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Smoking, Vaping, and Use of Edibles and Other Forms of Marijuana Among U.S. Adults

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Background:

Marijuana is commercially available in increasingly novel forms, such as edibles and concentrates, and with tetrahydrocannabinol (THC) content at levels that have unknown health effects (1). Current federally sponsored surveys report the prevalence of use of smoked marijuana among the U.S. population. Despite legalization of recreational marijuana in some states and the development of a multibillion dollar cannabis industry, national data on the prevalence of use of other forms of marijuana are not available.

Objective:

To examine the prevalence of different forms of marijuana use among U.S. adults.

Methods and Findings:

We surveyed a nationally representative sample of 16 280 U.S. adults aged 18 years or older using KnowledgePanel (GfK) in October 2017 (2). Questions assessed use of different forms of marijuana (for example, smoked, vaporized [use of which is known as *vaping*], edibles, concentrates, and topicals). We asked participants about which forms they had used in the previous year.

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The overall response rate was 55.3% ($n = 9003$) and did not vary by state legalization status (2). Among all respondents, 14.6% reported marijuana use in the past year and 8.7% reported use in the past 30 days. The prevalence of marijuana use in the past year was 20% (95% CI, 17.9% to 22.2%) in states where recreational use is legal, 14.1% (CI, 12.6% to 15.6%) in states where medical use is legal, and 12% (CI, 10.7% to 13.4%) in states where no use is legal.

A total of 12.9% of respondents reported smoking marijuana, 6% reported using edibles, 4.7% reported vaping, 1.9% reported using concentrates, and 0.8% reported using topicals. Overall, 6.7% reported using multiple forms in the past year. Prevalence of any use was inversely related to age, with persons aged 18 to 34 years reporting the highest use. The prevalence of smoking marijuana was 16% (CI, 13.9% to 18%) in states where recreational use is legal, 12.6% (CI, 11.2% to 14.1%) in states where medical use is legal, and 11.4% (CI, 10.1% to 12.7%) in states where no use is legal. The prevalence of use of any other form was 14.1% (CI, 12.3% to 15.9%) in states where recreational use is legal, 7.3% (CI, 6.2% to 8.5%) in states where medical use is legal, and 5.4% (CI, 4.5% to 6.3%) in states where no use is legal. Men were more likely than women to use marijuana in any form and to use multiple forms (Table 1). Reported use was similar among racial groups.

Smoking was the most prevalent form of marijuana use (55%) in 2017. Among persons who used multiple forms, 53% reported smoking and using edibles whereas 31% reported smoking and vaping. The prevalence of use of edibles was 11% (CI, 9.4% to 12.6%) in states where recreational use is legal, 5.1% (CI, 4.1% to 6.0%) in states where medical use is legal, and 4.2% (CI, 3.4% to 4.9%) in states where no use is legal. Baked goods/pastries and candies were the most common forms of edibles used by U.S. adults (Table 2).

Discussion:

We found that 1 in 7 U.S. adults used marijuana in 2017. Smoked marijuana was the most commonly used form, followed by edibles. One in 15 U.S. adults used multiple forms. Use of forms other than smoked was more prevalent in states where recreational marijuana is legal.

Commercially available marijuana contains THC content at levels with unknown health consequences (1). Edibles and concentrates are both available with the THC content as high as 7000 mg per package and at serving sizes ranging from greater than 1 to 202 mg (1). The data on adverse effects of marijuana from epidemiologic studies and clinical trials largely predate the development of today's marijuana industry and the proliferation of marijuana products. For example, in a meta-analysis of THC-based pharmaceuticals, the median THC content was 8 mg (1). The THC potency of plant-based marijuana smoked by participants in prior epidemiologic cohorts (about 4%) was substantially lower than that of the marijuana buds available today (about 21.2%) (1, 3, 4). Consumption of marijuana products with high THC content has been linked to psychosis (4, 5), and because cannabinoid receptors are ubiquitous in the human body, high-potency marijuana may have other adverse effects. The relatively common use of edibles and concentrates among U.S. adults is concerning from a

public health perspective because of insufficient data on the health effects of high-potency marijuana.

A limitation of our study is that those who participated in an online survey cohort may differ from those who did not, limiting generalizability. Respondents also may have under-reported rates of use.

Use of different forms of marijuana is common among U.S. adults and is more common among residents of states where recreational use is legal. Given trends in legalization, annual epidemiologic data on the different forms of use will be necessary to inform public policy. Studying the health effects of marijuana will also require exposure assessment tools that capture different forms of use.

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Table 1.

Prevalence of Marijuana Use Among U.S. Adults, by Form and Sociodemographic Characteristics *

Variable	Any Form (n = 1270)	Smoked (n = 1063)	Vaporized (n = 420)	Edibles (n = 593)	Concentrates (n = 190)	Topicals (n = 103)	Multiple Forms (n = 622)
Use in past year	14.6 (13.7–15.5)	12.9 (12–13.8)	4.7 (4.1–5.2)	6 (5.4–6.6)	1.9 (1.6–2.3)	0.8 (0.6–1)	6.7 (6–7.3)
Age							
18–34 y	22.8 (20.6–25.1)	20.5 (18.4–22.7)	8 (6.6–9.5)	10 (8.5–11.6)	4 (2.9–5.0)	1.3 (0.7–1.9)	11.4 (9.7–13)
35–49 y	15.5 (13.6–17.5)	13.6 (11.7–15.5)	5.7 (4.5–6.9)	6.7 (5.3–8)	1.7 (1.1–2.4)	0.8 (0.4–1.2)	7.2 (5.8–8.7)
50–64 y	11.8 (10.4–13.2)	10.6 (9.2–11.9)	2.9 (2.2–3.5)	4 (3.2–4.9)	1.1 (0.7–1.4)	0.6 (0.3–0.8)	4.8 (3.9–5.7)
>65 y	5.7 (4.6–6.8)	4.6 (3.6–5.5)	1.2 (0.7–1.7)	2.2 (1.5–2.8)	0.5 (0.2–0.7)	0.4 (0.1–0.7)	2.1 (1.5–2.8)
Sex							
Male	16.6 (15.1–18)	15.1 (13.7–16.5)	5.4 (4.6–6.3)	6.3 (5.5–7.2)	2.1 (1.6–2.7)	0.7 (0.4–1)	7.6 (6.6–8.6)
Female	12.8 (11.6–14)	10.8 (9.7–11.9)	4 (3.3–4.7)	5.7 (4.8–6.5)	1.7 (1.2–2.2)	0.9 (0.6–1.2)	5.9 (5.0–6.7)
Race							
White	13.8 (12.8–14.8)	12.2 (11.2–13.2)	4.9 (4.2–5.5)	5.9 (5.2–6.5)	2 (1.5–2.4)	0.8 (0.5–1)	6.6 (5.9–7.4)
Black	17.5 (14.2–20.8)	16.2 (13–19.5)	3.4 (1.9–4.9)	5.2 (3.3–7.1)	1.5 (0.6–2.4)	0.6 (0–1.2)	5.9 (3.9–7.9)
Hispanic	17.3 (14.4–20.1)	14.5 (11.7–17.2)	5.2 (3.6–6.7)	7.1 (5.3–9)	1.9 (0.8–2.9)	1.2 (0.5–1.9)	7.5 (5.6–9.4)
Other	11.4 (7.9–14.8)	10.4 (7.1–13.8)	4 (1.8–6.1)	5.9 (3.4–8.5)	2.4 (0.9–3.8)	0.4 (0–0.7)	6.8 (4–9.5)

* The survey was administered between 27 September and 9 October 2017. The response rate was determined by using methods outlined by the American Association for Public Opinion Research and was the ratio between respondents and all survey recipients. All analyses used weighting commands using the variable provided by GfK to generate national estimates. Respondents were asked about form of marijuana use with the following question: “In what forms have you used marijuana in the last year? Select all that apply.” Response options were as follows: smoking, vaping, edibles, concentrate, and topically.

Table 2.

Forms of Marijuana Use Among Past-Year Users *

Variable	Percentage
Forms of marijuana used among respondents who used 1 form in the past year (<i>n</i> = 1270)	
Smoked	55
Smoked, vaporized, and edibles	13
Smoked and vaporized	9
Edibles	8
Smoked, vaporized, edibles, and concentrates	6
Smoked, vaporized, edibles, concentrates, and topicals	3
Vaporized	3
Vaporized and edibles	1
Topicals	1
The most common combination of marijuana forms used among respondents who used multiple forms in the past year (<i>n</i> = 622)	
Smoked and edibles	53
Smoked and vaporized	31
Smoked, vaporized, concentrates, and edibles	10
Smoked, vaporized, and concentrates	7
Forms of edibles used among respondents who used edibles in the past year (<i>n</i> = 593) †	
Baked goods/pastries	68.2
Candies	60.2
Drinks	10.5
Spreads	7.7
Sublingual drops	7.1
Snacks	6.6
Pills	5.6
Mouth spray	2.5
Other	2.7

* Numbers are unweighted, and percentages are weighted. Each row heading refers to a different population. Percentages may not sum to 100 due to rounding.

† Examples of each edible category were provided. Examples of baked goods/pastries were cake pops, brownies, or cookies; examples of candies were gummy bears, chocolate, or lollipops; examples of drinks were tea, juice, or coffee; examples of spreads were butter, peanut butter, agave nectar, or chocolate–hazelnut; and examples of snacks were ice cream, chips, peanuts, or popcorn. No examples were provided for sublingual drops, pills, mouth spray, or other forms.