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Who is JUULing and Why? An Examination of Young Adult ENDS Users

Kathleen R Case, DrPH^{a,*}, Josephine T Hinds, MS^b, MeLisa R Creamer, PhD^a, Alexandra Loukas, PhD^b, Cheryl L Perry, PhD^a

^aUniversity of Texas Health Science Center at Houston, School of Public Health in Austin 1616 Guadalupe Suite 6.300 Austin, TX 78701

^bDepartment of Kinesiology and Health Education, University of Texas at Austin 1912 Speedway, Stop D5000 Austin, Texas 78712

Abstract

Purpose: The purpose of this study was to compare characteristics of usual JUUL users versus other electronic nicotine delivery systems (ENDS) users; to examine differences in reasons for use and perceptions across ENDS user groups; and to identify significant correlates of usual JUUL use.

Methods: This study utilized data from 510 young adult ENDS users (ages 18–29) from Wave 7 (Spring 2018) of the Marketing and Promotions Across Colleges in Texas Project (Project M-PACT). Chi-Square analyses, independent t-tests, and mixed effects logistic regression analyses were conducted to identify factors associated with usual JUUL use. Four separate regression analyses were conducted based on independent variables of interest; all models included demographics and ENDS/other tobacco use behaviors as covariates.

Results: Compared to other ENDS users, usual JUUL users were more likely to be male, younger, smoke cigarettes, reported a higher socio-economic status (SES), used ENDS on more days in the past 30 days, and reported nicotine “hit” as a reason for use. Usual JUUL users had a higher prevalence of perceiving JUUL/pod vapes as addictive as compared to other ENDS users, although perceived addictiveness was not significant in the multivariable models, nor were the cessation and dependence measures different between ENDS user groups.

Conclusions: Results highlight concerns about the dual use of JUUL and cigarettes, and raise additional concerns about the high nicotine concentration of JUUL. Future longitudinal research is needed to determine if usual JUUL users are more likely to develop symptoms of nicotine dependence as compared to other ENDS users.

*corresponding author: Kathleen.R.Case@uth.tmc.edu, Phone: 512-560-5266.

Implications and Contribution

Usual JUUL users reported a higher prevalence of dual use of JUUL and cigarettes, and using ENDS for the nicotine “hit” versus other ENDS product users. These results, coupled with the findings that usual JUUL users reported using ENDS more frequently than other ENDS users, raises concerns for future dependence.

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Introduction

Electronic nicotine delivery systems (ENDS) are a rapidly changing class of tobacco products, which are particularly popular among youth and young adults [1–3]. JUUL, a new ENDS product, provides a high amount of nicotine, with one “vape pod” containing a comparable amount of nicotine as a pack of cigarettes [4]. JUUL has exploded in popularity since it was first introduced to the U.S. market in 2015, now accounting for roughly 75% of sales in the ENDS retail market as measured through convenience store data [5]. Many in the public health community believe the rise of JUUL is largely responsible for the increase in ENDS product use among young people [3, 6]. According to National Youth Tobacco Survey data, past 30-day ENDS use increased by 78% among high school students from 2017 to 2018, with the introduction of JUUL as the only notable change to the ENDS landscape that would explain this rapid increase in use [3]. Data specific to young adults indicate that 11.2% of 18 to 21 year olds reported ever use of JUUL and 7.7% past 30-day use in 2018 [7]. Ultimately, JUUL has rapidly increased in popularity among young people, raising concerns in the public health community about JUUL’s impact on future morbidity [4].

While ENDS have been proposed as a harm reduction strategy for smokers [8, 9], current evidence suggests that JUUL users are not using these products in place of cigarettes [7, 10, 11]. Alarming, the limited research on JUUL use behaviors indicates that dual use of cigarettes and JUUL is high; Leavens et al. (2019) found that 42% of current JUUL users reported current use of cigarettes [10]. The dual use of ENDS and cigarettes raises health concerns due to potential exposure to high levels of potentially harmful constituents found in both ENDS products and cigarettes. Results from a recent study found that dual users of ENDS and cigarettes are exposed to higher levels of many of the toxic chemicals (e.g. heavy metals, volatile organic compounds, nicotine metabolites, and polycyclic aromatic hydrocarbons) found in tobacco products compared to single product users (i.e. ENDS-only, cigarette-only) [12].

The limited research on JUUL use suggests that 1) young adults (ages 18 to 24) report a higher prevalence of ever use of JUUL as compared to adolescents (ages 15 to 17)[13]; and 2) JUUL users report a high level of dual/polytobacco use [7, 10, 11]. In a study of adolescents and young adults, JUUL users reported using the product on more days in the past 30 days as compared to other ENDS users, and compared to cigarette users [11]. To date, however, most of the JUUL studies have examined a limited number of factors, including demographic characteristics, and other ENDS/tobacco use behaviors. Furthermore, most of the literature has been descriptive in nature [10, 11, 13, 14] and has not examined correlates of JUUL use after controlling for important covariates including demographic characteristics.

In one of the first studies to examine reasons to use among JUUL users, Leavens et al. (2019), found that adult JUUL users (mean age=33.2 years) reported that the most commonly endorsed reasons to use were friend use, curiosity, and similar “hit” as cigarettes [10]. Importantly, these items were asked among ever JUUL users, who may have different reasons for using JUUL than current or usual JUUL users. To date, only two studies have

examined perceptions of JUUL products among young adults [7, 14]. In a qualitative study of young adult ENDS users (ages 18 to 29), researchers found that current JUUL users (n=10) highlighted the unique product characteristics, such as “sleek” and simple design as well as the high nicotine content, as appealing factors of JUUL [14]. Furthermore, using a sample of adolescents and young adults (ages 15 to 34), Vallone et al., examined demographic characteristics, combustible tobacco product use, household combustible tobacco and ENDS use, ENDS harm perceptions, and sensation seeking, as correlates of ever and past 30-day JUUL use [7]. Findings indicated that perceiving ENDS as more harmful than cigarettes was associated with lower odds of ever and current JUUL use [7]. Importantly, neither young adult study examined other potential factors associated with JUUL use, including dependence/cessation behaviors, and perceptions specific to JUUL and pod vape products.

Research regarding factors associated with JUUL use among young adults (18 to 29 year olds) is warranted for several reasons. First, young adults are the youngest legal targets of the tobacco industry, including JUUL [15]. Due to the rapid increase in JUUL use among youth, the Food and Drug Administration (FDA) sent warning to ENDS manufacturers and retailers specific to limiting youth access to JUUL products [16]. As a result of increased pressure from the FDA, JUUL suspended the sale of non-tobacco and menthol flavored products from retail stores and ended social media marketing of their products [17]. JUUL also put additional screening policies in place to limit sales of products on their website to minors [17]. Notably, these limitations do not apply to young adults who are over the age of 21; therefore, it is necessary to investigate use behaviors and factors associated with use among this population. In addition, a focus on young adults is warranted as research suggests that this population may be particularly vulnerable to tobacco use given the significant life changes associated with this development time period [18–20]. A recent study published by Perry et al. (2018) found that young adults were more likely to initiate tobacco use as compared to adolescents [21]. Ultimately, more research is needed examining JUUL use among young adult populations.

Adding to the limited research on JUUL use among young adults, this study aims to: 1) compare demographic characteristics, ENDS use, other tobacco use, and cessation/dependence behaviors, among usual JUUL users versus other ENDS users; 2) examine differences in reasons for use and perceptions among ENDS user groups; and 3) identify significant correlates of usual JUUL use after controlling for demographic and ENDS/tobacco use behaviors.

Methods

Data were drawn from Wave 7 of the Marketing and Promotions Across Colleges in Texas Project (“Project M-PACT”). Project M-PACT is a rapid response surveillance system that assesses tobacco use and related behaviors among college students living in the four largest metropolitan areas in Texas (Austin, San Antonio, Dallas/Fort Worth, and Houston). A total of 24 colleges, six per city (three 2-year colleges, and three 4-year colleges) were recruited to draw participants. To be eligible to participate, individuals had to be enrolled as full-time or part-time degree or certificate-seeking undergraduate students attending a four-year

college or a vocational/technical program at a two-year college. Students who met the eligibility criteria were recruited to participate via e-mail and student consent was obtained online prior to study enrollment. Data collection began in Fall 2014/Spring 2015, with follow-up surveys administered every 6 months for 2.5 years (Waves 1 – 6) and a one-year follow-up administered in Spring 2018 (Wave 7). All data were collected via a web-based survey. Data for the present study were drawn from Wave 7 (n=4,124), conducted in Spring 2018, as this was the first wave in which JUUL items were included on the survey. Moreover, for purposes of the present study, only participants reporting past 30-day ENDS use were included (n=510).

Project M-PACT was approved by the University of Texas at Austin Institutional Review Board (2013-06-0034). Substantial cognitive testing was conducted on the initial survey prior to administration in order to refine the survey methods, particularly with respect to ENDS use items and terminology [22]. A more complete description of the methodology used in Project M-PACT, including recruitment details, has been published elsewhere [23].

Measures

A description of the questions and images used to measure ENDS use and related constructs are presented in Table 1.

ENDS User Groups

Usual JUUL users were a subset of past 30-day disposable ENDS users who selected JUUL as their usual brand of choice. All other participants who indicated past 30-day use of any ENDS product but did not indicate JUUL as their usual brand were coded as “other ENDS users.”

ENDS/Tobacco Use Behaviors

Days ENDS used.—Days ENDS used corresponded to the number of days of ENDS use in the past 30 days (0 to 30 days).

Other Tobacco Use.—Cigarette, cigar product, hookah, and smokeless tobacco use was assessed with similar past 30-day measures. Responses were dichotomized; participants who indicated 0 days of use in the past 30 days were classified as non-users, while those who indicated 1 or more days of use were classified as users.

Cessation/Dependence Behaviors

Use of ENDS for Smoking Cessation.—Using ENDS for smoking cessation was assessed using the yes/no question, “During the past 30 days have you used an ENDS product to try and quit smoking?”

ENDS Dependence Behaviors.—For the ENDS-specific dependence scale, three items were used, including time to first daily use [24, 25], strong craving [26], and really needing [26] an ENDS product. A summary scale corresponding to the number of ENDS-specific dependence symptoms (0–3) was created using the following criteria: use of ENDS within

30 minutes of waking, and yes responses to having a strong craving and really needing an ENDS product ($\alpha=0.87$).

Reasons for Use—Ten reasons for ENDS use were each assessed with 4-point Likert scale items ranging from “strongly disagree” to “strongly agree;” responses were dichotomized into “agree/strongly agree” versus “disagree/strongly disagree” [27]. Reasons included “helps me stay slim,” “helps when I’m feeling stressed,” “gives me a definite nicotine hit,” “is healthier than smoking regular cigarettes,” and “helps me look cool or fit in,” among others.

Perceptions of JUUL and Pod Vapes

Harm Perceptions.—Perceived harm of JUUL and pod vapes was measured with the question, “How harmful are these products to health? ENDS products (juul/pod vape)?” The item was scored on a scale ranging from 1 (“not at all harmful”) to 4 (“extremely harmful”). For perceived harm, responses of 1 or 2 were grouped into “not harmful;” responses of 3 or 4 were grouped into “harmful.”

Perceived Addictiveness.—Perceived addictiveness of JUUL and pod vapes was measured with the question, “How addictive are ENDS products (juul/pod vape)?” Response options included “not at all addictive,” “somewhat addictive, and “very addictive.” For addictiveness, responses were grouped as “not at all addictive” versus “somewhat addictive/very addictive.”

Demographic Characteristics

Sex, current age, subjective SES, and race/ethnicity (white/non-Hispanic versus other races) were also included in the analyses. For subjective SES, a picture of a 10-step ladder was displayed, asking participants to indicate where they fall on the ladder, with the bottom indicating people who are “worst off,” and the top indicating people who are the “best off” [28].

Analyses

Chi-Square analyses for categorical variables and independent t-tests for continuous variables were conducted to compare characteristics of usual JUUL users versus other ENDS product users. Mixed effects logistic regression analyses were conducted to identify significant correlates of usual JUUL use after controlling for covariates. All analyses included school as a random effect to account for school-level clustering. For the multivariable analyses, four different models were examined and for all four models, usual JUUL use versus use of other ENDS products was the outcome: 1) Model 1 (demographic and tobacco use model) included demographics, and ENDS/tobacco use behaviors as the independent variables of interest, 2) Model 2 (cessation/dependence model) included cessation/dependence behaviors as the independent variables of interest, controlling for demographics and ENDS/tobacco use behaviors, 3) Model 3 (reasons for use model) included reasons for use as the independent variables of interest, controlling for demographics and ENDS/tobacco use behaviors, and 4) Model 4 (perceptions of JUUL/pod

vapes model) included perceptions of JUUL/pod vapes as the independent variables of interest, controlling for demographics and ENDS/tobacco use behaviors.

Results

Of the 510 participants who reported past 30-day use of any ENDS product, 20.6% of past 30-day ENDS users reporting JUUL as their usual brand (n=105). Of the entire sample of past 30-day ENDS users (n=510), 46% were male, 41% were White, non-Hispanic, and their mean age was 24.3 years. As shown in Table 2, a significantly higher proportion of usual JUUL users were male, younger, and reported higher subjective SES as compared to other ENDS users. Usual JUUL users reported using any ENDS product on more days during the past 30 days as compared to other ENDS users (mean days “m”=12.1 versus m=9.5). A higher proportion of usual JUUL users reported currently smoking cigarettes than other ENDS users (53.3% versus 40.2%); however, there were no significant differences in using ENDS for smoking cessation between the two groups. A higher proportion of usual JUUL users reported using ENDS for nicotine “hit” as compared to other ENDS users (76.9% versus 56.5%). A higher proportion of usual JUUL users also perceived JUUL/pod vapes as addictive as compared to other ENDS users (45.1 % versus 29.6%); however, there were no significant differences in ENDS dependence scores or harm perceptions [Table 2].

Results from the mixed effects logistic regression analyses are presented in Table 3. Findings for demographic and ENDS/tobacco use variables were largely consistent across all four models. For all four models, male sex (adjusted odds ratios (AORs) ranged from 2.25–2.32) and higher subjective SES scores (AORs ranged from 1.32–1.35) were associated with significantly higher odds of usual JUUL use, while older age (AORs ranged from 0.70–0.73) was associated with significantly lower odds of usual JUUL use. With respect to ENDS/tobacco use behaviors, being a cigarette user was significantly associated with usual JUUL use across all models (AORs ranged from 1.74–1.99) compared to other ENDS use. Use of ENDS on more days during the past 30 days was associated with higher odds of being a JUUL user in three out of the four models (AORs ranged from 1.02–1.04). None of the other tobacco use variables were significantly associated with usual JUUL use. In the cessation/dependence behaviors model, none of the variables were significantly associated with usual JUUL use after controlling for demographic and ENDS/tobacco use behaviors. In the reasons for use model, only “nicotine hit” was significantly associated with higher odds of usual JUUL use after controlling for covariates (AOR=2.28, 95% CI=1.21, 4.26). For the perceptions of JUUL/pod vapes model, neither perceived harm nor perceived addictiveness were significantly associated with usual JUUL use after controlling for covariates.

Discussion

Overall, this study adds to the limited research on factors associated with JUUL use among young adults. Notable findings include demographic characteristics associated with use, including male sex, younger age, and higher subjective SES. Importantly, being a cigarette user was consistently significantly associated with higher odds of usual JUUL use; however, using ENDS for cessation purposes was not significantly different between groups. These findings provide a preliminary indication that a high proportion of young adults are dual

users of JUUL and cigarettes, but are not using JUUL specifically to stop smoking. This, coupled with our findings that a prominent reason for using ENDS products among usual JUUL users was the presence of a “nicotine hit,” is concerning and implications of these findings are discussed below.

Results from our study are consistent with previous research demonstrating that factors associated with JUUL include male gender [13], younger age [7], and higher SES [7, 13]. These findings have implications for the development of interventions targeting those who are most susceptible to JUUL use. Specifically, the finding that younger young adults have higher odds of usual JUUL use are concerning, as this may lead to earlier exposure to high levels of nicotine, thus increasing the risk for the development of nicotine dependence. We examined only past 30-day use of ENDS, so we cannot draw conclusions about continued use of JUUL. Future research is warranted to determine the prospective use patterns of these individuals, namely, whether they become regular JUUL users and develop symptoms of nicotine dependence over time.

Other notable findings include the high proportion of usual JUUL users who also reported current cigarette smoking, which is consistent with previous research [7, 10, 11]. This study adds to the extant literature by demonstrating that, even compared to *other ENDS product users*, a higher proportion of usual JUUL users report cigarette smoking. Importantly, current cigarette smoking was significantly associated with usual JUUL use across all multivariable models. JUUL products are marketed as an alternative to smoking, with language on the company website stating, “For Smokers. By Design” [29]. While we found that usual JUUL users were more likely to report current smoking than other ENDS product users, there were no differences between the two group in using ENDS for smoking cessation purposes. The concurrent use of JUUL and cigarettes is concerning as it may expose individuals to higher levels of nicotine and toxicants as compared to single product users [12, 30]. Future longitudinal research is also needed to evaluate whether JUUL use increases the risk of smoking, as substantial evidence indicates that ENDS use is a significant predictor of the initiation of smoking behaviors among youth and young adults [31, 32].

Of all the reasons to use ENDS products, only nicotine hit was significantly associated with usual JUUL use. Other studies have found that JUUL users commonly use for the nicotine content or “hit” [10, 14]. Taken together, our findings that 1) usual JUUL users reported “nicotine hit” as a prominent reason to use, 2) usual JUUL users had a high prevalence of dual use of JUUL and cigarettes, and 3) usual JUUL users reported using ENDS products on more days than other ENDS users, raise concerns for future dependence and subsequent morbidity. It is important to note, however, there were no significant differences in ENDS-specific dependence scores between exclusive JUUL users and other ENDS product users. One potential explanation for the lack of an observed difference in nicotine dependence scores among usual JUUL users versus other ENDS users may be due to the short time period of use. As stated previously, JUUL use is a recent phenomenon, therefore young adults who use JUUL may have done so for a shorter time period than those who use other ENDS products. In analyses not shown in the paper, there were significant differences in the duration of use of ENDS products for usual JUUL users versus other ENDS product users;

70% of usual JUUL users reported using ENDS products for a year or less compared to 51% of other ENDS users ($p=.003$). When asked specifically about JUUL/pod vape use, 88% of usual JUUL users indicated that they used JUUL/pod vapes for the first time a year or less ago. Further longitudinal research is needed to evaluate symptoms of nicotine dependence among JUUL users.

Our study builds upon previous research by examining correlates of usual JUUL use by including a thorough examination of potential correlates of use, such as demographic characteristics, ENDS/tobacco use behaviors, cessation/dependence behaviors, reasons for use, and addiction/harm perceptions. Specifically, our study expands on previous research of JUUL use among young adults by comparing usual JUUL users to other ENDS users, which demonstrates that even compared to current ENDS users, JUUL users have different correlates of use. Given our findings, the FDA should consider restricting the nicotine concentration for JUUL products, as JUUL products are not approved smoking cessation devices and young adults report nicotine “hit” as a prominent reason for use. Further proposed restrictions on flavors and point-of-sale restrictions may reduce appeal of ENDS products, particularly to nicotine-naïve young adults.

Strengths and Limitations

This study has numerous strengths including the focus on young adults, the JUUL-specific measures, and the inclusion of a wide-range of variables that are known correlates of ENDS and tobacco use behaviors. Previous research has investigated correlates of JUUL use among youth and young adults [7]; however, this is the first to examine these associations specific to young adult populations. With respect to the measures, this is the first study to examine harm perceptions and perceived addictiveness specific to JUUL/pod vape use. As JUUL products differ significantly from other ENDS products in appearance and nicotine concentration [4], it is important to ask questions that are product-specific in order to determine the associations with JUUL product use. Finally, the current study included an examination of factors such as symptoms of dependence [23, 33, 34] and harm perceptions [35–37], which are well-documented correlates of ENDS and tobacco use behaviors.

Importantly, there are several limitations to note, including the small sample size of JUUL users and the cross-sectional nature of the study. Furthermore, while the sample was racially and ethnically diverse, the data were from Texas and future research should replicate this research utilizing a national sample. In addition, given the nature of Project M-PACT and the need to limit survey items and minimize participant burden, only three items were used to assess nicotine dependence. Future research should include a more comprehensive scale to assess nicotine dependence specific to ENDS use, such as the PROMIS-E scale [38].

Conclusion

This study provides insight into use behaviors and reasons for use among young adult ENDS users, and highlights the role of nicotine in using JUUL products. Ultimately, the FDA should consider restricting the nicotine concentration for JUUL products, as JUUL products are not approved smoking cessation devices and young adults report nicotine “hit” as a prominent reason for use. Further proposed restrictions on flavors and point-of-sale

restrictions may reduce appeal of ENDS products, particularly to nicotine-naïve young adults.

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Table 1:

Measures used to assess ENDS product use; Project M-PACT



Variable	Question Text
Preamble to ENDS questions	<p>ENDS include a variety of products, like e-cigarettes, vape pens, juul/ pod vape, e-hookah, personal vaporizers, e-gos, and mods, among others. Many are battery-operated and may look like real cigarettes, and usually they produce vapor instead of smoke. They can be disposable or rechargeable, and often contain flavored “e-liquid” or “e-juice.” When we use the term ENDS (electronic nicotine delivery systems), we are asking about any of the products mentioned above.</p> 
ENDS user groups	<p>During the <u>past 30 days</u>, have you used <u>any ENDS product</u>, (i.e. an e-cigarette, vape pen, JUUL/ pod vape, e-hookah, or mod), even one or two puffs, as intended (i.e. with nicotine cartridges/pods and/or e-liquid/e-juice)? Response options: Yes/No</p> <p>If participants selected “yes” to the previous question they were asked about disposable ENDS use: During the past 30 days, have you used a <u>disposable</u> e-cigarette or an e-cigarette with a <u>disposable</u> nicotine cartridge or pod? Neither requires the addition of e-liquid/e-juice. E-cigarettes of this type are pictured below. Response options: Yes/No.</p>  <p>If participants selected “yes” to the previous question, they were asked the following: What brand of disposable e-cigarette or e-cigarette with disposable nicotine cartridges or pods do you usually use? (Note: neither requires the addition of e-liquid/e-juice.) Response options included a list of the following: Juul; blu; NJoy; Logic; Vuse; MarkTen; Fin; Mystic; Metro; 21st Century Smoke; Other; I don't smoke a usual brand of e-cigarette.</p>
Smoking cessation	During the past 30 days, have you used an ENDS product to try and quit smoking? Response options: Yes/No
ENDS dependence scale (3 items)	<p>1 How soon after you wake up do you typically use your first ENDS product (i.e. e-cigarette, vape pen, juul/ pod vape, e-hookah, or mod)? Response options: Within 5 minutes of waking, 6–30 minutes after waking, 31 –60 minutes after waking, 60 or more minutes of waking, and I am not a daily smoker of ENDS products.</p> <p>2 Have you ever felt like you really needed to use an ENDS product (i.e. e-cigarette, vape pen, juul/ pod vape, e-hookah, or mod)? Response options: Yes/No</p> <p>3 Have you ever had a strong craving for an ENDS product (i.e. e-cigarette, vape pen, juul/ pod vape, e-hookah, or mod)? Response options: Yes/No</p>
Want to quit ENDS	Do you want to completely stop using ENDS products right now? Response options: Yes/No
Reasons for use (10 items)	I think using ENDS products...(e.g. Helps me stay slim, Gives me a definite nicotine hit). Response options: Strongly Disagree (1) to Strongly Agree (4).
Perceived harm of JUUL	How harmful are these products to health? ENDS products (juul/pod vape). Response options: Not at all harmful (1) to Extremely harmful (4).
Perceived addictiveness of JUUL	How addictive are ENDS products (juul/pod vape)? Response Options: Not at all addictive (1), Somewhat addictive (2), Very addictive (3).

Table 2:

Characteristics of usual JUUL users as compared to other ENDS users; Wave 7 of Project M-PACT (N=510)

	Past 30-Day ENDS Users			p-value ^a
	Overall	Usual JUUL Users (n=105)	Other ENDS Users (n=405)	
Demographics				
Male; n (%)	235 (46.3)	68 (64.8)	167 (41.4)	<.001
Race/ethnicity				.23
White, non-Hispanic; n (%)	207 (40.6)	48 (45.7)	159 (39.3)	
Other; n (%)	303 (59.4)	57 (54.3)	246 (60.7)	
Age; m (sd)	24.3 (2.4)	23.3 (1.6)	24.5 (2.5)	<.001
Subjective SES; m (sd) ^b	5.7 (1.7)	6.4 (1.7)	5.5 (1.6)	<.001
ENDS/Tobacco Use Behaviors				
Days ENDS used; m (sd)	10.0 (11.1)	12.1 (11.4)	9.5 (11.0)	.03
Cigarette user; n (%)	219 (42.9)	56 (53.3)	163 (40.2)	.02
Cigar product user; n (%)	74 (14.7)	16 (15.4)	58 (14.5)	.82
Hookah user; n (%)	118 (23.4)	21 (20.2)	97 (24.3)	.38
Smokeless user; n (%)	33 (6.6)	9 (8.7)	25 (6.1)	.33
Cessation/Dependence Behaviors				
Used ENDS for cessation; n (%)	73 (14.4)	14 (13.3)	59 (14.7)	.72
Dependence score; m (sd)	0.8 (1.1)	0.9 (1.1)	0.8 (1.1)	.86
Want to quit ENDS; n (%)	120 (23.8)	28 (26.9)	92 (22.9)	.40
Reasons for Use^c				
Slim; n (%)	55 (10.9)	15 (14.4)	40 (10.0)	.20
Stress reduction; n (%)	350 (69.4)	80 (76.9)	270 (67.5)	.06
Relaxation; n (%)	377 (74.8)	83 (79.8)	294 (73.5)	.19
Energy; n (%)	157 (31.2)	39 (37.5)	118 (29.5)	.11
Concentration; n (%)	185 (36.7)	40 (38.5)	145 (36.3)	.68
Nicotine hit; n (%)	306 (60.7)	80 (76.9)	226 (56.5)	<.001
Healthier than smoking; n (%)	325 (64.4)	69 (66.4)	256 (63.8)	.63
More friends; n (%)	49 (9.7)	11 (10.6)	38 (9.5)	.74
Cool/fit in; n (%)	63 (12.5)	14 (13.5)	49 (12.2)	.73
More mature; n (%)	53 (10.5)	9 (8.7)	44 (11.0)	.49
Perceptions of JUUL/pod vapes				
Perceived harm; n (%) ^d	268 (53.5)	55 (53.9)	213 (53.4)	.92
Perceived addictiveness; n (%) ^e	164 (32.7)	46 (45.1)	118 (29.6)	.003

^a p-value for difference between usual JUUL users and Other ENDS users. m=mean, sd=standard deviation.

^b Subjective Socioeconomic Status (SES), 1–10 scale, with higher scores corresponding to higher SES.^[9]

^c Percentage corresponds to those who selected “Strongly Agree” or “Agree” for each item.

^d Percentage corresponds to the those who responded 3 or 4 on the scale from 1 “Not at all harmful” to 4 “Extremely harmful.”

^e Percentage corresponds to those who selected “Very addictive” or “Somewhat addictive.”

Table 3: Results from Logistic Regression Analyses Examining Correlates of Usual JUUL use; Wave 7 of Project M-PACT (N=510)

	Demographics and ENDS/Tobacco Use Behaviors Model ^d	Cessation/Dependence Behaviors Model ^b	Reasons for Use Model ^c	Perceptions of JUUL/pod vapes Model ^d
Demographics	Adjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Sex				
Female	REF	REF	REF	REF
Male	2.29 (1.38,3.79)**	2.25 (1.35,3.76)**	2.32 (1.37,3.95)**	2.29 (1.37,3.84)**
Race/ethnicity				
White, non-Hispanic	REF	REF	REF	REF
Other	1.02 (0.60,1.73)	1.00 (0.58, 1.70)	1.05 (0.60,1.84)	1.02 (0.60, 1.76)
Age	0.72 (0.63,0.83)***	0.73 (0.63,0.84)***	0.70 (0.60,0.81)***	0.72 (0.63, 0.84)***
Subjective SES ^e	1.32 (1.14, 1.54)***	1.32 (1.14, 1.54)***	1.35 (1.15, 1.58)***	1.33 (1.14,1.56)***
ENDS/Tobacco Use Behaviors				
Days ENDS used	1.02 (1.00, 1.05)*	1.04 (1.01, 1.07)**	1.02 (0.99,1.04)	1.02 (1.00, 1.05)*
Cigarette user	1.85 (1.12,3.04)*	1.99 (1.20,3.30)**	1.74 (1.03,2.95)*	1.92 (1.16,3.18)*
Cigar product user	0.79 (0.38,1.63)	0.81 (0.39, 1.69)	0.84 (0.40,1.78)	0.68 (0.32,1.44)
Hookah user	0.97 (0.51,1.83)	0.95 (0.50, 1.80)	0.95 (0.49,1.84)	0.97 (0.50,1.87)
Smokeless user	1.35 (0.51,3.54)	1.45 (0.54,3.91)	1.57 (0.57,4.3)	1.54 (0.57,4.16)
Cessation/Dependence Behaviors				
Used ENDS for cessation	---	0.69 (0.33, 1.46)	---	---
Dependence score	---	0.79 (0.59, 1.06)	---	---
Want to quit ENDS	---	1.49 (0.84,2.65)	---	---
Reasons for Use^f				
Slim	---	---	1.56 (0.72,3.38)	---
Stress reduction	---	---	1.84 (0.83,4.05)	---
Relaxation	---	---	0.94 (0.42, 2.09)	---
Energy	---	---	1.12 (0.59,2.13)	---

	Demographics and ENDS/Tobacco Use Behaviors Model ^d	Cessation/Dependence Behaviors Model ^b	Reasons for Use Model ^c	Perceptions of JUUL/pod vapes Model ^d
	Adjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Concentration	---	---	0.59 (0.31, 1.11)	---
Nicotine hit	---	---	2.28 (1.21, 4.26)*	---
Healthier than smoking	---	---	0.68 (0.38, 1.23)	---
More friends	---	---	1.44 (0.48, 4.26)	---
Cool/fit in	---	---	2.04 (0.70, 5.93)	---
More mature	---	---	0.33 (0.99, 1.10)	---
Perceptions of JUUL/pod vapes				
Perceived harm ^g	---	---	---	1.29 (0.77, 2.16)
Perceived addictiveness ^h	---	---	---	1.33 (0.78, 2.28)

* p<.05,

** p<.01,

*** p<.001;

^aDemographic and ENDS/tobacco use behaviors as independent variables of interest;^bCessation/dependence behaviors as independent variables of interest, controlling for demographic and ENDS/tobacco use behaviors;^cReasons to use as independent variables of interest, controlling for demographic and ENDS/tobacco use behaviors;^dPerceptions of JUUL/pod vapes as independent variables of interest controlling for demographic and ENDS/tobacco use behaviors.^eSubjective Socioeconomic Status (SES), 1–10 scale, with higher scores corresponding to higher SES.[9]^fPercentage corresponds to those who selected “Strongly Agree” or “Agree” for each item.^gPercentage corresponds to the those who responded 3 or 4 on the scale from 1 “Not at all harmful” to 4 “Extremely harmful.”^hPercentage corresponds to those who selected “Very addictive” or “Somewhat addictive.”