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ORIGINAL RESEARCH

Cannabis Use in California Following Legalization of Recreational Use

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Abstract

Introduction: Cannabis was legalized in California for recreational use through the passage of Proposition 64: The Adult Use Marijuana Act of 2016. This analysis from the Impact 64 study describes the cannabis use patterns of adults 21 years and older in California since the passage of Proposition 64.

Methods: An online questionnaire addressing use of tetrahydrocannabinol-containing cannabis (including frequency, product(s), length, source, and purpose) was administered from December 2022 to February 2023. Of the initial 15,309 census-weighted participants, a subset of participants completed a detailed cannabis use questionnaire, including 4,020 people who currently use cannabis. Cannabis users were grouped by use frequency, and chi-squared analysis was utilized for descriptive analysis. Multinomial logistic regression was applied to assess significant variables associated with specific use patterns.

Results: Of the initial sample of 15,208, 37% reported current cannabis use (with use in the past 3 months), 30% formerly used cannabis, and 33% were nonusers. Among current users, 38% reported very frequent use (multiple times a day), 33% frequent use (four times per week to daily), and 30% occasional use (three times per week or less). Compared with occasional users, very frequent users were more likely to be male (65%, odds ratio [OR] = 1.8, $p < 0.001$), less educated (OR = 1.7, $p < 0.001$), and have lower incomes (under 50K vs 100K, OR = 2.3, $p < 0.001$). Most users reported multiple cannabis products, mainly flower inhalation (80%), vaping (66%), and edibles (61%), primarily sourced from dispensaries (77%), which the majority (94%) perceived as licensed. Of all current users, most used cannabis at home (93%) or for entertainment (75%), with many reporting use during creative activities (45%), with alcohol (36%) and/or with cigarettes (24%). Positive impacts were reported in mental (82%), emotional (81%), and physical (62%) health. The internet (51%) and friends/family (50%) were the main sources of information. Most current users felt comfortable discussing cannabis with their primary doctor (78%), although only 66% of primary doctors knew about recreational use.

Discussion: There is a high prevalence of daily cannabis use among adult Californians, with most users obtaining products from perceived licensed dispensaries or delivery services. While most users feel comfortable discussing cannabis use with physicians, they primarily obtain information from other sources, highlighting the need to bridge this information gap.

Keywords: cannabis use; Proposition 64; dispensary; California; substance use; cannabis legalization

Introduction

In 2022, approximately 62 million people, or 22% of the U.S. population over aged 12 years, used cannabis at least once.[1] Daily cannabis use has surpassed alcohol, becoming the second most used substance after nicotine.[2–4] Despite federal illegality, as of June 2024, 38 states and the District of Columbia have legalized medicinal cannabis, and 24 of these also

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allow recreational use.[4,5] An additional nine states have legalized high cannabidiol (CBD)/low tetrahydrocannabinol (THC) products, leaving only four states that have no public cannabis access.[5] Expanding legalization has led to a significant increase in product variety, such as drinks and topicals, as well as higher THC concentrations and direct-to-consumer advertising.[1,6] Professional "budtenders" in dispensaries now guide consumers in product selection. Legal changes have also reduced penalties for cannabis-related offenses and cleared past arrest records.[7]

Cannabis, beyond the psychotropic effects of "high" or relaxation, is used by consumers for self-treating pain, insomnia, anxiety, stress, and symptoms of diseases such as multiple sclerosis and epilepsy.[8–12] However, data on the effectiveness of medicinal cannabis are mixed. A 2017 National Academies of Sciences report confirmed benefits for chronic pain, chemotherapy-induced nausea, and multiple sclerosis spasticity but only moderate support for other conditions,[13] primarily due to a lack of robust studies. Subsequent studies continue to show mixed results for conditions such as sleep disorders[10,14] and pain.[15]

Negative health consequences of cannabis can include mild side effects such as nausea and insomnia and serious though rare side effects such as paranoia, psychosis, and depression.[16,17] Chronic use can be associated with cognitive issues, psychiatric illness, and cannabis use disorder, especially in vulnerable populations.[18–20]

In California, cannabis was legalized for medicinal use in 1996 and adult recreational use with the 2016 citizen passage of Proposition 64: The Adult Use of Marijuana Act.[21] In 2021, the current "Impact 64" study was initiated to evaluate cannabis use of all types among adults in California in the post-Proposition 64 era. The aim of this report is to describe cannabis use, sources, attitudes, relationship with health care providers, and sources of information among California residents. For this study questionnaire, we emphasized that "cannabis" use involved the use of THC-containing products, to differentiate from CBD-only cannabis products.

Methods

Impact 64 employed a multiphase, mixed-methods approach, involving three phases: (1) subject matter expert (SME) interviews with 23 individuals, including legal professionals, medical providers, advocates, researchers, individuals who use cannabis, and dispensary representatives; (2) an exploratory questionnaire with 200 participants; and (3) a large-scale questionnaire targeting 5,000 California residents from an initial pool of 15,000 screened participants. This report focuses on the third phase. All study procedures were approved by the University of California San Diego Institutional Review Board.

Questionnaire development

Working with Quester, a market research firm, a 25-min questionnaire was developed that utilized quantitative and qualitative methods, informed by the SME interviews and an exploratory questionnaire. The scales for each question varied with type of response: multiple choices/options; yes/no; and ranges from "in favor" to "oppose." Sample questions can be found in Supplementary Appendix A3. The questionnaire emphasized to participants that for the purposes of this study, "cannabis" was defined as THC-containing products.

Participants and recruitment

Participants were recruited *via* quota sampling to complete a brief "screener" questionnaire that collected demographic data and cannabis use history; participants were unaware of the study's purpose during this phase. Recruitment aimed to match participant demographics (gender, age, race/ethnicity, and annual household income) to the 2020 California census. Inclusion criteria included California residency, aged 21 years or older, and the ability to read English or Spanish. Those employed in the cannabis, marketing/market research, or advertising/public relations industries were excluded.

A subset of participants was selected for the full questionnaire, with the goal of 5,000 total participants divided into three groups: people who currently use cannabis ("current users"; self-identified as current user and used within the past 3 months; $n = 4{,}000$), people who formerly use cannabis ("former users"; self-identified as a former user and has not used in at least 4 months; $n = 500$), and people who have never used cannabis ("nonusers"; $n = 500$). Participants completed the full questionnaire immediately after the screener, with recruitment ceasing once target numbers were met.

Data collection

The official questionnaire was launched on December 2, 2022, and remained open until February 6, 2023,

when all target participants had been recruited. The questionnaire was completed online and was compatible with computer and mobile devices.

Statistical analysis

Using rake weighting (iterative proportional fitting), screener questionnaire participants were weighted based on the overall California census on four key demographic criteria (age group, gender, race/ethnicity, and annual household income). Demographic profiles of each cannabis subgroup (current, former, and nonusers) were identified based on this weighted screener group, establishing target demographics for each subgroup.

Within each full questionnaire subgroup, participants were weighted to match each subgroup's demographic profile to the target. As a result, the screener participant group's demographics matched the broader California population, whereas each full questionnaire subgroup's demographics matched that user group within California.

Descriptive statistics were used to explore sample characteristics, and inferential statistics (chi-squared test and multinomial logistic regression) were performed to assess differences across groups and adjust for demographics. Statistical analysis was conducted using SPSS v. 28.0.0.0 and JMP Pro v. 17.0.0.[22] Statistical significance was assessed as $p < 0.05$, but results are $p < 0.001$ unless otherwise noted.

Results

Of 15,309 individuals who completed the initial screening, 15,208 provided both demographic and cannabis use information, without knowing the purpose of the survey. Although region was not included for quota sampling or weighting, the screener population approximated the census by region distribution. Weighted demographics for age, gender, race/ethnicity, and annual household income otherwise exactly matched census targets (Supplementary Appendix A1).

Of the 15,208 participants, 37% reported current cannabis use, 30% were former users, and 33% nonusers. A subset of 5,178 individuals completed the detailed questionnaire, including 4,020 current users, 523 former users, and 635 nonusers. The remaining 10,022 were excluded for not qualifying, exceeding quota, or incomplete participation. Target/weighted and unweighted demographics are given in Supplementary Appendix A2.

Demographics

Participant demographics. In multinomial regression analysis, current users, compared with former users, were more likely to be male (odds ratio [OR] = 1.8), married (OR = 1.2, $p = 0.03$), not Asian/Pacific Islander (OR = 0.3–0.5), and started cannabis later in life (OR for 35–44 = 2.5, OR for 45+ = 2.1). Current user status decreased with age (OR = 0.96 per year; Table 1).

Compared with nonusers, current users were more likely to be male (OR = 2.2) and have at least some college education compared with a graduate degree (OR = 1.6).

Frequency of use

Among current cannabis users, 40% reported multiple uses per day ("Very frequent use"), 32% reported using 4–7 times per week ("Frequent use"), and 28% reported using three times a week or less ("Occasional use"). "Frequent use" included 18% daily users and 14% who used 4–6 times per week.

Demographics by use frequency group. In multinomial regression analysis, compared with occasional users, very frequent users were more likely to be male (OR = 1.8), have a high school diploma or less (vs graduate degree, OR = 2.2), have household income under 50K (vs >100K, OR = 2.3; vs 50–99K, OR = 1.3, $p = 0.02$), be employed full time (vs unemployed, OR = 1.4, $p = 0.03$), have younger children (vs no kids, OR = 1.8), start cannabis use age 17 or younger (vs older ages; OR for 18–24 = 2.1, OR for 25–34 = 4.7, OR for 35–44 = 5.5, OR for 45+ = 11.0), and were less likely to be Asian/Pacific Islander (OR = 0.25–0.58; Table 2).

Cannabis products

Most people who use cannabis (91%) use multiple cannabis products, with only 9% using a single type, primarily flower (4.6%) and edibles (2.8%). Very frequent users are more likely than occasional users to use dried flower and dab (OR = 2.25 and 2.21). Table 3 details product use and demographics, highlighting significant differences between occasional and very frequent users.

Sources of cannabis

Most people who use cannabis (77%) buy cannabis from dispensaries, 35% use delivery services, 32% get it from family/friends, and 12% grow their own (Table 4). Very frequent users are more likely to use dispensaries

Table 1. Demographics of People Who Currently, Formerly, and Never Used Cannabis

Demographics	Current users (A) *N* = 4,020	Former users (B) *N* = 523	Nonusers (C) *N* = 635
Age			
Mean age	42 (SD 14)[bd,cd]	48 (SD 16)[cd]	52 (SD 16)
21–25	10%[b,c]	7%	6%
26–35	32%[b,c]	21%[c]	14%
36–45	22%[b,c]	17%	14%
46–55	17%	16%	17%
56–65	12%[b,c]	21%[c]	27%
Over 66	8%[b,c]	18%	22%
Gender			
Male	59%[bd,cd]	47%[cd]	40%
Female (ref)	41%[bd,cd]	53%[cd]	60%
Race/Ethnicity			
White non-Hispanic	38%[b]	44%[cd]	39%
Hispanic (all races)	42%[bd,c]	35%[cd]	30%
Black non-Hispanic	8%[bd,c]	5%	5%
Asian/Pacific Islander (ref)	11%[bd,c]	14%[cd]	25%
Educational status			
High school diploma or lower	18%	15%	17%
Some college or college degree	68%[cd]	69%[cd]	64%
Graduate degree (ref)	14%	15%	19%
Annual Household income			
Under 50K	24%[c]	26%	28%
50–100K (ref)	28%	29%	30%
Greater than 100K	48%[c]	45%	42%
Employment status			
Employed full time (ref)	64%[b,c]	50%	45%
Employed part time	13%	14%	14%
Unemployed	23%[b,c]	35%	41%
Marital status			
Single (ref)	45%[bd]	49%[c]	43%
Married or has partner	55%[bd]	51%[c]	57%
Kids in household[e]			
No kids in household (ref)	43%[b,c]	49%	53%
Kids in household	57%	51%	47%
Age 0–6	19%	19%	15%
Age 7–12	27%	18%	15%
Age 13–17	21%	15%	15%
Residence/region			
Northern region	26%	27%	24%
Central region	16%	17%	15%
Southern region (ref)	58%	57%	61%
Age of first cannabis use			
Mean age	24.4 (SD 13)	23.6 (SD 13)	—
17 or younger (ref)	33%	36%	—
18–24	34%	36%	—
25–34	16%	14%	—
35–44	7%[bd]	4%	—
45+	10%	10%	—

Significance was determined using bivariate analysis by comparing each cannabis user category. Annotations ([a, b, c]) show statistical significance using *p*-value <0.05, where the user groups (columns A, B, C) differed from each other user group. Column A is the reference group).

[d]Denotes significance between groups persists after multinomial regression, adjusting for all other listed variables, with age as a continuous variable.

[e]Kids in household are dichotomous variable for bivariate and multinomial analyses; age categories are presented for description only and were not included in analysis.

Definitions: "Current users"—self-identified as current user and used within the past 3 months. "Former users"—self-identified as a former user and not used in at least 4 months. "Nonusers"—no use.

SD, standard deviation.

or delivery services. Most users believe their dispensary or delivery suppliers are licensed (94% and 91%, respectively). Two-thirds (66%) consider it important that their source be licensed. Cost is the main factor for 40% of users when choosing where to buy cannabis.

Table 2. Demographics of Current Cannabis Users, by Use Frequency

Demographics	All current users *N* = 4,020	Current users by subgroup: Occasional use (A) *N* = 1,179 30%	Frequent use (B) *N* = 1,323 33%	Very frequent use (C) *N* = 1,518 38%
Age				
Mean age	42 (SD 15)	45 (SD 6[bd,c])	41 (SD 14[cd])	40 (SD 12)
21–25	10% (*N* = 536)	11%	9%	11%
26–35	32% (1562)	27%[b,c]	33%	36%
36–45	22% (1211)	18%[b,c]	22%	24%
46–55	17% (797)	17%	18%[c]	16%
56–65	12% (617)	15%[b,c]	12%	10%
Over 66	8% (455)	14%[b,c]	6%	4%
Gender				
Male	59%	51%[bd,cd]	60%[cd]	65%
Female (ref)	41%	49%[bd,cd]	40%[cd]	35%
Race/Ethnicity				
White (non-Hispanic)	38%	41%[b,cd]	39%[cd]	34%
Hispanic (all races)	42%	36%[bd,cd]	42%[cd]	47%
Black non-Hispanic	8%	6%[b,cd]	7%[cd]	11%
Asian/Pacific Islander (ref)	10%	15%[bd,cd]	10%[c]z	6%
Educational status				
High school diploma or lower	18%	11%[b,cd]	15%[cd]	26%
Some college or college degree	68%	72%[b,cd]	67%	65%
Graduate degree (ref)	14%	17%[cd]	18%[cd]	9%
Annual household income				
Under 50K	24%	18%[c]	18%[c]	33%
50–100K	28%	28%[cd]	27%[cd]	29%
Greater than 100K (ref)	48%	54%[cd]	55%[cd]	38%
Employment status				
Employed full time	64%	60%[b,c]	68%[cd]	64%
Employed part time	13%	13%	11%	13%
Unemployed (ref)	23%	27%[b]	20%[cd]	24%
Marital status				
Single	45%	40%[bd,c]	42%[c]	52%
Married or has partner (ref)	55%	60%[bd,c]	58%[c]	48%
Kids in HH[e]				
No kids in HH (ref)	43%	50%[b,c]	41%	40%
Have kids in HH	57%	50%[bd,cd]	59%	60%
Age 0–6	19%	15%	20%	22%
Age 7–12	27%	20%	31%	29%
Age 13–17	21%	17%	23%	23%
Region				
Northern CA	26%	27%	26%	26%
Central CA	16%	14%[c]	15%	18%
Southern CA	58%	59%	59%	57%
Age of first cannabis use				
Mean age	24.4 (SD 13)	28.4 (SD 15[b,c])	26.4 (SD 14[c])	19.6 (SD 8)
17 or younger (ref)	33%	22%[c]	24%[c]	49%
18–24	34%	32%[cd]	35%	34%
25–34	16%	21%[cd]	20%[c]	10%
35–44	7%	10%[cd]	9%[c]	4%
45+	10%	16%[b,cd]	12%[c]	3%

Significance was determined using bivariate analysis by comparing each cannabis user category. Annotations ([a, b, c]) show statistical significance using *p*-value <0.05, where the user groups (columns A, B, C) differed from each other user group. Column A is the reference group).

[d]Denotes significance between groups persists after multinomial regression, adjusting for all other listed variables, with age as a continuous variable.

[e]Kids in household are dichotomous variable for bivariate and multinomial analyses; age categories are presented for description only and were not included in analysis.

Definitions.

"Very frequent use" of cannabis—multiple times a day use.

"Frequent use"—four times per week to daily use.

"Occasional use"—three times a week or less.

CA, California; HH, household; (ref), reference category.

Table 3. Cannabis Products Among Current Cannabis Users, Grouped by Frequency of Use, with Demographic Analysis

Product type	All current users $N = 4,020$	Frequency of cannabis use	Percent use[a]	Demographical analysis[b] and OR (comparing stated product vs not stated product)
Dried flower (e.g., smoking, vaporized flower)	56%	Occasional use (O) $N = 1,179$	42%**	Male (OR = 1.4**), HH income under $50K (vs 100K+, OR = 1.5*), started cannabis 17 or younger (OR vs 25–34 = 1.8**, OR vs 35–44 = 1.5**, OR vs 45+ = 5.4**), use increased with age**
		Very frequent use (VF) $N = 1,518$	73%	College degree (vs HS or less, OR = 1.4*), started cannabis 17 or younger (vs OR 45+ = 6.7**), lived in Northern CA region (vs Southern OR = 1.4**), started cannabis 17 or younger (OR vs 25–34 = 2.7**, OR vs 35–44 = 2.1**, OR vs 45+ = 6.7**), use increased with age**
Edibles or capsules	50%	O	54%	Female (1.4), Southern CA region (vs Central, OR = 1.5*), HH income 100K+ (vs 50–99K, OR = 1.4*), started cannabis older age than 17 (OR vs 45+ = 1.8**)
		VF	45%**	HH income 100K+ (vs under 50K, OR = 1.4*), employed (vs unemployed, OR = 1.4*)
Vaping concentrates	36%	O	26%**	Have kids in HH (vs no kids, OR = 1.6**), started cannabis older age (OR for 45+ = 3.9**)
		VF	46%	Not Black non-Hispanic (OR = 0.5**), College degree (vs HS or less OR = 1.5**), decreased with age
Topical/transdermal (e.g., creams, lotions, salves, patches)	20%	O	21%	Female (vs male, OR = 1.5**), College degree (vs HS or less OR = 1.9*), Started cannabis older age than 17 (OR vs 45+ = 1.8**)
		VF	19%	Female (vs male OR = 1.5*), have kids in HH (vs no kids, OR = 1.5**), HH income 100K+ (vs under 50K, OR = 1.7**), Married (OR = 1.4*)
Dabbing concentrates	18%	O	6%**	Male (vs female, OR = 3.1**), started cannabis <17 (vs OR for 45+ = 7.5**)**
		VF	30%	Male (vs female OR = 1.5**), white or non-Hispanic (vs black non-Hispanic, OR = 2.1–2.4**), have kids in HH (vs no kids, OR = 1.4*), decreased with age
Oil/tinctures	16%	O	13%	College and some college degree (vs HS or less, OR = 2.8*), employed part time (vs unemployed, OR = 2.1**),
		VF	17%	HH income 100K+ (vs under 50K, OR = 1.5), started cannabis older age than 17 (OR for 35–44 = 6.7*), decreased with age**
Beverages	15%	O	12%	Male (vs female OR = 1.6**), have kids in HH (vs no kids, OR = 1.7**)
		VF	15%**	Graduate degree (vs HS or less, OR = 3.3**), employed full time (vs unemployed, OR = 1.9**), have kids in HH (vs no kids, OR = 1.6**), decreased with age**
Other forms of THC (Delta 8, Delta 10, THC-V)	6%	O	4%	Single (OR = 2.0*), Lived in Northern CA region (vs Southern CA, OR = 2.8*)
		VF	7%	Have kids in HH (vs no kids, OR = 1.6*)

[a]Percentage listed represents the proportion of occasional (O) or very frequent (VF) users who use that product, significance determined by chi-squared analysis.

[b]Multinomial regression analysis. As an example, row 3, 36% of current users, 26% of occasional users, and 46% of very frequent users used cannabis by vaping. Compared with occasional users who did not vape, occasional users who vaped were more likely to have kids in their HH, with an OR of 1.6 (ref no kids). Compared with very frequent users who did not vape, those who vaped were less likely to be Black non-Hispanic (OR = 0.5) and have college degree (OR = 1.6).

Statistical significance is shown by.

*p-value <0.05.

**p-value <0.01.

CA, California; HH, household; HS, high school; O, occasional; OR, odd ratios; THC, tetrahydrocannabinol; VF, very frequent.

Table 4. Source of Cannabis Among Current Cannabis Users and Grouped by Frequency of Use

		Current use by subgroup		
Source of cannabis[a]	All current users (*N* = 4,020)	Occasional use (*N* = 1,179)	Frequent use (*N* = 1,323)	Very frequent use[b] (*N* = 1,518)
Dispensary	77%	73%	74%	83%*
Licensed	94%	93%	95%	94%
Unlicensed	1%	1%	1%	2%
Don't know	5%	6%	4%	5%
Delivery	35%	24%	35%	44%*
Licensed	91%	88%	92%	91%
Unlicensed	2%	2%	4%	2%
Don't know	7%	10%	5%	7%
Family/Friends	32%	33%	31%	33%
Grow their own	12%	6%	12%	16%*

Reasons to buy from licenced dispensary	Licensed dispensary users *N* = 2,928	Reasons to buy from an unregulated/ unlicensed dispensary	Unlicensed dispensary users *N* = 40
Buying from them is secure/safe	62%	Don't want to pay taxes	38%
No worries about legal issues	56%	Habit/my usual place	33%
Products are higher quality	55%	Privacy/don't have to show my ID	25%
Greater product variety and options	53%	Better availability of cannabis products I use	25%
Convenient/close to me	51%	I prefer the payment methods offered	20%
Products are less likely to contain toxins or pesticides	42%	More conveniently located	5%
Dispensary staff/budtenders are more knowledgeable	40%	Prices are lower	4%
Products are more effective	33%		
Medical card discount	14%		

[a]Do not total to 100% as participants could select multiple options.
[b]Versus occasional users.
*Indicates $p < 0.001$.

Activity and place of cannabis use

Participants who currently use cannabis were asked to identify in what type of settings they use cannabis and during which other activities; participants could select as many that apply. Most current users (93%) consume cannabis at home, followed by using it at someone else's home (31%), parties (29%), outdoors (24%), or in their car (22%; Table 5). Sixty-five percent use it alone. Common activities while using cannabis include home entertainment (75%), creative activities (45%), and public entertainment (38%). Concurrent use of alcohol is reported by 36% of users, cigarettes by 24%, and other drugs by 9%.

Impact of cannabis use

Current users reported that cannabis has a mostly positive impact on their lives, with participants reporting improved emotional (82%), mental (81%), and physical (62%) health. Other perceived benefits included clear focused thinking (63%), improved relationships (57%), and work performance (42%). The most reported negative effects included brain fog (21%) and lack of motivation (21%). Further analysis is shown in Table 6.

Sources of information.

Across all people who currently use cannabis, the most common sources of cannabis information were the internet (51%) and friends/family (50%). Few users obtained information from doctors (15%) or therapists (11%). Very frequent users were more likely to get information from budtenders (43% vs 28–29%). Notably, 10% of users obtained information from the workplace. Further analysis is shown in Table 7. For dosage, 48% of current users relied on experience, 29% packaging details, 24% budtender advice, 20% internet, 20% friends or family, 15% doctors, and 15% did not seek dosing information (not shown in table).

Communication with clinicians.

Most people who currently use cannabis (78%) were comfortable discussing cannabis in general with their primary doctor; occasional users were less likely (71%) than very frequent users (81%). However, only 66% of recreational and 72% of medicinal users reported that their doctor was aware of their cannabis use, with occasional users being least likely (51% recreational and 59% medicinal). Among those with aware providers, 78% medicinal and 72% recreational received advice about possible drug

Table 5. Activity and Place of Use for Current Cannabis Users, Grouped by Frequency of Use, with Demographic Analysis

	Current users (N = 4,020)	Frequency of cannabis use	Percent use[a]	Demographical analysis[b] and OR (comparing stated location vs not stated location)
Location of cannabis use				
At home	93%	Occasional use (O) (n = 1,179)	94%	Use at home increased with age**
		Very frequent use (VF) (n = 1,518)	93%	HH income under 50K (vs 100K+, OR = 2.1**), use at home increased with age**, Northern CA region (vs southern, OR = 2.1**)
Someone else's home	31%	O	24%	Single (vs married, OR 1.7**), started cannabis use 17 or younger (OR vs 18–24 = 1.9**, OR vs 25–34 = 1.9**, OR vs 45+ = 7.9**)
		VF	42%**	Single (vs married, OR = 1.3**), started cannabis use 17 or younger (OR for 18–24 = 1.5**, OR for 25–34 = 2.1**, OR for 45+ = 2.7**)
Parties (indoor or outdoor)	29%	O	22%	Started cannabis use < 17yo (OR vs 25–34 = 1.8**, OR vs 35–44 = 1.8*, OR for 45+ = 6.6**)
		VF	37%**	Started cannabis use 17 or younger (OR vs 25–34 = 1.7**), use at parties decreased with age**
Outdoor public places (e.g., parks)	23%	O	12%	Started cannabis use 17 or younger (OR vs 18–24 = 2.1**, OR for 25–34 = 1.9**, OR for 35–44 = 5.1**, OR for 45+ = 13.6**), use at outdoor public places decreased with age**
		VF	36%**	Single (vs married, OR = 1.3*), started cannabis use 17 or younger (OR vs age 25–34 = 2.0**), use at outdoor public places decreased with age**
In the car	22%	O	10%	Single (vs married, OR = 2.0**), started cannabis use 17 or younger (OR vs 18–24 = 3.0**, OR vs 25–34 = 3.1**, OR vs 35–44 = 7.8**), use in the car decreased with age**
		VF	34%**	Single (vs married, OR = 1.3**), live in Southern CA region (vs Northern, OR = 1.6**), started cannabis use 17 or younger (OR vs 25–34 = 1.9**, OR vs 45+ = 2.4**), and use in the car decreased with age**
Indoor public places (e.g., bars, restaurants)	11%	O	6%	Have kids in HH (vs no kids, OR = 2.0*), use in indoor public places decreased with age*
		VF	15%**	100K income (vs 50–99K, OR = 1.7**), have kids (vs no kids, OR = 1.5**), started cannabis use at older age (OR for 35–44 = 2.5**), use at indoor public places decreased with age**
Work	8%	O	4%	Male (OR = 2.2*), started cannabis use 17 or younger (OR vs 18–24 = 4.1**), use at work decreased with age**
		VF	14%**	Male (vs female, OR = 1.5), have graduate degree (vs HS or less OR = 2.5**), have kids in HH (vs no kids, OR = 1.6**), started cannabis use 17 or younger (OR vs 25–34 = 3.3**) and use at work decreased with age**
School	4%	O	1%	Have kids in HH (vs no kids, OR = 5.6**) use at school decreased with age*
		VF	6%**	HH income 100K+ (vs under 50K, OR = 2.2**), use at school decreased with age**
Activity while cannabis use				
While doing recreational activities (e.g., play sports, play video games)	45%	O	30%	Male (vs female, OR = 2.4**), use when engaging in creative activity decreased with age**
		VF	59%**	Male (vs female, OR = 1.6**), have graduate degree (vs HS or less OR = 1.9**, Northern CA region (vs central, OR = 1.8**), use when engaging in creative activity decreased with age
While doing creative activities (e.g., paint, draw, write)	45%	O	32%	Employed part time (vs unemployed (OR = 2.2**)
		VF	54%**	Female (vs male, OR = 1.6**), white non-Hispanic (vs Asian/pacific islander, OR = 1.7*), college and some college degree (vs HS or less, OR = 1.6**), use when engaging in creative activity decreased with age
Public entertainment	40%	O	31%	Started cannabis use 17 or younger (OR vs 18–24 = 1.8**, OR vs 25–34 = 2.4**, OR vs 35–44 = 2.7**, OR vs 45+ = 5.3**)
		VF	47%**	Started cannabis use 17 or younger (OR vs 45+ = 4.8**) Have college degree (OR = 1.5**), employed full/part time (OR = 1.4 and 1.7, resp.)
While drinking alcohol	36%	O	36%	Started cannabis use 17 or younger (OR vs 18–24 = 1.5*, OR vs 45+ = 3.0**)
		VF	39%*	Not Asian/pacific islander (OR = 0.5**)

(*continued*)

Table 5. Continued

	Current users (N = 4,020)	Frequency of cannabis use	Percent use[a]	Demographical analysis[b] and OR (comparing stated location vs not stated location)
While smoking cigarettes	24%	O	13%	Male (vs female, OR = 1.9**), have HS diploma or less (vs college, OR = 2.2**), HH income under 50K (vs 100K+, OR = 3.2**), started cannabis use 17 or younger (OR vs 18–24 = 1.7*, OR for 45+ = 3.2*)
		VF	32%**	HS diploma or less (vs college, OR = 1.6**), make under 50K (vs 50–99K, OR = 1.6**) and employed full time (vs unemployed, OR = 1.6**)
While using other drugs	9%	O	4%**	HH income under 50K (vs 100K+, OR = 2.8*)
		VF	13%	Graduate degree (vs college, OR = 2.1**), employed full time (vs unemployed, OR = 1.6**) started cannabis use 17 or younger (OR vs 18–24 = 1.8**, OR vs 25–34 = 2.3*)

[a]Percent use compared O vs VF ("frequent use" is not included) using chi-squared analysis.
[b]Multinomial regression analysis.
*Statistically significant p-value <0.05.
**p-value <0.01.
CA, California; HH, household; HS, high school; O, occasional; OR, odds ratio; VF, very frequent.

interactions. Concerns about judgment (56%), stigma (52%), and fear of not being understood (39%) deterred some from discussing cannabis use with their doctor. Sixty-two percent of current users reported using cannabis instead of prescribed medication. Further analysis is shown in Table 8.

Discussion

This study of over 5,000 adults in California found a high prevalence of cannabis use, with 37% using in the past 3 months and the majority (57%) of those users reporting at least daily use. In contrast to public reporting regarding the strong presence of the illicit marketplace, over 90% of users purchasing from dispensaries or delivery services perceive their service as licensed. Most respondents cited positive impacts to their health, and although most felt comfortable discussing cannabis use in general with their clinicians, one-third said that their physician was not aware of their use. Findings from this project are unique in that there was robust matching to the 2020 California census on key demographic factors, and the use of supported survey methodology enabled large-sample querying of qualitative as well as quantitative results.

Proposition 64 legalized recreational cannabis in California.[23] Demographically matched to the 2020 California census, 37% of respondents reported using THC-containing cannabis within the last 3 months. This rate exceeds recent surveys, likely due to differing definitions of "current use." The 2022 California Health Interview Survey reported that 17.7% used cannabis in the past 30 days, whereas the 2022 National Survey on Drug Use and Health (NSDUH) found 16.0% had used cannabis in the last 30 days.[6] By allowing participants to self-identify as a current user, and using a longer (3 month) timeframe, this study captures more occasional users. Nevertheless, most current users (58%) consumed cannabis at least daily, a higher rate than most studies. An analysis of the Behavioral Risk Factor Surveillance System from 2016 to 2019 found 33.4% of past-month cannabis users used daily.[24] In the 2022 NSDUH, 28.2% of past-month cannabis users used daily, and at this rate, the number of daily users of cannabis surpassed the number of daily users of alcohol.[4,6]

While people who use cannabis represent a diverse demographic group, there were some differences between current versus former and nonusers. Current users were younger, more likely to be male, and less likely to be Asian/Pacific Islander. Compared with

Table 6. Perceived Positive and Negative Impacts of Cannabis Use Among Current Cannabis Users Grouped by Frequency of Use, with Demographic Analysis

	All current users (N = 4,020)	Frequency of use (N = 1,518)	Percent use[a]	Demographical analysis[b] and OR (comparing stated impact vs not stated impact)
Positive impacts				
Physical health	62%	O	51%**	Started cannabis use older than 17 (or vs 45+ = 3.1**), and lived in central CA region (vs Northern CA, OR = 1.9**)
		VF	69%	Married/have partner (vs single, OR = 1.4**), employed full time (vs part time, OR = 1.6*), and have kids in HH (vs no kids, OR = 1.2*), HH 100K+ income (vs under 50K, OR = 1.5**)
Mental health	81%	O	74%	Employed full time (vs unemployed, OR = 1.5**), live in central CA region (vs Southern CA, OR = 1.7*)
		VF	86%**	Married (OR = 1.4**), have kids (vs no kids, OR = 1.3*), employed full time (vs part time, OR = 1.8**), decreased with age**
Relationship	57%	O	43%**	Married/have partner (vs single, OR = 1.5**) and lived in central CA region (Northern CA, OR = 1.6*), positive impact on relationship decreased with age**
		VF	67%	Employed full time (unemployed, OR = 1.8**), positive impact on relationship decreased with age**
Emotional health	82%	O	77%	Married/have partner (vs single, OR = 1.4**), employed full time (vs unemployed, OR = 1.6**)
		VF	86%**	Increased with age**
Clear head/focus	63%	O	48%	Hispanic (vs white non-Hispanic, OR = 1.8**), positive impact on focus decreased with age**
		VF	74%**	Have kids in HH (vs no kids, OR = 1.5**), Hispanic (White non-Hispanic, OR = 1.7**), married (OR = 1.4**)
Working performance	42%	O	21%	Male (vs female, OR = 1.6**), decreased with age**
		VF	57%**	Hispanic (vs White non-Hispanic, OR = 1.8**), employed full time (vs unemployed, OR = 2.3**), have kids in HH (vs no kids, OR = 1.5**), positive impact on work performance decreased with age**
Negative impacts				
Paranoia	19%	O	21%*	Male (vs female, OR = 1.4*), started cannabis use 17 or younger (OR vs 45+ = 4.0**)
		VF	17%	Male (vs female, OR = 1.5**), paranoia decreased with age**
Fatigue	18%	O	20%*	Fatigue decreased with age**
		VF	16%	Female (vs male, OR = 1.6**), Asian/Pacific Islander (OR = 2.24**), fatigue decreased with age**
Brain fog	21%	O	23%*	Employed full time (vs unemployed OR = 1.6**), lived in southern CA region (vs Northern CA, OR = 1.6**)
		VF	20%	Female (OR = 1.4**), brain fog decreased with age**
Memory loss	15%	O	12%	Started cannabis use 17 or younger (OR vs 45+ = 3.6**)
		VF	19%**	Married/partner (vs single, OR = 1.4*), Asian/pacific islander (vs Black non-Hispanic, OR = 2.1*)
Lack of motivation	21%	O	20%	Started cannabis use 17 or younger (OR vs 45+ = 2.6**)
		VF	23%	Asian/pacific islander (vs Black non-Hispanic, OR = 2.2*), graduate degree (vs HS diploma or less, OR = 1.8*)
Weight gain	18%	O	17%	Lived in central CA region (Northern CA, OR = 2.1**), no kids (vs have kids, OR = 1.4*), and HH income under 50K (vs 100K+, OR = 1.8**)
		VF	19%	Female (OR = 1.3*)
Dependency to cannabis	9%	O	6%	Male (vs female, OR = 2.8**), drug dependency decreased with age**
		VF	12%**	Graduate degree (vs HS diploma or less, OR = 2.3**), drug dependency decreased with age**

[a]Percent use compared O vs VF ("frequent use" is not included) using chi-squared analysis.
[b]Multinomial regression analysis.
*Statistically significant p-value <0.05.
**p-value <0.01.
CA, California; HH, household; HS, high school; O, occasional; OR, odds ratio; VF, very frequent.

former users, current users were more likely to be married and were older when they began using cannabis. This may reflect shifts in recreational versus medicinal use. Previous data on such demographics are limited with the most recent one in 2020.[25,26]

The negative impact of cannabis among adolescents is well-documented and of ongoing concern.[27–30] Among all current users, 67% started using before age 25, and 33% before age 18. Very frequent users (more than daily) began cannabis use at a younger

Table 7. Source of Cannabis Information Among Current Cannabis Users Grouped by Frequency of Use

	Current users (N = 4,020)	Frequency of use	Percent use[a]	Demographical analysis[b] and OR (comparing stated source of information vs not stated source information)
Internet	51%**	O (n = 1,179)	52%	Male (vs female, OR = 1.3**), started cannabis older age (OR for 35–44 = 2.3*)
		VF (n = 1,518)	50%	College or some college degree (vs HS diploma or less OR = 1.4*)
Friends/family	50%*	O	43%	Male (vs female, OR = 1.5**), married/have partner (vs single, OR = 1.4*), have kids in HH (vs no kids, OR = 1.3*)
		VF	54%**	Lives in central CA region (vs Northern CA, OR = 1.6**), unemployed (vs part time, OR = 1.3**), have kids in HH (vs no kids, OR = 1.4**), started cannabis younger than 17 (OR vs 45+ = 2.1*)
Budtenders	34%*	O	28%	Not Asian/Pacific Islander (OR = 0.5), have college and some college (vs HS diploma or less, OR = 2.3**), and started cannabis use 17 or younger (OR vs 18–24 = 1.9**)
		VF	43%**	Lived in the Northern CA region (vs Southern CA, OR = 1.4*), have HS diploma or less (vs graduate degree, OR = 1.6**)
Doctor/Nurse practitioner	15%	O	11%	Male (vs female, OR = 1.9**), have graduate degree (vs HS diploma or less, OR = 2.7**), and started cannabis older than 17 (OR for 35–44 = 3.7**)
		VF	17%**	Graduate degree (vs HS diploma or less, OR = 2.0**), HH income 100K+ (vs under 50K, OR = 1.8**), married (OR = 1.4*)
Therapist	11%	O	7%	—
		VF	11%**	Graduate degree (vs HS diploma or less OR = 3.0**), and had kids in HH (vs no kids, OR = 1.5**)
Workplace	10%	O	7%	Male (vs female, OR = 3.1**), employed full time (vs unemployed, OR = 5.6**), lived in southern CA region (vs central CA, OR = 2.8*)
		VF	12%**	Male (vs female, OR = 1.8**), graduate degree (vs HS diploma or less, OR = 3.3**)
Nondoctor clinician (e.g., naturopath, chiropractor)	6%	O	5%	—
		VF	7%*	HH income 100K+ (vs under 50K, OR = 1.8*)
Other	3%	O	3%	Have kids in HH (vs no kids, OR = 1.7**)
		VF	2%*	Graduate degree (vs High school diploma, OR = 2.4**), make 100K +(vs GED, OR = 2.4**), have kids (vs no kids in HH, OR = 1.7**), started cannabis older age (OR for 25–34 = 2.0**)
I don't seek information on cannabis	11%	O	9%	Started cannabis 17 or younger (OR vs 45+ = 2.7**)
		VF	14%**	HS diploma or less (vs graduate degree, OR = 4.6**), unemployed (vs full time, OR = 2.0**), and started cannabis 17 or younger (OR vs 45+ = 5.5**)

[a]Percent use compared O vs VF ("frequent use" is not included) using chi-squared analysis.
[b]Multinomial regression analysis.
*Statistically significant p-value <0.05.
**p-value <0.01.
CA, California; GED, general education development; HH, household; HS, high school; O, occasional; OR, odds ratio; VF, very frequent.

age than occasional users. While most participants began cannabis use before legalization, and legalization's impact on youth cannot be assessed here, other research suggests that adolescent cannabis use is stable or decreased postlegalization.[30]

Most (91%) cannabis users consume multiple product types. Commonly used products include flower (56%), edibles (50%), and vaping (36%). These rates somewhat differ from a 2018 California Department of Public Health study, which reported flower inhalation (58.2%), ingestion (15.9%), and vaping (17.5%).[6] Participants using longer-acting products (e.g., edibles and topicals) were more likely to be occasional users, older, and more educated. This may reflect increasing access to different product types or a trend toward medicinal use, which will be evaluated in future analysis.[31–33] Northern CA shows higher flower use and other forms of use, warranting further study to understand regional consumer patterns.

The potential benefits of cannabis regulation depend on consumers using licensed sources. Most respondents (77%) reported using dispensaries and 35% delivery; over 90% believed these services were licensed with fewer than 3% knowingly using unlicensed providers. In contrast, in 2019 an estimated one-third of California's cannabis sales were illicit.[34,35] This discrepancy could reflect biased self-report or difficulty distinguishing licensed from unlicensed sources. For example, 54% of California cities do not permit cannabis

Table 8. Patient–Provider Relationship Among Current Cannabis Users Grouped by Frequency of Use

	All current users	Frequency of use	Percent use[a]	Demographical analysis[b] and OR (comparing stated relationship vs not stated relationship)
Felt comfortable talking about cannabis to primary doctor	78% (*N* = 4,020)	O	71%** (*N* = 1,179)	Have kids in HH (vs. no kids, OR = 1.4**), made 100K+ (vs. under 50K, OR = 1.5**)
		VF	81% (*N* = 1,518)	Male (vs. female, OR = 1.8**), lived in Southern CA region (vs central, OR = 1.8**), married/have partner (vs. single, OR = 1.7**), have kids in HH (vs. no kids, OR = 1.4*), southern CA region (vs central, OR = 1.8**), started cannabis use 17 or younger (OR for 45+ = 2.3*)
Primary doctor aware of patient's medicinal cannabis use	72% (*N* = 2,435)	O	59%** (*N* = 636)	Single (vs. married, OR = 2.0**), have kids in HH (vs. no kids, OR = 1.5*), HH income 100k+ (vs under 50K, OR = 1.8*), unemployed (vs. employed part time, OR = 2.5**), not Asian/Pacific islander (OR = 0.3**)
		VF	78% (*N* = 985)	Northern CA region (vs. Central CA, OR = 2.2**), have kids in HH (vs. no kids OR = 1.6**)
Primary doctor aware of patient's recreational cannabis use	66% (*N* = 3,194)	O	51%** (*N* = 871)	Single (, OR = 1.6**), male (vs female, OR = 1.4*)
		VF	75% (*N* = 1,306)	Married/have partner (vs. single, OR = 1.7**) and started cannabis 17 or younger (OR for 18–24 = 4.4**)
Provider informed them of possible drug interaction	63% (*N* = 3,105)	O	53%** (*N* = 837)	Have kids in HH (vs. no kids, OR = 1.5**), employed full time (vs unemployed, OR = 2.0*)
		VF	68% (*N* = 1,226)	Have kids in HH (vs. no kids, OR = 1.5*), married (OR = 1.5**)
Use cannabis instead of prescribed medication	62% (*N* = 3,761)	O	57% (*N* = 1,050)	HS diploma or less (vs. college, OR = 2.4**)
		VF	67%** (*N* = 1,438)	Started cannabis use 17 or younger (OR vs. 25–34 = 1.8**), HS diploma or less (vs. college, OR = 4.2**), HH income 50–99K (vs under 50K, OR = 1.6**)

Why don't you feel comfortable talking about cannabis with your primary doctor?	Percent (*N* = 221)
Feels like they are judging me	56%
Stigma attached to using cannabis	52%
Don't feel they understand	39%
Worried they will restrict the prescribing of other medication if I disclose cannabis use	28%
Don't feel like they are knowledgeable	18%
Risk of being reported to some authority	15%
Provider does not seem comfortable discussing it	13%
Have tried to discuss with doctor before but have been treated in a negative way	10%
My medical group does not endorse or allow discussion of medicinal cannabis	9%

Reasons for discomfort	Percent (*N* = 221)
Feels like they are judging me	56%
Stigma attached to using cannabis	52%
Don't feel they understand	39%
Worried they will restrict the prescribing of other medication if I disclose cannabis use	28%
Don't feel like they are knowledgeable	18%
Risk of being reported to some authority	15%
Provider does not seem comfortable discussing it	13%
Have tried to discuss with doctor before but have been treated in a negative way	10%
My medical group does not endorse or allow discussion of medicinal cannabis	9%

[a]Percent use compared O vs VF ("frequent use" is not included) using chi-squared analysis.
[b]Multinomial regression analysis.
*Statistically significant *p*-value <0.05.
***p*-value <0.01.
CA, California; HH, household; HS, high school; O, occasional; OR, odds ratio; VF, very frequent.

businesses, yet dispensaries are present and may appear legitimate.[35,36] About 20% of respondents obtained cannabis solely from family, friends, or growing, bypassing regulatable services. This group may thus unknowingly use unregulated products and may be unreachable *via* traditional public health messaging venues (e.g., notices at dispensaries).

Few studies have looked at cannabis use by location and activity, and these largely focus on incidental smoke exposure. One U.S.-based study found that 68% of cannabis users had no restrictions on at-home use; of these, 25% lived with children under 18.[37] The 2019 Global Drug Survey similarly found that 53.6% reported past-year in-home cannabis smoking.[38] In

the current analysis, 93% current users use cannabis at home, and 31% use at someone else's home for all cannabis types. Very frequent users were more likely to also use cannabis in locations other than home, including 14% who use THC-containing cannabis in the workplace. Key areas for future analysis include assessing exposure to second- and third-hand smoke, as well as safety related to public or workplace use.

Previous research found 33% concurrent cannabis and alcohol use similar to the 36% in the current study.[39] Twenty-four percent concurrently smoke cigarettes. Given evidence that higher alcohol consumption occurs when cannabis is also used,[40] and cannabis use may increase odds of initiating cigarettes,[41–43] these subgroups may benefit from targeted interventions.

Most current users reported positive benefits for mental (81%), emotional (82%), and physical (62%) health with fewer reported negative effects. Some studies note similar perceived benefits, such as better quality of life, and improved sleep, pain, and mood among medicinal users.[44] Others show varying outcomes of both positive and negative effects.[45] While it is not surprising that current users would report positive benefits of cannabis use, it remains important to conduct randomized clinical trials to objectively assess these perceived impacts.

Of public health interest is where users obtain cannabis-related information. Just over half (51%) of participants used the internet as their primary source for cannabis information, followed by friends and family. Only 15% relied on health providers, with other studies reporting similar rates (12–18%).[46,47] Reviews of cannabis-related websites have found low-quality information, often lacking evidence.[47,48] Most sites lacked essential details, including pharmacological dosage, side effects, and risks.[47] The internet presents challenges in ensuring that users have accurate information yet also provides opportunities for public health messaging. Individuals who sought information from providers were more likely to have graduate degrees, higher incomes, and younger children, suggesting a preference for reliable sources or increased contact with the health system.[49] Conversely, the 11% of participants who did not seek any information tended to have lower education, be unemployed, and have no children. Future research could further explore these demographic and cultural differences in information access.

Like other studies,[50–52] most current users in our study felt comfortable discussing cannabis with their primary care doctors, particularly very frequent (81%) and medicinal (72%) users. Yet despite this reported comfort, fewer participants had doctors who were aware of their use, and even fewer felt that the provider was a source of cannabis information. Additionally, more than half of participants used cannabis instead of prescribed medication; this is consistent with other studies, which show providers are often unaware of medication substitution.[50,53] This group tended to start using cannabis before age 18 and have lower educational status. Even when medical providers are aware of one's cannabis use, provider knowledge on cannabis can vary significantly.[52–55] Educating and alerting health providers about cannabis and its impact on traditional medical treatments would enhance treatment and minimize harm, given the significant online information gap and unmet consumer knowledge needs.[56]

The strength of this study lies in its large sample size, which was matched to California census demographics by age, race/ethnicity, gender, and income, and well-approximated regional population distribution. It ensured participant anonymity and used both qualitative and quantitative methods. While quota sampling can introduce bias, the findings are likely representative of cannabis users in California. Limitations include the focus on participants aged 21 years and above, limiting insights into younger users, and as a cross-sectional study, it can only indicate correlations not causality.

Conclusions

Proposition 64 legalized recreational cannabis use in California, leading to diverse consumption patterns. Daily cannabis use was common. Most users obtained cannabis from licensed dispensaries (though the accuracy of that perception is not clear) and reported mental, emotional, and physical health benefits. While patients claimed comfort in discussing cannabis generally with health providers, disclosure was less frequent, and providers were not seen as a primary source of cannabis-related information.

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Authors' Contributions

D.A., R.D.A., L.H., T.D.M., and T.S.: Survey development. D.A., I.L.-K., and T.S.: Analyze data. D.A. and S.B.: write. D.A., S.B., L.H., and T.D.M.: Editing. D.A., T.D.M., L.H., S.B., T.D.M. and L.H.: Supervise. J.R., A.G., and I.L.-K.: Survey development input. A.G.: Participant recruitment. T.S.: Compile data.

Author Disclosure Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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Supplementary Material

Supplementary Appendix

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Abbreviations Used

CA = California
CBD = Cannabidiol
HH = Household
HS = High School
N = Sample size
O = Occasional use
OR = Odd Ratio
ref = Reference category
SD = Standard Deviation
SME = Subject Matter Expert
THC = Tetrahydrocannabinol
VF = Very frequent