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# Attribution of Use Characteristics to Electronic Cigarette Brands in the National Youth Tobacco Survey

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## Abstract

**Background** This manuscript responds to a study published in the journal Drug and Alcohol Dependence (DAD). This re-analysis was submitted to DAD and received peer-review comments that were critical because the paper referred to the original authors by name and reviewers were concerned about conflict due to the sponsorship by JUUL Labs; no fundamental concerns were raised about the paper's methods or findings. Following an appeal letter to DAD (see Supplemental Materials), which did not reverse the refusal to publish, the manuscript was transferred to the companion journal DAD Reports, where it was rejected, again without methodological concerns being raised.

**Introduction** A previous publication, using NYTS data, reported higher electronic nicotine delivery system (ENDS) use frequency and tobacco cravings among adolescents using JUUL-brand ENDS vs other ENDS brands. Re-analysis explores the effect of methodological decisions the original study employed that confound brand attributions: (1) imputing non-JUUL use to those reporting they "don't know" what brand they used ("DKs"); and (2) counting as JUUL users those with *any* JUUL use, even if they *usually* used another ENDS brand.

**Methods** Analyses of the same data examined the effects of assigning DKs to the 'other brands' group vs. coding DKs as missing, and re-examined the effects reported for JUUL when brand assignment was based on *usual* and *exclusive* brand use, respectively.

**Results** DKs used ENDS significantly less frequently and were significantly less likely to report craving than other ENDS users; assigning DKs to the "other-brand" group, as in the original analysis, resulted in every ENDS brand, when considered in turn, appearing to be used more frequently and eliciting greater craving, than all comparison brands. When DKs were coded as missing, there was no association between JUUL use and these outcomes. When assignment was based on *usual* or *exclusive* use, JUUL users were significantly *less* likely to be frequent users, compared to non-JUUL users (Usual: Relative Risk Ratio (RRR): 0.45 (0.28–0.75); Exclusive: RRR: 0.31 (0.18–0.55)), and non-significantly less likely to report cravings.

**Conclusions** Previous findings are attributable to methodological confounds in brand usage definitions. Re-analysis illustrates the impact of such methodological decisions.

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## 1. Introduction

Tobacco use among adolescents is not safe – youth should not have access to or use any tobacco or nicotine-containing products, including Electronic Nicotine Delivery Systems (ENDS). Recent use of ENDS by adolescents is therefore concerning. Fortunately, the prevalence of ENDS use by US adolescents has declined considerably in recent years <sup>[1][2]</sup> from its peak in 2019 <sup>[3]</sup>. This includes a steep drop in the number of adolescents self-reporting use of JUUL, a particular brand of ENDS that at one time was the most-frequently reported ENDS brand among adolescent ENDS-users <sup>[1][4][5]</sup>.

One concern is the development of dependence associated with ENDS use in adolescents <sup>[6]</sup>, and JUUL ENDS in particular <sup>[7]</sup>. Until recently, no published empirical analyses compared adolescents' dependence on JUUL to dependence on other ENDS. Recently, Mantey et al., (<sup>[8]</sup>, hereafter 'the original study') analyzed data from the 2020 nationally representative National Youth Tobacco Survey (NYTS) <sup>[9]</sup>, concluding that adolescent users of JUUL ENDS reported more frequent ENDS use and more tobacco product craving than users of other ENDS brands.

However, the original study's analysis depends on several methodological decisions that have potential to affect the result. In the original study, respondents who reported past-30-day ENDS use, but said they did not know what brand they used, were classified as users of non-JUUL ENDS, even though they could have been using JUUL ENDS (as indeed was common among those who did report a brand <sup>[8]</sup>). This imputation of missing brand data could be material, as more frequent users would seem to be more likely to know what brand they use. Conversely, an adolescent who casually sampled an ENDS product offered by a social contact (social sources are the most-frequently-cited source of ENDS <sup>[10]</sup>) might be less likely to know the brand. Accordingly, we analyzed the NYTS data to assess whether those who did not know the brand used differed in use frequency and cravings, and to analyze the effect of imputing brand when respondents said they did not know the brand. One way to discern the impact of imputing "don't knows" to the 'other' brands category when analyzing any particular brand is to consider how each brand of ENDS (including the catch-all "some other brand(s) not listed here") fares when this approach is applied.

Another notable feature of the original study's analysis is the classification of brand use based on *any* use of the brand. Most analyses of ENDS-usage by brand, including those by the Centers for Disease Control and Prevention (CDC), use the respondent's report of which brand they "usually" used (NYTS), or used "most often" (Monitoring the Future survey), to categorize brand-specific use [1][4][5][11][12]. In the original study, JUUL ENDS users are defined as those reporting *any* use of JUUL products in the preceding 30 days, even if they reported that another brand was the ENDS product they *usually* used in the past 30 days. This would seem to complicate attribution of the frequency of use to JUUL ENDS in particular: e.g., when an adolescent reports that another brand was the one usually used, the frequency of use would seemingly be more attributable to that brand than to JUUL. Accordingly, we re-did the original study's analyses of JUUL users in the 2020 NYTS data, but basing brand categorization on the *usual* brand, and also basing categorization on those who stated they *only* used JUUL ENDS, which would make attribution of usage patterns most unambiguous.

## 2. Material and Methods

### 2.1. Participants

As in the previously-published analysis [8], data were drawn from the 2020 NYTS, a nationally-representative probabilistic school-based cross-sectional survey of the use of tobacco products among U.S. middle and high school students (N=14,531; age 9–19+ – henceforth referred to as "adolescents"), administered by the CDC. Data were collected from January 16 to March 16, 2020 before the fielding was truncated due to the COVID-19 pandemic [9]. Individuals were invited to participate in NYTS via a stratified, three-stage cluster sample design. Additional details regarding the 2020 NYTS survey methods are described in the CDC's methodology report [9]. As in the [8] analysis, the sample for these analyses consisted of adolescents who reported past-30-day ENDS use, who responded to survey questions on brand use, and who were not missing responses for control variables discussed below (N=1,712; the original sample of N=1,713 in the original study could not be replicated exactly due to ambiguity in the original study's methods related to their treatment of missing responses in NYTS variables).

### 2.2. Measures

As in the previously-published analysis, analyses were adjusted for respondents' demographic and tobacco variables. Participants' demographics including sex/gender (female or male), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic/Latino, or other), and school type (high school or middle school) were included, as were respondents' most often-used ENDS device type (pod or cartridge; non-pod or cartridge), and current (past 30-day) use of other tobacco products (including combustible cigarettes, cigars, smokeless tobacco, pipe tobacco, bidis, snus, dissolvable tobacco, and hookah).

### 2.3. Outcomes

The outcomes examined in the present study were ENDS use frequency and tobacco product cravings, defined as in the original study. ENDS use frequency was categorized by report of the number of days ENDS were used in the past 30 days, grouped into three strata: 1–5 days (reference category), 6–19 days, and 20–30 days (“frequent use”). Cravings were captured by the questions (1) “During the past 30 days, have you had a strong craving or felt like you really needed to use a tobacco product of any kind?” (Yes/No) and (2) “How soon after you wake up do you want to use a tobacco product?” Adolescents who said they had a strong craving *or* reported using a tobacco product within 30 minutes of waking were defined as having cravings.

## 2.4. Categorization of ENDS use

Current ENDS users were defined as adolescents who reported using ENDS in the past 30 days. These were categorized by the brand of ENDS they reported using. In the 2020 NYTS, ENDS brand use is assessed in two key questions:

1. “During the past 30 days, what e-cigarette brands did you use? (Select one or more)” with the response options “blu”, “JUUL”, “Logic”, “NJOY”, “SMOK”, “Suorin”, “Vuse”, “Some other brand(s) not listed here”, and “I don’t know the brand”. This captured *any* use of particular brands.
2. Respondents who reported use of more than one brand were further asked which single brand they “usually” used: “During the past 30 days, what brand of e-cigarettes did you usually use? (Choose only one answer)”, with the same response options as the first question, as well as the additional option “I did not use a usual brand”. This captured *usual* use of particular brands.

The previously-published analyses used only question (1) and disregarded (2), defining JUUL users by *any* JUUL use, “regardless of what other products they also reported using the past 30 days.” <sup>{m/}</sup>Mantey et al. 2021; p.2<sup>8/}</sup> Any users of non-JUUL ENDS brands were defined in the original study as past 30-day ENDS users who did not report “JUUL” in question (1), including those who responded “I don’t know the brand,” as well as those who endorsed another brand.

In contrast to those analyses, the present analyses examined JUUL product use based on *usual* brand use (designating “JUUL” in question (2)). Unless they also reported JUUL use in question (1), respondents who reported they ‘don’t know’ what brand they used in (1) were considered missing, since it is not known whether the ENDS product they used was or was not JUUL. Fifty-one participants who indicated they did not have a usual brand were also necessarily excluded; they did not differ from others in use frequency or craving ( $ps>0.05$ ).

Exclusive use of a particular brand provides the clearest possible brand attribution and, accordingly, was also analyzed. *Exclusive* JUUL users were identified as those who reported *only* JUUL and no other brands in (1); *exclusive* users of non-JUUL brands were those who reported using a single non-JUUL brand in (1).

## 2.5. Statistical Analysis

To assess the effect of treating respondents who said they did not know the ENDS brand they used, analyses separately considered these as non-JUUL users (as in the previously-published analyses) or as having missing brand data, with *any* use definitions. To assess the effect of this decision broadly on brand comparisons, analyses also contrasted users of brands other than JUUL (referred to as a ‘focal’ brand) to non-focal brand users, with the “don’t know” respondents being assigned to the non-focal-brand group, as in the original study. Following CDC practice <sup>[1]</sup>, estimates where denominators are less than 50 or coefficients of variation are greater than 0.3 are not shown.

Analyses were weighted with NYTS post-stratification weights to be nationally representative. As in the previous analyses, multivariable logistic regressions were used to examine associations between brand use and tobacco product cravings, with adjusted odds ratios (aOR) reported. Multivariable multinomial logistic regressions were used to examine the associations between brand use and ENDS use frequency, with adjusted relative risk ratios (aRRR) reported. Analyses were conducted in SAS version 9.4 with the survey procedures PROC SURVEYFREQ and PROC SURVEYLOGISTIC to take the complex survey design into account. The SAS code used to perform the analyses is provided in the online supplementary material.

## 3. Results

### 3.1. Imputing “don’t know” responses as ‘other brand’ versus treatment as missing

Overall, 303 NYTS respondents who reported past-30-day ENDS use stated they did not know what brand they used, but were imputed to the non-JUUL group in the previously-published analyses. These comprised 17.2% of ENDS users and 34.3% of those defined as non-JUUL in those analyses. As hypothesized, compared to those who reported a specific brand (or ‘other not listed’), those who said they did not know the brand they used were over 70% less likely to be frequent users (RRR vs. 1–5 days: 0.267, 0.167–0.426;  $p < 0.0001$ ) and their odds of reporting craving were more than 70% lower (aOR: 0.277, 0.187–0.410;  $p < 0.0001$ ). That is, not knowing the ENDS brand was associated with less frequent use and lower likelihood of craving.

To assess the effect of imputing the brand for these “don’t-knows” to the “other brand” category in analyses, analyses using the previous analyses’ *any* brand definitions considered in turn each of five (5) ENDS brands (plus the heterogeneous ‘Some other brand(s)’ category) with user samples of 50 or more as a focal brand. In each case, the users of the focal brand were contrasted to the rest of the ENDS users. When “don’t knows” were assigned or imputed to the non-focal brand group, *every* brand was deemed to have significantly higher rates of frequent use and higher likelihood of craving than all ‘other’ brands (Table 1).

To assess how assignment of “don’t knows” to the non-JUUL brand group in the previously published analysis of JUUL users affected the reported outcomes, the analysis was repeated while treating “don’t know” responses as missing. With this specification, *any* JUUL users were neither significantly more likely to report frequent ENDS use (RRR vs. 1–5

days: 0.822, 0.560–1.205;  $p=0.309$ ; Table 2) nor cravings (aOR: 1.214, 0.905–1.627;  $p=0.192$ ; Table 2) than those who reported no use of JUUL.

### 3.2. Categorizing JUUL brand by usual use or exclusive use of JUUL, versus any use

About half (49.9%; Table 3) of past 30-day adolescent ENDS users reported *any* JUUL use, but 41.3% of those did not report that JUUL was their “usual” ENDS brand. Overall, 28.4% of all ENDS users reported JUUL as their *usual* brand. Of those reporting *any* use of JUUL, 72.3% reported use of other brands as well, while 27.7% were *exclusively* JUUL users (13.8% of the total original study sample of ENDS users).

Analyses considered the association of frequency of ENDS use and report of craving with JUUL-brand use when use was based on *usual* or *exclusive* use definitions, to allow for more clear attribution to JUUL vs other brands. The NYTS data show that citing JUUL as the *usual* brand used was associated with a significantly *lower* likelihood of reporting frequent ENDS use, a decrease of more than 50% (RRR vs. 1–5 days: 0.454, 0.277–0.745;  $p=0.0022$ ; Table 2). *Usual* JUUL users also had 18% lower odds of reporting craving (aOR: 0.813, 0.622–1.062,  $p=0.127$ ; Table 2), though the effect was not significant.

These effects were also seen when the brand attribution was clearest, based on *exclusive* use of a particular brand. Frequent use was 68% less likely among respondents *exclusively* using JUUL, compared to those *exclusively* using a non-JUUL brand (RRR: 0.313, 0.178–0.551,  $p<0.0001$ ; Table 2), and *exclusive* JUUL users had non-significantly lower odds of reporting craving (aOR: 0.770, 0.482–1.231,  $p=0.269$ ; Table 2).

## 4. Discussion

In the analyses by Mantey et al., adolescents reporting *any* JUUL product use were reported to be more likely to use ENDS frequently and to report tobacco product cravings compared to non-JUUL users. These analyses were based on imputing respondents who did not know the brand they used to the non-JUUL category, and broadly defining JUUL use by *any* use of JUUL in the past 30 days, even if the respondent designated another brand as their “usual” brand. Analyses testing the effects of those methodological decisions showed that the reported results strongly depended on these decisions.

The previously published analyses assigned respondents who reported not knowing what brand of ENDS they used to non-JUUL brands although they could have used JUUL. Importantly, the NYTS data showed that these ‘don’t know’ respondents were systematically different from those who did know the ENDS brand used: specifically, they used ENDS less frequently and were less likely to report craving, consistent with the idea that these were more casual users. Because of this, as analysis showed, assigning these ‘don’t knows’ to the ‘other brands’ category systematically biased the analyses against the focal brand – any brand – being analyzed. The effect of this was such that *every* brand, taken individually, appeared to be associated with significantly more frequent use and craving than all other brands, which is not logical.

Our analysis revisited the analyses reported in the original study regarding JUUL users, and found that undoing this imputation materially changed the results from those in the original report. When ‘don’t know’ responses were more appropriately treated as missing, respondents who reported *any* use of JUUL were no more likely to report frequent ENDS use or cravings than non-JUUL users, contrary to the effect reported in the previous analyses.

The original study analyses also categorized brand use on the basis of *any* use of JUUL, even if the respondents reported that another brand was actually their “usual” brand; that is, even if they used another brand more frequently than they used JUUL. For example, if someone’s usual brand was X, and they used X on 25 days, and JUUL on 1-2 days, their ‘frequent’ use (20 days or more) was implicitly attributed to JUUL in the original study. Thus, it is difficult to attribute the outcomes (frequency of use and craving) to JUUL, *per se*. In analyses that tightened the attribution to brand, by considering those who designated JUUL as their *usual* brand – which is the usual practice<sup>[1][4][5][11][12]</sup> – the findings on frequency of use were reversed from what was reported in the original study: *usual* users of JUUL reported significantly *less* frequent use, and non-significantly lower likelihood of craving. This was further strengthened when the analysis focused on those who reported *exclusively* using JUUL, which provides the most unambiguous attribution of behavior to the brand. These analyses show that adolescent JUUL users were less likely to be frequent users, compared to users of other ENDS brands. It is not clear why this is so.

The present analyses illustrate the potential impact of analytic decisions on key outcomes, and show that the NYTS data do not support the original study’s attribution of greater use frequency and cravings to JUUL use, compared to use of other ENDS brands. The re-analyses illustrate the potential impact of analytical decisions regarding brand or product attributions.

In any case, adolescents’ ENDS use is problematic and adolescents should not have access to or use any tobacco or nicotine-containing products, including ENDS. Steps need to and are being taken to reduce it. Encouragingly, the prevalence of ENDS use (including JUUL use) has declined in the last two years. There are a number of factors which may be contributing to this change in use patterns, potentially including raising the legal age of purchase to 21<sup>[13]</sup>, the COVID-19 pandemic<sup>[14]</sup>, and the withdrawal of flavors other than tobacco and menthol in pod-based cartridge products like JUUL. It may be that further enforcement of age-of-purchase requirements, perhaps facilitated by technology requiring automated ID scanning at retail<sup>[15]</sup>, could help further reduce adolescent access to ENDS and other tobacco products.

The analyses presented are limited by the methods of NYTS, which relies on self-reports of ENDS use, including reports of ENDS brands used.

## 4.1. Conclusions

The present analyses highlight the potential impact on conclusions from even seemingly minor methodological decisions, such as assignment of brand usage and attribution to brands, and treatment of ‘don’t know’ responses to brand questions. To avoid potentially misleading results, analysts need to carefully consider such decisions, and perhaps conduct sensitivity analyses of their impact.



## 5. Ethics Statement

This research uses only publicly available de-identified survey data. Under exemption four of NIH definitions, this research is therefore exempt from NIH human subjects research.

## 6. Data Statement

The dataset supporting the conclusions of this article are freely available in the National Youth Tobacco Survey (NYTS) repository, [https://www.cdc.gov/tobacco/data\\_statistics/surveys/nyts/](https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/)

## 7. Author Disclosures

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The preparation of this manuscript was funded by JUUL Labs Inc (JLI). JLI provided comments on a draft manuscript and did not otherwise play a role in these analyses. The content and the decision to publish are the responsibility of the authors.

### Contributors

Saul Shiffman conceptualized the study. Floe Foxon managed the data and performed statistical analyses. Floe Foxon and Saul Shiffman drafted the manuscript.

### Conflict of Interest

Through PinneyAssociates, Floe Foxon and Saul Shiffman provide consulting services on tobacco harm reduction on an exclusive basis to Juul Labs Inc. Saul Shiffman also owns interest in a novel nicotine gum that has neither been developed nor commercialized.

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**TABLE 1.** Differences in frequency of use and prevalence of craving, contrasting ENDS brands to 'other brands' when brand use is defined by 'any' use of the brands, and respondents who did not know the brand are treated as 'other brand' users

	Tobacco Product Cravings: Yes <sup>a</sup>	Past-Month ENDS Use
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Original Any User Definitions <sup>a</sup> for other single brands, and treating 'I don't know the brand' as 'Other brands' <sup>b</sup>	(Referent: No)	(Referent: 1–5 Day(s))		
	% (n) aOR <sup>d,e</sup> (95% CI)	% (n) aRRR <sup>d,f</sup> (95% CI)		
		1–5 Days	6–19 Days	20–30 Days
Original analyses of JUUL by Mantey et al. <sup>a</sup>				
JUUL (N=862)	47.9 (403) <b>1.773 (1.365–2.303)</b>	40.5 (354) 1.00 (Referent)	20.0 (178) 1.307 (0.959–1.781)	39.4 (330) <b>1.417 (1.013–1.983)</b>
Non-JUUL (N=850)	32.6 (280) 1.00 (Referent)	47.9 (418) -	19.1 (150) 1.00 (Referent)	33.0 (282) 1.00 (Referent)
Analyses of other brands using the approach of Mantey et al.				
Blu (N=156)	62.1 (96) <b>2.226 (1.316–3.766)</b>	30.0 (48) 1.00 (Referent)	19.8 (32) 1.399 (0.637–3.072)	50.2 (76) <b>2.081 (1.195–3.624)</b>
Non-Blu (N=1556)	38.0 (587) 1.00 (Referent)	45.7 (724) -	19.5 (296) 1.00 (Referent)	34.8 (536) 1.00 (Referent)
NJOY (N=529)	54.1 (272) <b>2.183 (1.666–2.862)</b>	29.1 (160) 1.00 (Referent)	21.6 (111) <b>2.125 (1.558–2.900)</b>	49.3 (258) <b>2.787 (1.901–4.087)</b>
Non-NJOY (N=1183)	34.1 (411) 1.00 (Referent)	50.9 (612) -	18.7 (217) 1.00 (Referent)	30.4 (354) 1.00 (Referent)
SMOK (N=399)	51.3 (210) <b>1.630 (1.182–2.247)</b>	26.4 (102) 1.00 (Referent)	21.8 (77) <b>2.061 (1.381–3.078)</b>	51.8 (220) <b>2.889 (1.855–4.500)</b>
Non-SMOK (N=1313)	37.1 (473) 1.00 (Referent)	49.3 (670) -	18.9 (251) 1.00 (Referent)	31.8 (392) 1.00 (Referent)
Suorin (N=225)	60.1 (137) <b>2.344 (1.596–3.443)</b>	19.3 (46) 1.00 (Referent)	18.9 (41) <b>2.176 (1.347–3.515)</b>	61.7 (138) <b>4.052 (2.430–6.757)</b>
Non-Suorin (N=1487)	37.1 (546) 1.00 (Referent)	48.1 (726) -	19.6 (287) 1.00 (Referent)	32.2 (474) 1.00 (Referent)
Vuse (N=236)	62.0 (142) <b>2.560 (1.739–3.771)</b>	19.2 (48) 1.00 (Referent)	23.4 (53) <b>3.128 (1.847–5.296)</b>	57.4 (135) <b>4.249 (2.499–7.225)</b>
Non-Vuse (N=1476)	36.6 (541) 1.00 (Referent)	48.3 (724) -	18.9 (275) 1.00 (Referent)	32.8 (477) 1.00 (Referent)
'Some other brand' (N=519)	48.7 (248) <b>1.830 (1.430–2.341)</b>	29.0 (150) 1.00 (Referent)	22.1 (117) <b>2.104 (1.360–3.257)</b>	48.9 (252) <b>2.924 (1.886–4.535)</b>

Not 'Some other brand' (N=1193)	36.5 (435) 1.00 (Referent)	50.8 (622) -	18.5 (211) 1.00 (Referent)	30.7 (360) 1.00 (Referent)
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Bolded statistics designate statistically significant effects; i.e., confidence intervals not including 1.0.

<sup>a</sup> Any X brand users are defined as adolescent past 30-day ENDS users who reported any past-month use of X brand “regardless of what other products they also reported using in the past 30 days”. Any non-X brand users are defined as adolescent past 30-day ENDS users who reported any past-month use of blu, Logic, NJOY, SMOK, Suorin, Vuse, “Some other brand(s) not listed here”, and/or “I don’t know the brand,” excluding X.

<sup>b</sup> ‘Logic’ brand data not shown due to statistically unreliable sample size (unweighted denominator<50), per NYTS/CDC standard.

<sup>c</sup> Had a strong craving or felt like really needed to use a tobacco product of any kind in the past 30 days, or want to use a tobacco product within 30 minutes of waking.

<sup>d</sup> Adjusted for sex/gender, school type (high school or middle school), race/ethnicity, other tobacco product use (cigarettes including roll-your-own cigarettes, cigars, smokeless tobacco, pipe tobacco, bidis, snus, dissolvable tobacco, or hookah), and device type most often used (pod or cartridge; non-pod or cartridge).

<sup>e</sup> Multivariable logistic regression.

<sup>f</sup> Multivariable multinomial logistic regression.

**TABLE 2.** Differences in frequency of use and prevalence of craving, contrasting JUUL to non-JUUL when brand use is defined by any use of the brand, usual use of the brand, and exclusive use of the brand.

Original analyses by Mantey et al. ( <i>Any</i> User Definition, with 'I don't know the brand' treated as Non-JUUL <sup>a</sup> )	Tobacco Product Cravings: Yes <sup>d</sup> (Referent: No)  % (n) aOR <sup>e,f</sup> (95% CI)	Past-Month ENDS Use (Referent: 1–5 Day(s))  % (n) aRRR <sup>e,g</sup> (95% CI)		
		1–5 Days	6–19 Days	20–30 Days
JUUL (N=862)	47.9 (403) <b>1.773 (1.365–2.303)</b>	40.5 (354) 1.00 (Referent)	20.0 (178) 1.307 (0.959– 1.781)	39.4 (330) <b>1.417 (1.013– 1.983)</b>
Non-JUUL (N=850)	32.6 (280) 1.00 (Referent)	47.9 (418) -	19.1 (150) 1.00 (Referent)	33.0 (282) 1.00 (Referent)
Treating 'I don't know the brand' as missing				
<i>Any</i> User Definition				
JUUL (N=862)	47.9 (403) 1.214 (0.905–1.627)	40.5 (354) 1.00 (Referent)	20.0 (178) 0.831 (0.571– 1.209)	39.4 (330) 0.822 (0.560– 1.205)
Non-JUUL (N=547)	41.8 (231) 1.00 (Referent)	35.2 (195) -	22.1 (114) 1.00 (Referent)	42.8 (238) 1.00 (Referent)
<i>Usual</i> User Definition <sup>b</sup>				
JUUL (N=452)	43.1 (189) 0.813 (0.622–1.062)	50.8 (238) 1.00 (Referent)	17.6 (84) <b>0.534 (0.368– 0.776)</b>	31.6 (130) <b>0.454 (0.277– 0.745)</b>
Non-JUUL (N=858)	47.8 (405) 1.00 (Referent)	31.4 (265) -	22.3 (187) 1.00 (Referent)	46.2 (406) 1.00 (Referent)
<i>Exclusive</i> User Definition <sup>c</sup>				
JUUL (N=248)	31.4 (83) 0.770 (0.482–1.231)	64.4 (161) 1.00 (Referent)	16.9 (41) 0.711 (0.402– 1.257)	18.6 (46) <b>0.313 (0.178– 0.551)</b>
Non-JUUL (N=450)	38.7 (178) 1.00 (Referent)	38.2 (171) -	20.5 (89) 1.00 (Referent)	41.4 (190) 1.00 (Referent)

Bolded statistics designate statistically significant effects; i.e., confidence intervals not including 1.0.

<sup>a</sup> *Any* JUUL users are defined as adolescent past 30-day ENDS users who reported any past-month use of JUUL “regardless of what other products they also reported using in the past 30 days”. *Any* non-JUUL users are defined as adolescent past 30-day ENDS users who reported any past-month use of blu, Logic, NJOY, SMOK, Suorin, Vuse, “Some other brand(s) not listed here”, and/or “I don’t know the brand,” and who did not report past-month JUUL use.

<sup>b</sup> ‘Usual’ JUUL users are defined as adolescent past 30-day ENDS users who reported JUUL as the only brand they used, or as the brand they ‘usually’ used, in the past 30 days. ‘Usual’ non-JUUL users are defined as adolescents who reported blu, Logic, NJOY, SMOK, Suorin, Vuse, or “Some other brand(s) not listed here” as the only brand they used, or as the brand they ‘usually’ used, in the past 30 days. Participants who reported not knowing which brand they used or reported they had no usual brand were treated as missing.

<sup>c</sup> ‘Exclusive’ JUUL users are defined as adolescent past 30-day ENDS users who reported JUUL as the only brand they used in the past 30 days. ‘Exclusive’ non-JUUL users are defined as adolescent past 30-day ENDS users who reported one of blu, Logic, NJOY, SMOK, Suorin, Vuse, or “Some other brand(s) not listed here” as the only brand they used in the past 30 days. Participants who reported not knowing which brand they used were treated as missing.

<sup>d</sup> Had a strong craving or felt like really needed to use a tobacco product of any kind in the past 30 days, or want to use a tobacco product within 30 minutes of waking.

<sup>e</sup> Adjusted for sex/gender, school type (high school or middle school), race/ethnicity, other tobacco product use (cigarettes including roll-your-own cigarettes, cigars, smokeless tobacco, pipe tobacco, bidis, snus, dissolvable tobacco, or hookah), and device type most often used (pod or cartridge; non-pod or cartridge).

<sup>f</sup> Multivariable logistic regression.

<sup>g</sup> Multivariable multinomial logistic regression.

**TABLE 3.** Patterns of Reported JUUL brand usage in 2020 NYTS

Percent of Past 30-Day ENDS Users Who Reported <i>Any</i> Past-30 Day Use of JUUL <sup>a</sup> (N=1712)	Percent of Past 30-Day ENDS Users Who Reported ‘Usual’ Use of JUUL <sup>b</sup> (N=1610)	Percent of <i>Any</i> Users of JUUL Who Reported ‘Usual’ Use of JUUL <sup>c</sup>	Percent of <i>Any</i> Users of JUUL Who Reported ‘Exclusive’ Use of JUUL
% (n)	% (n)	% (n/N)	% (n/N)
49.9 (862)	28.4 (452)	58.7 (452/862)	27.7 (248/862)

<sup>a</sup> Denominator is all past 30-day ENDS users not missing data on Mantey et al.’s study variables.

<sup>b</sup> Denominator is all past 30-day ENDS users not missing data on Mantey et al.’s study variables, not missing ‘usual’ brand use question, and who reported a usual brand (i.e. did not say ‘I did not use a usual brand’).

<sup>c</sup> Conversely, the remaining percentage represents users who reported any use of JUUL, but then reported that a different brand was their ‘usual’ brand. I.e., 41.3% of respondents who reported any use of JUUL (100% - 58.7%) identified another brand as their usual brand.

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