

Youth Vaping and Tobacco Use in Context in the United States: Results from the 2018 National Youth Tobacco Survey

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ABSTRACT

Introduction: According to the National Youth Tobacco Survey (NYTS), youth e-cigarette use (vaping) rose between 2017-2018. Frequency of vaping and concurrent past 30-day (p30d) use of e-cigarettes and tobacco products have not been reported.

Methods: We analyzed the 2018 NYTS (N=20,189) for vaping among all students (middle and high school; 6-12th grades; 9-19 years old) by frequency of vaping, exclusive vaping, p30d poly-product use (vaping and use of one or more tobacco product), and any past tobacco product use.

Results: In 2018, 81.4% of students had not used any tobacco or vapor product in the p30d, and 86.2% had not vaped in the p30d. Among all students, of the 13.8% vaped in the p30d, just over half vaped on ≤ 5 days (7.0%), and roughly a quarter each vaped on 6-19 days (3.2%) and on 20+ days (3.6%). Almost three quarters of p30d vapers (9.9%) reported past or concurrent tobacco use and the remainder (3.9%) were tobacco naïve. 2.8% of students were tobacco naïve and vaped on ≤ 5 days; 0.7% were tobacco-naïve and vaped on 6-19 days, and 0.4% were tobacco-naïve and vaped on 20+ days.

Conclusions: Vaping increased among US youth in 2018 over 2017. The increases are characterized by patterns of low p30d vaping frequency and high poly-product use, and a low prevalence of vaping among more frequent but tobacco naïve vapers.

Implications: Results underscore the importance of including the full context of use patterns. The majority of vapers (60.0% - 88.9% by use frequency) were concurrent p30d or ever tobacco users. About 4% of students were tobacco naïve and vaped in the p30d, but few (0.4%) vaped regularly on 20 or more days. Reporting youth vaping data with frequency and tobacco product co-use will give public health decision-makers the best possible information to protect public health.

INTRODUCTION

Patterns of tobacco product (cigarettes, cigars, smokeless tobacco, hookah, pipe, bidis, snus, and dissolvable tobacco) and e-cigarette use (hereafter called “vaping”) among students in the United States (US) have changed dramatically since national data collection on e-cigarette (hereafter called “vapor products”) use first began with the 2011 National Youth Tobacco Use Survey (NYTS).¹ For example, the prevalence of any past 30-day (p30d) vaping among high school (HS) students increased from 1.5% in 2011 to a peak of 16.0% in 2015.^{1,2} After a decline to 11.8% in 2017, prevalence of any p30d vaping among HS students increased again to 20.8% between 2017 and 2018, exceeding the 2015 prior peak by 30%.^{1,2} While these top-line results are important for surveillance purposes, attention to only the prevalence of any p30d vaping obscures patterns of exclusive use and co-use with tobacco products. In addition, analyses of the NYTS data have not been presented for the full sample of youth (middle and high school students).

Examination of tobacco and vapor product use frequency and patterns of poly-product use (including dual use) in youth may be informative about the risk of continued use in adulthood. Prior research on cigarette smoking frequency shows that a small fraction of ever or infrequent cigarette smokers progress to become persistent lifetime users.³⁻⁸ A recent study that followed a cohort of teens (N=15,275) for over two years indicated that, over a short follow-up interval (6 to 18 months), any p30d use of a vapor or tobacco product was unstable.⁹ After 2.5 years, the most common patterns of use were from no product use to continued non-use, and transitions from any p30d use of smokeless tobacco use or vaping to no current use. Importantly, cigarette smoking was the exception, where any past cigarette use was associated with continued smoking 2.5 years later.^{9,10} Some studies also indicate that among young people, poly-tobacco use is associated with subsequent cigarette smoking into young adulthood.^{11,12} Another study found that vaping among non-smokers was associated

with subsequent trial of cigarettes, but that vaping on 1-5 of p30d was also associated with a reduction in subsequent cigarette smoking frequency among smokers.¹³ These data demonstrate the importance of exploring the impact of frequency of use and poly-product use when assessing the public health impact of tobacco and vaping products.

In addition to monitoring progression of use of tobacco and vapor products, understanding the specific patterns of tobacco use and vaping among youth is also important because vapor and tobacco products vary in their risk profiles,¹⁴⁻¹⁶ with substantially reduced toxicant exposure for exclusive vaping versus smoking combustible tobacco products (chiefly cigarettes and little cigars).^{14,16,17} It is also important to understand product use patterns and related exposures to harmful constituents to inform the US Food and Drug Administration's (FDA) regulation of tobacco and vapor products in light of its mandate to consider the public health standard of benefits and harms to the population as a whole.¹⁸⁻²²

In our previous analyses of the 2014 and 2015 NYTS, patterns and frequency of tobacco and vapor product use were quite stable, and the previous peak in vaping occurred in 2015. The majority of US students did not use any tobacco or vapor product (83.0% in 2014 and 81.3% in 2015).^{3,23} Among students who vaped, poly-product use (i.e., vaping plus using one or more tobacco products) was the dominant use pattern.^{3,23} Most vapers had already used a tobacco product (87.0% in 2014 and 86.1% in 2015) or were vaping and using a tobacco product (63.0% in 2014 and 65.2% in 2015).^{3,23} The prevalence of students who vaped and were tobacco naïve (i.e., had never used any tobacco product in the past or concurrently) was 1.2% in 2014 and 1.6% in 2015. Additionally, the distributions of the frequency of vaping and of cigarette smoking in the p30d differed from each other: in the 2014 NYTS, vaping prevalence was higher than that of smoking on 1-2 of the p30d (4.4% vs. 2.4%), but daily cigarette smoking was more prevalent than daily vaping (1.4% vs 0.9%).³

In this paper, we present detailed descriptive analyses of the NYTS 2018 data.^{3,23} We examined p30d frequency of cigarettes, cigars, combusted tobacco (cigarettes, all cigars, hookah, pipe, and bidis), smokeless tobacco (smokeless tobacco, snus, and dissolvables), and vapor product use among US students overall (N=20,189) and separately among middle and high school students. Building on former analyses of NYTS data from 2014 and 2015,^{3,23} as well as p30d estimates of vaping from 2018,^{24,25} the aims of this paper were to: (a) describe tobacco and vapor product use prevalence by frequency of use; (b) describe prevalence of all possible patterns of poly-product use; and (c) characterize p30d use patterns in the context of ever/former use and never use (i.e., naïve to any product use).^{3,23}

METHODS

NYTS is a national survey of US middle and high school students (9-19 years or older) (2018: N=20,189; response rate: 68.2%). Participants were asked about p30d use of various tobacco and vapor products including cigarettes, cigars (cigars, cigarillos or little cigars), smokeless tobacco, e-cigarettes (vapor products, excluding vaping of cannabis, cannabis concentrates, cannabis waxes, THC, or hash oils), hookah, pipe, bidis, snus, and dissolvables. Although the NYTS refers to e-cigarettes as tobacco products, we are using “vapor products” to distinguish between products that contain tobacco leaf and those that do not.²⁶ P30d use of each product was defined as using the product on at least one day in the past 30 days. P30d use was categorized into: 1) p30d combustible use (including cigarettes, cigar, hookah, pipe, and bidis); 2) p30d non-combustible use (including smokeless tobacco, snus, and dissolvables); 3) p30d exclusive vaping; and 4) no p30d use of tobacco or vapor products. Exclusive vaping was further defined as being naïve to tobacco (had never used a tobacco product) or having been a former tobacco user (reported ever using at least one tobacco product, but not in the p30d).

Participants were asked to identify p30d frequency of use for cigarettes, cigars, smokeless tobacco, vaping, and hookah among the following ranges of use: “0 days”, “1-2 days”, “3-5 days”, “6-9 days”, “10-19 days”, “20-29 days”, and “All 30 days”. We also computed any p30d use, use on five or less days, and 20 or more days to allow for direct comparisons to the CDC MMWR report.²⁴ Data on frequency of use were also divided into four product classes: cigarettes, cigars, smokeless tobacco, and vaping products. For each of these four products, we categorized all p30d users as exclusive (i.e., that product only) versus poly-product users (i.e., use of that product and at least one other product in p30d); among exclusive users, we further categorized them into ever used any tobacco product in past or not (ever poly-product use or always p30d exclusive use -- i.e., past tobacco naive). For the product-specific p30d frequency questions (i.e., for cigarettes, cigars, smokeless, and vapor products), missing responses were excluded. For p30d use items (i.e., hookah, pipe, bidis, snus, and dissolvables), missing responses (ranging from 2.1% for e-cigarettes to 3.7% for smokeless tobacco) were categorized as nonusers to be conservative in estimating prevalence.

Prevalence estimates and 95% confidence intervals of product-specific p30d use were weighted by primary sampling unit and sampling stratum to account for the complex survey design and adjusted for non-response using Stata/SE v.15.1.

RESULTS

Overall and Product-Specific Past 30-Day Use

Overall, 81.4% (80.1-83.1%) of US middle and high school students did not use a tobacco or vapor product in the p30d in 2018 (Figure 1). Inversely, the prevalence of p30d use of any tobacco or vapor product was 18.6% (17.2-20.1%). Use of any tobacco product in the p30d (excluding vapor products) was 11.1% (10.0-12.3%), and use of any combustible tobacco

product in the p30d was 9.7% (8.7-10.7%). Comparing individual product classes by p30d use, 13.8% (12.4-15.3%) of youth used any vapor product, 5.4% (4.6-6.2%) used cigarettes, 5.0% (4.4-5.7%) used cigars, 4.1% (3.5-4.8%) used smokeless tobacco, 2.9% (2.4-3.4%) used hookah, and 0.8% (0.6-1.0%) used pipe. Across all products, p30d use among HS students was more prevalent than among middle school (MS) students. We focus below on overall student use (middle and high school combined) consistent with two previous papers using the NYTS 2014 and 2015 data sets,^{3,23} as well as use separately for middle and high school students. For detailed data on MS versus HS differences, see Supplemental Figures 2 to 7.

Past 30-Day Frequency of Use

Prevalence of No Vaping or Tobacco Use in the Past 30 Days

Supplemental Figure 1 presents frequency of days used in the p30d among U.S. youth. In 2018, 86.2% (84.7-87.6%) of youth did not vape in the p30d, including 81.6% (80.1-83.1%) of youth who did not report use of any tobacco or vapor product in p30d, 3.8% (3.3-4.4%) who reported p30d combustible tobacco product use, and 0.8% (0.6-1.0%) who reported p30d non-combustible tobacco product use. Ninety-five percent (94.2-95.8%) of MS students reported no use of a vapor product in the p30d compared to 79.2% (77.0-81.3%) of HS students (Figure 1).

Prevalence of Past 30-Day Vaping and Associated Patterns of Tobacco Product Use

In the full sample of middle and high school students, 13.8% (12.4-15.3%) reported any p30d vaping (Table 1 and Figure 2). These vapers consisted of 6.2% who reported concurrent p30d use of at least one tobacco product in addition to the vapor product, 3.8% (3.2-4.4%) who were ever but not p30d tobacco users, and 3.9% (3.3-4.5%) who were tobacco-naïve

(reported neither trying a tobacco product in the past nor any concurrent tobacco product co-use in p30d) (Figure 2). Within the 6.2% who reported concurrent p30d tobacco use and vaping, 5.6% (4.9-6.4%) used a combustible tobacco product and 0.6% (0.5-0.8%) used a non-combustible tobacco product. The percentage of tobacco-naïve p30d vapers is therefore 28.3% (26.6-29.5%) of all p30d vapers; conversely, those who either used tobacco in the past or were concurrently using tobacco is 71.7% (68.7-75.6%).

Any p30d vaping was reported by 20.8% (18.8-23.0%) of HS students and 4.9% (4.2-5.8%) of MS students (Table 1 and Figure 1). Almost 10% of HS students and 2.0% of MS students concurrently vaped and used at least one tobacco product in the p30d. Just under 6% (4.9-6.8%) of HS students vaped in the p30d and had ever, but not currently, used a tobacco product, while only about 1.2% (0.9-1.5%) of MS students did so. About one quarter (26.4%) (24.4-28.9%) of HS and 36.7% (34.3-38.6%) of MS p30d vapers were tobacco naïve (Table 1 and Supplemental Figures 3 and 5).

Just over half of youth who reported recent vaping in 2018 (48.6% of HS p30d vapers and 63.3% of MS p30d vapers) did so on five or fewer days in the p30d [7.0% (6.4-7.7%)]. Similar proportions vaped on 6-19 days (3.2% [2.7-3.7%]) and on 20 or more days out of the p30d [3.6% (3.0-4.2%)] (Table 1). The proportion of youth who did not have a history of prior tobacco use decreased with frequency of vaping in the past month. Forty percent of youth who vaped on ≤ 5 days were tobacco-naïve [2.8% (2.4-3.2%) of the total youth sample], as were 11.1% of youth vaping 20+ days [0.4% (0.3-0.5%) of the total youth sample]. Conversely, 60.0% and 88.9% of youth vaping on ≤ 5 days and 20+ days, respectively, either used tobacco in the past or had also used tobacco in the p30d.

Exclusive Product Use Versus Poly-Product Use

Figure 3 presents exclusive use and poly-product use of four major product categories: cigarettes, cigars, smokeless tobacco, and vapor products. A greater proportion of p30d vapers were exclusive users (7.6%; 95% CI 6.6-8.8%) vs. p30d poly-product users (6.2%; 95% CI 5.7-6.7%) (Figure 3, Panel D; “always exclusive use” and “ever poly-product use, p30d exclusive use” combined across frequencies) while the majority of p30d users of cigarettes (Figure 3, Panel A), cigars (Figure 3, Panel C), and smokeless tobacco (Figure 3, Panel B) were poly-product users of at least one other product category (4.8% [4.1-5.6%], 4.0% [3.5-4.5%], 2.4% [2.0-3.0%], poly-product use combined across frequencies). With greater vaping frequency, there was a lower proportion of users who exclusively vaped (from 73.5% to 33.3%), while exclusive use of other products was relatively similar across frequencies. For all products (Figure 3), use on 1-2 days was highest (cigarettes: 2.2% [1.9-2.6%], smokeless tobacco: 1.1% [0.9-1.3%], cigars: 2.5% [2.1-2.9%], and vaping: 4.9% [4.4-5.5%]) compared to other frequencies. For cigars, use on 3-5 days was the second most prevalent frequency category at 0.8% (0.6-0.1%), while daily use and use on 3-5 days were tied at 0.9% (0.7-1.1%) for second most prevalent among cigarette smokers. Daily use was the second most prevalent category among smokeless tobacco users (0.9% [0.7-1.2%]) and vapers (2.4% [2.0-2.9%]). Patterns of use were slightly different comparing middle and high school students: smokeless use on 1-2 days and daily use was tied at 1.4% of HS students for the most prevalent frequency category (1-2 days: [1.1-1.7%]; daily use: [0.9-2.0%]), and vaping on 3-5 days was the second most prevalent frequency category among MS students (0.7% [0.6-1.0%]).

DISCUSSION

The majority (81.6%) of US youth in 2018 reported no tobacco or vapor product use in the p30d. Of the 13.8% of youth who reported any vaping in the p30d, about half used on five or fewer days, and about one-quarter used on 6-19 and on 20+ days out of 30. The majority of youth who vaped were former or current tobacco users (60.0-88.9% by use frequency), and of those who were tobacco naïve (3.9% of students), nearly two-thirds used on five or fewer days of the p30d. The majority of p30d and more frequent vapor product use is concentrated among HS students, highlighting the importance of reporting data stratified by school level.

Fluctuations in p30d prevalence of use should also be considered in a multi-year context because estimates in any given survey year vary around the true population value, even in large nationally representative surveys. According to published 2017 data, any p30d vaping increased in 2018 to a greater degree among HS students (11.7% in 2017 to 20.8% in 2018, an increase of 77.8%) than in MS students (3.3% in 2017 to 4.9% in 2018, an increase of 48.5%).^{24,27} When compared to the prior reported peak in youth vaping in 2015,²³ these increases are attenuated, but are still elevated: any p30d vaping increased 22.1% between 2015 and 2018 among all youth, and 30.0% among HS students.²³ Of note is that any p30d vaping decreased among MS students by 7.5% in 2018 from its prior peak in 2015.²³

Similar to the detailed analyses from two previous papers using 2014 and 2015 NYTS data,^{3,23} these 2018 NYTS results reveal exclusive product use for cigarettes, cigars and smokeless tobacco products was less than 1.1%. Unlike in 2014, where cigar and cigarette p30d use patterns diverged (with cigarettes having a high prevalence of daily use but not cigars), in 2018 NYTS patterns of exclusive cigarette and cigars use were similar. This finding is consistent with other research that has shown that cigarettes and cigars (primarily inexpensive little cigars and cigarillos) may be interchangeable as combustible tobacco products.²⁸

Compared to the prior peak in teen vaping reported in 2015, the prevalence of vaping on fewer than 10 days in 2018 was about the same (8.4% in 2015 and 8.5% in 2018).²⁹ However, vaping 20 or more out of p30d increased from 1.7% in 2015 and 1.6% in 2017 to 3.6% in 2018.²⁹ In contrast, daily cigarette smoking declined from 1.2% in 2015 to 0.9% in 2018.²³ In addition, the proportion of daily vapers who exclusively vaped increased over time, the majority of whom also were former tobacco users. In 2018, only 0.4% of tobacco-naïve youth vaped on 20 or more days, but the proportion of students who vaped at all in the p30d and were tobacco naïve (3.9%) more than doubled since 2015 (1.6%). Over two-thirds of any p30d vapers had either formerly used tobacco or were co-using tobacco, chiefly combusted products. This ratio is similar to data reported in our studies of the 2014 and 2015 NYTS data analyses^{3,23} and a recent analysis of 2018 data.²⁵

This study has several limitations. First, it was cross-sectional, so we are unable to ascertain initiation and cessation of products over time. Therefore, we cannot infer any causal relationships from these analyses. Second, we were not able to measure frequency of hookah and pipe tobacco from the NYTS, so we were not able fully characterize all tobacco use. Third, it is unclear whether youth self-reported use of vapor products with nicotine, with cannabis, or with flavoring only. The Monitoring the Future Survey includes an item that explicitly asks which substances respondents are vaping,³⁰ while in NYTS, the survey items assessing vaping include a preamble that states that e-cigarettes “usually contain a nicotine-based liquid,” and an additional item assessed ever use of cannabis in an e-cigarette (“Have you ever used marijuana, marijuana concentrates, marijuana waxes, THC, or hash oils in an e-cigarette?”). Analyses conducted by study authors (unpublished) indicate that in 2018 NYTS, 41.8% of respondents who reported ever vaping also reported ever vaping cannabis oils. Thus, there is likely some overlap and inability to separate the proportion of exclusive nicotine- and cannabis-containing vapes or use of both. Estimates of vaping in the 2018

NYTS overestimate vaping nicotine both because of including respondents who exclusively use cannabis and those who use only flavors without either cannabis oils or nicotine.

Since August 2019 in the US there has been a sudden outbreak of clusters of respiratory illnesses resulting in 47 deaths and 2,290 cases reported as of November 20th 2019 from contaminated black market tetrahydrocannabinol (THC) oils. The CDC and FDA warned consumers not to vape THC or any liquids obtained off the streets or from unknown sources. Vitamin E acetate, a THC product additive, was identified as “a chemical of concern.” Nicotine or flavored vaping liquids without nicotine or THC have not been implicated. Nonetheless several states and cities have conflated the sharp rise in youth vaping of flavors and nicotine with the tragic deaths and lung illnesses from vaping THC and acted on banning all nicotine vapor products and all flavors except tobacco flavor.³¹⁻³³ It is critical that future survey questions include specifics to more precisely clarify the extent of frequency and intensity by age of distinctions between concurrent and exclusive vaping of THC/cannabis oils, nicotine and/or just vaping flavors without either nicotine or THC.³⁴⁻³⁶

CONCLUSIONS

Among youth, the full public health impact of complex patterns of vaping and tobacco product use must be considered including: use frequency, intensity, duration and persistence of use, as well as use of tobacco and vaping products that vary along the harm continuum³⁷ and use of cannabis.^{38,39} Most national surveillance studies do not account for differences in use by frequency, nor do they describe all possible patterns of poly-product use, which are necessary to determine the overall public health impact of vaping.^{1,24} Any single year’s cross-sectional survey data must also be placed in the context of longitudinal studies used to inform models to consider how states of no use or product use either remain stable or transition over time.^{18,20,21,38} The detailed findings reported here can better inform the Food and Drug

Administration's (FDA) public health standard of net population benefit versus harm to adolescents as a whole and to the entire American population of users and non-users of tobacco and vaping products.¹⁸⁻²²

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DECLARATION OF INTERESTS

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Table 1. Past 30-Day Vapor Product Use, Overall and by Frequency in the 2018 National Youth Tobacco Survey (N=20,189).

| Age Group | Past 30-Day Vapor Product Use | Any P30D Use | | 1-5 days | | 6-19 days | | 20+ days | |
|------------------------|---|--------------|--------------|----------|-------------|-----------|------------|----------|------------|
| | | % | (95% CI) | % | (95% CI) | % | (95% CI) | % | (95% CI) |
| Middle school students | Any P30D Vaping ^a | 4.9 | (4.2, 5.8) | 3.2 | (2.7, 3.7) | 1.0 | (0.7, 1.3) | 0.8 | (0.6, 1.1) |
| | P30D Combustible + Vaping ^b | 1.8 | (1.4, 2.2) | 0.8 | (0.6, 1.0) | 0.4 | (0.3, 0.6) | 0.6 | (0.4, 0.9) |
| | P30D Noncombustible + Vaping ^c | 0.2 | (0.1, 0.3) | 0.1 | (0.0, 0.1) | 0.1 | (0.1, 0.2) | 0.0 | (0.0, 0.1) |
| | Ever Poly Use, P30D Exclusive Vaping ^d | 1.2 | (0.9, 1.5) | 0.9 | (0.7, 1.2) | 0.2 | (0.1, 0.3) | 0.2 | (0.1, 0.4) |
| | Tobacco Naïve, P30D Exclusive Vaping ^e | 1.8 | (1.4, 2.2) | 1.5 | (1.2, 1.8) | 0.3 | (0.2, 0.5) | 0.0 | (0.0, 0.1) |
| High school students | Any P30D Vaping ^a | 20.8 | (18.8, 23.0) | 10.1 | (9.2, 11.1) | 4.9 | (4.2, 5.8) | 5.8 | (4.9, 6.8) |
| | P30D Combustible + Vaping ^b | 8.6 | (7.5, 9.8) | 2.9 | (2.5, 3.5) | 2.2 | (1.7, 2.8) | 3.4 | (2.8, 4.1) |
| | P30D Noncombustible + Vaping ^c | 1.0 | (0.7, 1.3) | 0.4 | (0.2, 0.7) | 0.2 | (0.1, 0.4) | 0.3 | (0.2, 0.5) |
| | Ever Poly Use, P30D Exclusive Vaping ^d | 5.8 | (4.9, 6.8) | 2.9 | (2.5, 3.4) | 1.5 | (1.1, 2.0) | 1.4 | (1.0, 1.9) |
| | Tobacco Naïve, P30D Exclusive Vaping ^e | 5.5 | (4.6, 6.7) | 3.9 | (3.3, 4.6) | 1.0 | (0.8, 1.4) | 0.6 | (0.4, 0.9) |
| Full sample | Any P30D Vaping ^a | 13.8 | (12.4, 15.3) | 7.0 | (6.4, 7.7) | 3.2 | (2.7, 3.7) | 3.6 | (3.0, 4.2) |
| | P30D Combustible + Vaping ^b | 5.6 | (4.9, 6.4) | 2.0 | (1.7, 2.3) | 1.4 | (1.1, 1.8) | 2.2 | (1.9, 2.6) |
| | P30D Noncombustible + Vaping ^c | 0.6 | (0.5, 0.8) | 0.2 | (0.2, 0.4) | 0.2 | (0.1, 0.3) | 0.2 | (0.1, 0.3) |
| | Ever Poly Use, P30D Exclusive Vaping ^d | 3.8 | (3.2, 4.4) | 2.0 | (1.7, 2.3) | 0.9 | (0.7, 1.2) | 0.8 | (0.6, 1.0) |
| | Tobacco Naïve, P30D Exclusive Vaping ^e | 3.9 | (3.3, 4.5) | 2.8 | (2.4, 3.2) | 0.7 | (0.5, 0.9) | 0.4 | (0.3, 0.5) |

^a Any p30d vaping regardless of other product use; ^b Used a vapor and any combustible tobacco product (cigarettes, cigar, hookah, pipe, and bidis) in the p30d; ^c Used a vape and noncombustible tobacco product (smokeless tobacco, snus, and dissolvables) in the p30d; ^d Exclusively vaped in the p30d and had ever used a tobacco product; ^e Exclusively vaped in the p30d and had never used a tobacco product.

Figure 1

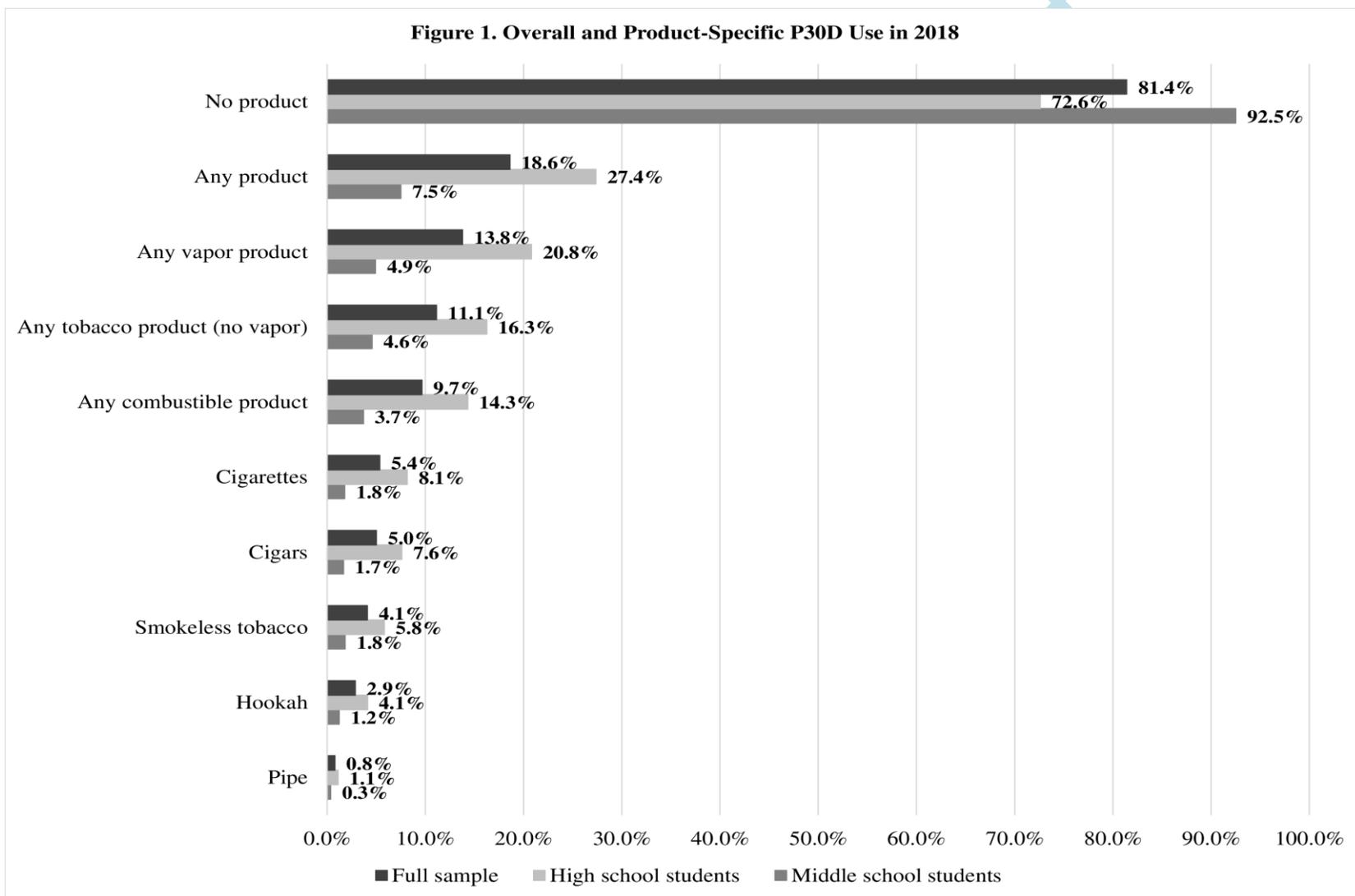


Figure 2

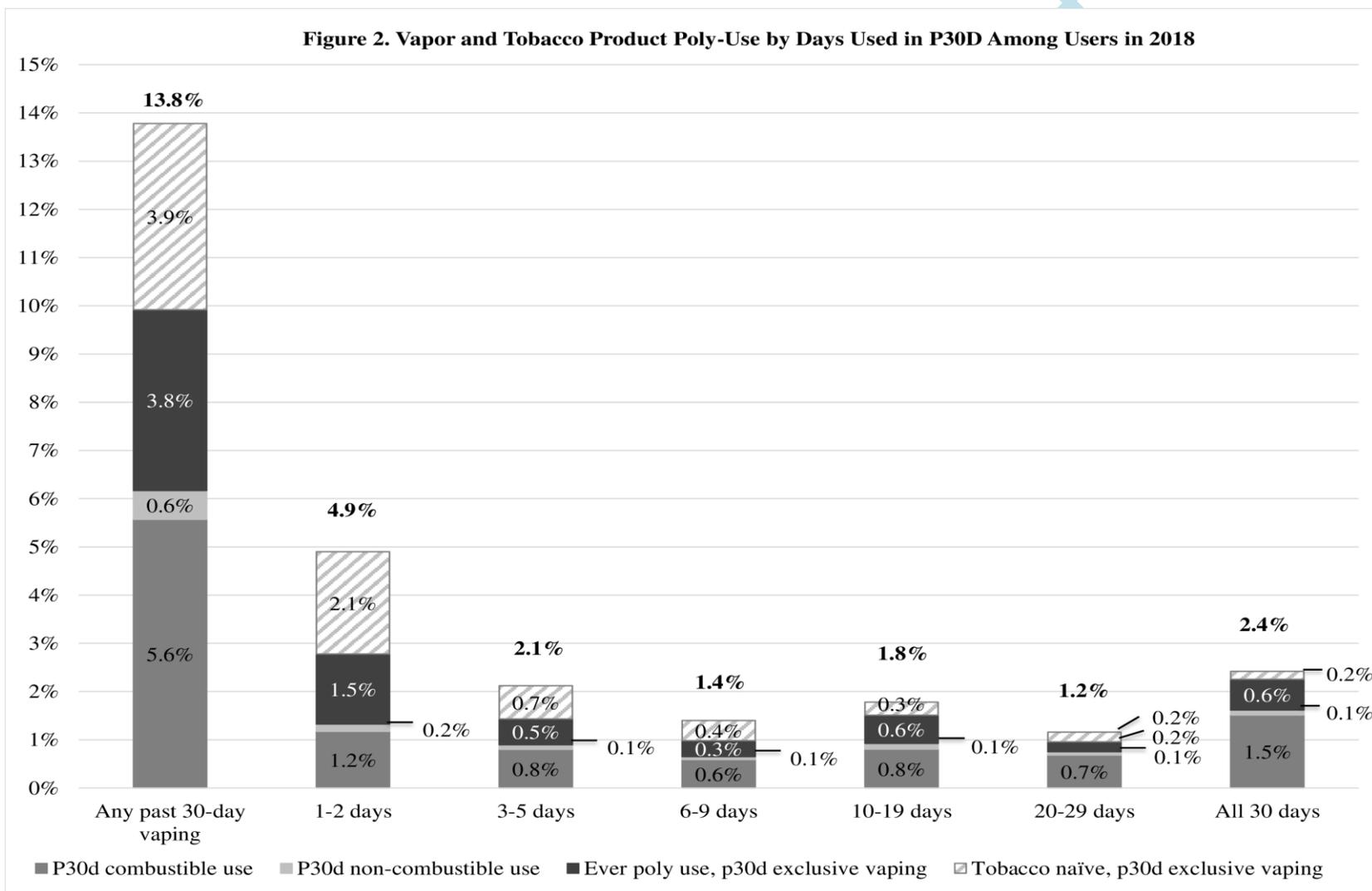


Figure 3



Figure 3. Poly-Use vs. Exclusive Use in P30D in 2018

