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Tetrahydrocannabinol (THC)-containing e-cigarette, or vaping, product use behaviors among adults after the onset of the 2019 outbreak of E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI)

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Abstract

Introduction—During the E-cigarette, or Vaping, Product Use-Associated Lung Injury (EVALI) outbreak, patient data on tetrahydrocannabinol (THC)-containing e-cigarette, or vaping, product (EVP) use was collected, but data on non-affected adult product use after the onset of the EVALI outbreak is limited. This study describes adult THC-EVP use after EVALI began.

Methods—THC-EVP use data came from an 18-state web-based panel survey of adult THC- and nicotine-containing EVP users conducted February 2020. Unweighted descriptive statistics were calculated; logistic regression assessed correlates of use.

Results: Among 3,980 THC-EVP users, 23.5% used THC-EVPs daily. Common brands of THC-EVPs used were Dank Vapes (47.7%) and Golden Gorilla (38.7%). Reported substances used included THC oils (69.6%), marijuana herb (63.6%) and THC concentrate (46.4%). Access sources included: recreational dispensaries (41.1%), friend/family member (38.6%) and illicit dealers (15.1%). Respondents aged 45–64 years had lower odds for daily use compared with those aged 25–34 years (aOR = 0.73; 95% CI = 0.60, 0.90). Compared with White respondents, Asian respondents had lower odds (aOR = 0.55; 95% CI = 0.36, 0.84) and Black respondents higher odds (aOR = 1.48; 95% CI = 1.17, 1.86) of daily use. Respondents odds of daily use and accessing THC-EVPs through commercial sources were higher among states with legalized nonmedical adult marijuana use compared to states without.

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Conclusions—Almost half of respondents reported daily or weekly THC-EVP use, and accessed products through both informal and formal sources, even after EVALI began. Given the potential for future EVALI-like conditions to occur, it is important to monitor the use of THC-EVPs and ensure effective education activities about associated risk.

Keywords

electronic cigarettes; e-cigarettes; marijuana; vaping; EVALI

1. Introduction

Beginning August 2019, the Centers for Disease Control and Prevention (CDC), the U.S. Food and Drug Administration (FDA), state and local health departments, and other public health stakeholders investigated a national outbreak of e-cigarette, or vaping, product use-associated lung injury (EVALI). (Krishnasamy et al., 2020) As of February 18, 2020, over 2,807 hospitalized EVALI patients and nearly 70 deaths were reported to CDC. Among EVALI patients with substance use information (as of January 14, 2020), 82% reported using tetrahydrocannabinol (THC)-containing e-cigarette, or vaping, products (EVPs) in the 3 months before symptom onset (Krishnasamy et al., 2020). In addition, most EVALI patients (as of January 7, 2020) who used THC-containing EVPs (74%) reported daily use, and 78% reported obtaining their THC-containing products from informal sources such as friends, family, and in-person or online dealers (Ellington et al., 2020). Further, among EVALI patients who reported information on the specific brands of THC-containing EVPs they used, Dank Vapes, a class of largely counterfeit THC-containing products (counterfeit in this case means of unknown origins, with common packaging that is easily available online and no clear centralized production or distribution) were the most commonly reported products used. (Ghinai et al., 2019; Lozier et al., 2019) Vitamin E acetate, an additive in some THC-containing EVPs, was strongly linked to the EVALI outbreak (Blount et al., 2020).

Almost 15% of middle and high school students reported ever using marijuana in an e-cigarette in 2018 (Dai, 2020), and approximately 4%, 13%, and 14% of 8th, 10th, and 12th graders, respectively, reported vaping marijuana during the past 30-days (Miech, Patrick, O'Malley, Johnston, & Bachman, 2020). Data are available on use of THC-containing EVPs among youth (Dai, 2020; Miech et al., 2020; Trivers, Phillips, Gentzke, Tynan, & Neff, 2018), but data on the use of THC-containing EVPs among adults are limited (Baldassarri, Camenga, Fiellin, & Friedman, 2020; Morean, Lipshie, Josephson, & Foster, 2017; Schauer, King, Bunnell, Promoff, & McAfee, 2016; Trivers et al., 2019). Particularly lacking is detailed information about adult behaviors and usage patterns (e.g. brands and device types used, frequency of use, access source), correlates of THC-containing EVP use, and whether there are differences by state-level marijuana legalization status. One study found that, in 2017, approximately 18% of current (past-30 day) adult EVP users reported past-year marijuana use in their EVP (Trivers et al., 2019), and another study observed that among adults who self-reported any marijuana use in 2017 and 2018, almost 11% reported vaping as their main mode of use (Baldassarri et al., 2020). Unlike EVALI, where patient data on THC-containing EVP use and use behaviors was collected and reported, data on

non-affected adult product use and behaviors after the onset of the EVALI outbreak is limited

As of the first quarter of 2020 when the survey was fielded, non-medical marijuana use was legal in 11 states and the District of Columbia for adults aged 21 years or older (NORML), representing over a quarter of the population of the United States, and 33 states and the District of Columbia had legalized marijuana use for medical purposes (NORML). As additional states consider legalizing the sale of marijuana, shifts in acceptability, availability, and use of marijuana continues to occur.

There is some evidence to support that cannabis or cannabinoids are effective in the treatment of chronic pain among adults, as antiemetics in the treatment of chemotherapy-induced nausea and vomiting, and for improving patient-reported spasticity symptoms from multiple sclerosis (National Academies of Sciences Engineering and Medicine, 2017). Harmful health consequences associated with marijuana use include: increased risk of respiratory problems; declines in memory, attention, and learning; increased occurrence of schizophrenia and other psychoses; increased dependence on cannabis and other substances; and increased risk of low birth weight among babies exposed *in utero* (National Academies of Sciences Engineering and Medicine, 2017). The marijuana product landscape includes a variety of modes of use (e.g. smoked, aerosolized, edibles) and products which vary in THC potency. For example, aerosolized marijuana often uses concentrates that can contain substantially higher THC levels than levels found in dried marijuana plant material (Al-Zouabi, Stogner, Miller, & Lane, 2018; Aston, Farris, Metrik, & Rosen, 2019; Murray, Quigley, Quattrone, Englund, & Di Forti, 2016). Given the ongoing scientific debate about the risks and potential benefits of marijuana use (National Academies of Sciences Engineering and Medicine, 2017), the rapid emergence of the EVALI outbreak in 2019, and the continuously evolving marijuana product landscape (Al-Zouabi et al., 2018; Aston et al., 2019; Murray et al., 2016), there is a need for timely surveillance of THC-containing EVP use behaviors. This study describes THC-containing EVP use behaviors among adults after the onset of the 2019 – 2020 outbreak of EVALI.

2. Methods

2.1. Data Source

Data on self-reported THC-containing EVP use behaviors among adults (aged 18 years) are from a web-based panel survey conducted from February 25, 2020 and February 29, 2020. Respondents (n = 3,980) were selected from the US YouGov panel, a proprietary opt-in internet panel survey of 1.8 million U.S. residents. U.S. YouGov panel members are recruited through several methods to help ensure diversity in the panel composition, including web advertising campaigns, partner sponsored solicitations, telephone to web recruitment, mail to web recruitment, and traffic to the YouGov website for polling content. YouGov survey respondents are not paid to join the panel but they receive incentives through a points-based loyalty program for taking individual surveys (Ashley Grosse, YouGov, personal communication, September 24, 2020).

The inclusion criteria for the THC-containing EVP survey were: (1) aged 18 years; (2) used nicotine-containing and marijuana or THC-containing EVP, or reported dabbing, (i.e., using a highly concentrated form of THC) in the past 3 months; (3) no diagnosis of probable or confirmed EVALI in the past year; and (4) resident of 1 of 18 selected states (California, Colorado, Florida, Illinois, Michigan, Minnesota, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Washington, and Wisconsin). States were selected to capture geographic diversity, burden of EVALI patients (CDC) and status of THC/marijuana legalization (National Conference of State Legislators) (medical only use legalized, medical and non-medical use legalized, and not legalized).

To protect the privacy of respondents' and to ensure non-disclosure of reported information, the THC-containing EVP survey and the associated data were protected by an Assurance of Confidentiality stating that the information obtained will be held in strict confidence, will be used only for the purposes stated, and will not otherwise be disclosed or released without the individual's consent. This work was determined to be public health practice by CDC during human subjects review.

2.2. Measures

Survey questions primarily focused on the use of THC-containing EVPs in the 3 months before the survey; most response options were 'select all that apply', therefore, percentages could add up to more than 100%. Questions included "Which THC substance(s) did you use in an e-cigarette, vaping device, vaporizer, or dab rig in the past 3 months? (Answer choices were: Marijuana herb (flower or leaves), THC oils, Butane hash oil, THC concentrate (e.g., wax, badder/budder, crumble, shatter, pull and snap), THC powder form (e.g., dry sift), or Other); "What type of device(s) did you use to vape or dab THC-containing products in the past 3 months?" (Answer choices were: Disposable e-cigarette or vape, E-cigarette or vape with prefilled cartridges, E-cigarette or vape with a tank that you refill with liquids (including sub-ohm, mod or modifiable systems), E-cigarette or vape with prefilled or refillable "pods" or pod cartridges (e.g. JUUL, Suorin), Dab rig, Vaporizer (for dry herbs, etc.), Other); and "What brand of THC-containing cartridge(s) were used with device(s)?" (Answer choices were: Rove, Dank Vapes, Golden Gorilla, Smart Cart, other).

Sources for THC-containing EVPs were assessed by the following question "Where did you obtain these THC-containing products? (Answer choices were: Medical dispensary, Recreational dispensary (retail cannabis/marijuana shop), Vape or smoke shop, Pop-up shop, Grocery store/Drug store/Convenience store, Family or friend, Illicit dealer, Online, Other). "Informal" sources include accessing from a family member or friend, illicit dealer, or online. All others were categorized as 'commercial' sources.

Frequency of THC EVP use was determined by the following question: "Approximately how frequently did you vape THC-containing products in the past 3 months?" (Answer choices were: Monthly or less, a few days per month, a few days per week, daily) and length of time using THC-containing EVPs was assessed with the following question: "How long have you been vaping or dabbing THC-containing products?" (Answer choices were: < 3 months, 3–6 months, 7–12 months, >1 year).

Basic demographic characteristics were also assessed on the survey including sex (male or female), age (subsequently grouped into 18–24, 25–34, 35–44, 45–64, and 65–86 years), and race or ethnicity (“What racial or ethnic group best describes you”; answer choices were: White, Black, Hispanic, Asian, Native American, Mixed, Other or Middle Eastern). Racial/ethnic categories were mutually exclusive and were collapsed into the following groups (White, Black, Hispanic, Asian, and ‘other’ which included all other categories).

2.3. Statistical Analysis

Descriptive statistics of the sample were calculated. Prevalence was calculated, along with 95% confidence intervals (CIs) for the THC-containing EVP use behaviors assessed in the survey. A dichotomous “daily THC-containing product use” variable was created by using responses to the THC-containing EVP frequency of use question. Respondents who selected “a few days per week,” “a few days per month,” and “monthly or less” were classified as non-daily users.

Multivariable logistic regression was used to examine the association between demographic characteristics and daily versus non-daily THC-containing EVP use. Multivariable logistic regression, adjusting for age, race or ethnicity, and sex, was used to examine the association between specifics of THC-containing EVP use behaviors and living in a state with legalized adult nonmedical marijuana use (i.e., state-wide law allows for personal possession and consumption of marijuana for all adults; California, Colorado, Illinois, Michigan, Oregon, Washington) versus living in a state without legalized adult nonmedical marijuana use (Florida, Minnesota, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Tennessee, Texas, Utah, Wisconsin). Because the response options were select all that apply, separate multivariable logistic regression models were run for each response option comparing yes to no responses (e.g., respondents reporting yes to the use of disposable EVPs versus those who did not report such use). Results for the multivariable logistic regression models are presented as adjusted odds ratios (aOR) and associated 95% CIs. Unweighted data are analyzed and reported because the sampling frame only included selected states and is not representative of state or national populations. Analyses were conducted using SAS 9.4 (Cary, NC).

3. Results

3.1. Descriptive Findings

Among the 3,980 adult respondents, 53.5% were female and the median age was 36 years (range 19 – 86 years). Of respondents, 71% identified as White, 11.0% Hispanic, 10.0% Black, 4.4% Asian, and 3.7% all other groups (Table 1).

Among respondents (Table 2), 53.1% used prefilled cartridge-based THC-containing EVPs, 37.9% used a tank system, 33.2% used disposable EVPs, and 32.7% used prefilled or refillable pods or pod cartridges in the past 3 months (Table 2). Less than 25% of respondents reported using dab rigs or vaporizers. The most common brand of THC-containing cartridge used was Dank Vapes (47.7%), followed by Golden Gorilla (38.7%), Smart Cart (21.8%), and Rove (20.1%). Nineteen percent of respondents reported using

other brands. The most reported type of THC-based substance used in THC-containing EVPs was THC oils (69.6%), followed by marijuana herb (63.6%), THC concentrate (46.4%), butane hash oils (14.2%), and THC powder (11.6%).

Respondents reported obtaining their THC-containing EVPs from a variety of sources including, a recreational dispensary (41.1%), a friend or family member (38.6%), vape/smoke shop (38.4%), medical dispensary (25.5%), an illicit dealer (15.1%), grocery, drug or convenience store (9.0%), and online (7.4%).

Almost one-fourth (23.5%) of respondents used THC-containing EVPs daily, 23.0% weekly, 18.6% a few days per month, and 34.7% monthly or less. Most users (67.7%) reported using THC-containing EVPs 0–5 times per day, 13.7% reported 6–10 times per day, and 18.6% used over 10 times per day on the days they used THC-containing EVPs. Approximately 41% of respondents reported using THC-containing EVPs for more than a year, 19.2% for 7–12 months, 24.6% for 3–6 months, and 15.5% had been using for less than 3 months.

3.2. Multivariable Findings

After adjustment for gender, race or ethnicity, and state nonmedical marijuana legalization status, respondents aged 45–86 years had lower adjusted odds of reporting daily use compared to those aged 25–34 years (aOR = 0.74; 95% CI = 0.61, 0.90) (Table 3). Compared to White respondents, Asian respondents had lower adjusted (for age, gender, state nonmedical marijuana legalization status) odds [aOR = 0.55; 95% CI = 0.36, 0.84] of reporting daily THC-containing EVP use. Black or other respondents had higher adjusted odds of reporting THC-containing EVP use daily (Black respondents aOR = 1.48; 95% CI = 1.17, 1.86; other respondents, aOR = 1.51; 95% CI = 1.05, 2.17). Those living in legalized nonmedical marijuana states had higher adjusted (for age, gender, race/ethnicity) odds of using THC-containing EVPs daily than those living in non-legalized marijuana states (aOR = 1.18; 95% CI = 1.01, 1.37). No other significant differences were observed among the assessed groups.

After adjusting for age, race or ethnicity, and sex, adults reporting THC-containing EVP use via a disposable device, a dab rig, or a vaporizer had higher adjusted odds of living in a legalized nonmedical marijuana state (aOR for disposable device = 1.16; 95% CI = 1.01, 1.32; aOR for dab rig = 1.39; 95% CI = 1.18, 1.62; aOR for vaporizer = 1.21; 95% CI = 1.04, 1.42) compared to those not using those particular devices (Table 4). Further, those reporting using marijuana herb, butane hash oil, and THC concentrate had higher adjusted odds of living in a legalized nonmedical marijuana state (aOR for marijuana herb = 1.38; 95% CI = 1.20, 1.58; aOR for butane hash oil = 1.59; 95% CI = 1.32, 1.91; aOR for THC concentrate = 1.27; 95% CI = 1.11, 1.43). There was limited variation in brands of THC products by residence in a legalized nonmedical marijuana state; however, users of the Golden Gorilla or ‘other’ brand had higher adjusted odds of living in a legalized nonmedical marijuana state (aOR for Golden Gorilla = 1.18; 95% CI = 1.03, 1.35; aOR for ‘other’ = 1.21; 95% CI = 1.02, 1.42). THC-containing EVP users who reported sourcing THC-containing EVPs through commercial means (e.g., recreational or medical dispensaries) had higher adjusted odds of living in a legalized nonmedical marijuana state (aOR for recreational dispensaries = 3.96; 95% CI = 3.45, 4.54, aOR for medical dispensary

= 1.47; 95% CI = 1.27, 1.71; aOR for vape or smoke shop = 1.40; 95% CI = 1.23, 1.61). Correspondingly, accessing products via informal sources such as friends and family, the internet, or an illicit dealer was associated with lower adjusted odds of living in a legalized nonmedical marijuana state (aOR for illicit dealer = 0.47; 95% CI = 0.39, 0.58; aOR for family or friend = 0.56; 95% CI = 0.49, 0.64; and aOR for online source = 0.70; 95% CI = 0.54, 0.91). Those reporting first using THC-containing EVPs within the last year had lower odds of living in a legalized nonmedical marijuana state compared to adults who reported using THC-containing EVPs for more than a year (e.g., OR for < 3 months = 0.69; 95% CI = 0.57, 0.84). No other assessed groups had significant differences.

4. Discussion

Among adults from a geographically diverse sample of 18 states who reported use of THC-containing EVPs after the onset of the EVALI outbreak, but who did not develop EVALI, almost half reported daily or weekly use. In addition, nearly 50% of respondents reported using Dank Vapes, a class of largely counterfeit THC-containing EVPs of unknown origin that was also commonly reported among EVALI patients (Lozier et al., 2019). In addition, respondents reported obtaining products through informal sources, with approximately 40% obtaining EVPs from friends or family, 15% from illicit dealers, and 7% from an online source. Ultimately, EVALI was strongly linked to THC-containing products from informal sources. Equally concerning, nearly 1 in 6 respondents started using THC-containing EVPs within 3 months of the survey, meaning they initiated use during or after the EVALI outbreak.

In addition, a substantial proportion of respondents reported using highly potent THC substances (e.g., butane hash oils and concentrates) and those living in legal nonmedical marijuana states were more likely to report use of these products, which could indicate easier access to higher potency products in these states (Al-Zouabi et al., 2018; Struble, Ellis, & Lundahl, 2019). Overall, THC potency in marijuana products has increased during the past 2 decades (ElSohly et al., 2016) and little is known about the differential health effects and characteristics of various forms of THC substances.

Our results also demonstrated that living in a state that has legalized nonmedical marijuana sales was associated with longer-term and more frequent use of THC-containing EVPs. This is consistent with a prior study, which found that living in a state with medical marijuana laws was associated with a higher likelihood of ever vaping THC (Borodovsky, Crosier, Lee, Sargent, & Budney, 2016), however others have observed little impact of medical marijuana laws on use (Harper, Strumpf, & Kaufman, 2012). Given the limited and inconsistent data currently available, rapidly changing marijuana policy landscape and product marketplace in states, more research is needed to better understand the relationship between marijuana legalization (both medical and nonmedical use) and adult use behaviors and outcomes. In addition, given the documented health risks associated with marijuana use, as well as the uncertainty regarding therapeutic benefits for a range of medical conditions (National Academies of Sciences Engineering and Medicine, 2017), further efforts to provide evidenced-based information to the public, clinicians, and policymakers could be beneficial.

Respondents in this investigation were older, on average, than EVALI patients and there are differences in time frames of data collection and populations assessed. Most EVALI patients (74%) reported daily use of THC-containing products (Ellington et al., 2020), whereas only 23.5% of this sample reported daily use. Most EVALI patients (78%) reported only using THC-containing products from informal sources (Ellington et al., 2020), whereas respondents in this sample, especially those living in legalized non-medical marijuana states, more frequently reported using products obtained from formal sources. Similarly, a survey conducted in Illinois during the midst of the EVALI outbreak which found that EVALI patients reported more frequent use of THC-containing EVPs and were more likely to obtain them through informal sources than a comparison group of THC-containing EVP users who did not develop EVALI (Navon et al., 2019).

The strengths of this investigation are its robust overall sample size, the geographic diversity of states included in the survey, and the ability to rapidly collect these data in the period during and after the EVALI outbreak. This manuscript describes in depth THC containing EVP use behaviors after the onset of the nation-wide EVALI outbreak in the U.S. However, it is subject to at least three limitations. First, although we prospectively targeted a set of states that were diverse geographically, with laws regarding medical and nonmedical marijuana use, and burden of EVALI patients, the sample is not representative of national or state populations and was limited to those who reported using both THC- and nicotine-containing EVPs. Therefore, results cannot be generalized to states, the nation or to all THC EVP users. Second, some groups had small sample sizes (e.g., older age groups, and non-White race or ethnicity), limiting our analysis among these groups. Finally, the data are self-reported and subject to recall or measurement bias. Misclassification is likely among the response options for the access source variable in particular. Most of the comparison states without legalized adult nonmedical marijuana use included in the survey had some form of legalization of marijuana for medical use, therefore the ability to access legal medical marijuana may have partially confounded the observed relationship between legalization for adult nonmedical marijuana use and use behaviors. Social desirability bias may also have been present, given the sensitive nature of some of the questions. However, the THC-EVP survey was covered by an Assurance of Confidentiality, with reminders throughout the questionnaire that confidentiality would be maintained.

4.1 Conclusion

Almost half of survey respondents reported daily or weekly use of THC-EVP, and many accessed products through informal sources, even after EVALI began. These findings underscore that EVALI-like outcomes could occur again and highlight the importance of continued surveillance of THC-containing EVP use and expanded education and awareness about the potential risks associated with their use.

This work expands understanding of THC EVP use among adults in the U.S., which is particularly important in the midst of the evolving landscape of state-level marijuana policies and in the aftermath of the nation-wide outbreak of serious lung injuries associated with the use of THC-containing EVPs. Additional in-depth surveillance and research on EVP use behaviors, contents (including additives), product sources, associations with awareness of

EVALI, and motivations for use, including the information provided from this report, can further inform prevention and education efforts and guide future outbreak response efforts.

CDC and FDA recommend that people not use THC-containing e-cigarette, or vaping, products, particularly from informal sources like friends, family, or in-person or online dealers. Because Vitamin E acetate is strongly linked to EVALI, it should not be added to any e-cigarette, or vaping, products. Additionally, people should not add any other substances not intended by the manufacturer to products, including products purchased through retail establishments. Evidence is not sufficient to rule out the contribution of other chemicals in either THC or non-THC products, in some of the reported EVALI patients. E-cigarette, or vaping, products (nicotine- or THC-containing) should never be used by youths, young adults, or women who are pregnant. THC use has been associated with a wide range of health effects, particularly with prolonged frequent use. The best way to avoid potentially harmful effects is to avoid the use of THC-containing e-cigarette, or vaping, products.

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Table 1.

Demographic characteristics of adults (18+ years) reporting Tetrahydrocannabinol (THC) vaping or dabbing¹ and nicotine vaping— Selected States², United States, February- March 2020

Characteristics	No./Total No. (% ³)
Demographics	
Sex	
Male	1850/3980 (46.5)
Female	2130/3980 (53.5)
Median age, years (range)	36 (19–86)
Age Group (years)	
18–24	585/3980 (14.7)
25–34	1145/3980 (28.8)
35–44	987/3980 (24.8)
45–64	1071/3980 (26.9)
65–86	192/3980 (4.8)
Race/Ethnicity	
White	2825/3980 (71.0)
Black	399/3980 (10.0)
Hispanic	436/3980 (11.0)
Asian	174/3980 (4.4)
Other	146/3980 (3.7)

¹Dabbing is the use of concentrated forms of THC

²California, Colorado, Florida, Illinois, Michigan, Minnesota, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Washington, Wisconsin

³Percentages may add up to more than 100% due to rounding.

Table 2:

Tetrahydrocannabinol (THC)-vaping characteristics of adults (18+ years) reporting THC vaping or dabbing¹ and nicotine vaping in the past 3 months— Selected States², United States, February- March 2020

	Frequency	Percent	95% Confidence Intervals	
Type of device(s) used to vape or dab THC-containing products³				
Disposable e-cigarette or vape	1322	33.2	31.7	34.7
E-cigarette or vape with prefilled cartridges	2115	53.1	51.6	54.7
E-cigarette or vape with a tank that you can refill with liquids	1508	37.9	36.4	39.4
E-cigarette or vape with prefilled or refillable pods or Pod cartridges	1300	32.7	31.2	34.1
Dab Rig	857	21.5	20.2	22.8
Vaporizer	839	21.1	19.8	22.3
Other	86	2.2	1.7	2.6
Brand of THC-containing cartridge(s) used with device(s)³				
Rove	800	20.1	18.9	21.3
Dank Vapes	1901	47.7	46.2	49.3
Golden gorilla	1539	38.7	37.1	40.2
Smart cart	868	21.8	20.5	23.1
Other	757	19.0	17.8	20.2
THC substance(s) used in THC-containing devices, vaporizer, or dab rig in the past 3 months?³				
Marijuana Herb	2533	63.6	62.2	65.1
THC oils	2768	69.6	68.1	71.0
Butane hash oils	563	14.2	13.1	15.2
THC concentrate (wax, badder/budder, crumble, shatter, pull and snap	1846	46.4	44.8	47.9
THC powder form	462	11.61	10.61	12.60
Access source of THC-containing products³				
Medical Dispensary	1014	25.5	24.1	26.8
Recreational dispensary	1637	41.1	39.6	42.6
Vape or smoke shop	1530	38.4	36.9	39.9
Pop up shop	331	8.3	7.5	9.2
Grocery/Drug store/Convenience store	360	9.0	8.2	9.9
Family/friend	1538	38.6	37.1	40.1
Illicit dealer	601	15.1	14.0	16.2
Online	296	7.4	6.6	8.25
Other	54	1.4	1.0	1.7
Frequency of THC-containing vaping product use³				
Monthly or less	1382	34.7	33.2	36.2
A few days per month	742	18.6	17.4	19.8
A few days per week	917	23.0	21.7	24.3
Daily	937	23.5	22.2	24.9

	Frequency	Percent	95% Confidence Intervals	
Average number of times per day THC-containing vaping products used³				
0–5 times per day	2696	67.7	66.3	69.2
6–10 times per day	544	13.7	12.6	14.7
Over 10 times per day	740	18.6	17.4	19.8
Length of time vaping or dabbing THC-containing products³				
< 3 months	618	15.5	14.4	16.7
3–6 months	978	24.6	23.2	25.9
7–12 months	763	19.2	18.0	20.4
> 1 year	1621	40.7	39.2	42.3

¹Dabbing is the use of concentrated forms of THC

²California, Colorado, Florida, Illinois, Michigan, Minnesota, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Washington, Wisconsin

³Response options were not mutually exclusive

Table 3:

Adjusted odds of daily vs non-daily tetrahydrocannabinol (THC)-vaping or dabbing¹ and age, race, and living in a legalized nonmedical marijuana state² among adults (18+ years)— Selected States³, United States, February- March 2020

Characteristic	Adjusted OR*	95% Confidence Intervals		p-value**
Gender (Female vs. Male)	1.16	1.00	1.34	0.059
Age Group, years (vs. 25–34)				
18–24	0.88	0.71	1.10	0.27
35–44	0.88	0.72	1.08	0.22
45–86	0.74	0.61	0.90	0.0027
Race (vs. White respondents)				
Asian	0.55	0.36	0.84	0.01
Black	1.48	1.17	1.86	0.00
Hispanic	0.83	0.65	1.06	0.14
Other	1.51	1.05	2.17	0.025
Living in legalized non-medical marijuana state (vs not)	1.18	1.01	1.37	0.033

¹Dabbing is the use of concentrated forms of THC

²California, Colorado, Illinois, Michigan, Oregon, Washington

³California, Colorado, Florida, Illinois, Michigan, Minnesota, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Washington, Wisconsin

* Adjusted for all other variables in the tables

** p-value from chi-square test

Table 4:

Adjusted odds of living in a legalized nonmedical marijuana state¹ by tetrahydrocannabinol (THC)-vaping or dabbing² characteristics among adults (18+ years)— Selected States, United States³, February- March 2020

	Adjusted OR*	95% Confidence Intervals		p-value**
Type of device(s) used to vape or dab THC-containing products (yes vs no)				
Disposable e-cigarette or vape	1.16	1.01	1.32	0.040
E-cigarette or vape with prefilled cartridges	1.12	0.98	1.27	0.091
E-cigarette or vape with a tank that you can refill with liquids	0.92	0.81	1.05	0.23
E-cigarette or vape with prefilled or refillable pods or Pod cartridges	1.13	0.99	1.30	0.075
Dab Rig	1.39	1.18	1.62	<.0001
Vaporizer	1.21	1.04	1.42	0.016
Other	1.06	0.68	1.64	0.81
Which THC substance(s) did you use in an e-cigarette, vaping device, vaporizer, or dab rig in the past 3 months? (yes vs no)				
Marijuana herb (flower or leaves)	1.38	1.20	1.58	<.0001
THC oils	0.86	0.75	0.99	0.035
Butane Hash Oil	1.59	1.32	1.91	<.0001
THC Concentrate	1.27	1.11	1.45	0.0004
THC Powder	1.17	0.96	1.43	0.12
Other	0.76	0.50	1.14	0.18
Brand of THC-containing cartridge(s) used with device(s)				
Rove	1.17	1.00	1.37	0.055
Dank Vapes	0.88	0.78	1.01	0.063
Golden gorilla	1.18	1.03	1.35	0.014
Smart cart	0.86	0.73	1.01	0.061
Other	1.21	1.02	1.42	0.026
Access source of THC-containing products (yes vs no)				
Medical Dispensary	1.47	1.27	1.71	<.0001
Recreational dispensary	3.96	3.45	4.54	<.0001
Vape or smoke shop	1.40	1.23	1.61	<.0001
Pop up shop	0.99	0.78	1.25	0.92
Grocery/Drug store/Convenience store	0.92	0.73	1.15	0.44
Family/friend	0.56	0.49	0.64	<.0001
Illicit dealer	0.47	0.39	0.58	<.0001
Online	0.70	0.54	0.91	0.0066
Other	0.70	0.39	1.26	0.23
Average number of times per day THC-containing vaping products used				
0–5 times per day	0.97	0.82	1.14	0.70
6–10 times per day	0.98	0.78	1.23	0.85

	Adjusted OR*	95% Confidence Intervals		p-value**
Type of device(s) used to vape or dab THC-containing products (yes vs no)				
Over 10 times per day	ref			
Length of time vaping or dabbing THC-containing products				
< 3 months	0.69	0.57	0.84	0.0002
3–6 months	0.76	0.64	0.89	0.0009
7–12 months	0.81	0.68	0.97	0.0223
<1 year	ref			

¹ California, Colorado, Illinois, Michigan, Oregon, Washington

² Dabbing is the use of concentrated forms of THC

³ California, Colorado, Florida, Illinois, Michigan, Minnesota, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Washington, Wisconsin

* Adjusted for age, race/ethnicity, sex

** p-value from chi-square test