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Brief report

Use of JUUL E-cigarettes Among Youth in the United States

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Abstract

Introduction: JUUL has emerged as the leading brand in a rapidly evolving electronic cigarette (e-cigarette) market. JUUL is distinctive for its novel nicotine delivery method that results in high nicotine concentrations, as well as its sleek, discreet design. This study examined national estimates of JUUL among youth in the United States, including whether JUUL users report different patterns of use compared to users of other e-cigarettes.

Methods: Data were analyzed from the US arm of the International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and E-cigarette Survey, an online survey conducted in July–August 2017 with youth aged 16–19 years recruited from consumer panels (n = 4086).

Results: Overall, 14.2% of respondents had used an e-cigarette in the past 30 days. JUUL was the second-most popular brand reported by past-30-day e-cigarette users (9.7%). Compared to e-cigarette users of other brands, JUUL users were significantly older (adjusted odds ratio [aOR] = 2.50, 95% confidence interval [CI] = 1.56 to 4.01) and reported a greater number of computers in the household (a socioeconomic status proxy; aOR = 1.55, 95% CI = 1.22 to 1.96), with no differences by sex, race/ethnicity, or student status. Controlling for sociodemographic variables, JUUL users were more likely than other e-cigarette users to have ever tried to quit e-cigarettes (aOR = 2.65, 95% CI = 1.12 to 6.30), with no differences observed by smoking status, frequency of e-cigarette use, urges to use e-cigarettes, or perceived addiction to e-cigarettes.

Conclusions: JUUL was among the most popular e-cigarette brands among youth, and there were few differences in sociodemographic profile or patterns of use between users of JUUL and other e-cigarette brands.

Implications: This study examined national estimates of JUUL e-cigarette use among youth in the United States, during the early phase of JUUL's popularity. JUUL was among the most popular e-cigarette brands among youth, and there were few differences in sociodemographic profile or patterns of use between JUUL and other e-cigarette brands. The findings help to characterize the rapid rise of this new product category within the rapidly evolving e-cigarette market at a time when the US Food and Drug Administration and public health community are seeking to understand JUUL and its appeal among young people.

Introduction

In the United States (US), electronic cigarettes (e-cigarettes) are the most prevalent nicotine product among youth, with 11.3% of high school students reporting use in the past 30 days in 2016.[1] The most common reasons for e-cigarette use among youth include use by friends or family, availability of flavors, and perceptions that e-cigarettes are less harmful than cigarettes.[2]

Branding is an important component of nicotine product marketing for attracting new users and maintaining brand loyalty.[3] However, there is limited information on the brands and types of e-cigarettes used by young people. Previous data from the 2015 National Youth Tobacco Survey found that "Blu" and "Vuse" were the most commonly reported brands tried among ever e-cigarette "triers" who could recall the brand.[4] The popularity of these brands among youth may be attributed in part to their ownership by major tobacco companies with high advertising resources and point-of-sale visibility.[4,5]

Over the past year, a new e-cigarette brand, JUUL, has emerged as the most popular e-cigarette in the United States.[6,7] JUUL is notable for the innovative way it delivers nicotine. JUUL was among the first products to use nicotine salts (the natural state of nicotine in tobacco leaves) and benzoic acid to deliver much higher concentrations of nicotine than most conventional e-cigarettes that vaporize nicotine from its liquid form. The result is a distinctive sensory profile that is ostensibly more similar to the physiological sensation of smoking. Following the success of JUUL, other popular e-cigarette brands, such as Blu and Vuse, as well as e-liquid manufacturers, have also recently introduced products that use nicotine salts. Like many other e-cigarettes, JUUL also comes in popular flavors such as mango and crème brulee. JUUL is also notable for its small, sleek rectangular design, which closely resembles a USB flash drive. JUUL can be recharged in USB ports and is refilled via "pods" that each contain the nicotine equivalent of a pack of cigarettes.[8] Although these features are not unique to JUUL, it was among the first to popularize this mini "pod" design.

JUUL appears to be popular among young people and high school students in particular. An online survey conducted in late 2017 reported that 10% of young people aged 15–24 recognized and had ever used JUUL.[9] News media describe JUUL use as an "epidemic," reporting anecdotes of teachers and school administrators struggling to enforce restrictions on e-cigarettes.[10–12] News reports and social media analyses suggest that JUUL's discreet product design, and similar appearance to USB flash drives, makes it easier for youth to conceal the product from parents and use in school.[11,13] In a survey conducted in April 2018, 18% of youth aged 12–17 reported having seen JUUL used in school.[14] The popularity of JUUL has also led to distinctive terminology, in which the term "JUULing" is used rather than vaping or smoking.[9,13] However, it remains unclear whether youth perceive JUUL differently from other brands or types of vaping devices in terms of perceptions of risk.[11] For example, research has found that 37% of 15- to 24-year-old JUUL users are uncertain whether the product contains nicotine.[9]

JUUL's combination of attractive design and innovative nicotine delivery has upended the rapidly evolving nicotine market in the United States. Following its introduction in 2015, JUUL sales increased by more than 600% in 2017 to make it the top selling e-cigarette brand in US convenience and mass-market stores.[6,7] A recent analysis credits the growth in e-cigarette retail sales in the second quarter of 2017 exclusively to JUUL.[7] Recently, the US Food and Drug Administration announced greater enforcement of restrictions on sales of JUUL and other e-cigarettes to youth, as well as new actions to examine JUUL's appeal among youth and a prevention campaign, to limit youth access and uptake.[15] However, to date, evidence of JUUL's popularity among youth is largely anecdotal. The aim of this study was to provide national estimates of JUUL use among US youth, and examine whether JUUL users have different characteristics or patterns of use compared to users of other e-cigarette brands.

Methods

Data Source

Data are from Wave 1 of the International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and E-cigarette Survey, conducted in Canada, England, and the United States. Data were collected via self-completed web-based surveys conducted in July–August 2017 with youth aged 16–19. Respondents were recruited through Nielsen Consumer Insights Global Panel and their partners' panels, either directly or through their parents. E-mail invitations (with a unique link) were sent to a random sample of panelists (after targeting for age criteria); panelists known to be ineligible were not invited. Respondents provided consent before completing the survey and received remuneration in accordance with their panel's usual incentive structure. The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21847) and the King's College London Psychiatry, Nursing and Midwifery Research Ethics Subcommittee. A full description of the study methods can be found in the Technical Report.[16]

Outcome Measure

Past 30-day e-cigarette users were asked, "What specific brand of e-cigarette/vaping device do you currently use most often?," and provided with a list of 11 popular brands in the United States (Apollo, Blu, Fin, GreenSmoke, Juul, KangerTech, Logic, MarkTen, VaporFi, V2, and Vuse), as well as options for "Other brand (please specify):", "I don't have a usual brand", "Don't know", and "Refused."

Analysis

Analyses were limited to the US arm of the survey. Sample weights were constructed based on age, sex, geographic region, race/ethnicity, and cigarette smoking status (*see Technical Report*[16] *for details*). Logistic regression models were estimated to examine JUUL use among the subsample of e-cigarette users: a base model including sociodemographic variables (age, sex, race/ethnicity, student status, and number of computers in the household) was first estimated, and then other characteristics were added individually to this model to test each for significance. Adjusted odds ratios and weighted estimates are shown in all cases unless otherwise noted. Analyses were conducted using IBM SPSS Statistics 25.

Results

Sample

Table 1 shows characteristics of the full US sample and the subsample who had used an e-cigarette in the past 30 days. Of the full sample (n = 4086), 14.2% (unweighted n = 444) had used e-cigarettes in the past 30 days.

E-cigarette Brand and JUUL Use

When asked, "What specific brand of e-cigarette/vaping device do you currently use most often?," 9.7% past 30-day e-cigarette users

Table 1. US Sample Characteristics, International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and E-cigarette Survey 2017, Unweighted and Weighted (n = 4086)

	Total sample (n = 4086)		Past 30-day e-cigarette users (n = 444)	
Characteristic	Unweighted % (n)	Weighted %	Unweighted % (n)	Weighted[1] %
Sex				
Male	39.6 (1619)	53.3	41.9 (186)	60.0
Female	60.4 (2467)	46.7	58.1 (258)	40.0
Age				
16	21.6 (884)	22.9	17.1 (76)	15.2
17	22.2 (909)	23.8	17.8 (79)	16.6
18	31.1 (1270)	29.9	33.6 (149)	34.8
19	25.0 (1023)	23.4	31.5 (140)	33.4
Race/ethnicity				
White, non-Hispanic	65.2 (2664)	73.4	66.7 (296)	74.2
Black or African American	9.4 (386)	12.8	9.5 (42)	12.6
White, Hispanic	3.4 (138)	3.9	4.5 (20)	5.0
Other	21.3 (972)	9.9	19.4 (86)	8.2
Student status				
Current/returning student	91.0 (3720)	89.4	85.1 (378)	80.4
Not current/returning student	8.6 (351)	10.3	14.9 (66)	19.6
Don't know/Refused	0.4 (15)	0.3	0	0
Computers in household				
None	0.4 (16)	0.4	0.5 (2)	0.4
One	9.0 (367)	9.6	12.4 (55)	13.9
Two	18.9 (774)	20.7	23.4 (104)	24.9
Three	24.4 (997)	24.4	23.0 (102)	23.8
Four	18.5 (757)	17.8	17.8 (79)	15.9
Five	11.6 (472)	10.7	9.9 (44)	8.8
More than five	16.3 (664)	15.5	12.4 (55)	11.3
Don't know/Refused	1.0 (39)	1.0	0.7 (3)	1.0
Smoking status[2]				
Never smoker	67.6 (2763)	60.7	18.0 (80)	10.7
Experimental smoker	27.4 (1118)	28.0	59.0 (262)	46.9
Former smoker	0.6 (26)	1.3	2.0 (9)	4.3
Current smoker	4.4 (176)	10.0	20.9 (93)	38.1
E-cigarette status[3]				
Never vaper	67.6 (2761)	63.8	0	0
Experimental vaper	28.8 (1175)	30.3	77.0 (342)	69.5
Former vaper	0.7 (28)	1.0	0	0
Current vaper	2.2 (90)	4.1	20.3 (90)	29.0
Missing	0.8 (32)	0.7	2.7 (12)	1.4

[1]Weights were rescaled for analyses with past 30-day electronic cigarette (e-cigarette) users only [sample weight*(444/579)].

[2]Never smokers said "No" to "Have you ever tried cigarette smoking, even one or two puffs?"; experimental smokers said "Yes" to ever cigarette smoking, but had smoked less than 100 cigarettes in their life (in response to "How many cigarettes have you smoked in your entire life?"); current smokers had smoked at least 100 cigarettes in their life (selected "100 or more cigarettes" to lifetime use) and smoked in the past 30 days (in response to "When was the last time you smoked a cigarette, even one or two puffs?"); former smokers had smoked at least 100 cigarettes in their life, but did not smoke in the past 30 days.

[3]E-cigarette status categories paralleled smoking status categories: never vapers said "No" to "Have you ever tried an e-cigarette/vaped, even one or two puffs?"; experimental vapers said "Yes" to ever vaping, but had vaped on less than 100 days in their life (in response to "On how many days have you used an e-cigarette/vaped in your entire life?"); current vapers had vaped on at least 100 days in their life (selected "100 or more days" to lifetime use) and vaped in the past 30 days (in response to "When was the last time you used an e-cigarette/vaped?"); former vapers had vaped on at least 100 days in their life, but did not vape in the past 30 days.

selected "Juul" (equivalent to 1.4% of the total sample), whereas 65.6% indicated some other brand, and 24.7% did not indicate a usual brand. JUUL was the second-most popular brand behind "Blu" (18.1%), ahead of "Vuse" (8.4%).

Characteristics of JUUL Users

Table 2 shows the characteristics of past 30-day e-cigarette users who specified JUUL as their usual brand, compared to those who specified another brand or did not have a usual brand. In terms of sociodemographic characteristics, JUUL users were significantly older and reported a greater number of computers in the household, with no differences by sex, race/ethnicity, or student status. JUUL users were more likely than other e-cigarette users to have ever tried to quit e-cigarettes, with no differences observed by smoking status, frequency of e-cigarette use, urges to use e-cigarettes, or perceived addiction to e-cigarettes.

Discussion

The findings suggest that the initial rise in popularity of JUUL products was also present among young people. The results suggest

Table 2. Characteristics of Past 30-Day Electronic Cigarette (E-cigarette) Users Who Usually Used JUUL Versus Another/Unknown/No Usual Brand, International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and E-cigarette Survey, US, 2017 (n = 444)

	Weighted %		Model estimates[1]
	JUUL users (weighted n = 43)	Other (weighted n = 401)	aOR [95% CI]
Socio-demographic characteristics[2]			
Sex			X^2=0.9 (p = .34)
Male	60.4	59.9	
Female	39.6	40.1	
Age			X^2=14.5 (p < .001)
16	0	16.8	b = 0.917
17	7.8	17.5	aOR = 2.50 [1.56 to 4.01]
18	39.4	34.3	
19	52.9	31.4	
Race/ethnicity			X^2 = 7.1 (p = .07)
White, non-Hispanic	72.1	74.4	
Black or African American	4.2	13.5	
White, Hispanic	9.1	4.6	
Other	14.7	7.5	
Student status			X^2 = 2.1 (p = .15)
Current/returning student	90.6	79.3	
Not current/returning student	9.4	20.7	
Computers in household			X^2 = 13.3 (p < .001)
None	2.6	0.2	b = 0.437
One	0	15.4	aOR = 1.55 [1.22 to 1.96]
Two	11.5	26.3	
Three	18.5	24.3	
Four	19.5	15.5	
Five	16.6	8.0	
More than five	26.5	9.7	
Don't know/Refused	4.9	0.5	
Smoking-/E-cigarette-related			
Smoking status[3]			X^2 = 2.9 (p = .40)
Never smoker	14.1	10.3	
Experimental smoker	40.6	47.6	
Current smoker	45.3	37.4	
Former smoker	0	4.8	
Lifetime use of e-cigarettes			X^2 = 2.7 (p = .75)
1 d	3.0	7.6	
2–10 d	15.9	19.2	
11–20 d	9.1	16.0	
21–50 d	17.7	17.1	
51–99 d	11.8	12.0	
100 d or more	42.5	28.1	
Frequency of e-cigarette use in past 30 days - # of days, mean (SD)			X^2 = 0.2 (p = .64)
Plans to quit e-cigarettes	13.4 (10.7)	10.1 (9.6)	X^2 = 5.7 (p = .23)
Within the next 6 months	10.2	21.8	
In the future, beyond 6 months	26.2	18.1	
Not planning to quit	37.4	35.8	
Do not currently use	7.3	9.6	
Don't know	18.9	14.8	
Ever tried to quit e-cigarettes			X^2 = 4.9 (p = .03)
No	59.4	75.4	Ref.
Yes	40.6	24.6	aOR = 2.65 [1.12 to 6.30]
Urges to use e-cigarettes[4]			X^2 = 2.3 (p = .68)
Never	36.0	27.3	
Less than once a week	7.0	14.7	
At least once a week	20.2	20.9	
Every day or most days	15.6	17.6	
Several times a day	21.1	17.4	
Don't know/Refused	0	2.0	

Table 2. *Continued*

	Weighted %		Model estimates[1]
	JUUL users (weighted n = 43)	Other (weighted n = 401)	aOR [95% CI]
Addicted to e-cigarettes[5]			$X^2 = 5.9$ ($p = .12$)
Not at all	55.8	60.8	
Yes, a little addicted	27.5	26.0	
Yes, very addicted	11.6	11.0	
Don't know/Refused	5.2	2.2	

aOR = adjusted odds ratio; CI = confidence interval.

[1]All estimates are weighted, from logistic regressions models adjusting for age, sex, race/ethnicity, student status, and number of computers in household. Wald X^2 statistics reported for overall test of significance in model. Boldface denotes significance ($p < .05$) in the model.

[2]Sociodemographic characteristics were tested together in the base model, to which all other variables were later added (one by one).

[3]Never smokers said "No" to "Have you ever tried cigarette smoking, even one or two puffs?"; experimental smokers said "Yes" to ever cigarette smoking, but had smoked less than 100 cigarettes in their life (in response to "How many cigarettes have you smoked in your entire life?"); current smokers had smoked at least 100 cigarettes in their life (selected "100 or more cigarettes" to lifetime use) and smoked in the past 30 days (in response to "When was the last time you smoked a cigarette, even one or two puffs?"); former smokers had smoked at least 100 cigarettes in their life, but did not smoke in the past 30 days

[4]Responses to the question, "In the past 30 days, how often did you have a strong urge to use an e-cigarette/vape?" "Don't know/Refused" responses excluded from the model.

[5]Responses to the question, "Do you consider yourself addicted to using e-cigarettes/vaping?"

that, compared to other e-cigarette brands, JUUL was particularly popular among youth who were older and of higher socioeconomic status, as measured through the proxy of number of computers in the household. This is generally consistent with recent research that also found that JUUL use was more common among young adults than youth aged 15–17, as well as those reporting greater financial security.[9] This is consistent with the price point of JUUL, which is lower than smoking, but higher than many "open" e-cigarette systems that use "tanks" and refillable liquid.

Few differences were observed compared to other brands in terms of the patterns of e-cigarette use or smoking status. As with other e-cigarette brands, most youth who usually used JUUL were also current or experimental smokers; JUUL users were not significantly more likely to be "never smokers" than users of other e-cigarette brands. JUUL users did not report using e-cigarettes nor having urges to use e-cigarettes more frequently than users of other brands. However, JUUL users were more likely to have tried to quit e-cigarettes in the past.

The current data were collected in July 2017, during the early phase of JUUL's popularity. More recent data are also needed to examine the extent to which the subsequent increase in sales has been driven by youth versus adults, as well as whether JUUL has greater appeal among nonsmokers compared to conventional cigarette brands. Although much of the discussion around JUUL has focused on its popularity among youth, it remains unclear whether the product has greater appeal to youth, or whether the popularity of JUUL among young people simply reflects the overall market success of the product. More recent data on longer-term patterns of use should examine whether the distinctive nicotine delivery profile of JUUL is associated with different patterns of use, particularly given the increasing number of vaping brands that are using nicotine salt technology. There is an urgent need to examine the potential implications of this type of nicotine delivery system for how products such as JUUL are used by smokers and nonsmokers.

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Declaration of Interests

DH has provided paid testimony in tobacco litigation on behalf of governments and class-action plaintiffs on issues related to tobacco product science and regulation. The other authors have no financial relationships relevant to this article to disclose.

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