive norms and e-cigarette use behavior,^{3,12,41} it is important to examine how the perceived descriptive norms surrounding

e-cigarette use were formed through media consumption. Considering that younger populations are at a development stage where they are particularly sensitive to normative cues in mass media⁴² and that the college-aged population has the most dramatic increase in risky behaviors and substance use,^{11,43} the present study aims to examine how college students’ descriptive norm perceptions are formed as a result of exposure to news articles reporting e-cigarette issues.

Purpose

The purpose of this study is to examine whether and how exposure to e-cigarette-related news articles shapes individuals’ descriptive norm perceptions about real-world e-cigarette use. In the section that follows, we discuss specific hypotheses and research questions.

Influence of media exposure on prevalence perceptions

The effect of normative messages in persuasion context on normative perceptions have been well documented^{21,22,44} but is insufficiently examined in news media. Social norm campaign messages often convey behavioral prevalence information with explicit summary statements, such as “the majority of college students do not drink when partying.”^{19,45} However, it is not yet known whether similar summary information embedded in news articles would produce a similar effect. Presumably, readers may process such normative information quite differently compared to an intentionally persuasive message in health campaigns. News articles, particularly those reporting scientifically contested health topics, are basically not produced for the purpose of persuasion but instead to inform readers. Journalists tend to report scientifically contested issues in an impartial manner and focus more on surrounding debates, as reviewed above, than making the prevalence information salient to users. Moreover, information processing theory suggests that media users may pay attention to only selected subsets of information that are available in media content.^{46,47} Because normative information included in the news is not saliently depicted as it is in social norm campaigns, it has to compete with various other types of information content conveyed by the news. For example, e-cigarette news stories have focused substantially on the progress of scientific findings and reactions of relevant organizations. Journalists also pay attention to legislative frameworks, tobacco companies’ responses, and health-related issues. Each separate issue conveyed in a single news article is therefore subject to users’ selective attention. It follows that there is a likelihood that

normative information is not retained and processed when people read news articles. It may then fail to influence users' normative perceptions. Even if people can recall prevalence information, their interpretations of social norms may be confounded by personal experience, surrounding environment, and pre-existing beliefs. Therefore, testing the effect of normative information embedded in news articles on readers' perceptions will contribute to norm-building theory in the context of routine mass media exposure.

H1: e-Cigarette news articles containing prevalence information on e-cigarette use will affect readers' perceived descriptive norms, such that those who read e-cigarette news articles that contain high-prevalence information on average will have significantly higher descriptive norm perceptions about e-cigarette use than those who read news articles that contain low-prevalence information.

To understand the absolute changes from the baseline produced by prevalence information, the following hypotheses are put forth:

H2a: Those who read e-cigarette news articles that contain high-prevalence information on average have significantly *higher* descriptive norm perceptions about e-cigarette use than those who read news articles that do not contain any explicit prevalence information.

H2b: Those who read e-cigarette news articles that contain low-prevalence information on average will have significantly *lower* descriptive norm perceptions about e-cigarette use than those who read news articles that do not contain any explicit prevalence information.

The exposure dosage of normative information

The focus theory of normative conduct emphasizes the importance of norm salience in affecting behavior.⁹ Considering the possibility that normative information embedded in news articles may be obscured by the richness of the news content, the present study also examines whether increasing the salience of normative information during information reception and processing influences perceived descriptive norms. Zillmann suggests that frequently activated cognitive schemata on social perceptions under conditions related to some level of ambiguity (in this case, perceived descriptive norms) may influence social judgments of an issue.⁴⁸ The literature in mass communication has indicated that news stories can affect the salience, or enactment, of a cognitive schemata depending on how much

news users have been exposed to.⁴⁹ In addition, health communication researchers have demonstrated that increasing exposure to consistent media messages influences the formation of perceptions and attitudes through learning and memorization.⁵⁰ Health campaigns that use mass media messages are advised to not only ensure audience reach but also sufficient frequency of exposure to influence the target audience.^{51,52} Therefore, increasing the exposure dosage of normative information in news articles is likely to enhance normative perceptions.

H3: News articles that include double doses of normative information have a greater influence on descriptive norm perceptions compared to their single-dose counterparts.

In addition, we are interested in understanding how normative directions and exposure dosage may interact to influence descriptive norm perceptions:

RQ1: Are there any interaction effects between normative directions (ie, high vs low prevalence) and exposure dosage (ie, single vs double dosage) in affecting descriptive norm perceptions about e-cigarette use?

The moderating role of behavior status

Research has found that future tobacco-related product use intention is associated with past smoking and vaping experience.^{34,53} Adolescents with experience in cigarette smoking and e-cigarette vaping were found to be more likely to use e-cigarettes than those with no experience.^{2,54,55} The influence of behavior status on perceived descriptive norms as a result of news exposure has not been examined in the literature. However, research has concluded that people's learning from news content is influenced by their engagement in making a mental connection between new information they receive from a media stimulus and information from past experiences that was already stored in their minds.⁴⁵ Advertising research has found that adolescents who experimented with cigarettes were more likely to attend to advertised tobacco products.⁵⁶ Thus, those who had experience of smoking and/or vaping may have an attention bias toward e-cigarette use normative information. In addition, previous smoking and vaping trials likely provide individuals with experiential knowledge about peer e-cigarette use prevalence through their interpersonal networks. Such experiential knowledge enables news users to engage in issue-relevant thinking,⁵⁷ which is likely to increase accessibility and recall of related behavioral information. Thus, the

current research attempts to determine whether ever vaping and smoking experience may moderate the news-induced descriptive norm perception formation.

H4: Ever vaping and smoking experience moderate the association between news exposure and perceived descriptive norms about e-cigarette use such that the descriptive norm perceptions produced by news content will be more pronounced among (a) individuals with ever vaping experience compared to those with no vaping experience and (b) those with ever smoking experience compared to those with no smoking experience.

Implicit normative cues conveyed by news

Social norm theorists suggested that people are motivated to gain information about what others are doing to help with decision making.²⁰ People can also sense descriptive norms through various informational cues.¹³ Fiske and Taylor theorized that human beings, in general, are cognitive misers, and they may use mental shortcuts to make generalizations on what is typical in their surroundings.⁵⁸ Tankard and Paluck explained that this motivation derives from the desire to be accurate about events, facts, and social appropriateness.²⁰ Therefore, people may act as naïve scientists as they try to make sense of social phenomena.⁵⁹

Although news articles were found to shape public normative perceptions by providing explicit information on others' behavior choices,⁶⁰ implicit behavioral cues and institutional cues depicted in mass media may also influence normative perceptions.²⁰ *Behavioral cues* refers to behaviors (or lack thereof) performed by social others in the surrounding environment or through media portrayals.^{8,61} *Institutional cues* come from institutions such as government, schools, and mass media.²⁰ Institutions' acts and innovations can communicate norms, because they may be perceived to represent or serve the interest of a group. For example, after the issuance of a cigarette ban on campus, students may infer that fewer people smoke on campus. Mass media may be perceived as a carrier of descriptive norms due to people's beliefs that the media reports what the public is interested in or what the public opinion is.²⁰ Hence, mass media may inadvertently send normative signals through merely reporting on certain arguments.⁶² However, there is a surprising paucity of health communication research to investigate what cues or traces people identify as normative cues in news articles that do not contain explicit prevalence information. The dearth of research on this topic presents both challenges to understanding how social norms can be formed through routine media consumption and opportunities to change

behaviors via mass media. To explore this phenomenon, we designed an open-ended question in our survey instrument that allows participants to qualitatively express their thoughts related to how they formed normative perceptions on e-cigarette use in the absence of prevalence information in the news.

RQ2: Through what sources or indicators do people infer descriptive norms from e-cigarette-related news articles that do not contain any explicit prevalence information?

Method

Participants

A total of 298 college students were recruited through a research subject pool at a large public university in the United States. The participants received class credit for their participation. There were more males (49.0%) than females (39.3%) in the sample, with 11.7% not reporting gender. The average age was 19.23 years (SD = 1.39). The majority described themselves as Caucasian (69.2%), with the remainder identifying as African American (6.2%), Asian (11.7%), Hispanic (7.6%), and other (5.3%). About half of the participants reported having smoked (54%) or vaped (49.3%), even one or two puffs.

Procedure and design

This study employed a 2 normative direction (high vs low prevalence) × 2 exposure dosage (single vs double dose) between-subjects factorial design, with a fifth group serving as the control condition. In the 4 treatment conditions, we varied the direction and amount of e-cigarette-related normative information (ie, single-dose high-prevalence vs double-dose high-prevalence vs single-dose low-prevalence vs double-dose low-prevalence) contained in the stimuli. In the control condition, no normative information was presented in the stimuli. Participants were invited to an online Qualtrics survey. They were first provided with information about the study and asked to provide informed consent if they chose to participate. They were then randomly assigned to the experimental conditions, where they were presented with one of 10 randomly selected news articles about e-cigarettes (see details below) within each condition. Next, participants completed a set of questions measuring perceived e-cigarette use descriptive norms, prior smoking and vaping behaviors, and demographic variables. Immediately

following the descriptive norm perception question, participants were asked to provide explanations for their ratings on this question with an open-ended question. The entire study took approximately 15 minutes to complete. Participants were debriefed upon completion, thanked for their participation, and dismissed.

Stimulus materials

To address the potential case-category confounding issue, we created more than one news articles ($N = 10$) for use in the study.⁶³ Thus, even for participants in the same treatment conditions, the news article that was shown to them would be randomly chosen from the pool of the 10 articles. Thus, the results would be less likely to be confounded by some unexpected characteristics associated with a single news article stimulus. All 10 news articles were created by modifying real news articles from online websites of top news outlets, such as the *Wall Street Journal*, *Huffington Post*, the *New York Times*, *The Guardian*, *The Age*, and Reuters. The topics of the news articles were related to the debates surrounding the benefits and risks associated with e-cigarette use, including as a smoking cessation aid, general health safety, long-term effects (both health and social impacts), vaping in the workplace, vaping in public places, secondhand vaping, vaping etiquette, public opinion about e-cigarettes, and e-cigarette flavors.

All 10 news articles were created to be of equivalent length with a neutral photo of an e-cigarette appended to its side (randomly chosen from a pool of similar photos), to maximally resemble the formatting and convention of online news websites, thus enhancing the materials' ecological validity. All photos were controlled for normative, behavioral, and gender cues by showing only the image of a gender-neutral hand holding an e-cigarette. The valence of the news articles was held balanced. That is, they were designed to contain an equal presence (quantity and description length) of positive and negative e-cigarette-related topics. The news headlines were also created to be neutral and balanced so that they would not establish frames of reference that may convey normative or preference implications.⁶⁴ Specifically, the headlines were either crafted as questions (eg, "Are e-Cigarettes a Public Health Hazard or the Key to Quitting Smoking?") or stated in a neutral tone (eg, "e-Cigarettes: Where We Stand Now"). Participants were told that they would read a news story, with no reference to the news

agencies. The original 10 articles did not contain any normative information.

To manipulate normative direction and exposure dosage, we collected true statements of normative information about e-cigarette use to be incorporated into the 10 news articles from the Centers for Disease Control and Prevention website⁶⁵ and news articles published by the same news outlets that we used to collect our stimulus materials. A pool of 10 normative statements (5 containing low-prevalence information and 5 containing high-prevalence information) was obtained. Some examples of low-prevalence statements include "Only 10% of U.S. adults vape, according to a recent online poll," or "As it is a pretty new product on the market, it is relatively new to users and only a few have tried e-cigarettes." Examples of high-prevalence statements are "In recent years, e-cigarette use by youth and young adults has increased" and "e-Cigarettes are now the most commonly used tobacco product among youth in the United States." We next randomly chose and assigned these statements based on the design of each treatment condition. Specifically, in each of the 10 articles for the high-prevalence and single-dose condition, one high-prevalence statement was randomly selected out of the pool of 5 to be included as the last sentence of the first paragraph. In the high-prevalence and double-dose condition, 2 of these statements were randomly selected from the pool and added to the end of the first and last paragraphs respectively for each of the 10 articles. The same manipulation using low-prevalence statements was conducted for the low-prevalence conditions. In the control condition, the 10 original articles that contained no explicit normative information were used (see Appendix for a set of news stimuli associated with the same original news article used in different conditions).

Measures

Descriptive norm perceptions about e-cigarette use

Descriptive norm perceptions were assessed by asking participants to rate the prevalence of e-cigarette use in the real world on a 7-point Likert scale, ranging from 1 (*very low*) to 7 (*very high*).

Ever smoking experience

Ever smoking experience was assessed with the question, "Have you ever smoked, even one or two puffs?" The responses were recorded on a dichotomous scale where 0 = no and 1 = yes.

Ever vaping experience

Ever vaping experience was assessed by one question, “Have you ever used an e-cigarette, even one or two puffs?” The responses were recorded on a dichotomous scale where 0 = no and 1 = yes.

Demographics

Demographics included age, sex (male/female), and race/ethnicity (African American, Asian, Caucasian, Hispanic, other).

Sources of normative inference

In the control condition, an open-ended question immediately following the descriptive norm perception question asked participants to indicate the sources or indicators on which they formed their descriptive norm perceptions: “Which part of the article makes you think the prevalence of e-cigarette use is [insert their answer to the descriptive norm perception question]? You can either explain in your own words, or quote the relevant content from the article.”

Data analysis

SPSS 24 was used for statistical analysis. Data were initially screened and examined for normality and outliers. No age difference, $F(4, 291) = 0.630$, $P = .64$, or gender difference, $\chi^2(4) = 1.963$, $P = .85$, was observed across conditions. Because our focal manipulation was the absence, presence, and dose of prevalence information statements, which were considered intrinsic message features, manipulation checks were not necessary.^{66,67} Descriptive norm perceptions of e-cigarette use were outcomes induced by the message stimuli.

To examine the main (H1 and H3) and interaction effects (RQ1) of the 2 factors (ie, normative direction and exposure dosage), we first conducted a 2-way analysis of variance (ANOVA) within the treatment conditions. Then two planned contrasts (high prevalence vs control and low prevalence vs control) were performed followed by a one-way ANOVA with a 3-condition independent variable (high prevalence conditions, low prevalence conditions, and control) and e-cigarette descriptive norm perceptions as the dependent variable. To test H4, we conducted moderator analyses within the treatment conditions to examine whether ever smoking or vaping experience would influence the effects of our experimental manipulation (high prevalence vs low prevalence) on perceived e-cigarette descriptive norms.

To answer RQ2, we focused on the control condition ($n = 55$). We analyzed the open-ended responses using systematic categorization and coding.⁶⁸ Using the

coding scheme, each of the authors reviewed the responses iteratively to identify categories of responses by the forcefulness, recurrence, and repetition of the data.⁶⁹ We then discussed the themes to refine and reorganize the responses according to the identified patterns within categories.⁶⁸ Finally, we reread the responses to verify the compatibility between the themes and the actual expressions in the data.

Results

Hypothesis testing

A 2-way full-factorial ANOVA within the treatment conditions was first conducted, with normative direction and exposure dosage as fixed factors and perceived descriptive norms of e-cigarette use as the dependent variable. The overall model was significant, $F(3, 220) = 674.72$, $P < .001$, $\eta_p^2 = 0.93$. Normative direction was found to significantly influence perceived descriptive norms of e-cigarette use, $F(1, 220) = 174.60$, $P < .001$, $\eta_p^2 = 0.44$, such that participants in the high-prevalence conditions ($M = 5.58$; $SD = 1.09$) reported significantly higher e-cigarette use prevalence perceptions than those in the low-prevalence conditions ($M = 3.27$; $SD = 1.53$; $P < .001$). H1 was supported. Although the main effect of exposure dosage (H3) was not found to be significant in the omnibus test, $F(1, 220) = 1.06$, $P = .30$, $\eta_p^2 = 0.01$, a significant interaction (Figure 1) between the normative direction and exposure dosage was observed, $F(1, 220) = 8.76$, $P < .01$, $\eta_p^2 = 0.038$ (RQ1). Simple effects analysis indicated that in low-prevalence conditions, double dosage significantly lowered descriptive norm perceptions compared to that produced by a single dose of low-prevalence information ($P < .05$), but double doses of high-prevalence information did not significantly increase descriptive norm perceptions compared to that in the single-dose high-prevalence condition ($P = .66$).

H2 predicted that those who read e-cigarette-related news articles containing prevalence information would produce significantly higher (H2a) or lower (H2b) descriptive norm perceptions about e-cigarette use compared to baseline (ie, descriptive norm perceptions of those who read news articles that did not contain any explicit normative information). The one-way ANOVA test results showed a significant omnibus effect, $F(2, 277) = 93.76$, $P < .001$, $\eta_p^2 = 0.40$. Planned contrasts suggested that participants in the high-prevalence conditions ($M = 5.58$; $SD = 1.09$) reported significantly higher e-cigarette use prevalence perceptions than those in the control conditions ($M = 5.07$; $SD = 1.17$; $P < .05$), whereas participants in the low-prevalence

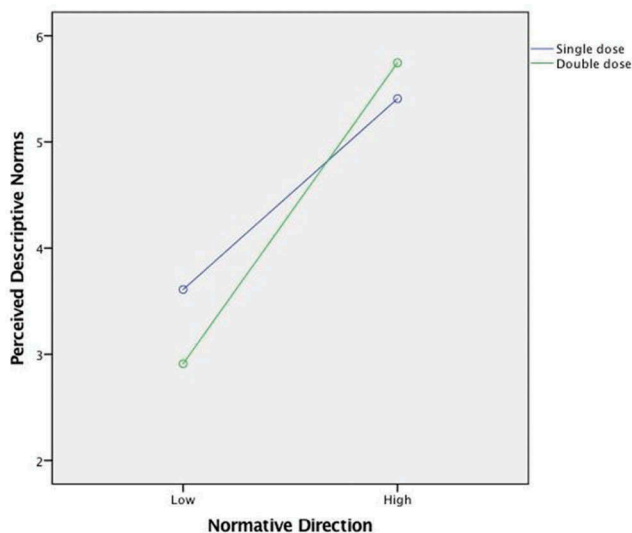


Figure 1. Interaction between normative direction and exposure dosage on perceived descriptive norms of e-cigarette use.

conditions ($M = 3.27$; $SD = 1.53$) reported significantly lower prevalence perceptions than those in the control condition ($P < .001$). Thus, H2 was supported. See Table 1 for means and standard deviations of the descriptive norm perceptions in all conditions.

Hypothesis 4 predicted the moderating effects of ever vaping and smoking experience on the relation between news exposure and perceived descriptive norms about e-cigarette use. Moderator analysis results indicated that neither ever vaping, $F(1, 204) = 1.09$, $P = .40$, $\eta_p^2 = 0.003$, nor ever smoking, $F(1, 205) = 1.04$, $P = .31$, $\eta_p^2 = 0.005$, was found to be a significant moderator. On average, those who never used e-cigarettes ($M = 4.39$, $SD = 0.13$) formed descriptive norm perceptions similar to those of ever users ($M = 4.41$, $SD = 0.12$). Similarly, those who never smoked ($M = 4.30$, $SD = 0.14$) reported similar levels of perceived descriptive norms compared to ever smokers ($M = 4.46$, $SD = 0.11$). Thus, H4 was not supported.

Qualitative data analysis

RQ2 asked how participants in the control condition formed descriptive norm perceptions for e-cigarette use

Table 1. Means and standard deviations for perceived descriptive norms of e-cigarette use.

Experimental condition	<i>n</i>	Mean	SD
Low prevalence/single dose	59	3.61	1.52
Low prevalence/double dose	56	2.91	1.47
High prevalence/single dose	54	5.41	.90
High prevalence/double dose	55	5.75	1.24
No prevalence information (control)	56	5.07	1.17

based on what they read in the news articles, which did not contain explicit normative information and had a balanced or neutral tone toward e-cigarettes. The qualitative analysis results converged on two salient themes: institutional signals and misattributed behavioral cues. Each theme identified was endorsed by a minimum 32% occurrence in participants' responses.

Institutional signals

According to Tankard and Paluck, institutions such as universities, governments, and mass media can influence normative perceptions by their credibility and perceived legitimacy to represent groups' interests.²⁰ Interestingly, our analysis of participants' responses showed that institutional signals emerged in different forms. We found that participants tended to attribute a behavior being reported in the news as having high salience, and thus high prevalence, in the public. Based on the fact that professional journalists and media agencies decided to report e-cigarette-related news, they inferred that use of e-cigarettes must be a salient and important social issue. Participants also responded that although e-cigarette use was neither explicitly supported nor objected to, the news article insinuated a negative connotation that led them to estimate high prevalence of e-cigarette use. Though the news valence was by design held balanced through an equal presentation of positive and negative e-cigarette-related topics, some frequently used language appearing in an e-cigarette news report (eg, smoke, cigarettes, chemicals, etc) may have elicited negative impressions about e-cigarettes through unwittingly creating a misconception about the resemblance between smoking and vaping. For example, one participant stated, "The article is describing a new form of 'smoking' and fears of e-cigarettes are used as a stalking horse by tobacco companies, who want to promote the habit."

Another institutional signal that influenced participants' normative perceptions was the mention of e-cigarette-related research in the news. Participants explained that if institutions were already investing resources to understand the health consequences of e-cigarette use, then there the product must be widely used. Mentions of research evidence coming from different countries were used by participants to infer that e-cigarette use is a global issue. One participant wrote, "The prevalence of e-cigarette use must be somewhat high if officials, such as Carlos Corvalan, from Environmental Health Australia is concerned about it. Based on this article, I would assume that Environmental Health Australia is a large government entity." Moreover, participants used institutional actions, such as when an institution introduced a new

e-cigarette-related regulation or policy, to infer perceived descriptive norms. For example, after reading a news article that discussed vaping in the workplace, one participant stated, “The fact that there is a need for organizations to start forming policies on the usage of e-cigarettes demonstrates that the prevalence of e-cigarettes is high.”

Misattributed behavioral cues

We found that participants paid attention to language that characterized the state of the e-cigarette debates to infer the prevalence of e-cigarette use. Three participants stated that because the news articles stated that e-cigarette use was the subject of hot debate, they concluded that vaping must be trendy and attractive to others. Some participants explained that a large number of people must use e-cigarettes because the news article mentioned the “diverse range of flavors” and “most of the flavors are safe chemicals often added to foods.” This means that normative information about the rich features of e-cigarettes, such as their diverse flavors, were used to make inferences about e-cigarette use prevalence. Words that were used to describe the range of e-cigarette flavors, such as *diverse*, *variety*, and *different*, were picked up by the participants and misattributed as evidence of the popularity of the behavior. Moreover, one participant suggested that because the news reported that e-cigarettes were an “alternative to smoking,” vaping should be just as popular as smoking. Another participant suggested, “This phenomenon has had a relatively high level of interaction and involvement with society, if it has a commonly used nickname and its users are also referred to by this name.”

The analysis of the open-ended responses also revealed that participants used firsthand knowledge of e-cigarettes to form their perceived descriptive norms. For example, participants said that they had seen others using e-cigarettes on a college campus, at a workplace, or in a neighborhood. They also used their prior observations of others’ smoking behaviors to infer e-cigarette use norms. One participant commented, “So many people smoke cigarettes and with a product in the same market, I assume many people use e-cigarettes as well.”

Discussion

This research investigated the influence of exposure to normative information embedded in news articles on individuals’ descriptive norm perceptions about e-cigarette use among college-aged young adults. Results from the experiment supported our hypothesis that normative information contained in the news

articles can effectively influence participants’ perceptions of e-cigarette use prevalence, in both normative directions. Findings also indicated that dosage of normative information played a significant role in influencing perceived descriptive norms in the low-prevalence conditions but not in the high-prevalence conditions, such that double doses of normative information in the low-prevalence condition significantly reduced perceived descriptive norms compared to that in the single-dose condition. This effect, however, was not found in the high-prevalence conditions. The data also indicated that the influence of news article exposure on perceived descriptive norms was not dependent on whether or not individuals had ever vaped or smoked. The results of the qualitative analysis showed that individuals utilized institutional and misattributed behavioral cues to infer e-cigarette use prevalence in the absence of explicit normative information.

The study sheds light on the process of descriptive norm perception formation through exposure to news articles. Despite scholars’ postulation of the influence of mass media on social norm formation, it is unclear whether prevalence information contained in news articles indeed affects descriptive perceptions and how such influence operates.¹³ If the news does have an effect on social norm formation, it is also unclear whether the directions of norms (low- and high-prevalence information) conveyed in the news would carry the same weight in influencing social norm formation. Mass communication theories about how exposure to mass media affect normative perception, such as cultivation theory, suggest a norm formation mechanism in which descriptive norms are gradually formed overtime.⁷⁰ This experiment, however, showed that the effect of news media can be a one-off and direct stimuli-response reaction, in which normative perceptions of e-cigarette use were successfully formed and reported.

The results of the experiment showed that the normative directions (low- and high-prevalence information) conveyed by the news articles can effectively influence individuals’ descriptive norm perceptions. The exposure dosage factor (single and double doses), however, was found to only enhance social norm formation in low-prevalence conditions. Particularly, individuals who were exposed to news articles with 2 doses of low-prevalence information perceived significantly fewer people using e-cigarettes, compared to those who read news articles containing only one dose. This finding suggests that low-prevalence information mentioned in the news articles may carry greater weight than information of high prevalence in influencing people’s descriptive norm perceptions. Such “negation

bias” echoes previous studies that examined descriptive norm perception formation process through exposure to online user-generated comments.⁶⁰ Research has found that negation of implementing a behavior received more attention from individuals during evaluation formation and information recalled.^{71,72} The likely existence of negation bias suggests that Health Educators may benefit from increasing the dosage of low-prevalence information in messages to maximize effects of social norm appeals on normative perceptions and behavior change.

Our study provided insights into how individuals may form their descriptive norm perceptions from news consumption, in the absence of explicitly communicated prevalence information. Indeed, the findings of the qualitative analysis revealed that individuals capitalized on institutional and behavioral cues from mass media content to interpret what was normative in society. This finding provided further empirical evidence to the theorization of the sources of social norms perception formation.^{8,20} People take information delivered by mass media agencies and actions performed by professional organizations as indicators of social norms. Specifically, when news stories report on a health-related behavior, readers assume that the behavior must be significant and prevalent. In addition, institutional actions, such as allocating resources for research and regulation, were perceived as signals of prominence as well. This suggests that the current media coverage of the debates on scientific evidence of e-cigarette use and how to regulate it are likely to have an impact on media users’ prevalence estimation about vaping.

We observed a spillover effect related to the semantic knowledge that influenced individuals’ heuristic judgments of descriptive norms. We found that participants tended to transfer the product attributes to behavioral attributes for descriptive norm formation, particularly when descriptions of products attributes were positively perceived. That is, the description of e-cigarettes as having a diverse range of flavors and designs initiated a positive impression of the product, meaning that the product is attractive and popular to consumers. This description, which was commonly used in e-cigarette news articles, appeared to have an effect on news readers’ subsequent estimations of e-cigarette use norms. This is consistent with previous research on spreading activation effects, in which associative relatedness of information influenced cognitive elaboration and recall.^{73,74} Research in health communication has also found a health halo effect in product labeling, such that products titled with positive information heightened cognitive accessibility and judgment

of the overall healthfulness perceptions.⁷⁵ Thus, we suspected that a mediation mechanism takes place whereby product attributes indirectly influence social norm perceptions via behavioral attributes. Given this finding, it would be informative for future studies to further examine this potential mediation pathway.

The results of the test for Hypothesis 4, which predicted the moderating effect of ever smoking and vaping experience on the association between news exposure and descriptive norm formation, were corroborated by the findings from the qualitative analysis. Specifically, the quantitative analysis indicated that Hypothesis 4 was not supported, and the qualitative findings showed that participants who have ever vaped or smoked did not rely on their own behavior to generate normative perceptions. We found that they relied on their observations of others’ vaping and utilized this memory to estimate descriptive norms. The combined findings presented here point to the role of mass media and reference others, rather than one’s own prior experience, in informing one’s judgment about the prevalence of a behavior. Research has indicated that people made less use of their own experience to infer normative cues when media cues were present.⁷⁵ This finding further consolidated the significant influence of mass media on individuals’ normative perceptions of e-cigarette use.^{34,39}

This research has limitations. The study measured the outcome variables immediately after participants’ exposure to the stimuli materials, which may not be informative about the long-term effects of media news stories on social norm perceptions. The use of single items to measure the dependent variable may be subject to reliability issues. It would be a fruitful future direction to include multiple items for the measured dependent variables and assess the long-term effect of news exposure on descriptive norm perceptions. In addition, our attempt to qualitatively analyze news readers’ interpretations of social norm sources was limited in scale and depth. However, to the best of our knowledge, our efforts are among pioneering endeavors that aim to decompose this phenomenon with concrete understandings above and beyond the quantitative results. In this sense, the results do provide some ideas for future studies where more systematic qualitative investigation of the subject matter will be conducted.

Translation to Health Education Practice

This study found evidence for the role of the news media in influencing individuals’ normative perceptions about a scientifically contested health behavior, for which descriptive norms are often more influential

than they are for well-established behaviors.^{77,78} The study results, when translated to the real world, reveal that people can successfully form descriptive norms for e-cigarette use based on the explicit prevalence information as well as other implicit informational cues included in the news. The TNSB has indicated that descriptive norms lead to more consumption of tobacco products. Although the health effects of e-cigarette use are still scientifically divisive, research has shown that e-cigarette use can be a gateway to smoking renormalization. The Centers for Disease Control and Prevention also warns that e-cigarettes are not safe for youth, young adults, and adults who do not currently use e-cigarettes.¹

Social norm campaigns have focused more on crafting ads with persuasive intent or interpersonal communication than the influence of individuals' daily news consumptions, which is also an influential source of normative perception. News media, which presumably have much greater societal influence and exist in people's day-to-day life, may have unintentionally increased normative perceptions of risk behaviors through highlighting implicit and explicit high-prevalence information. Given the pervasiveness of media content reporting e-cigarette debates and the fact that perceived descriptive norms often guide individuals' behavior decisions, anti-tobacco Health Educators should consider paying close attention to normative cues related to e-cigarette use delivered through people's routine media encounters. Although it is impractical to try to change journalists' reporting practices, being cognizant of the mechanism of normative perception formation through news exposure may help Health Educators identify important risk factors hindering their social change efforts. Health Educators should carry out formative research to examine normative perceptions of e-cigarette use. In case e-cigarette use norms are inflated, norm-debiasing strategies should be adopted to readjust college students' normative misperceptions of e-cigarette use with actual norms.⁷⁹ Such an approach helps prevent inflated descriptive norm perceptions triggered by exposure to normative media content. As to social norm message design, this research suggests that social norm interventions should consider increasing the dosage of low-prevalence information to maximize the effect of normative appeals. Further research to replicate and expand these findings will generate more insights into understanding the process of normative perception formation and how to optimally leverage its potent power to influence desirable behavior change.

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ORCID

Hue Trong Duong  <http://orcid.org/0000-0001-8742-1040>

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Appendix

Are E-Cigarettes a Public Health Hazard or the Key to Quitting Smoking?



E-cigarettes are metal tubes that heat liquids typically laced with nicotine and deliver vapor when inhaled. E-cigarettes work by heating a pure liquid called e-juice – composed of flavorings, propylene glycol, glycerin and often nicotine – until it vaporizes.



Do e-cigarettes help smokers kick their bad habits? “The short answer, is no”, says Dr. Stanton Glantz, a professor of medicine at the University of California, San Francisco, who analyzed a number of studies that examined the effects of e-cigarettes in quitting smoking. He found that they may lower a person’s chance of successfully quitting cigarettes. Not everyone has come to the same conclusion, though. Muhannad Malas, a researcher at the University of Toronto, says that his own analysis of previous studies comparing e-cigs with other smoking cessation aids found that they have been helpful for smokers in quitting or reducing cigarette smoking.

“E-cigarettes are a debatable topic,” Hedman of Umeå University in Sweden says. “Some feel they can’t stand behind the product until it is proven to be a safe alternative. Others argue that e-cigarettes are a solution to the tobacco epidemic, as a crutch for quitting”, she says. The current scientific evidence is generally mixed and we need more evidence to say who’s right.

(A). Example news stimuli with no prevalence information

Are E-Cigarettes a Public Health Hazard or the Key to Quitting Smoking?



E-cigarettes are metal tubes that heat liquids typically laced with nicotine and deliver vapor when inhaled. E-cigarettes work by heating a pure liquid called e-juice – composed of flavorings, propylene glycol, glycerin and often nicotine – until it vaporizes. Only 10 percent of U.S. adults vape, according to a recent online poll.



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“E-cigarettes are a debatable topic,” Hedman of Umeå University in Sweden says. “Some feel they can’t stand behind the product until it is proven to be a safe alternative. Others argue that e-cigarettes are a solution to the tobacco epidemic, as a crutch for quitting”, she says. The current scientific evidence is generally mixed and we need more evidence to say who’s right. As it is a pretty new product in some markets, it is relatively new to users and only a few have tried e-cigarettes.

(B). Example news stimuli with double doses of low-prevalence information

Are E-Cigarettes a Public Health Hazard or the Key to Quitting Smoking?



E-cigarettes are metal tubes that heat liquids typically laced with nicotine and deliver vapor when inhaled. E-cigarettes work by heating a pure liquid called e-juice – composed of flavorings, propylene glycol, glycerin and often nicotine – until it vaporizes. E-cigarette use has increased considerably in recent years, growing an astounding 900% among high school students from 2011 to 2015



Do e-cigarettes help smokers kick their bad habits? “The short answer, is no”, says Dr. Stanton Glantz, a professor of medicine at the University of California, San Francisco, who analyzed a number of studies that examined the effects of e-cigarettes in quitting smoking. He found that they may lower a person’s chance of successfully quitting cigarettes. Not everyone has come to the same conclusion, though. Muhannad Malas, a researcher at the University of Toronto, says that his own analysis of previous studies comparing e-cigs with other smoking cessation aids found that they have been helpful for smokers in quitting or reducing cigarette smoking.

“E-cigarettes are a debatable topic,” Hedman of Umeå University in Sweden says. “Some feel they can’t stand behind the product until it is proven to be a safe alternative. Others argue that e-cigarettes are a solution to the tobacco epidemic, as a crutch for quitting”, she says. The current scientific evidence is generally mixed and we need more evidence to say who’s right. E-cigarettes are used in many bars and places, where people can take advantage of this device to entice youngster to take part in.

(C). Example news stimuli with double doses of high-prevalence information