Trends in and Factors Associated With Current Cannabis Vaping Among U.S. Adolescents, 2022-2024

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ABSTRACT

Objective: Electronic vapor products are widely used by adolescents and are increasingly used to vape cannabis, posing ongoing health risks. This study aimed to examine trends in and factors associated with current (past 30-day) cannabis vaping among U.S. adolescents. **Method:** Using pooled adolescent data from the 2022-2024 National Survey on Drug Use and Health (n = 34,875), we calculated the prevalence of current cannabis vaping overall and by sociodemographic, policy, and other substance use characteristics for each year. Employing multivariable logistic regression, we examined linear trends in cannabis vaping and associations with each covariate. Subgroup-specific trends were estimated from models that included interactions between survey year and participant characteristics, with linear combinations of coefficients used to derive subgroup estimates. **Results:** Current cannabis vaping increased from 2022-2024 (3.5% to 4.2%, p = .001) and among older (aged 16-17; 6.6% to 7.6%, p = .01), male (2.9% to 3.7%, p = .01), non-Hispanic White (3.8% to 4.7%, p = .01), and wealthier ($75,000+ annual household income; 3.2% to 3.8%, p = .02) adolescents, as well as adolescents covered by state medical cannabis laws (3.5% to 4.1%, p = .004). In pooled analyses, current cannabis vaping between 2022-2024 was associated with older age, compared to younger age (e.g., AOR: 4.61, 95% CI: 2.93-7.26 for 16-17 vs. 12-13-year-olds), and nicotine vaping (AOR: 24.00, 95% CI: 17.44, 32.96). **Conclusions:** Cannabis vaping may be rising among certain U.S. adolescent subgroups. Further research is needed to monitor trends in cannabis vaping over time, particularly among at-risk groups such as adolescents engaging in polysubstance use, among whom use has increased.

Key words: cannabis; vaping; adolescents; nicotine; alcohol; illicit drug

Electronic vapor products (EVPs) were initially designed to administer nicotine as the main ingredient (Grana et al., 2014). These products rose in popularity in the early 2010s among adolescents, and EVP use remains elevated compared to other forms of nicotine use (e.g., smoking; Mattingly & Hart, 2024). EVPs can also deliver psychoactive substances including cannabis derivatives (e.g., tetrahydrocannabinol, THC), with younger populations endorsing higher cannabis vaping in recent years (Lim, Sun, et al., 2022). Illicit cannabis vaping was associated with

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E-cigarette or Vaping product use-Associated Lung Injury (EVALI) in 2019 (Blount et al., 2020). National data suggest that adolescent vaping behaviors, including cannabis vaping, declined during the 2019 EVALI outbreak into 2020 and remained suppressed through the COVID-19 pandemic period, likely reflecting heightened risk perceptions, reduced access, and increased parental supervision (Hoots et al., 2023; Mattingly & Hart, 2024). More recent evidence suggests that vaping behaviors began to rebound following pandemic-related disruptions (Chung et al., 2025; Mattingly & Hart, 2024), underscoring the importance of examining post-2021 trends in adolescent cannabis vaping. Further, although concerns about EVALI have diminished following identification of vitamin E acetate as its primary cause through use of many THC-containing vape products—allowing for targeted public health responses—cannabis vaping among adolescents continues to pose health risks and is associated with adverse developmental and mental health outcomes (Fischer et al., 2020; Valter et al., 2025).

A recent meta-analysis found that from 2013 to 2020, adolescent cannabis vaping prevalence ranged from 6.1% to 13.6% (lifetime) and 1.6% to 8.4% (past 30 days) in Canada and the United States (U.S.; Lim, Sun, et al., 2022). Beginning in the late 2010s, trends indicate that U.S. adolescent cannabis use patterns may be shifting away from cannabis smoking due to the increasing popularity of other use modalities, such as cannabis vaping and edibles (Keyes et al., 2022; Lim, Chan, et al., 2022; Patrick et al., 2020). The growing popularity of cannabis vaping may stem from the perception that it is less harmful than smoking and offers a more discreet method of consumption (Aston et al., 2019). Further, a recent trends analysis (2021-2023) using National Youth Tobacco Survey data found that adolescent cannabis vaping across various products (e.g., THC, CBD, synthetic cannabinoids) significantly increased over time (Chung et al., 2025). These results highlight the urgency of research investigating the current prevalence of cannabis vaping behaviors in the 2020s. The current study aimed to investigate the trends in and factors associated with current cannabis vaping among U.S. adolescents from 2022-2024 using nationally representative data.

METHODS

Data and Participants

We used data on adolescents (aged 12-17 years) from the 2022-2024 National Survey on Drug Use and Health (NSDUH), a nationally representative, repeated cross-sectional survey (n = 34,875) (Center for Behavioral Health Statistics and Quality & Substance Abuse and Mental Health Services Administration, 2023, 2024, 2025). The NSDUH employs a multistage, stratified sampling approach to recruit participants quarterly, collecting data on drug use and mental health through in-person, computer-assisted self- or interviewer-administered questionnaires. Because NSDUH investigators use imputation to replace missing data, our analysis has no missing values (Center for Behavioral Health Statistics and Quality & Substance Abuse and Mental Health Services Administration, 2017). This study was deemed exempt from review by the University of Kentucky Institutional Review Board due to the use of publicly available, deidentified data.

Measures

In NSDUH, participants were asked about their recency of cannabis use, and those who reported use were subsequently asked about the modalities through which they used cannabis. Specifically, adolescents were asked, "*During the past 30 days, that is, since [DATEFILL], in which of the following ways did you use marijuana or any cannabis product?*" We defined current cannabis vaping as any use in the past 30 days via EVPs (i.e., not via other cannabis use modalities such as smoking, dabbing, or ingesting).

For sociodemographic characteristics, we included age (12-13 years, 14-15 years, 16-17 years), sex (male, female), race and ethnicity (Hispanic, non-Hispanic [NH] White, NH Black, NH multiracial, another NH race [NH Asian, NH American Indian/Alaskan Native, and NH Native Hawaiian/other Pacific Islander]), annual household income (<$20,000; $20,000-$49,999; $50,000-$74,999; $75,000+), and metropolitan status (large metropolitan, small metropolitan, nonmetropolitan). Metropolitan status was defined using the Office of Management and Budget metropolitan statistical area (MSA) classifications into large metro (MSA population ≥1,000,000), small metro (MSA population <1,000,000), and

nonmetro (not located in an MSA; Center for Behavioral Health Statistics and Quality & Substance Abuse and Mental Health Services Administration, 2025).

For substance use characteristics, we included state medical cannabis law (MCL) coverage (yes/no), current nicotine vaping (yes/no), current other tobacco use (yes/no), current alcohol use (yes/no), and current other illicit drug use (yes/no). For each substance, current use was defined as past 30-day use. Other tobacco use included use of cigarettes, cigars, pipe, and smokeless; other illicit drug use included use of cocaine, hallucinogens, heroin, inhalants, methamphetamine, and psychotherapeutics.

Statistical Analysis

We calculated the weighted prevalence of each study characteristic overall and by year. We used survey-weighted multivariable logistic regression with survey year as the predictor to estimate linear trends in cannabis vaping overall, the odds of cannabis vaping over the 3-year period. To assess whether trends varied across sociodemographic subgroups, we fit interaction models between survey year and subgroup indicators. Adjusted within-group trends and corresponding p-values were obtained using Wald tests of linear combinations of regression coefficients derived from these interaction models. We conducted analyses in Stata MP 19.5 (StataCorp LLC, 2025).

RESULTS

Participant counts in 2022, 2023, and 2024 were 11,969, 11,572, and 11,334, respectively (Table 1). The age and sex distributions were relatively even (e.g., 31.6% aged 12-13 years; 51.2% male) The sample was primarily NH White (49.3%), Hispanic (26.2%), and NH Black (13.8%), and the majority had annual family household incomes of $75,000+ (50.7%), and lived in large metropolitan areas (56.4%).

Table 1. *Descriptive Statistics Among U.S. Adolescents, the National Survey on Drug Use and Health, 2022-2024 (n = 34,875)*

	n (%)
Survey year	
2022	11969 (33.2)
2023	11572 (33.4)
2024	11334 (33.4)
Age in years	
12-13	11102 (31.6)
14-15	12283 (34.9)
16-17	11490 (33.5)
Sex	
Male	18032 (51.2)
Female	16843 (48.8)
Race and ethnicity	
Hispanic	9155 (26.2)
Non-Hispanic White	15480 (49.3)
Non-Hispanic Black	4940 (13.8)
Non-Hispanic multiracial	2498 (3.7)
Another non-Hispanic race [a]	2802 (7.0)
Annual household income	

<$20,000	5114 (12.7)
$20,000-$49,999	9037 (23.5)
$50,000-$74,999	4860 (13.1)
$75,000+	15864 (50.7)
Metropolitan status	
Large metropolitan	16419 (56.4)
Small metropolitan	13428 (31.9)
Nonmetropolitan	5028 (11.7)
Past 30-day cannabis vaping	1482 (3.8)
Past 30-day nicotine vaping	2580 (6.3)
Past 30-day other tobacco use [b]	833 (1.9)
Past 30-day alcohol use	2493 (6.7)
Past 30-day other illicit drug use [c]	744 (1.9)
State medical cannabis law coverage	27173 (71.4)

Note. [a]Another non-Hispanic race included respondents who identified as non-Hispanic Asian, non-Hispanic American Indian/Alaskan Native, and non-Hispanic Native Hawaiian/other Pacific Islander. [b]Other tobacco products included cigarettes, cigars, pipe, and smokeless. [c]Other illicit drugs included cocaine, hallucinogens, heroin, inhalants, methamphetamine, and psychotherapeutics.

The overall proportion of adolescents who currently vaped cannabis was 3.8%. The proportions of adolescents who vaped nicotine, used other tobacco products, consumed alcohol, and used illicit drugs were 6.3%, 1.9%, 6.7%, and 1.9%, respectively. About 7 in 10 adolescents (71.4%) lived in a state with MCL coverage.

Survey year (2022-2024) was associated with current cannabis vaping (AOR: 1.26, 95% CI: 1.10-1.44; Table 2). Relative to younger adolescents, 14-15-year-olds (AOR: 3.47, 95% CI: 2.21-5.45) and 16-17-year-olds (AOR: 4.61, 95% CI: 2.93-7.26) had higher odds of current cannabis vaping. Finally, compared to non-current use for each respective substance use variable, current nicotine vaping (AOR: 24.00, 95% CI: 17.44-32.96), other tobacco product use (AOR: 1.80, 95% CI: 1.20, 2.70), alcohol use (AOR: 3.51, 95% CI: 2.53-4.86), and other illicit drug use (AOR: 3.05, 95% CI: 2.03-4.60) were associated with current cannabis vaping.

Table 2. *Past 30-Day Cannabis Vaping Overall and by Participant Characteristics Among U.S. Adolescents, 2022-2024*

	Year, *n* (%) [a]				
	2022	2023	2024	*p* [b]	AOR (95% CI) [c]
Past 30-day cannabis vaping	479 (3.5)	524 (3.8)	479 (4.2)	**.001**	**1.26 (1.10, 1.44)**
Age in years					
12-13	34 (0.6)	30 (0.6)	32 (0.8)	.16	REF
14-15	141 (3.3)	174 (3.9)	146 (3.7)	.09	**3.47 (2.21, 5.45)**
16-17	304 (6.6)	320 (6.6)	301 (7.6)	**.01**	**4.61 (2.93, 7.26)**
Gender					
Male	216 (2.9)	231 (3.2)	221 (3.7)	**.01**	REF
Female	263 (4.1)	293 (4.5)	258 (4.7)	.06	1.10 (0.89, 1.36)
Race and ethnicity					

Hispanic	126 (4.0)	158 (4.0)	114 (4.2)	.06	1.26 (0.92, 1.71)
Non-Hispanic White	234 (3.8)	229 (4.1)	239 (4.7)	**.01**	REF
Non-Hispanic Black	62 (2.5)	46 (2.6)	57 (3.9)	.09	0.88 (0.67, 1.17)
Non-Hispanic multiracial	32 (3.7)	64 (6.9)	41 (3.4)	.97	1.03 (0.62, 1.71)
Another non-Hispanic race [d]	25 (1.4)	27 (1.5)	28 (1.6)	.43	0.53 (0.27, 1.02)
Annual household income					
<$20,000	76 (3.8)	78 (3.4)	64 (4.3)	.54	REF
$20,000-$49,999	128 (4.1)	136 (3.7)	129 (4.7)	.13	0.87 (0.62, 1.23)
$50,000-$74,999	77 (3.3)	92 (4.2)	69 (4.7)	.08	0.86 (0.59, 1.24)
$75,000+	198 (3.2)	218 (3.9)	217 (3.8)	**.02**	0.85 (0.64, 1.15)
Metropolitan status					
Large metropolitan	221 (3.3)	216 (3.6)	204 (3.7)	**.002**	REF
Small metropolitan	199 (4.3)	220 (4.2)	210 (4.9)	.15	1.12 (0.88, 1.42)
Nonmetropolitan	59 (2.5)	88 (3.9)	65 (4.5)	.26	0.71 (0.51, 1.00)
Past 30-day nicotine vaping					
No	145 (1.2)	155 (1.3)	138 (1.5)	.24	REF
Yes	334 (34.2)	369 (40.2)	341 (49.7)	**.001**	**24.00 (17.44, 32.96)**
Past 30-day other tobacco use [e]					
No	349 (2.8)	398 (3.2)	352 (3.3)	**.02**	REF
Yes	130 (39.2)	126 (35.7)	127 (52.1)	**.01**	**1.80 (1.20, 2.70)**
Past 30-day alcohol use					
No	246 (2.0)	273 (2.0)	244 (2.4)	.12	REF
Yes	233 (22.9)	251 (28.9)	235 (30.0)	**<.001**	**3.51 (2.53, 4.86)**
Past 30-day other illicit drug use [f]					
No	413 (3.1)	464 (3.5)	414 (3.7)	**.001**	REF
Yes	66 (27.2)	60 (22.7)	65 (24.6)	.38	**3.05 (2.03, 4.60)**
State medical cannabis law coverage					
No	128 (3.6)	92 (2.7)	101 (4.4)	.10	REF
Yes	351 (3.5)	432 (4.3)	378 (4.1)	**.004**	1.15 (0.89, 1.48)

Note. Counts are unweighted. All percentages and other descriptive estimates are weighted. [a]Substratum counts and percentages are calculated among adolescents reporting past 30-day cannabis use. [b]Subgroup-specific p-values for linear trends (2022-2024) were estimated using linear contrasts from survey-weighted interaction models. [c]Adjusted odds ratios and 95% confidence intervals were calculated using multivariable logistic regression between survey year and each participant characteristic and current cannabis vaping; the coefficient for current cannabis vaping represents the effect of survey year. [d]Another non-Hispanic race included respondents who identified as non-Hispanic Asian, non-Hispanic American Indian/Alaskan Native, and non-Hispanic Native Hawaiian/other Pacific Islander. [e]Other tobacco products included cigarettes, cigars, pipe, and smokeless. [f]Other illicit drugs included cocaine, hallucinogens, heroin, inhalants, methamphetamine, and psychotherapeutics.

The prevalence of current cannabis vaping in 2022, 2023, and 2024 was 3.5%, 3.8%, and 4.2%, significantly increasing across the study period (p = .001). Changes in current cannabis vaping were observed across several sociodemographic subgroups, including adolescents who were aged 16-17 (6.6% to 7.6%, p = .01), male (2.9% to 3.7%, p = .01), NH White (3.8% to 4.7%, p = .01), members of households with $75,000k+ in annual household income (3.2% to 3.8%, p = .02), and residing in large metropolitan areas (3.3% to 3.7%, p = .002).

For substance use characteristics, current cannabis vaping increased among adolescents who currently vaped nicotine (34.2% to 49.7%, p = .001), used other tobacco products (39.2% to 52.1%, p = .01), and used alcohol (22.9% to 30.0%, p < .001), but not among adolescents who currently used other illicit drugs (27.2% to 24.6%, p = .38). Finally, the prevalence of cannabis vaping increased for adolescents living in states with MCLs (3.5% to 4.1%, p = .004).

DISCUSSION

This study provides updated population prevalence estimates of cannabis vaping among US adolescents from 2022 to 2024. Findings indicate that cannabis vaping increased during these years and point to the need for continued monitoring of such usage in future years. We observed a statistically significant increase in cannabis vaping among adolescents who were older, male, NH White, wealthier, and living in large metropolitan areas, as well as those who currently vaped nicotine, used other tobacco products, used alcohol, and resided in states with MCL coverage. Additionally, adolescents who used other illicit drugs had higher odds to vape cannabis, but no trend was observed over time.

Several factors may explain the increase in cannabis vaping observed among adolescents observed from 2022 to 2024 and the subgroup differences identified in this study. The higher odds of cannabis vaping among adolescents who were older, male, non-Hispanic White, in households with higher income, and residing in large metropolitan areas may reflect greater exposure to and availability of vaporized cannabis products, which are often marketed as discreet and technologically advanced alternatives to smoking and may be particularly appealing to these groups (Anic et al., 2021; Chaffee et al., 2023). Further, adolescents residing in states with MCLs had higher odds of cannabis vaping, consistent with prior evidence suggesting that evolving cannabis policies may increase product availability and normalization, including for vaporized products (Pawar et al., 2024).

The strong associations between cannabis vaping and concurrent nicotine vaping, other tobacco product use, and alcohol use observed in this sample suggest that cannabis vaping occurs within broader polysubstance use patterns, potentially driven by shared EVP features, such as flavors and device design, as well as cross-substance marketing strategies (Anic et al., 2021; Trangenstein et al., 2021). Exposure to cannabis marketing and social media content, including influencer-based promotion, may further reinforce these patterns, particularly among adolescents already engaged in nicotine vaping or other substance use (Lee et al., 2023). Notably, while current illicit drug use was associated with cannabis vaping, we did not observe increases in cannabis vaping over time within this subgroup, suggesting that recent increases may be driven by adolescents who are newer to cannabis or substance use rather than those already engaged in higher-risk drug use. Together, these findings highlight the need for continued surveillance of cannabis vaping trends and underscore the importance of prevention efforts and tobacco and cannabis regulatory approaches that address cannabis vaping within the broader context of nicotine use, alcohol use, and evolving policy environments (Davis et al., 2025; Moustafa et al., 2022).

Cannabis vaping among adolescents residing in large metropolitan areas increased from 2022 to 2024, whereas changes in other geographic areas were not statistically significant. The lack of statistical significance, despite a large percentage change, may reflect small subgroup sample sizes. This consideration may be particularly relevant for adolescents residing in nonmetropolitan areas, where the descriptive prevalence increased from 2.5% in 2022 to 4.5% in 2024. Prior research suggests that cannabis use among rural adolescents in some U.S. regions now approaches levels observed among their urban counterparts (Ryerson et al., 2024), a trend mirroring nicotine vaping in recent years (Bae et al., 2025; Dai et al., 2021). Despite not observing increases in current cannabis vaping in small and nonmetropolitan areas, the prevalence of use in both areas was reportedly higher than in large metropolitan areas. Differences between those findings and ours may reflect variation in geographic scope (e.g., rural or urban vs. metropolitan or nonmetropolitan), timeframe examined, and outcome definitions.

Together, these findings underscore the importance of continued surveillance of cannabis vaping in nonmetropolitan areas to identify emerging increases in use. The modest but

statistically significant increase observed in large metropolitan areas further highlights the need to examine similarities and differences in cannabis marketing, access, and tobacco and cannabis regulatory environments across geographic contexts. Further, cannabis vaping increased among adolescents who currently used other substances including other tobacco products and alcohol, with potentially significant public health and addiction implications. Future research is needed to unpack drivers of this trend and approaches to best address cannabis and alcohol co-use. Adolescent alcohol use is often influenced by peer and social factors (Kaner et al., 2022; Sanchez et al., 2023), and cannabis vaping may represent a newer form of substance use driven by similar mechanisms.

This study has several limitations. First, measures are self-reported and subject to response biases. Second, we did not examine how other cannabis use modalities or nicotine and cannabis co-use affect trends and disparities. This study also did not assess the frequency or intensity of cannabis vaping, limiting interpretation of potential dose-response relationships and associated health risks. Third, the NSDUH does not ask adolescents about their sexual orientation, prohibiting exploration of trends and disparities among sexual minority adolescents. Fourth, some subgroups, such as those identifying as NH multiracial, had small sample sizes and wide confidence intervals, indicating imprecise estimates. Fifth, NSDUH does not differentiate between types of cannabis vaporization devices; therefore, the term "vaping marijuana" in the questionnaire may encompass heterogeneous practices and be interpreted differently by respondents. Finally, public-use NSDUH data include only a limited indicator of state-level MCL coverage; more detailed variation in medical and recreational cannabis policies could not be examined without access to restricted-use files. State MCL coverage was also measured using a binary indicator and thus did not capture heterogeneity in the scope, restrictiveness, or implementation of medical cannabis programs across states.

In conclusion, cannabis vaping increased overall and among certain U.S. adolescent subgroups (e.g., adolescents who were male, non-Hispanic White, living in states with MCL coverage, and currently using tobacco/nicotine or alcohol). These patterns suggest that cannabis vaping may be occurring within broader substance use behaviors and evolving policy environments. Persistent subgroup differences highlight the need for prevention efforts that address cannabis vaping, particularly among adolescent populations where prevalence appears to be increasing. Continued surveillance of cannabis use modalities is needed to inform targeted prevention strategies and tobacco and cannabis regulatory approaches aimed at reducing vaping-related harms among adolescents.

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