HHS Public Access

Author manuscript

Qual Health Res. Author manuscript; available in PMC 2022 March 01.

Published in final edited form as:

Qual Health Res. 2021 March ; 31(4): 703–712. doi:10.1177/1049732320971236.

"Taking up a new problem" - Context and determinants of pod-mod e-cigarette use among college students

Christine M Kava[1], **Eric K Soule**[2], **Laura Seegmiller**[3], **Emily Gold**[2], **William Snipes**[2], **Taya Westfield**[3], **Noah Wick**[3], **Rima Afifi**[3]

[1]University of Washington, Seattle, Washington, USA.

[2]East Carolina University, Greenville, North Carolina, USA.

[3]University of Iowa College of Public Health, Iowa City, Iowa, USA.

Abstract

In this article, we explore the context and determinants of pod-mod e-cigarette (ECIG) use among college students aged 18-24 in the U.S. We conducted semi-structured interviews with 55 students (mean age=20 years, 56% female, 65% White) on three campuses in the Northwest, Midwest, and Southeast. We performed a thematic analysis. Students described ECIG use by peers, increased ECIG exposure and prevalence in college, and school-related stress as reasons for vaping. Pod-mod features such as convenience, design, easy concealment, and flavors made vaping more appealing. Negative aspects of vaping included addiction, cost, and possible health consequences. Most viewed vaping as a college behavior and intended to quit after graduation. Our results show that the college environment plays a major role in young adult ECIG use. These findings can inform the development of targeted interventions to prevent and control uptake of ECIGs by young adults.

Keywords

e-cigarettes; pod mods; university; college students; young adults; qualitative

Introduction

Electronic cigarettes (ECIGs) are a class of products that use a heater to aerosolize a liquid that usually contains nicotine, propylene glycol, vegetable glycerin, and chemical flavorants for user inhalation (Breland et al., 2017). ECIGs entered the U.S. market in 2006 and their use has increased rapidly since 2011 among youth and young adults (Cullen et al., 2019; King et al., 2018; McMillen et al., 2015), leading the U.S. Surgeon General to declare vaping an epidemic among youth in the U.S. (U.S. Department of Health and Human Services, 2018).

Declaration of Conflicting Interests

Dr. Eric Soule is named on a patent application for a smartphone app that determines electronic cigarette device and liquid characteristics. All other authors have no conflicts to report.

As of 2014, ECIGs were the most commonly used nicotine product by young adults in the U.S. (U.S. Department of Health and Human Services, 2016). Data from the 2016 Behavioral Risk Factor Surveillance System show the highest prevalence of current ECIG use among 18-24 year olds, at 9.2% (Mirbolouk et al., 2018). Further, use among young adults increased substantially between 2014-2018 (Dai & Leventhal, 2019). Some proportion of the increase in youth and young adult use of ECIGs since 2015 can be attributed to the presence of a new class of ECIGs known as pod mods.

Pod mods are small ECIG devices that can be easily concealed in a user's hand and utilize a small container, or "pod," to store liquid to be aerosolized for user inhalation. These pods can be refilled or replaced after the liquid is consumed. Pod-mod devices typically operate at lower electrical power, but aerosolize liquids with concentrations of nicotine salts (e.g. greater than 60 mg/ml) and are capable of exposing users to cigarette-like doses of nicotine (Talih et al., 2019).

JUUL, a pod-mod device that resembles a USB memory stick, is an exemplar of this class. By 2018, JUUL had captured over 70% of the ECIG market share (Vallone et al., 2019). Reasons given by young adults for using ECIGs – including JUUL – include its modern design, high nicotine content, variety of flavors, reduced exhaled aerosol, reduced odor, ability to be hidden and used discretely, and greater social acceptability compared to traditional cigarettes (Chen et al., 2019; Fadus et al., 2019; Huang et al., 2019; Lee et al., 2017; Luzius et al., 2019; U.S. Department of Health and Human Services, 2018).

The college environment may be particularly conducive to experimentation, given age-related risk taking and greater independence from parental control. College students "have historically been at the forefront of societal changes in substance use that later materialize within the general population" (Sutfin et al., 2013, p. 3). In a previous study, the most common reason for JUUL use among college students was because their friends had used, and nearly half of students reported their closest friends would approve of their use (Leavens et al., 2019).

There has been an abundance of quantitative survey research tracking use of ECIGs by young adults over the last few years. There has been less qualitative research conducted, which allows for a more in-depth understanding of participant experiences, values, and opinions. Findings from previous qualitative studies have centered around the positive and negative aspects of ECIG use, including flavors, convenience, social and peer environment, addiction, and health effects (Cheney et al., 2018; Choi et al., 2012; Coleman et al., 2016; Getachew et al., 2018; Harrell et al., 2019; Keamy-Minor et al., 2019; Kong et al., 2015; McDonald & Ling, 2015; Pokhrel, Herzog, Muranaka, & Fagan, 2015; Pokhrel, Herzog, Muranaka, Regmi, et al., 2015; Wong et al., 2019).

Most of the qualitative studies cited above use focus group discussions. Interviews allow for a more candid discussion of ECIGs, which is important given the impact of social influence on ECIG perceptions and behavior (Leavens et al., 2019). Further, few have addressed dependence in their analysis of themes. Given the high nicotine content in many ECIGs (Romberg et al., 2019) and the health consequences associated with ECIG use, it is

important to understand the extent to which young adults perceive addiction as an issue or problem for them.

Lastly, ECIG products have changed substantially since their introduction into the market. The popularity of earlier products has waned, while pod-mod devices such as JUUL have surged in popularity among youth and young adults (Barrington-Trimis et al., 2018; King et al., 2018). In contrast to earlier products, pod mods are more customizable and typically more efficient at delivering aerosol to the lungs (Barrington-Trimis et al., 2018). As these products have changed, it is important to revisit reasons for their use and the environments in which young adults vape.

In this article, we explore the context and determinants of pod-mod ECIG use (vaping) among college students aged 18-24 years old in the U.S.

Methods

Study Setting and Population

Study participants were U.S. college students aged 18-24 years who currently used pod-mod products; for example, JUUL, Bo, Sourin, or similar products. Additional inclusion criteria were as follows: (a) had lived in the U.S. since at least 2015 (since other countries market and regulate ECIGs differently, we wanted to obtain a sample of students who had experiences with these products in the U.S.); and (b) used pod-mod products at least twice a week within the past month on average. Students came from three large public research universities (~30,000+ students) located in the Northwest, Midwest, and Southeast.

Recruitment

We recruited students via mass e-mail, social media (Twitter), and flyers posted on campus. All recruitment materials provided a link to an online survey that assessed eligibility for study participation. We contacted eligible students to schedule an in-person interview. In total, 378 were eligible to participate and 55 students completed an interview. Our sample size of students was not pre-determined; we discontinued interviews when we reached saturation, i.e. when no new insight emerged from our data.

Procedures

We collected data between April and August 2019. At the beginning of the visit, students reviewed a consent form with the interviewer that included information about study procedures and protections of confidentiality. After reviewing the consent form, students were asked to check either ‘Yes’ or ‘No’ to whether they agreed to participate in the study. (Note: To protect student anonymity, we did not ask students to sign the consent form). We asked students who consented to participate to complete a brief online survey, which included questions on sociodemographics, ECIG use, and other tobacco product use.

Immediately following the survey, we conducted interviews using a semi-structured interview guide. Key interview topics included: (a) initial impressions of ECIGs; (b) how ECIG use (vaping) fit into their lifestyle and daily activities; (c) changes in vaping behavior and thoughts about quitting; (d) emotional and physiological consequences of vaping,

including addiction; and (e) influences on the rise in ECIG use and popularity, including product appeal. At the beginning of the interview, we told students to think specifically about pod-mod products. Refer to supplementary materials for a list of interview questions.

We audio-recorded interviews with the verbal consent of the student. The interviews lasted between 20-40 minutes on average. After the interview, we asked students to complete another brief online survey about their ECIG use. As incentive for participating in the study, students received a $25 gift card. The Institutional Review Boards at East Carolina University, University of Iowa, and University of Washington approved all study procedures.

Data Analysis

We conducted a qualitative analysis in NVivo version 12 (QSR International Pty Ltd., 2018). Professional transcriptionists transcribed the interviews verbatim. We censored information that could potentially identify the student (e.g. student mention of specific names or locations in the interview) prior to analysis. Members of the research team chose three transcripts, one from each university, to code independently.

We followed an inductive coding approach (Thomas, 2006), whereby each team member conducted an initial read of the three transcripts and developed a set of codes based on our data. Given their relevance to our study objectives, we also considered constructs from Social Cognitive Theory (Bandura, 2001) and the Theory of Planned Behavior (Ajzen, 1991) during the coding process. Since this was an exploratory study, we used both frameworks as a guide to identify themes, but also considered emerging themes during our analysis process.

After coding, we met as a team to discuss our codes. We compared coding for redundancy and overlap, and then developed a codebook. To assess trustworthiness of findings (Lincoln & Guba, 1985), we independently coded one more transcript with our codebook. We debriefed to discuss discrepancies in coding, came to a consensus, and made clarifications to our coding process. The final codebook contained 22 codes and was used to code the remaining transcripts, which were divided among the team. We performed a thematic analysis by identifying common patterns across the interviews. To support our interpretation, we have included interview quotations when describing the results (below).

Results

Participant Characteristics

Table 1 displays the demographic characteristics of our sample. Most students were white (n=35, 65%) and female (n=31, 56%). The mean age of students was 20 (SD=1.16). Approximately 11% (n=6) of students identified as Hispanic or Latino/a. Students were evenly distributed across college years. Over half of students (n=32, 58%) reported vaping seven days a week. On the days that students vaped, 50% (n=27) reported vaping fairly frequently or almost always throughout most of the day. Only 12% (n=6) of students were current cigarette smokers.

Determinants and Consequences of Vaping

Peer and Social Influence—Students did not feel pressured to vape but described ECIG use by their peers as a reason for initiating vaping or continuing to vape. When discussing their first experiences vaping, nearly all students described being with peers or using a friend's device.

> I think it was just everyone around me was using them, and then my friend from here lives 40 minutes away, so over the summer I went and hung out with her friends and they were all using them. And then I slept over at her house and one of her friends did, too, and were just using it, and then I ended up getting my own after that. (Female, Non-Hispanic White, Sophomore)

Students would frequently share devices with others, and some perceived vaping as a way to connect or bond with their peers. Some students described performing tricks on their devices with friends.

Students also described how social media influencers and celebrities influence vaping perceptions and behavior. In particular, students noted seeing more and more celebrities promoting vaping on social media and using these products on film. Social media platforms mentioned included Twitter, Facebook, Instagram, YouTube, and Snapchat. A few students described watching video tutorials online to learn vaping tricks.

> Well, I noticed that more celebrities are starting to use JUUL and vape. So then I will see that and I am like oh, if they do it, then it is totally okay if I do it…People will post and have their JUUL in the background, and you will be like oh, they JUUL so it is cool. (Female, Non-Hispanic Multiracial, Junior)

Despite the fact that students described peers as a reason for vaping, they saw themselves and others in their age group as capable of making their own decisions about vaping, particularly in comparison to children and teenagers ("As for young adults it is their decision. For the younger children it is just they are still growing and it just really sucks that it is cool to that extent that kids want to do it." – Female, Non-Hispanic White, Senior). Young adults were viewed as being responsible for their own choices and consequences, while youth were seen as less mature and susceptible to peer influence.

College Environment—Among students who started vaping in high school, most described an increase in their vaping since entering college. Aspects of the college environment conducive to vaping included increased exposure to ECIGs and more freedom to vape. Students were frequently exposed to vaping at parties and other social events.

> …in high school, it was made very clear you cannot vape on the premises. Then as well, living at home with my parents did not want me doing that. Then now in college, you kind of can do whatever. There is only so many rules and when you are out at a party or at the bars or whatever, it is pretty easy to hit and just, everyone around you is using it as well. (Female, Non-Hispanic White, Freshman)

It was common for students to combine vaping and other substance use during social events. Among students who described using other substances with ECIGs, alcohol was the most

commonly used substance. Students described having a stronger urge to vape when drinking ("Yes, it is like immediately when I get drunk it is like where is the JUUL." – Female, Non-Hispanic White, Senior), and vaping being more pleasurable when combined with alcohol.

Vaping was perceived as the norm in college; when asked to indicate what percentage of college students vaped, several students believed that over 50% engaged in this behavior. Students described the prevalence of vaping as being very high among certain groups, like sororities and fraternities ("Partying is definitely more of a thing in the sorority and like everyone in the Greek system has a vaping device, and so it is very hard to get away from it." – Female, Non-Hispanic Asian, Freshman).

Lastly, students used vaping as a way to reduce school-related stress. Notably, students described vaping as helping them focus when studying for an exam or doing homework.

> I think that when you spend a lot of days on campus studying and drinking a lot of coffee — after you're like writing a paper to take a break and you're staying outside…having an e-cigarette is pretty nice. It kind of like relaxes me. Yes, I think in stressful situations I do [vape] more. (Male, Hispanic, Senior)

Product Features—Students described pod mods as convenient and portable, having a "sleek and attractive" design, and being easy to conceal ("…you can put it in your pocket or put it in your desk or something like that and not have anyone worry about it." – Male, Non-Hispanic African American, Senior). Students compared pod mods to larger devices, noting that the latter were less convenient and harder to hide due to their size and number of components. A few students described liking the LED light on JUUL devices, which flashes different colors when the device is waved.

Students enjoyed the taste of the flavored pods, which enticed them to continue vaping. Mango, mint, and menthol were commonly mentioned flavors, although students noted more broadly that fruity flavors were very appealing. Some students described restrictions on in-store sales of certain flavors, notably JUUL's mango. While interest in these flavors remained high, the restrictions caused students to switch to other flavors (e.g. "I used to get mango, but whenever they stopped selling it I started getting the mint or menthol." – Male, Non-Hispanic African American, Senior).

Students described disliking the tobacco flavor, perceiving it as a deterrent to initiation and continued use of ECIGs (e.g. "…if they eliminated everything but the tobacco pods, I would probably stop [vaping]." – Male, Non-Hispanic White, Sophomore). Some students compared ECIGs to cigarettes, with the former perceived as more convenient, potentially healthier, and cleaner (e.g. less smoke and smell).

Addiction and Dependence—For many students, vaping was not tied to a particular event; instead, students would vape when they were alone or bored. Some students habitually reached for their device, a characteristic described as a sign of addiction. Other signs of addiction included feeling frustrated when losing their device, having to interrupt their day to vape, or feeling bad about needing to vape ("Well, I just kind of look at it like,

wow, dude, that is the equivalent of like 20 cigarettes and you could not even make it a day? Come on, man. I just feel bad about myself." – Male, Non-Hispanic White, Freshman).

One student noted that while ECIGs are marketed for smoking cessation, not everyone uses them for this purpose, leading to new issues with addiction:

> [Vaping is not] really giving you the biggest of benefits, and so it is like well, I do not know. And then like none of them smoke cigarettes anyway and so it is like why are you? It is marketed to like help people who were addicted to cigarettes, but you never had that problem. So then you are just taking up a new problem that you had never had. (Female, Non-Hispanic White, Senior)

While not always described in the context of addiction, several students noted that they had to vape more over time to experience the same physical effects (e.g. headrush). Some students seemed reluctant to describe themselves as addicted to vaping ("I do not think I am completely dependent on it…" – Female, Non-Hispanic White, Freshman). Instead, it was common for students to share stories of their peers when asked to describe the signs of addiction.

> One of my roommates, we will be studying and we will be out for like an hour. And then she is like I think that I am going to go home and go hit the JUUL, because I am just craving it really badly. She is someone who is constantly needing to have it I guess. (Female, Non-Hispanic White, Senior)

Financial Costs—Students perceived vaping as an expensive habit. Purchasing pod refills for their device was a major expense.

> I think that the biggest impact it is had on me is financially because I am sure as you know, JUULing is quite expensive. It costs 15, 16 dollars a pack and going through a pack a week adds up quickly. So I think that is how it is affected me the most personally. (Male, Non-Hispanic White, Sophomore)

Students also described having to purchase new devices over time, as these were commonly lost. While cost did not preclude students from vaping, some decided to switch to a cheaper device in order to save money. In other cases, students shopped around to find the best deals.

Health—In the short term, students described having less stamina and being more out of breath when physically active. While not all students attributed these effects to their vaping, most believed it did or could play a role. Some students described vaping as being at odds with their attempts to engage in healthy behaviors.

> I like going outside and hiking and climbing. I feel like in that way it is kind of like contradictory, because like a JUUL is really bad for your health but I am trying to do things that are trying to go and keep me active and healthy. (Female, Non-Hispanic Asian, Freshman)

Students recognized the potential harms of vaping ("I think almost everyone is aware that they are probably not good for you." – Male, Non-Hispanic White, Sophomore), but were less certain about long-term effects. Notably, students described a lack of long-term research

on the health effects of vaping, stating that their generation would be the first to learn ("We are complete guinea pigs. I do not know if this is going to be really bad for me in the future or not, and like that is kind of scary to me." – Male, Non-Hispanic White, Sophomore).

Students compared this process of learning to cigarettes, pointing out that smoking was once considered safe. In some cases, students used a perceived lack of evidence on the long-term health consequences of vaping as justification to continue using ECIGs. Some students also discussed the possibility of vaping leading to other substance use, including cigarettes.

Vaping Practices

Intentions to Quit—Almost all students intended to quit vaping at some point, and some were actively trying to quit. Students described vaping as a behavior that they currently enjoyed but planned to stop after graduating from college. For many students, their perceptions of vaping were inconsistent with their decision to vape; words used to describe the behavior included "trashy", "dumb", and "embarrassing". Most students seemed confident in their ability to quit vaping after college, perceiving the behavior as something that they would grow out of once they fully entered adulthood.

Notably, students also described vaping as "childish" and "not professional", believing that it would be inappropriate to continue vaping once they secured a full-time job or had children ("I definitely do not think that I am gonna be JUUL-ing after college. I feel like it is more of a college, high school, thing. I am not gonna be at the office JUUL-ing. Like, no, that is not cute." – Male, Non-Hispanic Multiracial, Junior). Others described wanting to quit or reduce their vaping due to some of the consequences associated with vaping (e.g. addiction, negative health effects, and financial cost).

Self-Regulation—Students trying to quit or reduce their vaping engaged in several self-regulatory behaviors, including leaving their device at home, refraining from purchasing new devices and/or pods, switching to a less convenient device, and making a conscious decision to vape less. One student described setting up a contract:

> [The contract] had a list of terms of when I could [vape] and when I could not and consequences if I broke the rules. I had to buy my friends food and things like that. I would keep my JUUL at my friend's house so I would not be tempted and they agreed to hold me accountable. – Female, Non-Hispanic Multiracial, Sophomore

Self-regulatory behavior also occurred in the absence of wanting to quit. Some students described taking a break from ECIGs in order to get a headrush, which went away after too much vaping. Students also regulated their behavior in certain settings, like during class or at school-related events ("I do not necessarily do it in class or anything, just because of respect for other people's personal space." – Male, Non-Hispanic African American, Senior).

Students described parents or other family members as being unaware or disapproving of their vaping, thus chose not to vape around these individuals. Similarly, students described refraining from vaping around strangers or peers that may be uncomfortable. Although some students described restrictions on ECIG use in certain areas on campus, these restrictions seemed to have little influence on students' vaping behavior ("…people do not really follow

the rules, but I know the university is a smoke-free campus. It is illegal to smoke inside, I feel like. I have seen people, heard people, JUULing in class" – Female, Non-Hispanic Multiracial, Sophomore).

Discussion

This study explored the context and determinants of pod-mod ECIG use among college students aged 18-24. Our study took a qualitative interview approach to understanding ECIG use while addressing issues of dependence, which have been less studied. We also focused specifically on pod mods, currently the most popular ECIG device on the market (King et al., 2018). Our findings suggest that college plays an important role in young adult initiation and continuation of vaping. A range of determinants at multiple levels, including individual, interpersonal, and community, provided a conducive environment for vaping. These findings are consistent with previous studies. Notably, in a qualitative study on college student vaping, Cheney et al. (2018) found that personal beliefs, perceptions of vaping from peers and parents, and campus and community messaging influenced vaping behavior.

While the students in our study described several reasons for vaping, peers and social influence seemed to play the largest role. This is also consistent with previous studies, which have described the importance of friends and peers on e-cigarette use (Harrell et al., 2019; Leavens et al., 2019; Wallace & Roche, 2018). Prior studies on cigarette smoking have suggested that while youth may not feel directly pressured to smoke, an "unspoken pressure" exists when they are around peers who do (Clark et al., 2002). This unspoken pressure seemed to exist among our sample of students, who described not feeling pressured to vape but noted the ubiquity of vaping.

Given these findings, it is imperative that vaping interventions for young adults address interpersonal influences. For example, peer support strategies have been used in smoking cessation interventions (An et al., 2008; Ford et al., 2013), and potentially serve as an important approach to reducing vaping. Given our findings on the influence of social media, limiting celebrity endorsements of ECIG products could help to reduce positive perceptions of vaping. Social media platforms could also be leveraged when designing communication campaigns. Recent studies have found this approach promising, with social media messaging to educate youth about ECIGs leading to greater knowledge and beliefs about the dangers of vaping (Lazard, 2020).

In a recent study examining ECIG use patterns among young adults, the prevalence of past-30 day ECIG use was 10% among college students (Buu et al., 2019). This statistic is at odds with perceptions of vaping in our study, as several students believed that more than half of college students vaped. Given this, social norms campaigns may be another approach to reducing ECIG use. These campaigns involve correcting misperceptions of perceived norms to decrease risky behaviors, and have been implemented successfully among college students to other reduce behaviors such as alcohol misuse (Perkins & Craig, 2006).

It was clear that students believed they would not be vaping for the rest of their lives; many pointed out their intentions to quit after college and felt confident in their ability to do so.

Although students described several signs of vaping addiction, they often spoke about these signs from a third-person perspective. Further, very few students mentioned possible challenges with overcoming addiction when describing their intentions to quit vaping. Previous studies have found that college students' perceptions of addiction are lower for ECIGs compared to cigarettes (Cooper et al., 2017). Taken together, these findings suggest that interventions to prevent and reduce vaping should include information about the strong potential for addiction when using ECIGs.

Notably, only 12% of students were current cigarette users and, similar to prior studies (Triandafilidis et al., 2017), tended to have negative perceptions of cigarette smoking. Instead, students commonly described vaping when consuming alcohol. Our findings align with past research showing that a high proportion of youth and young adult ECIG users engage in binge drinking and cannabis use (Gilbert et al., 2020; Lanza et al., 2020). Given this information, interventions to address ECIGs should consider the compounded harms of poly-substance use and how this type of behavior could encourage continued use.

Lastly, policy-level interventions can also help to reduce vaping. In our study, students spoke about the benefits of using pod mods over other ECIG devices, among which included convenience, design, and flavors. This is similar to previous studies, which have suggested that these features encourage youth and young adults to vape (Chen et al., 2019; Keamy-Minor et al., 2019). Enforcement of the recently implemented Tobacco 21 law; more widespread enforcement priorities on currently marketed products, including tobacco and menthol flavored ECIGs; and increased implementation of ECIG excise taxes are actions that should be taken to reduce accessibility and popularity of these products.

Opportunities exist for additional research. First, students described a high prevalence of vaping in sororities and fraternities. Future studies should seek to quantitatively examine rates of vaping among different college sub-groups to better target intervention efforts. Second, given that students seemed to perceive addiction as more of an issue for others versus themselves, future studies should also examine third-person effects of mass media communication about vaping. Recent studies on ECIG advertising (Pardun et al., 2017) have supported this hypothesis, which predicts that people perceive communications to have a greater effect on others than on themselves (Davison, 1983). Understanding how and to what extent this occurs for ECIG messages could have direct implications for designing health communication campaigns.

Third, most students believed that vaping was not healthy but were less sure about the long-term health effects of use. Since we conducted our interviews, the U.S. experienced an outbreak of ECIG or vaping product use associated lung injury (EVALI). As of February 18, 2020, approximately 2,800 hospitalized cases or deaths due to EVALI have been reported (Centers for Disease Control and Prevention, 2020). Given this outbreak, student perceptions of the health effects of vaping and their intentions to quit may have changed. Future studies should explore these topics, in addition to how the outbreak has affected the initiation of vaping among youth and young adults. While the current study focused on the vaping of nicotine, future studies should explore and compare perceptions of vaping nicotine vs. THC, the latter being more strongly linked to EVALI.

This study has several strengths and limitations. Our qualitative study design allowed for a more in-depth and comprehensive understanding of ECIG use among college students. Since we conducted this study at three universities across the U.S., our findings may be relevant to a larger population of students. Previous studies have shown an association between sociodemographic characteristics such as race and ECIG use patterns (Sharapova et al., 2018). While we aimed to obtain a diverse sample of students, data are limited for key demographic subgroups such as African Americans. Despite this limitation, this study contributes to our understanding of ECIG use among college students and can help to inform intervention efforts to reduce vaping.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding

This article is a product of two Health Promotion and Disease Prevention Research Centers (PRCs), supported by Cooperative Agreement (CA) numbers U48-DP-005013 and U48-DP-006389 from the Centers for Disease Control and Prevention (CDC). The CA includes funding from the National Cancer Institute (NCI) through the PRC Program's Cancer Prevention and Control Research Network. This research was also supported by East Carolina University and Dr. Eric Soule's effort is supported by grant numbers U54DA036105 and R21DA04735801 from the National Institute on Drug Abuse (NIDA) and grant number R21CA239188 from NCI of the National Institutes of Health (NIH) and the Center for Tobacco Products of the U.S. Food and Drug Administration (FDA). The content is solely the responsibility of the authors, and does not necessarily represent the official views of NCI, NIH, CDC, or FDA.

References

Ajzen I (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. 10.1016/0749-5978(91)90020-t

An LC, Klatt C, Perry CL, Lein EB, Hennrikus DJ, Pallonen UE, Bliss RL, Lando HA, Farley DM, Ahluwalia JS, & Ehlinger EP (2008). The RealU online cessation intervention for college smokers: A randomized controlled trial. Preventive Medicine, 47(2), 194–199. 10.1016/j.ypmed.2008.04.011 [PubMed: 18565577]

Bandura A (2001). Social cognitive theory: An agentic perspective. Annual Review of Psychology, 52(1), 1–26. 10.1146/annurev.psych.52.1.1

Barrington-Trimis JL, Gibson LA, Halpern-Felsher B, Harrell MB, Kong G, Krishnan-Sarin S, Leventhal AM, Loukas A, McConnell R, & Weaver SR (2018). Type of e-cigarette device used among adolescents and young adults: Findings from a pooled analysis of eight studies of 2166 vapers. Nicotine & Tobacco Research, 20(2), 271–274. 10.1093/ntr/ntx069 [PubMed: 28371890]

Breland A, Soule E, Lopez A, Ramoa C, El-Hellani A, & Eissenberg T (2017). Electronic cigarettes: What are they and what do they do? Annals of the New York Academy of Sciences, 1394(1), 5–30. 10.1111/nyas.12977 [PubMed: 26774031]

Buu A, Hu YH, Wong SW, & Lin HC (2019). Comparing American college and noncollege young adults on e-cigarette use patterns including polysubstance use and reasons for using e-cigarettes. Journal of American College Health, 1–7. 10.1080/07448481.2019.1583662

Centers for Disease Control and Prevention. (2020). Outbreak of lung injury associated with the use of e-cigarette, or vaping, products. Retrieved 4 8 from https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html

Chen JC, Green K, Fryer C, & Borzekowski D (2019). Perceptions about e-cigarette flavors: A qualitative investigation of young adult cigarette smokers who use e-cigarettes. Addiction Research & Theory, 27(5), 420–428. 10.1080/16066359.2018.1540693

Cheney MK, Gowin M, & Clawson AH (2018). Using the ecological model to understand influences on college student vaping. Journal of American College Health, 66(7), 597–607. 10.1080/07448481.2018.1440578 [PubMed: 29452051]

Choi K, Fabian L, Mottey N, Corbett A, & Forster J (2012). Young adults' favorable perceptions of snus, dissolvable tobacco products, and electronic cigarettes: Findings from a focus group study. American Journal of Public Health, 102(11), 2088–2093. 10.2105/AJPH.2011.300525 [PubMed: 22813086]

Clark VLP, Miller DL, Creswell JW, McVea K, McEntarffer R, Harter LM, & Mickelson WT (2002). In conversation: High school students talk to students about tobacco use and prevention strategies. Qualitative Health Research, 12(9), 1264–1283. 10.1177/1049732302238249 [PubMed: 12448671]

Coleman BN, Johnson SE, Tessman GK, Tworek C, Alexander J, Dickinson DM, Rath J, & Green KM (2016). "It's not smoke. It's not tar. It's not 4000 chemicals. Case closed": Exploring attitudes, beliefs, and perceived social norms of e-cigarette use among adult users. Drug and Alcohol Dependence, 159, 80–85. 10.1016/j.drugalcdep.2015.11.028 [PubMed: 26708706]

Cooper M, Loukas A, Harrell MB, & Perry CL (2017). College students' perceptions of risk and addictiveness of e-cigarettes and cigarettes. Journal of American College Health, 65(2), 103–111. 10.1080/07448481.2016.1254638 [PubMed: 27805472]

Cullen KA, Gentzke AS, Sawdey MD, Chang JT, Anic GM, Wang TW, Creamer MR, Jamal A, Ambrose BK, & King BA (2019). E-cigarette use among youth in the United States, 2019. JAMA. 10.1001/jama.2019.18387

Dai H, & Leventhal AM (2019). Prevalence of e-cigarette use among adults in the United States, 2014-2018. JAMA. 10.1001/jama.2019.15331

Davison WP (1983). The third-person effect in communication. Public Opinion Quarterly, 47(1), 1 10.1086/268763

Fadus MC, Smith TT, & Squeglia LM (2019). The rise of e-cigarettes, pod mod devices, and JUUL among youth: Factors influencing use, health implications, and downstream effects. Drug and Alcohol Dependence, 201, 85–93. 10.1016/j.drugalcdep.2019.04.011 [PubMed: 31200279]

Ford P, Clifford A, Gussy K, & Gartner C (2013). A systematic review of peer-support programs for smoking cessation in disadvantaged groups. International Journal of Environmental Research and Public Health, 10(11), 5507–5522. 10.3390/ijerph10115507 [PubMed: 24169412]

Getachew B, Payne JB, Vu M, Pillai D, Shah J, Levine H, & Berg CJ (2018). Perceptions of alternative tobacco products, anti-tobacco media, and tobacco regulation among young adults: A qualitative study. American Journal of Health Behavior, 42(4), 118–130. 10.5993/AJHB.42.4.11 [PubMed: 29973316]

Gilbert PA, Kava CM, & Afifi R (2020). High school students rarely use e-cigarettes alone: A socio-demographic analysis of poly-substance use among adolescents in the USA. Nicotine & Tobacco Research. 10.1093/ntr/ntaa037

Harrell PT, Brandon TH, England KJ, Barnett TE, Brockenberry LO, Simmons VN, & Quinn GP (2019). Vaping expectancies: A qualitative study among young adult nonusers, smokers, vapers, and dual users. Substance Abuse: Research and Treatment, 13, 1178221819866210. 10.1177/1178221819866210

Huang J, Duan Z, Kwok J, Binns S, Vera LE, Kim Y, Szczypka G, & Emery SL (2019). Vaping versus JUULing: How the extraordinary growth and marketing of JUUL transformed the US retail e-cigarette market. Tobacco Control, 28(2), 146–151. 10.1136/tobaccocontrol-2018-054382 [PubMed: 29853561]

Keamy-Minor E, McQuoid J, & Ling PM (2019). Young adult perceptions of JUUL and other pod electronic cigarette devices in California: A qualitative study. BMJ Open, 9(4), e026306 10.1136/bmjopen-2018-026306

King BA, Gammon DG, Marynak KL, & Rogers T (2018). Electronic cigarette sales in the United States, 2013-2017. JAMA, 320(13), 1379–1380. 10.1001/jama.2018.10488 [PubMed: 30285167]

Kong G, Morean ME, Cavallo DA, Camenga DR, & Krishnan-Sarin S (2015). Reasons for electronic cigarette experimentation and discontinuation among adolescents and young adults. Nicotine & Tobacco Research, 17(7), 847–854. 10.1093/ntr/ntu257 [PubMed: 25481917]

Lanza HI, Motlagh G, & Orozco M (2020). E-cigarette use among young adults: A latent class analysis examining co-use and correlates of nicotine vaping. Addictive Behaviors, 110, 106528 10.1016/j.addbeh.2020.106528 [PubMed: 32679436]

Lazard AJ (2020). Social media message designs to educate adolescents about e-cigarettes. Journal of Adolescent Health. 10.1016/j.jadohealth.2020.05.030

Leavens ELS, Stevens EM, Brett EI, Leffingwell TR, & Wagener TL (2019). JUUL in school: JUUL electronic cigarette use patterns, reasons for use, and social normative perceptions among college student ever users. Addictive Behaviors, 99, 106047 10.1016/j.addbeh.2019.106047 [PubMed: 31442788]

Lee HY, Lin HC, Seo DC, & Lohrmann DK (2017). Determinants associated with e-cigarette adoption and use intention among college students. Addictive Behaviors, 65, 102–110. 10.1016/j.addbeh.2016.10.023 [PubMed: 27816034]

Lincoln YS, & Guba EG (1985). Naturalistic inquiry. SAGE Publications, Inc.

Luzius A, Dobbs PD, & Jozkowski KN (2019). College students' reasons for using different e-cigarette products: A mixed methods analysis. Journal of American College Health, 1–7. 10.1080/07448481.2019.1618313

McDonald EA, & Ling PM (2015). One of several 'toys' for smoking: Young adult experiences with electronic cigarettes in New York City. Tobacco Control, 24(6), 588–593. 10.1136/tobaccocontrol-2014-051743 [PubMed: 25564287]

McMillen RC, Gottlieb MA, Shaefer RM, Winickoff JP, & Klein JD (2015). Trends in electronic cigarette use among U.S. adults: Use is increasing in both smokers and nonsmokers. Nicotine & Tobacco Research, 17(10), 1195–1202. 10.1093/ntr/ntu213 [PubMed: 25381306]

Mirbolouk M, Charkhchi P, Kianoush S, Uddin SMI, Orimoloye OA, Jaber R, Bhatnagar A, Benjamin EJ, Hall ME, DeFilippis AP, Maziak W, Nasir K, & Blaha MJ (2018). Prevalence and distribution of e-cigarette use among U.S. adults: Behavioral Risk Factor Surveillance System, 2016. Annals of Internal Medicine, 169(7), 429–438. 10.7326/M17-3440 [PubMed: 30167658]

Pardun CJ, McKeever R, & Bedingfield S (2017). Smoke gets in their eyes? Third-person effects of electronic cigarette advertising. Journal of Promotion Management, 23(5), 708–726. 10.1080/10496491.2017.1297980

Perkins HW, & Craig DW (2006). A successful social norms campaign to reduce alcohol misuse among college student-athletes. Journal of Studies on Alcohol and Drugs, 67(6), 880–889. 10.15288/jsa.2006.67.880

Pokhrel P, Herzog TA, Muranaka N, & Fagan P (2015). Young adult e-cigarette users' reasons for liking and not liking e-cigarettes: A qualitative study. Psychology & Health, 30(12), 1450–1469. 10.1080/08870446.2015.1061129 [PubMed: 26074148]

Pokhrel P, Herzog TA, Muranaka N, Regmi S, & Fagan P (2015). Contexts of cigarette and e-cigarette use among dual users: A qualitative study. BMC Public Health, 15(1), 859 10.1186/s12889-015-2198-z [PubMed: 26341634]

QSR International Pty Ltd. (2018). NVivo qualitative data analysis software. In (Version 12)

Romberg AR, Miller Lo EJ, Cuccia AF, Willett JG, Xiao H, Hair EC, Vallone DM, Marynak K, & King BA (2019). Patterns of nicotine concentrations in electronic cigarettes sold in the United States, 2013-2018. Drug and Alcohol Dependence, 203, 1–7. 10.1016/j.drugalcdep.2019.05.029 [PubMed: 31386973]

Sharapova SR, Singh T, Agaku IT, Kennedy SM, & King BA (2018). Patterns of e-cigarette use frequency-National Adult Tobacco Survey, 2012-2014. American Journal of Preventive Medicine, 54(2), 284–288. 10.1016/j.amepre.2017.09.015 [PubMed: 29129463]

Sutfin EL, McCoy TP, Morrell HE, Hoeppner BB, & Wolfson M (2013). Electronic cigarette use by college students. Drug and Alcohol Dependence, 131(3), 214–221. 10.1016/j.drugalcdep.2013.05.001 [PubMed: 23746429]

Talih S, Salman R, El-Hage R, Karam E, Karaoghlanian N, El-Hellani A, Saliba N, & Shihadeh A (2019). Characteristics and toxicant emissions of JUUL electronic cigarettes. Tobacco Control, 28(6), 678–680. 10.1136/tobaccocontrol-2018-054616 [PubMed: 30745326]

Thomas DR (2006). A general inductive approach for analyzing qualitative evaluation data. American Journal of Evaluation, 27(2), 237–246. 10.1177/1098214005283748

Triandafilidis Z, Ussher JM, Perz J, & Huppatz K (2017). An intersectional analysis of women's experiences of smoking-related stigma. Qualitative Health Research, 27(10), 1445–1460. 10.1177/1049732316672645 [PubMed: 27738259]

U.S. Department of Health and Human Services. (2016). E-cigarette use among youth and young adults: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

U.S. Department of Health and Human Services. (2018). Surgeon General's advisory on e-cigarette use among youth. Retrieved 7 1 from https://e-cigarettes.surgeongeneral.gov/documents/surgeon-generals-advisory-on-e-cigarette-use-among-youth-2018.pdf

Vallone DM, Bennett M, Xiao H, Pitzer L, & Hair EC (2019). Prevalence and correlates of JUUL use among a national sample of youth and young adults. Tobacco Control, 28(6), 603–609. 10.1136/tobaccocontrol-2018-054693 [PubMed: 30377241]

Wallace LN, & Roche MJ (2018). Vaping in context: Links among e-cigarette use, social status, and peer influence for college students. Journal of Drug Education, 48(1-2), 36–53. 10.1177/0047237918807706

Wong SW, Lin HC, Piper ME, Siddiqui A, & Buu A (2019). Measuring characteristics of e-cigarette consumption among college students. Journal of American College Health, 67(4), 338–347. 10.1080/07448481.2018.1481075 [PubMed: 29979924]

Table 1.

Descriptive statistics (n=55)

Variable	N	%
Age (Mean, SD)	19.76	1.16
Gender		
Male	23	41.82
Female	31	56.36
Other	1	1.82
Year in College		
Freshman	16	29.63
Sophomore	15	27.78
Junior	9	16.67
Senior	14	25.93
Race		
Asian	9	16.67
Black or African American	3	5.56
White	35	64.81
Other	1	1.85
Multiracial	6	11.11
Ethnicity		
Hispanic or Latino	6	11.11
Non-Hispanic or Latino	48	88.89
Vaped seven days per week	32	58.18
Vaped fairly frequently/almost always throughout day	27	50.00
Smoking status		
Current smoker	6	12.00
Former smoker	3	6.00
Never smoker	41	82.00