{JUUL} Awareness, Trial, and Continued Use among {Undergraduate Students} in Mississippi

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abstract

Significance: JUUL e-cigarettes can rapidly deliver nicotine to the brain, are not complicated to maintain and use, and can be used discreetly. These features may be attractive to adult cigarette smokers looking for a product to replace cigarettes, but may also attract nonsmoking youth and young adults. JUUL has changed the e-cigarette landscape in a short span of time, yet little is known about JUUL use among young adults. The current study assessed awareness and nicotine perceptions of JUUL, and the prevalence of trial and frequency of use of JUUL among undergraduate students at three Mississippi universities. We also examined misclassification issues in survey assessment of e-cigarette and JUUL use.

Methods: A random sample of undergraduate students completed a web-based survey on the Qualtrics platform. Respondents were asked about e-cigarette trial and then about JUUL awareness, trial, and use.

Results: Most students had seen or heard of the JUUL (69.5%), and about half of those who had heard of the JUUL were aware that one JUUL pod has an equivalent amount of nicotine to a pack of cigarettes (59.4%). More than a third of students reporting have tried JUULs (37.1%); and more than half of trial users reported either daily or past week JUUL use (55.6%), another 20.5% reported past 30-day use but not in the past week, and the remaining quarter had not used a JUUL in the past 30 days (23.9%). Males, smokers, and students in the Greek system were more likely to report daily or past week JUUL use than others, p<.05. On a measurement note, 9.9% of students who reported JUUL trial did not report e-cigarette trial. Females (18.9%) were more likely than males (4.1%) and nonsmokers (15.5%) were more likely than some day smokers (3.3%) and daily smokers (0.0%) to misclassify JUULs as not being ecigarettes, p<.05.
Conclusion: Awareness and trial of JUUL are high among undergraduate students in Mississippi. Moreover, most trial users report past 30-day use, in contrast to many previous studies finding that most trial use is discontinued. Daily/weekly use among more than 4 of ten nonsmokers who tried JUUL raises concerns about nicotine addiction among nonsmokers.

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introduction

E-cigarettes are a rapidly evolving class of battery-powered devices that heat nicotine, flavor additives, and chemicals to the point of aerosolization. JUUL Labs developed a novel approach to these products in 2015 producing an e-cigarette that could approximate the ability of a cigarette to rapidly deliver nicotine to the brain in a device that is easy to maintain and use. The JUUL is a pod-based, closed-system that uses a non-refillable pod of nicotine solution. Each JUUL pod contains 59 milligrams of nicotine, or 5% nicotine as displayed on the package. The level of nicotine in each pod is equivalent to a pack of cigarettes; significantly higher than the nicotine delivered by other e-cigarettes currently on the market.

These features may be appealing to adult cigarette smokers looking for a product to replace cigarettes, but the tech sleekness; ease of discreet use (JUULs are small and produce less noticeable aerosol plumes due to higher level of propylene glycol compared to other e-cigarettes); and availability in flavors may also attract non-smoking youth and young adults. The potent delivery of nicotine raises concerns that nicotine-naïve trial users are at risk for nicotine addiction. A recent survey of U.S. adult JUUL users found that 12.7% of users were never smokers when they first used a JUUL.

Despite public health concerns and legal challenges, JUUL e-cigarettes are becoming a widespread phenomenon. JUUL is currently the best and fastest selling e-cigarette on the market and represented 72.2 percent market share in the four-week period ending August 11, 2018, according to Nielsen data.

JUUL has changed the e-cigarette landscape in a short span of time, yet little is known about JUUL use among young adults. The current study investigates awareness and use of JUUL among undergraduate students at three Mississippi universities. Specifically, the current study assessed awareness and nicotine perceptions of JUUL and the prevalence of trial and continued past 30-day use, as well as frequency of use among trial users. We also examined misclassification issues in survey assessment of e-cigarette and JUUL use. There is no standard terminology for these diverse class of products25 and we were interested in examining surveillance challenges to estimating prevalence of e-cigarette use.

methods

Design and sample

This study is a cross-sectional, web-based survey of undergraduate students at three Mississippi universities. In the spring semester of 2018, we administered a web-based survey via Qualtrics survey software to students at three Mississippi universities.

Procedures

The study population included undergraduate students at these universities during April 2018 who were 18 years of age or older. The three universities provided 15,303, 16,741 and 10,596 undergraduate student e-mail addresses, and 50% of the email addresses provided were randomly sampled to take part in the survey. Completed surveys were obtained from 593, 614, and 252 students, respectively.

Students at each university received an initial e-mail asking for their participation in the survey. Students who chose to participate clicked on an embedded URL address that linked students to the survey website. Respondents who did not finish the survey or who did not start the survey after the initial e-mail were sent two additional emails requesting their participation. No more than three e-mails were sent to any student in the sample. Precautions were taken to protect the privacy of respondents.

Measures

E-cigarettes

Respondents were provided the following information concerning e-cigarettes, "The next questions are about electronic cigarettes, also known as e-cigarettes, vaping devices, or hookah pens. E-cigarettes look like regular cigarettes but are battery-powered and produce vapor instead of smoke." Then respondents were asked, "Have you ever used an e-cigarette, even one or two puffs?" Students who selected "Yes" were classified as trial e-cigarette users. Trial e-cigarette users were asked, "When did you last use an e-cigarette, even one or two times?" Trial users were asked about frequency of use rather than past 30-day use in order to avoid equating any level of past 30-day use with current use.26 Those who selected "Earlier today," or "Not today, but sometime during the past 7 days," were classified as daily or weekly users; students who replied, "Not during the past 7 days, but sometime during the past 30 days" were classified as past 30-day users; and those who reported that last use of an e-cigarette was more than 30 days ago were classified as having not used an e-cigarette in past 30 days. Any trial user who reported use within the past 30 days was considered to have continued use and to be a past 30-day user.

JUUL

Students may not consider JUUL devices to be e-cigarettes, but rather view JUUL as a new class of product. To address this possibility, questions about JUUL were asked independently of previous responses to e-cigarettes questions. That is, all respondents were asked about JUUL trial, not just the students who had previously reported e-cigarette trial. The survey allowed the possibility for a student to not report e-cigarette use, but to later in the survey report JUUL use.
Following questions about e-cigarettes, all respondents were provided an image of the JUUL and this statement, "The JUUL nicotine-delivery device looks like a USB flash drive." and asked, "Have you ever seen or heard of the JUUL before this study?" Those who replied yes were asked, "Are you aware that the amount of nicotine in one JUUL pod is equivalent to a pack of cigarettes?" to assess nicotine perceptions of JUUL. To assess JUUL use, respondents who had seen or heard of the JUUL were asked, "Have you ever used a JUUL, even one or two puffs?" Those who selected "Yes" were classified as trial JUUL users. Past 30-day JUUL use among trial users was assessed using the same protocol as past 30-day e-cigarette use.

Demographic variables and smoking status

Self-reported gender, race, year in school, cigarette smoking status, and membership in a Greek organization were included as covariates in analyses. Respondents were asked, "Have you ever tried cigarette smoking, even one or two puffs?" Those who reported no were classified as non-smokers. Those who reported yes were asked, "How old were you when you smoked a whole cigarette for the first time?" Those who reported, "I have never smoked a whole cigarette" were classified as non-smokers. Those who reported yes were asked, "On how many of the last 30 days did you smoke cigarettes?" Students who reported, "I did not smoke cigarettes at all in the past 30 days" were classified as non-smokers. Those who reported smoking on at least one day but not all 30 days were classified as nondaily smokers, whereas those who reported, "I smoked cigarettes every day in the past 30 days" were classified as daily smokers.

Data analysis

Sample demographics from each university are presented alongside population distributions (provided by the Institutional Research website for each university) in order to assess the representativeness of each sample. Descriptive analyses for JUUL awareness, trial, and use provide prevalence estimates, while Chi-squared tests compare these outcome variables across demographic variables and by cigarette smoking status. Chi-squared tests also compared the percentage of trial users who continued as past 30-day users among those who had tried e-cigarettes, but not JUULs, and those who had tried JUULs.

To examine misclassification issues in survey assessment of e-cigarette and JUUL use, frequency analysis provided the percent of students who reported JUUL use, but not e-cigarette use, while Chi-squared tests compared these outcome variables across demographic variables and by cigarette smoking status.

TABLE 1: POPULATION AND SAMPLE CHARACTERICS

	Universities					
	Population	Sample	Population	Sample	Population	Sample
Freshman	23.9%	24.6%	26.0%	28.3%	20.8%	12.9%
Sophomore	21.0%	20.7%	22.3%	19.7%	16.5%	17.9%
Junior	22.4%	29.3%	23.2%	23.6%	25.0%	27.5%
Senior and Beyond	32.7%	25.4%	28.5%	28.3%	37.6%	41.8%
Female	49.2%	47.6%	54.8%	55.5%	62.8%	65.4%
Male	50.8%	52.4%	45.2%	44.5%	37.2%	33.8%
Black	20.2%	6.1%	12.5%	5.6%	28.6%	13.8%
White	72.1%	85.8%	78.0%	85.6%	60.9%	76.4%
Other	7.8%	8.1%	9.6%	8.8%	10.5%	9.8%

TABLE 2: JUUL AWARENESS

	Had heard or seen of the JUUL (n=1,371)	Aware that one JUUL pod has an equivalent amount of nicotine to a pack of cigarettes (n=951)
Overall	69.5%	59.4%
Gender	**p=.001**	**p=.001**
Male	74.5%	68.9%
Female	64.7%	50.9%
Race	**p<.001**	**n/a**
White	75.4%	60.9%
African American	21.2%	n/a
Other	60.2%	52.7%
Year	**p<.001**	**p=.004**
First Year	80.4%	64.2%
Sophomore	80.0%	66.0%
Junior	65.0%	55.4%
Senior	57.3%	51.8%
Cigarette Smoking	**p<.001**	**p<.001**
Nonsmoker	64.6%	52.9%
Smokes on Some Days	89.9%	75.9%
Daily Smoker	61.0%	66.7%
Member of a Greek Organization	**p<.001**	**p<.001**
Yes	95.9%	71.7%
No	56.7%	49.5%

TABLE 3: JUUL TRIAL AND CURRENT USE

	Trial Use (n=1,459)	Current JUUL use among trial users (n=507)		
		Daily or weekly user	Past 30-day user, but not in the past week	Has not used in past 30 days
Overall	37.1%	55.6%	20.5%	23.9%
Gender	**p<.001**			**p=.004**
Male	48.0%	60.4%	15.7%	23.9%
Female	27.2%	48.8%	27.4%	23.9%
Race	**p<.001**			**ns**
White	40.4%	55.4%	20.5%	24.1%
African American	4.4%	n/a	n/a	n/a
Other	33.3%	56.1%	19.5%	24.4%
Year	**p<.001**			**ns**
First Year	47.1%	60.9%	17.4%	21.7%
Sophomore	46.2%	54.9%	20.5%	24.6%
Junior	32.3%	55.5%	21.8%	22.7%
Senior	26.7%	49.0%	24.0%	26.9%
Cigarette Smoking	**p<.001**			**p<.001**
Nonsmoker	27.4%	43.5%	24.7%	31.8%
Smokes on Some Days	71.5%	72.7%	15.2%	12.1%
Daily Smoker	44.1%	57.7%	15.4%	26.9%
Member of a Greek Organization	**p<.001**			**p<.001**
Yes	68.3%	61.5%	22.1%	16.4%
No	21.6%	45.4%	18.9%	35.7%

TABLE 4: REPORTS OF E-CIGARETTE TRIAL AMONG JUUL TRIAL USERS

	Did not report e-cigarette trial (n=507)
Overall	9.9%
Gender	**p<.001**
Male	4.1%
Female	18.9%
Race	**ns**
White	10.0%
African American	n/a
Other	9.8%
Year	**ns**
First Year	9.9%
Sophomore	5.7%
Junior	13.4%
Senior	10.6%
Cigarette Smoking	**p<.001**
Nonsmoker	15.5%
Smokes on Some Days	3.0%
Daily Smoker	0.0%
Member of a Greek Organization	**p=.049**
Yes	12.0%
No	6.6%

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results

Participants

Sample and population demographic characteristics of each university (provided on the website for Institutional Research) are presented in Table 1. The demographic distributions within each university's undergraduate student population and the survey sample were similar; however, African American students were underrepresented in survey results for each of the three universities.

JUUL Awareness and Nicotine Perceptions

Most students had seen or heard of JUUL, and more than half of those who had heard of JUUL were aware that one JUUL pod has an equivalent amount of nicotine to a pack of cigarettes (see Table 2). Awareness tended to be higher among males, white students, younger students, non-daily smokers, and members of Greek organizations. More than half of students (59.4%) who were aware of JUUL had accurate perceptions of the amount of nicotine in a JUUL pod. Males, younger students, non-daily smokers, and members of Greek organizations were more likely to have accurate nicotine perceptions, p<.05.

JUUL Use

More than a third of students (37.1%) reported having tried JUULs; and trial was higher among males, students who were not African American, first-year/sophomore students, smokers, and students in the Greek system. Most trial users also reported current past 30-day use. More than half of trial users reported either daily or past week JUUL use, 20.5% reported past 30-day use (but not in the past week), and the remaining quarter had not used a JUUL in the past 30 days (See Table 3). Males, smokers, and students in the Greek system were more likely to report daily or past week JUUL use than others, p<.05.
Continued use following JUUL trial was more likely than continued use following trial of other forms of e-cigarettes. Past 30-day use among trial users was more than three times higher among students who had tried a JUUL (74.4%) than those who had tried e-cigarettes but not a JUUL (19.5%), p<.001. Conversely, more students who had tried e-cigarettes, but not JUUL, discontinued use more than six months ago (63.6%) versus those who had discontinued JUUL use (8.7%), p<.001.

Assessment of JUUL and e-Cigarette Use

All respondents were asked about e-cigarette trial prior to being presented with questions specific to JUUL. These e-cigarette questions did not mention JUUL. To address the possibility that some students did not consider JUULs to be e-cigarettes, we examined responses to the earlier question about e-cigarette trial among students who later reported trial of the JUUL. Indeed, 9.9% of students who reported JUUL trial did not report e-cigarette trial. Females, non-smokers, and students in the Greek system were more likely to report JUUL but not e-cigarette trial (see Table 4).

conclusions

Awareness of JUUL is high and more than a third of students report JUUL trial. Moreover, most trial users report past 30-day or more frequent use, in striking contrast to many previous studies finding that most trial e-cigarette use is discontinued and only a small percentage of trial users are current users. Furthermore, continued use of JUUL among trial users in this sample was three times higher than in previous annual surveys of e-cigarette use among this population. In 2017, approximately a quarter of trial e-cigarette users continued as past 30-day users, whereas more than three-quarters of JUUL trial users did so in 2018. This finding suggests that many JUUL users may not be experimenting with the device, but using it regularly.

These findings, along with sales data indicating an increasing market share, illustrate the rapid pace with which JUUL is becoming ingrained into the social climate of youth and young adults. Although the FDA has recently begun to address the rising popularity of these products among youth, public health efforts to curb use among nonsmokers will likely face substantial challenges as use becomes more prevalent.

Another challenge facing survey surveillance concerns terminology. As previously stated, one in ten students who reported JUUL use did not report e-cigarette use earlier in the survey, suggesting that these respondents did not consider JUUL use to be e-cigarette use. Researchers need to carefully consider terminology when designing surveys about these products.

Limitations

1. The response rates for each university were low. However, the demographic distribution of each sample closely matched that of the undergraduate students as a whole, with one exception. The under-representation of African American students, who are less likely to use e-cigarettes, may have inflated estimates of JUUL use.
2. The survey could not differentiate between students who used JUUL e-cigarettes exclusively and those who used JUUL and other types of e-cigarettes. Students who reported JUUL trial but not e-cigarette trial likely only had tried pod-based systems. However, students who reported both e-cigarette and JUUL trial may have tried both JUUL and other forms of e-cigarettes or may have tried the JUUL e-cigarette exclusively, but recognized this product as an e-cigarette when responding to the e-cigarette trial question.
3. Several other pod-based systems entered the market from the time we designed the survey to the time in which we concluded data collection. Our survey asked about JUUL by brand name and did not address other brands of pod-based systems. Estimates may not accurately describe trial and use for pod-based systems in general.
4. These findings are from undergraduate students in Mississippi and may not be representative of students outside of the state.

Conclusion

Awareness and trial use of JUUL are high. Moreover, most trial users report daily or past week use, in contrast to many previous studies finding that most trial use is discontinued. Universities and policy makers need to be aware of JUUL use among undergraduates, particularly those who are non-smokers.