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## Prevalence and reasons for Juul use among college students

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### Abstract

**Objective:** Examine Juul use patterns, sociodemographic and personal factors associated with Juul use, and reasons for Juul initiation and current use, among college students.

**Participants:** Convenience sample of 371 undergraduates at a large university in the southeast; recruited April 2018.

**Methods:** Cross-sectional design using an online survey. Logistic regression identified the personal risk factors for current use.

**Results:** Over 80% of participants recognized Juul; 36% reported ever use and 21% past 30-day use. Significant risk factors for current Juul use were: male, White/non-Hispanic, lower undergraduate, and current cigarette smoker. Current Juul users chose ease of use and lack of a bad smell as reasons for use. Ever Juul users most commonly endorsed curiosity and use by friends as reasons for trying Juul. Conclusions: Given the propensity for nicotine addiction among youth and young adults, rates of Juul use are alarming and warrant immediate intervention.

### Keywords

E-cigarette; tobacco prevention; young adult

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Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board of the University of Kentucky.

## Introduction

Electronic cigarettes (e-cigarettes) are the most commonly used tobacco product among high school students<sup>1</sup> and continue to emerge as popular among young adults.<sup>2</sup> There is substantial evidence that e-cigarette use can result in symptoms of dependence and increases risk of using combustible tobacco cigarettes among youth and young adults.<sup>3</sup> Juul is currently the most popular e-cigarette in the U.S. with a 4-week market share of over 60% as of April 2018.<sup>4</sup> Juul, introduced in 2015, is a type of e-cigarette that resembles a USB flash-drive. Each Juul cartridge has the same amount of nicotine as a pack of cigarettes.<sup>5</sup> Juul is sleek and easy to hide, and has garnered the fascination of youth as evidenced by social media chatter and news pieces.<sup>6</sup> Prevalence data collected in 2017 reinforces the growing trend of Juul use, with 7% among 15–17 year olds and 12% of those aged 18–24 reporting ever use.<sup>5</sup> The study also suggests a majority of ever Juul users transition from experimentation to regular use, unlike with other e-cigarettes. Despite its dramatic increase in sales and usage, research on Juul is sparse.<sup>5,6</sup>

In Fall 2017, 17.7% of college students had ever used e-cigarettes;<sup>2</sup> Juul use, specifically, was not assessed. Documented common reasons for initiating use of e-cigarette products among youth, young adults, and college students are: curiosity (most common), harm reduction, and social influence.<sup>7–11</sup> Less is known about reasons for continued use of e-cigarettes and specific appeal of Juul among youth and young adults.<sup>12,13</sup> This study examined: (1) Juul use patterns;(2) sociodemographic and personal factors associated with current Juul use; and (3) reasons for Juul initiation and current use, among college students.

## Methods

A cross-sectional survey was administered April 2018 to a convenience sample of undergraduate students 18 or older attending a large public university in the southeastern U.S. Students were recruited from general core required classes and activity classes ( $N=2,671$ ) offered by the university. A total of 436 undergraduates responded to the survey (16.3% response rate). Of those who responded, 371 completed the items relating to tobacco use and demographics and form the sample for this analysis, indicating an effective response rate of 13.9%. Of those omitted from the analysis for missing data, most did not complete any of the demographic items at the end of the survey ( $n=51$ ). The prevalence of Juul use did not differ significantly between those who skipped all demographic items and those who did not(27.5% vs. 20.9%, respectively;  $\chi^2 = 1.2, p .28$ ).

All procedures were approved by the university's Institutional Review Board. Students were invited via email to participate in an online survey using an anonymous link through Qualtrics. Students were informed they were only permitted to complete the survey one time to avoid duplicate entries. The email reinforced the purpose of the study, 'to learn about college students' attitudes toward and use of various tobacco products' to help improve on-campus tobacco prevention efforts. The email also reinforced our interest in surveying all college students, whether or not they had ever or currently used tobacco. Two follow-up reminders were sent during a two-week time period. All survey completers were eligible for

a drawing to win one of twenty \$25 gift cards. Gift card entries were not linked to participant responses.

## Measures

### Tobacco product use

Participants were asked to indicate number of days (of the past 30) they used each of conventional cigarettes, e-cigarettes, and Juul. The latter two products were distinct from each other as we purposely did not specify that Juul was a type of e-cigarette. Responses to each included “I have used, but not in the last 30 days,” “0 days,” “1–2 days,” “3–5 days,” “6–9 days,” “10–19 days,” “20–29 days,” and “use daily.”<sup>2</sup> Those who had used the product at least 1–2 days in the last 30 were coded as *current* users for the respective product. Respondents were asked if they had ever heard of Juul and ever used Juul (even a puff; yes/no), as well as timing of first Juul use (“in the past week” to “more than a year ago”).

### Reasons for initiation and current use of Juul

Participants were asked to indicate how strongly they agreed or disagreed, using a 4-point Likert scale, “Strongly Disagree” to “Strongly Agree,” with a list of items reflecting possible reasons for first and current Juul use (eg, ‘curiosity,’ ‘my friends use it,’ ‘good flavors’).<sup>10</sup> Responses were dichotomized into Agree vs. Disagree for analysis.

### Demographic and personal characteristics

We assessed age (years), gender (“Male,” “Female,” “Transgender,” “Do not identify with these”), race/ethnicity, academic status, and member of fraternity/sorority. Race/ethnicity was dichotomized as “White/non-Hispanic” versus “Other” for analysis. Academic status response options were dichotomized as lower (1st or 2nd year) or upper (3rd–5th year) undergraduate.

## Data analysis

Descriptive statistics, including means and standard deviations or frequency distributions, summarized use patterns and reasons for first Juul use (among ever users) and current Juul use (among current users only). Multiple logistic regression was used to evaluate the associations of sociodemographic characteristics with current Juul use. Due to small cell sizes, students who identified as “transgender” or “do not identify as listed categories” were not included in the regression model. The Hosmer-Lemeshow test was used to determine model fit and variance inflation factors (VIFs) were evaluated to ensure multicollinearity did not cause regression parameter distortion. All data analysis was conducted using SAS, version 9.4, with an alpha level of .05 throughout.

## Results

Of the 371 students included in the analysis, the average age was 20.0 years ( $SD = 2.9$ ). The majority were female (74%), White/non-Hispanic (77%), in their first two years of college (67%), and members of a social fraternity/sorority (70%).

Over one-quarter reported smoking conventional cigarettes (29%) or e-cigarettes (31%) at least once, while less than 10% of all students reported use in the past month (9% and 8%, respectively). Most students (82%) reported awareness of Juul, while over one-third (36%) said they had ever used Juul. Nearly all (91%) ever Juul users reported first use within the past year. Approximately one in five students (21%) reported using Juul in the past 30 days; 37.2% 1–2 days, 14.1% 3–5 days, 12.8% 6–9 days, 11.5% 10–19 days, 7.7% 20–29 days, and 16.7% daily. Among current Juul users, almost one-third (31%) reported smoking conventional cigarettes and 28% reported current e-cigarette use.

The multiple logistic regression model to assess factors associated with *current* Juul use was significant overall ( $X^2=75.7$ ;  $p < .001$ ); gender, race, student status, and conventional cigarette use were significant. Male (compared to female) and White/non-Hispanic students (versus other race/ethnicity groups) were approximately two times more likely to have used Juul in the past 30 days ( $OR = 1.98$ ,  $p = .046$  and  $OR = 2.48$ ,  $p = .045$ , respectively; see Table 1). Lower undergraduates were almost four times more likely to be current Juul users, compared to upper undergraduate students ( $OR = 3.80$ ,  $p = .009$ ), and current smokers were nearly 20 times more likely to use Juul ( $OR = 19.28$ ;  $p < .001$ ). Age and membership in a social fraternity/sorority were not significantly associated with current Juul use. The Hosmer-Lemeshow test was nonsignificant ( $X^2=12.0$ ,  $p = .2$ ), indicating the model fit was appropriate. All VIFs were less than 2, indicating multicollinearity did not distort parameter estimates.

Among *ever* Juul users who provided reasons for use ( $n = 133$ ), the most frequently reported reason for *initiating use* was “curiosity” (95%), followed by “my friends use it” (81%), “doesn’t smell bad” (77%), “ease of use” (74%), and “good flavors” (67%). Among *current* Juul users who provided reasons for use ( $n = 55$ ), the most popular reasons were “ease of use” (91%), “doesn’t smell bad” (87%), “it is portable” (85%), “stress/relaxation” (82%), and “good flavors” or “easy to charge” (80% for both; see Figure 1).

## Comment

This study is the first to investigate Juul prevalence and use among college students. Over 80% of participating students reported awareness of Juul, which is notably higher than most recent reports citing 25% recognition among a convenience sample of 18–25 year olds in 2017.<sup>5</sup> Nearly all Juul users in our study reported first use within the past year, consistent with the increase in sales and social media presence from 2017 to 2018.<sup>6</sup>

Over a third of participating college students reported ever Juul use and one in five reported current Juul use, much higher than their reported current use of conventional cigarettes or e-cigarettes. Despite limited prevalence data on Juul use, rates from this study are considerably higher than the 12% aged 18–24 who reported ever using a Juul in 2017 (the majority of those experimenting with Juul were also past 30-day users).<sup>5</sup> Findings from our study suggest that more young adults may be trying Juul than a year ago. This is concerning given the high concentration and efficient delivery of nicotine in Juuls and the large number of tweets mentioning cravings or addiction.<sup>6</sup> Exposure to nicotine through young adulthood can be harmful to brain development, leading to decreased cognitive ability, and increased

risk for mental health disorders.<sup>14</sup> Current cigarette users in this study were almost 20 times more likely to use Juul, increasing the risk of nicotine dependence and other health consequences.<sup>15</sup> Previous research suggests that use of e-cigarettes has been linked to symptoms of dependence, increased risk of using combustible tobacco cigarettes and polytobacco use among youth and young adults.<sup>3,16</sup> As Juul use continues to climb, there is need to further understand the appeal of the product, as well as risk for addiction and polytobacco use among youth and young adults.

Interestingly, only 28% of current Juul users reported current e-cigarette use. This suggests that over two thirds of current Juul users do not consider Juul as an e-cigarette. These findings are consistent with the need to integrate Juul-specific terminology into existing tobacco surveillance systems to accurately assess Juul prevalence rates.<sup>5</sup> Youth and young adults may not identify themselves as e-cigarette users, which also has implications for health communication and prevention campaigns. To accurately assess prevalence on college campuses, college health professionals should add Juul use to standard intakes when assessing risk for tobacco use.

Males were approximately two times more likely to have used Juul in the past 30 days. These gender differences are consistent with previous research on Juuls,<sup>5</sup> e-cigarettes,<sup>8,11</sup> and risk for polytobacco use,<sup>15</sup> reinforcing the need to target males in prevention and cessation efforts. The fact that lower undergraduate students were nearly four times more likely to be current Juul users is particularly interesting given the company raised the minimum age to purchase Juul products online to 21 years in August 2017.<sup>17</sup> Youth and young adults share ways to avoid age verification to purchase online and/or they find other ways to obtain Juuls.<sup>6</sup> Future research is needed to determine purchasing patterns and availability of Juul in this population.

The most frequently reported reason for initiating Juul use was curiosity, consistent with previous literature on e-cigarettes.<sup>8,9</sup> Naïve tobacco users (20–40% of young adult current e-cigarette users) report curiosity as a reason for initial use of e-cigarettes more so than current or former conventional smokers.<sup>8</sup> The second most frequently cited reason for first using a Juul, use by friends, is also consistent with previous literature on e-cigarettes and other tobacco products implying the importance of social influence.<sup>9,18</sup> Limited research exists on reasons for current use of e-cigarettes<sup>11</sup> and this is the first study to report reasons for current use of Juul. The most popular reasons for current Juul use were related to product design (ie, ease of use, not smelling bad, portability, and easy to charge). Longitudinal research is needed to explain why those experimenting with Juul report continued use.<sup>5</sup>

## Strengths and limitations

The primary strength of this study is the sample of undergraduate college students who may be most at risk for initiation and continuing use of Juul. This study adds to a growing but limited area of research into an emerging tobacco product whose acceptability among youth and young adults is widespread.<sup>5,6</sup> One limitation of this study is use of a convenience sample rather than a random selection of students. A prior study of randomly sampled students from this university yielded a similar sample demographic profile (70% female,

81% White/non-Hispanic, 72% lower undergraduate).<sup>19</sup> In addition, the response rate is relatively modest (13.9%). This concern is mitigated given a recent study of college student survey response rates<sup>20</sup> which found that estimates of outcome measures were generally reliable even with response rates as low as 5–10%, as long as at least 500 students were invited to participate (invited 2,671 invited in this study). An additional limitation is that some students did not complete the demographic section and were not retained in the analysis; however, this concern is lessened as there was no difference in Juul use prevalence between respondents who did and did not complete the demographic items. Finally, since this study was limited to one university in the southeast, these findings may not be generalizable more widely.

## Conclusions

Over 80% of college students reported awareness of Juul; 36% reported ever Juul use and one in five reported current Juul use. Males, lower undergraduates, and current cigarette smokers were more likely to use Juul. Given the propensity for nicotine addiction among young adults, these rates are alarming and warrant immediate attention by college health professionals. The most frequently reported reasons for initiating Juul use were curiosity and use by friends, consistent with previous literature on e-cigarettes.<sup>8,9,18</sup> The most popular reasons for current Juul use were related to product design, which highlights the need for FDA regulation on emerging products such as Juul.

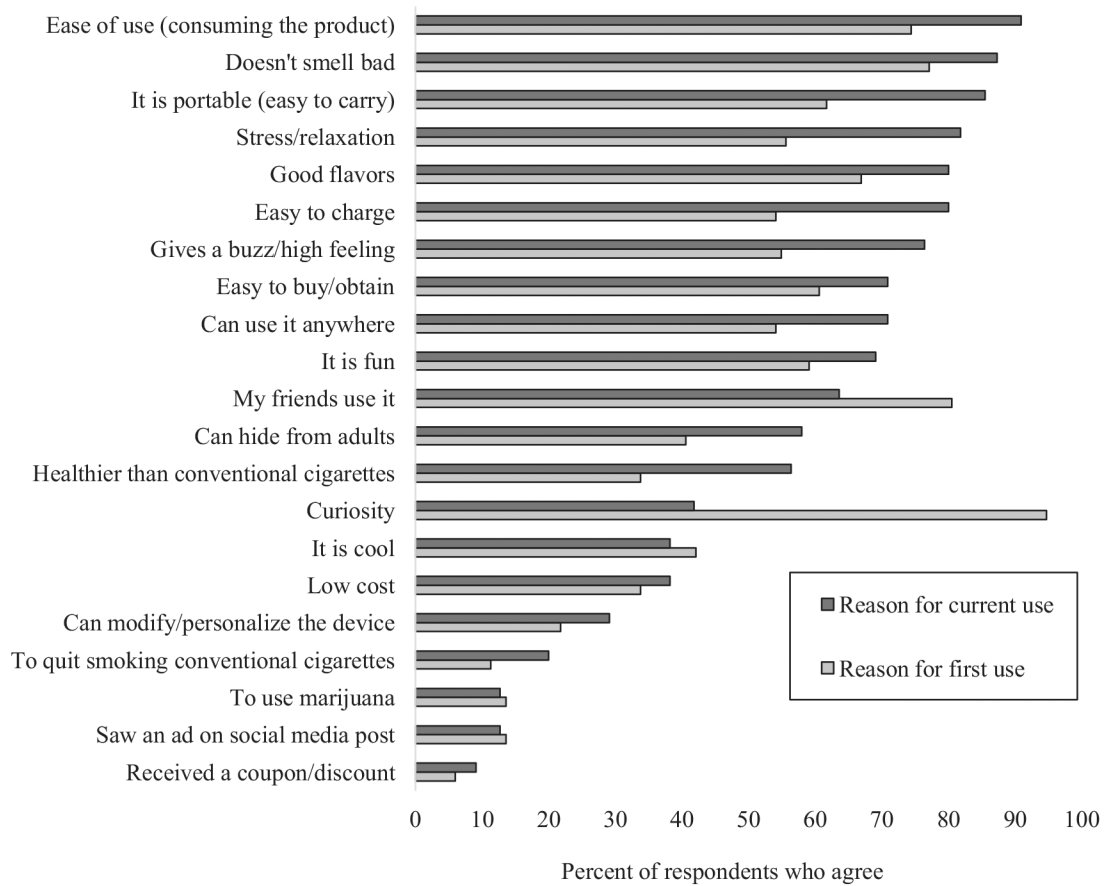
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**Figure 1.** Percent of participants who agreed or strongly agreed with each item on a list of reasons for first Juul use (among ever users,  $n=133$ ) and current Juul use (among current users,  $n=55$ ). *Note:* Participants were asked to rate all that apply; so percentages total to more than 100.



**Table 1.**

Multiple logistic regression modeling associations between sociodemographic characteristics and current juul use ( $n = 341$ ).

	Adjusted odds ratio	95% confidence interval	<i>p</i>
Age	0.85	0.67–1.08	.18
Gender			
Male	<b>1.98</b>	<b>1.01–3.86</b>	<b>.046</b>
Female	ref		
Race			
White/non-Hispanic	<b>2.48</b>	<b>1.02–6.05</b>	<b>.045</b>
Other	ref		
Student status			
Lower undergraduate	<b>3.80</b>	<b>1.39–10.42</b>	<b>.009</b>
Upper undergraduate	ref		
Social fraternity/sorority membership			
Yes	1.74	0.93–3.26	.08
No	ref		
Current smoker (conventional cigarettes)			
Yes	<b>19.28</b>	<b>6.76–54.98</b>	<b>&lt;.001</b>
No	ref		

*Note:* Only those with complete data on all variables were retained in the model.