



## A qualitative examination of e-cigarette use among California young adults during the EVALI outbreak

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### ABSTRACT

The 2019 outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI) increased awareness of potential health risks associated with vaping among the general public. Little is known, however, about how unfolding information regarding EVALI affected knowledge, attitudes, and behaviors among e-cigarette users, particularly among young adults. This study describes attitudinal and behavioral responses to EVALI among young adult e-cigarette users. In October and November 2019, seven focus groups were held with college-going young adult tobacco users from two four-year public universities in California. Focus groups included questions regarding knowledge of and reaction to EVALI news, and how the news affected product use. Text from current e-cigarette users was extracted to develop individual phenomenological textural-structural descriptions of e-cigarette use for 38 individuals which were used to create a composite experience of e-cigarette use in light of EVALI. Experiences indicated that e-cigarette users were aware of information regarding EVALI and received information from numerous sources. Information was filtered for legitimacy of EVALI claims and causes of EVALI. Risk rationalizations were developed to assess potential harm of continued e-cigarette use and provided reasoning for behavioral responses to EVALI. The emerging harm associated with EVALI prompted e-cigarette users to engage in a cognitive process resulting in employment of a range of rationalities to justify continued use. These results suggest how environmental, cognitive, and behavioral factors may interact as young adults negotiate e-cigarette-related harms.

### 1. Introduction

Electronic cigarette (e-cigarette), or nicotine vape, use among youth and young adults has been increasing in the United States (Gentzke et al., 2019; Bao et al., 2020), a cause for concern due to potential nicotine addiction, increased risk for use of other tobacco products and drugs, and long-term health risks (Chadi et al., 2019). Evidence has also shown a wide array of short-term adverse experiences attributed to e-cigarette use (Thota and Latham, 2014; Khan et al., 2018; Phung and Lam, 2020; Hua and Talbot, 2016; Cantrell, 2014; Durmowicz et al., 2016; King et al., 2019; King et al., 2019; Hua et al., 2020). E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI), a uniquely severe adverse experience, garnered significant public attention in the summer of 2019 when a case series of patients presenting with pulmonary illness associated with e-cigarette use was reported (Layden et al., 2020) and an increasing number of hospitalizations occurred across the United States (Krishnasamy et al., 2020). Hospitalization admissions for

EVALI peaked in September 2019 and declined through the end of that year. By the end of January 2020, 2,668 hospitalized EVALI cases were reported to the U.S. Centers for Disease Control and Prevention (CDC). Sixty-eight EVALI deaths have also been confirmed in the United States as of February 2020 (Centers for Disease Control and Prevention, 2019). Tetrahydrocannabinol (THC)-containing products were highly associated with EVALI cases, with 82% of hospitalized patients using any THC-containing vaping product, though 14% of hospitalized cases reported using only nicotine-containing products (Krishnasamy et al., 2020).

Previous research suggests that among smokers, discontinuation of e-cigarettes was attributed to factors related to product characteristics such as taste, not adequately resembling the smoking experience, or cost (Biener et al., 2015; Biener and Hargraves, 2015; Weaver et al., 2020; Yong et al., 2019). Among former and never smoker young adults, however, feeling that e-cigarettes were bad for one's health was shown to be a major reason for discontinuation of e-cigarettes, but being made sick from trying e-cigarettes was not (Biener et al., 2015). This suggests

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that adverse symptoms and health concerns may operate as distinct constructs among young adult former e-cigarette users. The possible distinction made between adverse symptoms and health concerns suggests that a more nuanced understanding of how young adult e-cigarette users process and respond to information about e-cigarette harm is needed. In the context of the EVALI outbreak and its impact on young adult e-cigarette users, it is unclear how the news and information about the disease affected current and future e-cigarette use attitudes and behavior. Hence, this study conducted an in-depth qualitative assessment of young adult e-cigarettes users' understanding of and response to the EVALI outbreak.

## 2. Materials and methods

### 2.1. Data collection

In Fall 2019, college students who use tobacco products on-campus were recruited from two four-year public universities in Southern California to participate in focus group discussions as part of a larger study on compliance with tobacco-free policies. Two marketing firms managed recruitment of participants and project logistics for focus groups which were held at off-campus facilities. One marketing firm was assigned to each university and utilized panels of potential participants, social media outreach, on-campus recruiting, and participant referral to recruit participants. In addition, research staff passed out study flyers to individuals observed smoking or vaping on-campus referring potential participants to marketing firms for study recruitment.

Inclusion criteria for the larger study were: (1) age 18 or older; (2) student at one of the two universities; and (3) self-reported use of a tobacco product on university property. Inclusion criteria of participants were verified by the market research companies and included participants furnishing university identification cards prior to assignment to focus groups held in October and November 2019. As this analysis focused on young adult populations, we excluded responses from participants older than 29 years of age and not being a current e-cigarette user.

Upon arrival at the focus group facility, a study alias, informed consent materials, and a demographic and tobacco use questionnaire were given to each participant. Informed consent forms and demographic questionnaires could be completed prior to focus groups in the facility lobby, or after entering the focus group room if participants had questions. Free and informed consent was obtained from all participants. Seven mixed-gender focus groups were held, 3 with students from University 1 and 4 with students from University 2, with participants assigned to groups based on reported tobacco products used on campus.

Groups had an average of 7.85 participants (range: 6 to 9) and average duration of 78.7 min (range: 72–88 min). Focus groups were facilitated by the first author (JSY) and followed a semi-structured protocol. Open ended questions regarding EVALI were “Can you describe to me when you first heard about EVALI and what your reaction was?” and “How did the news [about EVALI] affect your tobacco or e-cigarette use?” with follow-up probes used to extract details about individual experiences, beliefs, and attitudes. Students who completed the focus group were given a \$125 incentive for participation. Focus groups were recorded and verbatim transcripts were provided by the market research firms. The study protocol was approved by the Institutional Review Board at California State University, Fullerton (HSR-18-19-532).

### 2.2. Data analysis

In 2020, focus group transcripts were reviewed for accuracy by research assistants then imported into and analyzed using Atlas.ti 8 qualitative data analysis software (ATLAS, 2019). The principal investigator (JSY) developed an initial coding scheme based on the focus group discussion protocol and emergent themes from a close reading of a

subset of two transcripts. Two research assistants (AF, AS) coded a subset of focus group transcripts using the initial coding scheme and added new codes as needed. The analysis team (JY, AF, AS) met to review and finalize the coding scheme. An iterative process of coding, assessing intercoder agreement, and resolving differences in coding was repeated until a Krippendorff's  $\alpha = 0.862$  was reached. Research assistants then coded all focus group data. The principal investigator created a subcode for each coded data fragment, which was reviewed by research assistants for appropriateness. The analysis team met and resolved conflicts to achieve a consensus subcoding of data fragments. Research assistants then recoded the data with subcodes within Atlas.ti.

A phenomenological approach was utilized to analyze the focus group data (Creswell and Poth, 2018; Bradbury-Jones et al., 2009). Data relating to EVALI were extracted for participants who reported past 30 days use of e-cigarettes and analyzed for major thematic elements which provided an initial framework to conduct the phenomenological analysis. Following the process described by Moustakas (Moustakas, 1994), a textural and structural description of e-cigarette users' understanding of and behavioral response to EVALI was created for each participant from the focus group transcripts. Textural and structural commonalities among individual experiences were organized into themes to construct a composite description of how e-cigarette users understand and respond to EVALI. The composite description identifies both essential structures of experience as well as thematic variations in meaning.

## 3. Results

### 3.1. Sample description

Individual textural-structural descriptions were constructed for 38 individuals aged 19–28 years among a total of 47 e-cigarette (nicotine) users who participated in focus group discussions; insufficient data for nine focus group participants prevented the development of individual textural-structural descriptions for these participants. Sample characteristics are provided in Table 1.

### 3.2. E-cigarette use in light of EVALI: Essential structures

The experience of e-cigarette use within the context of EVALI was composed of four essential structures: awareness, information filtering, risk rationalization, and behavior. *Awareness* is the initial stage of becoming alerted to and learning about any element(s) of EVALI. *Information filtering* is the process of comprehending, accepting, and prioritizing the information encountered about EVALI. *Risk rationalization* refers to the development of rationalizing a course of action in

**Table 1**  
Sample characteristics.

	University 1 (n = 17)	University 2 (n = 21)	Total
Sex			
Male	8	15	23
Female	9	6	15
Race/ethnicity			
White	3	6	9
Black	0	1	1
Hispanic	1	2	3
Asian	1	8	9
Middle Eastern	8	0	8
Multi-racial	4	4	8
Past 30-day product use			
E-cigarette only	3	6	9
Dual e-cigarette/ATP	3	2	5
Polytobacco	11	13	24

ATP: alternative tobacco product, including cigar, cigarillo, chewing tobacco, hookah, bidis, kreteks, or dissolvable tobacco products.

light of information accepted about EVALI, perceptions of harm associated with EVALI, and past and existing e-cigarette behaviors and experiences. *Behavior* is the action taken in response to risk rationalization. Each domain is composed of interrelated themes which constitute patterns of experience (Fig. 1).

### 3.3. Awareness

Awareness of EVALI was universal, as information about EVALI was perceived to be “all over” social media and the news. Information channels for EVALI included family members, peers, conventional news outlets, aggregated news feeds through social media services, and user content on social media platforms. Interpersonal and news channels contributed to informational awareness (e.g., reporting of cases, symptoms, possible causes) while social media platforms provided anecdotal information or user self-reported experiences (e.g., viral videos of patients suffering from symptoms).

### 3.4. Information filtering

The highly visible reporting of EVALI cases resulted in a considerable amount of – and sometimes conflicting – information and opinions that had to be comprehended, accepted, and prioritized as salient. The first level of filtering pertained to the very legitimacy of reported EVALI cases. While EVALI cases and reported symptoms were generally accepted as conveyed through information channels, five participants questioned whether EVALI was “fake news,” a “government conspiracy” funded by the tobacco industry, or part of a government effort to ban e-cigarettes.

A second level of filtering by some participants focused on causes of EVALI. Three causes of EVALI were the most salient: “fake” cannabis vape products, any “fake” vaping product, and excessive vaping. The most accepted cause of EVALI, reported by nearly a quarter of respondents, was “more of the THC, like fake THC carts” or identification of a particular brand: “Most [EVALI cases] were using something called a Stizzy... a weed type of vape and most of them get fake cartridges.”

EVALI was also thought to be caused by any “fake” product (n = 7), including nicotine and cannabis vaping together. Irreputable products and sources were described as “bad carts... you buy off the street” or “fake cartridges... [that] weren’t like Juul, they weren’t like Suorin, weren’t these name brand trusted sources.”

A third accepted cause of EVALI noted by five participants was

excessive vaping of nicotine products. Participants were told that “you can actually be harmed by smoking too much” or viewed cases as people who “were smoking three pods a day or something” or “were really addicted to [Juuls].”

### 3.5. Risk rationalization

Accepted information from the filtering process was one variable in developing a risk rationalization which also incorporated previous or existing experiences and beliefs. Among those who accepted the legitimacy of EVALI as a potential source of harm without engaging a second level of filtering on the causes of EVALI, increased risk was rationalized as either a basis for modifying behavior (n = 11) or disregarded altogether (n = 5). Those who disregarded potential harm of EVALI suggested they did not “care if it is bad for me. I’m going to do it anyway.” Dual users of cigarettes and e-cigarettes said that “if I wanted to be healthy, I wouldn’t smoke [cigarettes]” or that “I’m already dead right? Because cigarettes are worse.”

Among those who engaged in a second level of information filtering, two dominant risk rationalizations were developed which minimized the perceived risk of continued use. The first risk rationalization constructs harm as tied to perceived causes of EVALI, and avoidance of those specific causes as the basis of protection from harm (n = 14). Participants who concluded that EVALI was related to “fake” cannabis products, any “fake” products, or excessive vaping suggested that because they either did not use “fake” cannabis or nicotine products or vaped infrequently or “in moderation,” they were not at risk for EVALI because they did not use specific product types or vape excessively

The second risk rationalization references not having experienced EVALI-like symptoms in the past as the basis of protection from harm (n = 6). For example, one participant suggested that “at this point, I feel that if it [e-cigarette] was going to do that I feel that it would have done it already or something like that, so... I don’t think it’s going to be me that that happens to” encapsulates this point well.

### 3.6. Behavior

Participants who acknowledged but disregarded increased risk of harm from EVALI reported no change in or intention to reduce or stop e-cigarette use. On the other hand, participants who perceived increased susceptibility to harm from EVALI considered changing their e-cigarette use with varying degrees of follow up (n = 8). Some made no change

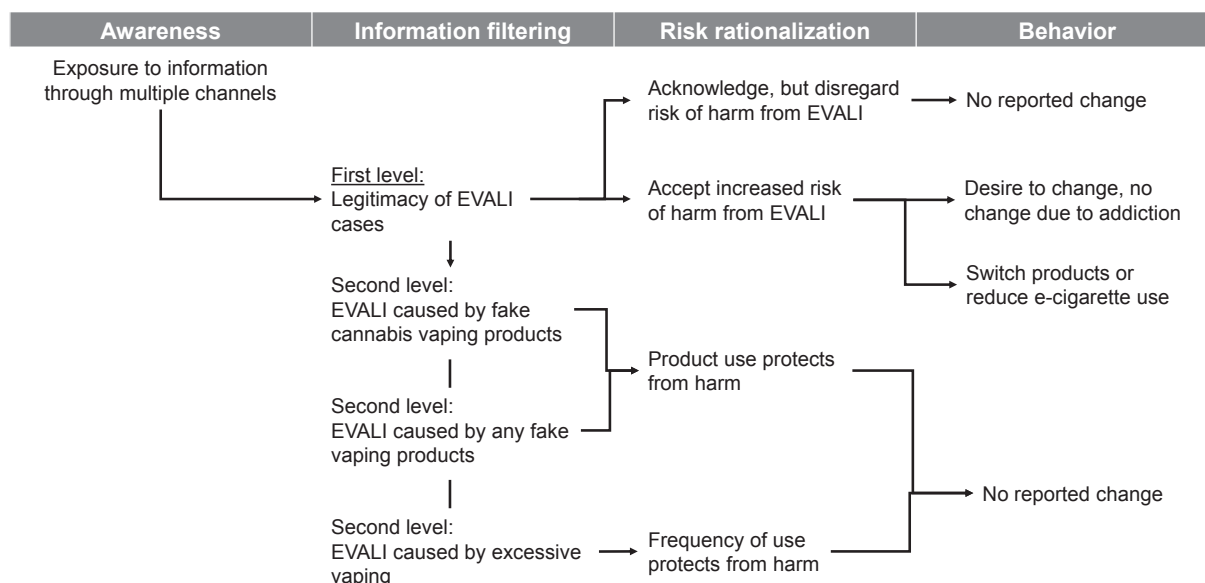


Fig. 1. Essential structures of e-cigarette use in the context of EVALI.

because of chemical dependence/addiction ( $n = 6$ ). Though people knew they should not vape, quitting “was easier said than done.” Inability to carry through on desires to quit or cut back were also due to vaping as “like a lifestyle.” Reported behavior change due to EVALI included transitioning to exclusive cigarette use or increased hookah use to reduce vaping. Others were able to reduce use without substituting for other products. Participants “cut back a lot,” were “trying to Juul a lot less,” and not “buying my own” e-cigarettes and only using when offered by another person (i.e., using someone else’s device instead of buying their own).

Participants who developed a risk rationality which minimized perceived harm based on their understanding of the causes of EVALI or because of past experiences used those rationalities to justify continued e-cigarette use. EVALI “didn’t do anything to dissuade” people from vaping because they felt that “I don’t fall into the category of vaping” that puts them at risk for EVALI, such as cannabis vaping or frequent e-cigarette use. Similarly, some participants continued vaping because they only “hit it every once in a while” or thought EVALI was “not going to happen to me because I’ve been doing this for a couple years now. I’ll be fine, you know?”

#### 4. Discussion

In this study, three essential structures were found to mediate the relationship between exposure to EVALI information and behavior: awareness, information filtering, and risk rationalization. Awareness of EVALI was universally reported, and the legitimacy of EVALI as a health concern was generally accepted. There was suspicion, however, about whether EVALI was “fake news” or part of a government conspiracy. Accepted information about the causes of EVALI included fake cannabis vaping products, any fake (including cannabis and nicotine) vaping products, and excessive e-cigarette use. Behavior was linked to information filtering and EVALI risk rationalization. Those who acknowledged but disregarded the harms associated with EVALI reported no change in behavior. Those who accepted the harms associated with EVALI either reduced their e-cigarette use or intended to but did not follow through due to challenges of addiction. Continued use was rationalized by not using implicated products, moderate use, or lack of previous EVALI-associated experiences.

At the time data were collected, numerous reports on the harms associated with EVALI had been released and reported (Schier et al., 2019; Ghinai et al., 2019; Moritz et al., 2019) and the CDC recommended that people should refrain from using all e-cigarette products (Moritz et al., 2019). Health communications research has found that harm messaging may be effective in discouraging vaping (Owusu et al., 2020; Rohde et al., 2020; Grummon et al., 2020), which would support the presumption that government reports of harm from e-cigarettes and warnings to refrain from e-cigarette use during the EVALI outbreak would be salient and heeded.

However, the results of this study provide possible insights into why harm messages may not discourage vaping in young adult e-cigarette users. The essential structures in e-cigarette users’ experiences described above suggest a central role for cognitive processes in mediating the effect of EVALI information on behavior. Eveland’s emphasis on attention and elaboration (connecting new information to other information stored in memory) as essential cognitive elements of learning from the news are reflected in the awareness and information filtering constructs (Eveland, 2001). Participants were universally aware of EVALI-related harms and connected EVALI information to past experiences and existing knowledge. However, learning from news is also tied to motivation, and Kunda suggests that individuals motivated to reach a particular conclusion may attempt to be rational but selectively search for beliefs and rules or combine knowledge to create new beliefs to support a desired conclusion (Kunda, 1990). This “motivated reasoning” would suggest that participants in this study filtered for information and developed risk rationalizations based on the underlining motivation to

continue vaping. Thus, non-compliance with recommendations to refrain from e-cigarette use based on harm messaging may have less to do with the information needs of target audiences and more with their motivation to continue vaping. Importantly, this study identified EVALI-specific situational rationalizations that could inform future public health efforts to address EVALI and e-cigarette-related harms that may have an impact on future quitting or cessation behavior (King et al., 2020).

For participants who expressed a desire to cut back use or had begun to successfully do so, the EVALI outbreak acted as a focusing event on the dangers of e-cigarettes. The opportunity to support e-cigarette cessation was missed for some whose difficulty in cutting back or quitting led to continued use or transition to another product. Though both universities from which study participants were recruited have student health centers that offer cessation services, none of the participants who attempted or considered cutting back or quitting mentioned knowing about or seeking services from the student health center or other resources. This underscores a potential need to make available cessation services tailored to young adult e-cigarette users and communicating the benefits of these programs from a harm reduction perspective; the results of this study provide some potential dimensions on which to tailor such programs. Outreach for cessation services for young adults through colleges and universities may be particularly important during focusing events to take advantage of heightened interest in cessation due to concerns related e-cigarette harm prompted by EVALI.

The study was limited to college-going young adults, and thus additional research is needed among a community sample of young adults. Limiting participants to students at two universities may bias results to reflect the pool of knowledge or experiences available at those two universities. In addition, the sample of students in the analysis was drawn from those who have used tobacco products in violation of university policy and may have been particularly amenable to information justifying e-cigarette use, dismissive toward information discouraging e-cigarette use, or doubtful of their ability to change behavior. Because this study focused on current users, we were unable to explore the ways in which adverse events may lead to quitting e-cigarettes. The results of this study are not generalizable to all college going young adults but provide descriptions of risk rationalities to be explored in future inquiry. While the risk rationalities described may not be exhaustive of e-cigarette user experiences and textural and structural descriptions could not be created for 9 focus group participants, the study findings provide a basis for guiding future research for public health actions against EVALI. Finally, this study highlights the need for greater understanding of how urgent public health events with large information gaps, such as EVALI and COVID-19, are understood by at-risk groups, and the most effective communication and intervention strategies to bring about desired change.

#### 5. Conclusions

EVALI represents the most severe and publicized large-scale adverse event experience associated with e-cigarette use. In spite of existing information on the health harms of e-cigarette use and recommendations to discontinue use during the EVALI outbreak, young adults in this study justified continued use through cognitive processes linking information about EVALI to their own behavior. However, other adverse health impacts associated with e-cigarette uptake and use (e.g., poisoning, harm in developing the adolescent brain, and harms related to long-term nicotine dependence and exposure) also require further study in the context of information filtering and risk rationalizations to develop future public health interventions and messaging. As efforts to monitor and address future e-cigarette-related adverse events and possible new EVALI cases emerge, public health campaigns to raise awareness may benefit from incorporating situational risk rationalities to minimize potential harms and be coupled with increased access to and awareness of e-cigarette cessation services among this critical

population.

### CRedit authorship contribution statement

**Joshua S. Yang:** Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing, Supervision, Project administration, Funding acquisition. **Angela Sou:** Data curation. **Afsana Faruqui:** Data curation. **Tim K. Mackey:** Conceptualization, Methodology, Writing - review & editing, Supervision, Funding acquisition.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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