

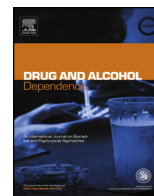


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Reasons for using flavored liquids among electronic cigarette users: A concept mapping study

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ABSTRACT

Background: Electronic cigarettes (ECIGs) aerosolize liquids often containing flavorants for inhalation. Few studies have examined the role of flavors in ECIG use. This study's purpose was to examine reasons for flavored ECIG use using a mixed-method approach, concept mapping (CM).

Methods: Forty-six past 30-day adult ECIG users recruited from vape forums/conferences completed three online CM tasks. Participants brainstormed responses to a prompt: "A specific reason I use flavored e-liquid in my electronic cigarette product is...". The final 107 brainstormed statements were sorted by participants into groups of similar content. Participants rated each statement on a 7-point scale (1-Definitely NOT a reason to 7-Definitely a reason) based on a prompt: "This is a specific reason why I used flavored e-liquid in my electronic cigarette product in the past month." A cluster map was generated from participants' sorting and ratings using CM statistical software. Cluster mean ratings were compared.

Results: Analysis revealed five clusters of reasons for flavored ECIG use including Increased Satisfaction/Enjoyment, Better Feel/Taste than Cigarettes, Variety/Customization, Food Craving Suppression, and Social Impacts. Statements in the Increased Satisfaction/Enjoyment and Better Feel/Taste than Cigarettes clusters were rated significantly higher than statements from other clusters ($p < 0.05$). Some statements indicated flavors were perceived as masking agents for nicotine or other bad tastes associated with cigarette smoking making ECIG use more palatable.

Conclusions: Flavored ECIGs are used for many reasons. Some statements suggested flavors may increase the rewarding and possible addictive effects of ECIGs. These results support continued examination of the role of flavors and ECIG use behaviors.

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1. Introduction

While combustible cigarette smoking prevalence has reached an all-time low in the United States (U.S. Department of Health and Human Services (USDHHS), 2014), there has been a rise in popularity of a new alternative tobacco product among all age groups in the U.S.: electronic cigarettes (ECIGs; Centers for Disease Control and Prevention (CDC), 2013; Arrazola et al., 2015; King et al., 2015; McMillen et al., 2012, 2014; Shoenborn and Gindi, 2015). ECIGs are a class of products/devices that use an electrically-powered heating element to aerosolize a liquid solution that often contains a combination of propylene glycol, vegetable glycerin, nicotine, and chemical flavorings. The vast majority of adult ECIG users are either

current or former combustible cigarette smokers (Shoenborn and Gindi, 2015), however, a small percentage of adult never-tobacco users also use ECIGs (e.g., Barnett et al., 2015; CDC, 2013; Dockrell et al., 2013; Hamilton et al., 2014; King et al., 2013, 2015; Krishnan-Sarin et al., 2015; Loukas et al., 2015; McMillen et al., 2012, 2014; Porter et al., 2015; Saddleson et al., 2015; Sutfin et al., 2013; Wang et al., 2014). One product characteristic of ECIGs that is unique from combustible cigarettes is the availability of a wide variety of flavors. Recent estimates put the number of ECIG flavors at nearly 8000 (Zhu et al., 2014). Available flavors include those common to combustible cigarettes (e.g., tobacco or menthol) and other categories such as fruit, candy, dessert, drink, and spices.

Limited research has examined which flavors are the most popular among ECIG users (Dawkins et al., 2013), however, the availability of flavors has been reported as a reason for using ECIGs (Berg et al., 2014; Farsalinos et al., 2013b; Kong et al., 2015; Soule et al., 2016b). No study has provided an in-depth examination of

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the role flavorings play in ECIG use initiation or continued use. Assuming that ECIG users report using flavors in their devices solely because of the taste may ignore other important roles that flavors may play in ECIG use. For instance, a review summarizing characteristics of use and perceptions of flavored tobacco products (Feirman et al., 2016) reported that individuals perceive flavored tobacco products are more favorable than non-flavored products (Soldz and Dorsey, 2005; Manning et al., 2009; Ashare et al., 2007), are attractive or appealing (Richter et al., 2002; Choi et al., 2012; Griffiths et al., 2011; Liu et al., 2014; Sifaneck et al., 2005), can disguise the risks of tobacco use (Griffiths et al., 2011), and can hide the smell of marijuana use (Sifaneck et al., 2005). Research is needed to understand how the use of flavorings in ECIGs impact ECIG users' perceptions and behaviors. The first step in this process is to identify and describe user-identified reasons for using flavors in ECIG products.

Survey methods allow for estimating the prevalence of phenomena, however, they are limited in examining topics about which researchers do not have a vast understanding. Rather, when attempting to understand new or emerging behaviors, such as using ECIGs with flavorings, incorporating qualitative methods can help to identify fully the domains relevant to the behavior of interest. While qualitative methods have the advantage of gathering rich data, qualitative methods are associated with researcher biases that may impact interpretation and utilization of study results. Quantitative methods may be less likely to include this bias. One method that allows researchers to take advantage of the strengths of qualitative techniques to gather rich data while also using quantitative methods to transform empirically qualitative data into usable results is concept mapping (CM). CM is an innovative participatory approach that integrates qualitative and quantitative methods to develop a framework that describes phenomena, such as ECIG use. This method has been used previously to examine other health issues (DeRidder et al., 1997; Stillman et al., 2012; Trochim et al., 2004) including ECIG use (Soule et al., 2016a,b). The purpose of this study was to use CM to identify and describe the reasons experienced ECIG users report using flavorings in their ECIG products.

2. Material and methods

2.1. Overview

This study was approved by the Virginia Commonwealth University Institutional Review Board. CM, an integrative mixed method participatory approach that uses multidimensional scaling and hierarchical cluster analyses to identify latent constructs, was used to identify and describe reasons for using flavors in ECIG devices among experienced ECIG users. This process included generation of statements through a brainstorming task, sorting and rating a final list of statements, using sorting and rating data to generate a concept "map", and analyses allowing for interpretation of themes and examination of group differences.

2.2. Participants and procedures

For the preparation phase of the concept mapping procedure, researchers developed the focus prompt of "A specific reason I use flavored e-liquid in my electronic cigarette product is. . ." The term "e-liquid" was used in the prompt (as opposed to the term "liquid" used throughout the text) as this term is colloquial among ECIG users. Experienced ECIG users were recruited via internet advertisements in electronic cigarette forums and at vape conferences and participated in the study during 2014–2015. Potential participants contacted study personnel and were screened to confirm

they were over the age of 18 and had been using an ECIG device for at least one month. Eligible participants were directed to a website (The Concept System® Global MAX™) to complete CM tasks. These tasks including a brainstorming task, a sorting task, and a rating task. Prior to completing the CM tasks, participants answered questions related to demographics, ECIG use, and other tobacco product use. Participants received \$10 online gift cards for completing the brainstorming task, \$15 for the sorting task, and \$10 for the rating task. After completing the CM tasks, participants were contacted and asked to identify their top three favorite flavors they use in the ECIG device in an online survey.

Forty-eight participants were assigned to the brainstorming task and 46 participants completed the brainstorming task (response rate=95.8%). Most participants identified as White (87.0%) and were non-Hispanic (97.8%). Just over half (58.7%) were male and the mean age was 38.5 years (SD=10.52). In the brainstorming task, participants completed demographic and tobacco and ECIG use questions and were asked to provide five to eight statements that completed the focus prompt. For example, a participant might enter the statement "because it tastes good" or "I enjoy the experience better" to complete the focus prompt regarding why they used flavored ECIG liquid. Each participant could see the statements generated by previous participants and were asked to review the previous statements to prevent repeating the same ideas. Researchers reviewed the list of statements continuously until content saturation was reached. When content saturation was reached, the brainstorming section of the online program was closed, and researchers reviewed the list of statements to remove statements that did not relate to the focus prompt, nonsensical statements, and consolidated redundant statements resulting in a final list of 107 statements.

After developing the final list of statements, 44 of the participants from the brainstorming task were able to be contacted and invited to complete the sorting and rating tasks. Of these, 33 completed the sorting task correctly (response rate=75%) and 37 completed the rating task correctly (response rate=84.1%; see sorting and rating rules below). For the sorting task, (Rosenberg and Kim, 1975; Weller and Romney, 1988) each participant was asked to organize all of the statements into piles of statements. Individually, each participant dragged statements from a list of the 107 statements generated in the brainstorming task into piles of similar content. Each pile was required to be comprised of statements that related to a single topic or theme (e.g., "Tastes good" pile, "Smells nice" pile, etc.). The sorting task had three rules: participants could not have only one pile that contained all statements, participants could not have an "other" pile, and participants could not create piles based on priority or value such as "Important", "Hard to do", or "Random". Participants also assigned names to each of the categories they created based on the content of the statements in each pile. After sorting all statements into piles, participants rated all 107 statements based on the prompt, "This is a specific reason why I used flavored e-liquid in my electronic cigarette product in the past month," with response options ranging from 1 (Definitely NOT a reason) to 7 (Definitely a reason).

2.3. Data analysis

Using CM software, a 107 × 107 matrix of similarities (Trochim, 1989) was created based on aggregated sort data from the participants who completed the sorting task. Each cell within the matrix represented the total number of times two statements were sorted into the same piles in all of the participants' sorting of the 107 statements generated in the brainstorming task. Using multidimensional scaling, each statement was assigned a two-dimensional coordinate (x,y) resulting in a point map (see Fig. 1; Kruskal and Wish, 1978) that displayed a representation of each statement in

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