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JUUL in school: JUUL electronic cigarette use patterns, reasons for use, and social normative perceptions among college student ever users

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Abstract

Background: JUUL electronic cigarettes have surged in popularity since their emergence on the market in 2015. JUUL is slim and simple in design and is capable of delivering cigarette-like levels of nicotine. However, little research has examined JUUL use patterns, reasons for use, and normative perceptions of JUUL among young adults.

Methods: Participants were college students ($N = 243$) who reported ever using a JUUL electronic cigarette. Eligible participants completed a survey assessing JUUL use patterns, reasons for JUUL use, and normative perceptions of JUUL.

Results: Most participants reported using JUUL once or twice (47.7%) and almost one-third reported using JUUL daily or monthly (29.6%). Overall, participants reported a low level of nicotine dependence ($M_{\text{electronic cigarette HONC}} = 0.93$, $SD = 2.04$). Cool Mint was the most preferred flavor (35.8%) followed by Mango (12.0%). The top reasons for use were because “friends were using it” (27.0%) and “curiosity” (19.4%). Nearly half (49.8%) of participants reported that they would tell all five of their five closest friends that they use JUUL. Only 10.7% reported a belief that none of their friends would approve of their JUUL use.

Conclusions: The high percentage of daily and monthly JUUL users coupled with the relatively high rates of perceived acceptability of use indicates the possibility of high uptake among college students. Findings also suggest college students perceive JUUL as highly acceptable and that their friend’s use and curiosity were primary motivators of their initial use, indicating the importance of peer influence in college student JUUL use.

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All authors contributed to the conceptualization of the research. ELSL and EMS collected the data. ELSL completed analyses. ELSL, EMS, and EIB drafted the manuscript. All authors edited the final manuscript. All authors have approved the final article.

Declaration of competing interests
No conflicts declared.

Keywords

Electronic cigarette; College students; Normative perceptions

1. Introduction

Since being introduced to the market in 2015, JUUL's market growth has been significant, now accounting for approximately 70% of the dollar share of the electronic cigarette (e-cigarette) market, excluding online and tobacco/vape shop sales (Herzog & Kanada, 2018). JUUL and similar e-cigarettes differ from those on the market prior to 2015 in their design, ease of use, and e-liquid. JUUL is slim and simple in design, resembling a USB flash-drive. To use the JUUL, the user simply puts the device to their mouth and inhales. The flavored e-liquid is contained in closed pods that are easily switched and contain 3–5% nicotine salts. According to the JUUL e-liquid patent documents, JUUL is capable of delivering cigarette-like levels of nicotine to the user (Brown & Xing, 2015).

Because of JUUL's surge in popularity since 2015, it has caught the attention of the media, researchers, and lawmakers and regulatory bodies. Additionally, while youth and young adult e-cigarette use increased substantially from 2011 to 2014 (Arrazola et al., 2015), use appears to have tapered off in recent reports (Jamal et al., 2017). However, JUUL has the potential to threaten these trends among this vulnerable group. In a national survey (Willett et al., 2018), 10% of youth and young adults (15–24 years old) reported ever using JUUL while 8% reported past 30-day use. Interestingly, only 37% of current users knew JUUL e-liquid always contains nicotine (Willett et al., 2018), indicating a lack of knowledge regarding the potentially addictive nature of JUUL. Moreover, analyses of JUUL-related social media posts show that social media may be impacting social norms around JUUL, increasing the acceptability of use (Brett et al., 2018; Kavuluru, Han, & Hahn, 2018), and facilitating social bonds around JUUL use (Allem, Dharmapuri, Unger, & Cruz, 2018). To date, no research has investigated use among college students. Not only are young adults aged 18–24 years old more likely to initiate tobacco/nicotine use compared to youth aged 11–17 years old, but college students may be at unique risk for initiating substance use compared to their non-college counterparts (Carter, Brandon, & Goldman, 2010; Sidani, Shensa, Yabes, Fertman, & Primack, 2018).

Of particular interest are students' JUUL use patterns, reasons for use, and normative perceptions of JUUL use due to JUUL's rapid rise in popularity, particularly in comparison to rates of uptake of earlier generation e-cigarettes (Meier, Tackett, Miller, Grant, & Wagener, 2015; Sutfin, McCoy, Morrell, Hoepfner, & Wolfson, 2013). Understanding reasons and motivations for JUUL use, particularly first use, would inform prevention efforts aimed at limiting youth and young adult experimentation with JUUL. Understanding ever users' normative perceptions of JUUL use could similarly inform prevention and intervention efforts. Consistent with the theory of social normative behavior (Perkins, 2002), greater perceived approval of a behavior is associated with greater engagement in the behavior. Social norms are particularly salient among college students, a population often living and regularly interacting with peers. Normative perceptions are malleable and

therefore can be targeted in individual-, campus-, and community-level interventions. The current study begins to fill important gaps in the JUUL literature by exploring JUUL use patterns, reasons for use, and normative perceptions of JUUL among college students.

2. Methods

2.1. Participants and procedures

College students at a large, Midwestern university who were at least 18 years old and reported ever using a JUUL e-cigarette were invited to participate in the study via the university's online research participant pool. The subject pool is comprised primarily of students enrolled in introductory psychology and speech courses. Eligible participants self-selected into the study from a list of various other studies. Participants completed informed consent and, if interested, completed the study questionnaire. For their time and participation, participants were compensated with credit to be applied to their course. Study procedures were approved by the University's Institutional Review Board.

2.2. Measures

2.2.1. Participant characteristics—Participants completed self-report measures assessing age, gender, and ethnicity.

2.2.2. Other tobacco product use—A series of questions assessed use of other nicotine/tobacco products. Each question was accompanied by a photo of the product being assessed to enhance clarity. Response options included, “Never tried, not even once”, “Tried it before (once or twice) but never again”, “Use yearly, less than monthly”, “Use monthly, less than weekly”, “Use weekly, less than daily”, “Use daily”, and “Used regularly (i.e., daily or weekly) but have since quit.” Rates of regular product use are presented, with regular use defined as daily or weekly use of the product. For some analyses, participants were grouped further into never users (“Never tried, not even once”), former users (“Used regularly [i.e., daily or weekly] but have since quit”), ever users (“Use yearly, less than monthly” and “Tried it before but never again”), and current users (“Use daily”, “Use weekly, less than daily”, and “Use monthly, less than weekly”).

2.2.3. JUUL use patterns—Overall JUUL use patterns were assessed via one item asking participants to choose the answer that best describes their JUUL use. Response options included, “Tried it before (once or twice) but never again”, “Use yearly, less than monthly”, “Use monthly, less than weekly”, “Use weekly, less than daily”, “Use daily”, and “Used regularly (i.e., daily or weekly) but have since quit.” The question included a photo of the JUUL device and pod to increase clarity. Because there are not well-established guidelines for assessing e-cigarette use patterns, the assessment of JUUL use patterns was based on items created by the Ontario Tobacco Research Unit (Diemert, Victor, Chaiton, & Bondy, 2010). Prior to completing the assessment of JUUL vape sessions, participants read a definition of a “vape session” for the purposes of the survey. The definition stated, “For the purposes of this study, a vaping session starts from your first puff and ends with your last puff before you take a break to do something else. A session can last for any length of time and involve any number of puffs, depending on the person.” Number of lifetime JUUL vape

sessions were assessed with the question, “How many vape sessions, using a JUUL brand e-cigarette, have you had in your lifetime?” Possible response options were, “1 session”, “2–4 sessions”, “5–10 sessions”, “11–20 sessions”, “21–50 sessions”, “51–100 sessions”, and “100+ sessions”.

2.2.4. JUUL dependence—JUUL dependence was assessed using a JUUL-adapted version of the Hooked on Nicotine Checklist (HONC) in which words like “smoke” and “cigarette” were replaced with “vape/use JUUL” and “JUUL”. The HONC is comprised of 10 dichotomous (yes/no) questions such as “Have you ever tried to quit, but couldn’t?” and “Have you ever felt like you were addicted to JUUL?”. Items were summed to create a total score with higher scores indicating greater dependence and endorsement of any item (score 1) indicating loss of autonomy over tobacco. One item (question 9) was missing from the HONC and therefore scores likely underestimate nicotine dependence.

2.2.5. JUUL pod flavor preference—JUUL flavor preference was assessed using the item, “What JUUL pod flavor do you prefer?” Flavor options included flavors that were available from JUUL at the time the survey was posted and were, “Cool Mint”, “Virginia Tobacco”, “Mango”, “Fruit Medley”, and “Creme Brulee”. Participants could choose “none of these” in the case they preferred a flavor not presented in the survey.

2.2.6. Reasons for first use—Reasons for first JUUL use were assessed by the question, “Why did you try JUUL for the first time?” Participants were presented with 19 response options including, “my friends were using it”, “just because”, “for a quick buzz”, “to quit other tobacco”, and “comes in flavors I like”. An “other” option was included to allow participants to provide an alternative response. Participants were instructed to select all that apply.

2.2.7. Normative perceptions—Normative perceptions of JUUL were captured using two questions. First, participants were asked, “How many of your five closest friends would you tell that you use JUUL?” Second, participants were asked, “How many of your five closest friends would approve of your JUUL use?” For both questions, response options ranged from zero to five friends (adapted from Heinz et al., 2013).

3. Results

3.1. Participant characteristics

Participants were 243 college students who reported ever using a JUUL e-cigarette. Participants had a mean age of 19.2 ($SD = 1.0$) years and the majority identified as women ($n = 154$; 63.6%) and Caucasian ($n = 229$; 79.5%).

3.2. Other tobacco product use

Other e-cigarettes were the most commonly used other tobacco products [tank style ($n = 36$; 14.9%), mod style ($n = 32$; 13.2%), cig-a-like ($n = 14$; 5.8%)]. Only 4.1% ($n = 10$) of participants reported regular cigarette smoking with an additional 4.1% ($n = 10$) reporting former smoking. See Table 1 for complete product use results. Chi-squared tests for

independence were conducted to compare other product use status by JUUL product use status. Of note, a significant proportion of ever users of other e-cigarette (cig-a-like, tank, mod) reported JUUL ever use ($n = 83$; 59.7%) compared to former ($n = 4$; 44.4%) or current JUUL use ($n = 25$; 26.6%; $X^2(6, N = 242) = 57.45, p < .001$) and a significant proportion of never cigarette smokers reported JUUL ever use ($n = 94$; 67.6%) compared to former ($n = 3$; 33.3%) or current JUUL use ($n = 9$; 9.6%; $X^2(6, N = 242) = 28.66, p < .001$). Complete results are presented in Table 2.

3.3. JUUL use patterns

Almost half of participants ($n = 116$; 47.7%) reported only trying JUUL once or twice but never again while 29.6% ($n = 72$) reported regular use [daily use ($n = 35$; 14.4%), weekly use ($n = 37$; 15.2%)]. Additionally, 9.5% ($n = 23$) reported at least monthly use, and 9.5% ($n = 23$) reported at least yearly use. Only 3.7% ($n = 9$) reported past regular use but since quitting. The majority of participants reported having 10 or fewer JUUL sessions in their lifetime ($n = 140$; 57.9%) while 12.0% ($n = 29$) reported having > 100 JUUL sessions in their lifetime. In terms of pod flavor preference, Cool Mint was the most preferred ($n = 87$; 35.8%) followed by Mango ($n = 59$; 24.3%), Fruit Medley ($n = 21$; 8.6%), Creme Brulee ($n = 12$; 4.9%), and Virginia Tobacco ($n = 6$; 2.5%). An additional 23.9% ($n = 58$) denied a preference for the presented JUUL flavors. See Table 1 for complete use pattern results.

3.4. JUUL dependence

Overall, participants reported a mean level of dependence of 0.93 ($SD = 2.04$). Levels of dependence were compared by JUUL use status (former, ever, current user) using One-way Analysis of Variance (ANOVA). Results indicated current users were significantly more dependent ($M = 1.98, SD = 2.70$) compared to ever users ($M = 0.18, SD = 0.90; F(2,240) = 26.94, p < .001$). Former JUUL users reported levels of dependence approaching that of current users ($M = 1.44, SD = 1.88$). Levels of dependence were explored further among current users to assess differences in dependence between daily, weekly, and monthly users using ANOVA. Group differences in level of dependence emerged [$F(2,92) = 14.87, p < .001$] such that daily users ($M = 3.71, SD = 3.09$) reported significantly greater levels of dependence compared to both weekly ($M = 0.92, SD = 1.62, p < .001$) and monthly users ($M = 1.04, SD = 2.10, p < .001$).

3.5. Reasons for use

The top reason for first JUUL use was because “friends were using it” ($n = 178$; 27.0%). Other top reasons included “curiosity – just to try it” ($n = 128$; 19.4%), “just because” ($n = 66$; 10.0%), “I heard it gave a strong buzz” ($n = 61$; 9.3%), “for a quick buzz” ($n = 60$; 9.1%), “tastes better” ($n = 32$; 4.9%), “less harmful than smoking” ($n = 23$; 3.5%), “does not smell” ($n = 21$; 3.2%), “comes in flavors I like” ($n = 21$; 3.2%), “satisfy cravings” ($n = 16$; 2.4%), “to quit other tobacco products” ($n = 12$; 1.8%), and “similar hit as a cigarette” ($n = 11$; 1.7%). The following reasons were endorsed by < 1% of participants: “to cut down on other tobacco”, “to use in places other tobacco is not allowed”, “to not disturb others”, “to save money”, “to increase concentration”, “weight loss”, and “other”.

3.6. Normative perceptions of JUUL use

Nearly half of participants reported that they would tell all five of their five closest friends that they use JUUL ($n = 121$; 49.8%) while only 21.4% ($n = 52$) reported they would tell none of their friends of their JUUL use. Similarly, 47% ($n = 115$) reported a perception that all of their five closest friends would approve of their JUUL use while only 10.7% ($n = 26$) reported a belief that none of their friends would approve of their JUUL use.

4. Discussion

Among this sample of JUUL triers, there was a high percentage of daily and nondaily JUUL users, indicating the possibility of high uptake among college students. The rates of regular use observed in the current sample are higher than those seen with other e-cigarettes, potentially indicating greater abuse liability of JUUL compared to other e-cigarettes. Moreover, only 4.1% of the JUUL triers in the current sample were former smokers and only 2.7% reported trying to quit or cut down on tobacco use as a primary reason for first trying JUUL. This pattern of results may indicate JUUL is being used by college students who are not utilizing JUUL as a means for harm reduction but rather out of curiosity or for social reasons. It may be that JUUL is a particularly appealing product to youth and young adults who were previously naive to nicotine and tobacco products. Of concern, these use patterns were associated with elevated levels of nicotine dependence, particularly among daily users, which may be exacerbated by the high nicotine concentration in JUUL e-liquid. This especially elevated level of dependence among daily users may work to maintain longer-term use among this group.

A primary question about JUUL has centered around products that are used in conjunction with JUUL or for which JUUL is substituted. In terms of other tobacco product use, other e-cigarettes were the most commonly used other tobacco product among this sample of JUUL ever users. Interestingly, a relatively high proportion of ever e-cigarette users reported also being JUUL ever users indicating that college students may be generally curious about and interested in experimenting with e-cigarettes. Of potential concern, a relatively high proportion of never smokers reported JUUL use suggesting JUUL may be used by young adults who are naive to combustible tobacco.

Participants reported an important social aspect in terms of both reasons for and normative perceptions of JUUL use. The top reason for first trying JUUL was because their friends were using it, followed by curiosity. Consistent with this, most students reported high perceived approval of their JUUL use by friends with almost 50% reporting they would tell all of their five closest friends that they use JUUL and that all of their five closest friends would approve of their JUUL use. According to the theory of social normative behavior, greater perceived approval of a behavior is associated with increased engagement in the behavior. It is possible that social norms surrounding JUUL are contributing to JUUL's proliferation among college students. This finding is consistent with content analyses showing that social media may also be normalizing JUUL use (Allem et al., 2018; Kavuluru et al., 2018). If replicated, these findings may suggest a need for prevention and intervention efforts aimed at altering normative perceptions of JUUL. Corrective social norms campaigns often involve providing information that allows individuals to compare their personal

engagement in a behavior or perceived approval of a behavior with actual data regarding rates of engagement and approval. Following these interventions, those outside the norm often report more accurate perceived norms and are more likely to change their behavior to be more in line with the norms (Cronce & Larimer, 2011; Miller et al., 2013).

Interestingly, and consistent with previous research (Kavuluru et al., 2018), Cool Mint was the most preferred flavor. Other preferred flavors included Mango and Fruit Medley. Virginia Tobacco was the least preferred with only 2.5% of participants endorsing it as their preferred flavor. These findings are consistent with national data on preferred e-cigarette flavors and may provide support for regulations aimed at limiting youth/young adult access to non-tobacco flavored e-liquid (Rose et al., 2018).

The current study is not without limitations. First, the study was conducted at a single, Midwestern university. In order to draw stronger conclusions, similar studies should be conducted across multiple universities to understand the generalizability of the current findings and to inform appropriate regulatory and intervention efforts. Similarly, participants self-selected into the study and may therefore be biased. To mitigate this, the study was given a general name and did not specifically mention JUUL or e-cigarette use in the description. Finally, prospective studies are needed to understand the temporal relationships between perceived norms and JUUL initiation and maintenance.

The current research is the first to investigate JUUL use patterns, reasons for use, and normative perceptions of JUUL among a college sample. The findings show trends that may indicate significant experimentation and uptake among college students. Students report their friends' JUUL use as an important factor in their initiation of JUUL and perceive high acceptability of their JUUL use by peers. Future research should replicate the current study in a more generalizable sample of young adults and college students and assess the accuracy of both descriptive and injunctive normative perceptions.

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HIGHLIGHTS

- Almost one third of participants were daily or monthly users of JUUL.
- Top reasons for JUUL use were because friends were using it and out of curiosity.
- Almost half of students reported they would tell their friends of their JUUL use.
- Nearly half of students believed all of their friends would approve of their JUUL use.
- Normative feedback may be efficacious for decreasing college student JUUL use.

Table 1

JUUL and other tobacco product use patterns.

| | n | % |
|-----------------------------------|-----|------|
| JUUL use status | | |
| Tried before but never again | 116 | 47.7 |
| Use yearly, less than monthly | 23 | 9.5 |
| Use monthly, less than weekly | 23 | 9.5 |
| Use weekly, less than daily | 37 | 15.2 |
| Use daily | 35 | 14.4 |
| Used regularly but quit | 9 | 3.7 |
| Lifetime JUUL sessions | | |
| 1 session | 48 | 19.8 |
| 2–4 sessions | 61 | 25.2 |
| 5–10 sessions | 31 | 12.1 |
| 11–20 sessions | 22 | 9.1 |
| 21–50 sessions | 26 | 10.7 |
| 51–100 sessions | 25 | 10.3 |
| 100+ sessions | 29 | 12.0 |
| Pod flavor preference | | |
| Cool mint | 87 | 35.8 |
| Mango | 59 | 24.3 |
| Fruit medley | 21 | 8.6 |
| Crème brulee | 12 | 4.9 |
| Virginia tobacco | 6 | 2.5 |
| None of these | 58 | 23.9 |
| Other regular tobacco product use | | |
| Tank style EC | 36 | 14.9 |
| Mod style EC | 32 | 13.2 |
| Cig-a-like EC | 14 | 5.8 |
| Cigarillos | 12 | 5.0 |
| Combustible cigarettes | 10 | 4.1 |
| Smokeless tobacco | 10 | 4.1 |
| Pipe tobacco | 2 | 0.8 |
| Hookah | 1 | 0.4 |
| Cigars | 1 | 0.4 |

Note. EC = electronic cigarette.

Table 2

Other tobacco use status by JUUL use status.

| Product | Former user (n = 9) | | Ever user (n = 139) | | Current user (n = 95) | | Total (N = 243) | | X ² | p |
|--------------|---------------------|------|---------------------|------|-----------------------|------|-----------------|------|----------------|---------|
| | n | % | n | % | n | % | n | % | | |
| Other EC * | | | | | | | | | | |
| Never | 0 | 0.0 | 15 | 10.8 | 9 | 9.6 | 24 | 9.9 | 57.5 | < 0.001 |
| Former | 4 ^a | 44.4 | 4 ^b | 2.9 | 5 ^b | 5.3 | 13 | 5.4 | | |
| Ever | 2 ^a | 22.2 | 83 ^b | 59.7 | 25 ^a | 26.6 | 110 | 45.4 | | |
| Current | 3 ^{a,b} | 33.3 | 37 ^b | 26.6 | 55 ^a | 58.5 | 95 | 39.3 | | |
| Cigarettes | | | | | | | | | | |
| Never | 3 ^a | 33.3 | 94 ^b | 67.6 | 37 ^a | 39.4 | 134 | 55.4 | 23.6 | 0.001 |
| Former | 0 | 0.0 | 5 | 3.6 | 5 | 5.3 | 10 | 4.1 | | |
| Ever | 4 | 44.4 | 35 | 25.2 | 32 | 34.0 | 71 | 29.3 | | |
| Current | 2 ^a | 22.2 | 5 ^b | 3.6 | 20 ^a | 21.3 | 27 | 11.2 | | |
| Cigarettes** | | | | | | | | | | |
| Hookah | | | | | | | | | 35.9 | < 0.001 |
| Never | 3 ^{a,b} | 33.3 | 91 ^b | 65.5 | 39 ^a | 41.5 | 133 | 55.0 | | |
| Former | 0 | 0.0 | 0 | 0.0 | 2 | 2.1 | 2 | 0.8 | | |
| Ever | 6 ^a | 66.7 | 44 ^b | 31.7 | 47 ^a | 50.0 | 97 | 40.1 | | |
| Current | 0 | 0.0 | 4 | 2.9 | 6 | 6.4 | 10 | 4.1 | | |
| SLT | | | | | | | | | | |
| Never | 3 ^a | 33.3 | 113 ^b | 81.3 | 45 ^a | 47.9 | 161 | 66.5 | 34.0 | < 0.001 |
| Former | 0 | 0.0 | 1 | 0.7 | 4 | 4.3 | 5 | 2.1 | | |
| Ever | 4 ^a | 44.4 | 20 ^b | 14.4 | 29 ^a | 30.9 | 53 | 21.9 | | |
| Current | 2 ^a | 22.2 | 5 ^b | 3.6 | 16 ^a | 17.0 | 23 | 9.5 | | |
| Other*** | | | | | | | | | | |

| Product | Former user (n = 9) | | Ever user (n = 139) | | Current user (n = 95) | | Total (N = 243) | | X ² | p |
|---------|---------------------|------|---------------------|------|-----------------------|------|-----------------|------|----------------|---|
| | n | % | n | % | n | % | n | % | | |
| Never | 4 ^a | 44.4 | 121 ^b | 87.1 | 54 ^a | 57.4 | 179 | 74.0 | | |
| Former | 0 | 0.0 | 0 | 0.0 | 2 | 2.1 | 2 | 0.8 | | |
| Ever | 5 ^a | 55.6 | 17 ^b | 12.2 | 32 ^a | 34.0 | 54 | 22.3 | | |
| Current | 0 ^{a,b} | 0.0 | 1 ^b | 0.7 | 6 ^a | 6.4 | 7 | 2.9 | | |

The p-values were made bold to highlight those that were significant at $p < .05$

Note. Matching superscripts denote column proportions that do not differ significantly. EC = electronic cigarette.

* other e-cigarette category includes cig-a-like, tank, and mod style e-cigarettes.

** cigar category includes Cuban cigars, cigarillos, and little cigars.

*** other category includes snus and pipe tobacco users.