Toking, Vaping, and Eating for Health or Fun

Marijuana Use Patterns in Adults, U.S., 2014

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Introduction: Policies legalizing marijuana for medical and recreational use have been increasing in the U.S. Considering the potential impact of these policies, important knowledge gaps exist, including information about the prevalence of various modes of marijuana use (e.g., smoked in joints, bowls, bongs; consumed in edibles or drinks) and about medical versus recreational use. Accordingly, this study assessed (1) prevalence and correlates of modes of current and ever marijuana use and (2) prevalence of medicinal and recreational marijuana use in U.S. adults.

Methods: Data came from Summer Styles (n=4,269), a nationally representative consumer panel survey of adults aged ≥18 years, collected in 2014. The survey asked about past 30–day (current) and ever mode of marijuana use and current reason for use (medicinal, recreational, both). Weighted prevalence estimates were computed and correlates were assessed in 2014 using logistic regression.

Results: Overall, 7.2% of respondents reported current marijuana use; 34.5% reported ever use. Among current users, 10.5% reported medicinal-only use, 53.4% reported recreational-only use, and 36.1% reported both. Use of bowl or pipe (49.5%) and joint (49.2%) predominated among current marijuana users, with lesser use of bong, water pipe, or hookah (21.7%); blunts (20.3%); edibles/drinks (16.1%); and vaporizers (7.6%); 92.1% of the sample reported combusted-only marijuana use.

Conclusion: Combusted modes of marijuana use are most prevalent among U.S. adults, with a majority using marijuana for recreation. In light of changing policies and patterns of use, improved marijuana surveillance is critical for public health planning.

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Introduction

Marijuana is the most commonly used federally illicit drug in the U.S.,[1,2] with 7.6% of adults reporting past 30–day use in 2013.[3] Although the health effects associated with marijuana use are widely debated, regular use poses potential public health concerns, including reduced educational attainment; risk of injury from driving; increased respiratory symptoms; potential long-term health consequences such as cancer, chronic obstructive pulmonary disease, and heart disease; addiction in some users; and increased risk of psychoses in vulnerable populations.[2]

State-level policies legalizing marijuana use are increasing, though use remains illegal federally. In 2010, 11 states had medicinal marijuana policies and none had legalized marijuana recreationally; by November 2014, a total of 23 states had enacted laws legalizing medicinal use,[4] and four states (Alaska, Colorado, Oregon, and Washington) and the District of Columbia had legalized recreational use.[5–8] This rapidly shifting landscape raises questions about the potential benefits and harms of marijuana use.[2,9] Despite a number of reviews that have summarized individual and public health effects,[10–15] data on marijuana use are limited.

One gap relates to mode of use. Most surveillance systems only monitor ever and current use. Although marijuana is thought to be primarily smoked,[2] little is known about different modes of use. Marijuana can be

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consumed in multiple ways, including smoking or inhaling it in joints, bowls or pipes, bongs, water pipes, hookahs, and blunts (cigars filled with marijuana); eating or drinking it in food products and beverages; or vaporizing it. These modes are used to consume different marijuana products, including cannabis herb (dried and crushed marijuana flowers); resin (hashish); and oil (hash, butane honey, or butane hash oils).[16] The oil, which may contain more than 60% tetrahydrocannabinol (THC)—versus 5% to 10% in the herb or resin—is extracted using solvents, like butane, and can be vaporized, smoked, or inhaled (in "dabs").[16,17] Surveillance of modes of use and consumption of different marijuana products is critical, as these factors could be associated with differential health effects.[18]

A second gap is knowledge of the primary reason for use: medicinal use to treat or decrease health condition symptoms versus recreational use for pleasure or satisfaction. Although the size of the illicit marijuana market has been quantified,[19] no nationally representative data exist on adult consumption of marijuana for medical versus recreational reasons. This is important to understand because policies, regulations, and taxes may differ based on whether consumption is recreational or medicinal.

To address these gaps, this study assessed nationally representative, web-based survey data from U.S. adults to determine (1) prevalence and correlates of modes of current and ever marijuana use and (2) prevalence of medicinal and recreational marijuana use.

Methods

Study Sample

Data came from 2014 Summer Styles, a seasonal, national consumer panel survey conducted by Porter Novelli Public Services. Summer Styles assesses health-related indicators among U.S. adults aged ≥18 years, and draws from GfK's KnowledgePanel, an online panel initiated in 1999 that uses probability-based sampling to reach respondents regardless of landline phone or Internet access.[20] For 2014 Summer Styles, Knowledge Networks conducted probability-based sampling from an address-based sample of respondents from the larger KnowledgePanel. Participants were recruited and completed the survey online. In total, 4,269 participants completed Summer Styles during June–July 2014, yielding a response rate of 69%. Post-stratification sample weights were used to account for selection probabilities, and to achieve representativeness of the U.S. adult population based on seven factors from the Current Population Survey: sex, age, race/ethnicity, education, U.S. region, metropolitan area, and Internet access. GfK completes human subjects review for surveys using the KnowledgePanel. This study was exempt from CDC human subjects review because de-identified secondary data were used.

Measures

To determine mode of use, participants were asked, *Have you ever used marijuana or hashish in any of the following ways?* Responses included *joint, blunt or cigar with marijuana in it, bowl or small glass pipe, bong or water pipe, hookah pipe, vaporizer or other electronic device, baked in food, drank it, some other way*, or *I have never used marijuana or hashish*. Participants could select more than one response. Those who selected *I have never used marijuana or hashish* or who did not select any modes were considered never users. This question was modified from two similar fielded questions: the first from a cannabis consumption survey that RAND conducted in Washington State in 2013 that asked about consumption of specific marijuana products,[21] and the second from the 2014 Oregon Behavioral Risk Factor Surveillance System about mode of marijuana use (which was subsequently fielded by Washington and Colorado as well).[22]

Participants who reported ever use were asked, *In the past 30 days, have you used marijuana in any of the following ways?* They could select multiple responses from the same options as the ever use question. Those with no use in the past 30 days or who did not select any modes of use were considered to not be current users. All others who selected any form of use were considered current users.

For both ever and current use, *hookah* was combined with *bong or water pipe*, as these terms can be synonymous.[23,24] *Baked in food* was combined with *drank it* due to limited sample size. A count variable was computed to assess the total number of administration modes for both ever use and past 30–day use (range, 1–8). Joints, blunts, bowls/pipes, and bongs/waterpipes/hookah were considered combusted modes of use.

To determine reason for use, current users were asked, *When you used marijuana or hashish during the past 30 days, was it for medical reasons to treat or decrease symptoms of a health condition, or was it for non-medical reasons to get pleasure or satisfaction (such as: excitement, to "fit in" with a group, increase awareness, forget worries, or for fun at a social gathering)?* Response options were *only for medical reasons to treat or decrease symptoms of a health condition, only for non-medical purposes to get pleasure or satisfaction, both medical and non-medical reasons, and don't know/not sure*. Those who responded *don't know/not sure* were excluded from the analyses of reasons for use (n=17). Any medicinal use was defined as using marijuana for only medicinal reasons or using marijuana for both medicinal and recreational reasons. Any recreational use was defined as only recreational use or both recreational and medicinal use. This question was developed in consultation with subject matter experts at CDC and in Washington and Colorado.

Assessed socoiodemographic characteristics included sex, age in years, race/ethnicity, education, and U.S. region.

Statistical Analysis

Analyses were conducted in 2014 using SAS-callable SUDAAN, version 9.2. Weighted frequencies and 95% CIs were computed for current use, ever use, mode of use, and reason for use. Respondents reporting current use but not ever use (<1%) were imputed as ever users. Sociodemographic differences were assessed by modes of ever use, and by the three most common modes of current use (joints; bowl or pipe; and bong, water pipe, or hookah). Bivariate and multivariable logistic regressions were used to assess correlates

of current and ever use, and to identify correlates of current medicinal use (α=0.05). Sample size precluded assessment of correlates across mutually exclusive groups of recreational-only or medical-only use. Estimates with relative SE ≥40% were suppressed.

Results

Overall, 7.2% of respondents reported past 30–day (current) marijuana use (Table 1). Among current users, nearly half used a bowl or pipe in the past 30 days (49.5%); 49.2% used joints; 21.7% used a bong, water pipe, or hookah; 20.3% used a blunt or cigar with marijuana in it; 16.1% consumed marijuana in edibles or drinks; 7.6% used a vaporizer or other electronic devices; and 4.8% consumed marijuana in other ways. More than half of current users reported only one mode of use (58.8%); 22.4% reported two modes; and 18.8% reported three or more modes (Table 1). A majority of current users consumed marijuana in combusted-only form (92.1%, 95% CI=86.7%, 95.4%), with 7.9% consuming non-combusted-only forms (95% CI=4.6%, 13.3%).

Current use was higher among male (8.9%) than female (5.7%) participants; among those aged 18–24 years or 25–34 years than those aged 35–49 years or ≥50 years; and among those with less than a high school degree (13.0%) than those with more education (5.8%) (Table 2). Among current users, the prevalence of joint; bowl or pipe; and bong, waterpipe, or hookah use differed by sex, age, race/ethnicity, education, and region (Table 2).

In multivariable analyses, the odds of current use were greater among male participants (AOR=1.6, 95% CI=1.2, 2.2), adults aged 18–24 years or 25–34 years (versus ≥50; AOR=2.4, 95% CI=1.6, 3.8 and AOR=2.3, 95% CI=1.6, 3.4, respectively), and those with less than a high school education (versus more education; AOR=2.1, 95% CI=1.3, 3.4). By mode of use, the odds of current joint use were lower among adults aged 25–34 years (versus ≥50 years), and odds of current bowl/pipe use were lower among non-Hispanic blacks and Hispanics (versus non-Hispanic whites).

Among current users, 46.6% self-reported any medicinal use and 89.5% self-reported any recreational use (10.5% self-reported medicinal-only use, 53.4% self-reported recreational-only use, and 36.1% self-reported both) (Figure 1). In multivariable analysis, only region was associated with any past month medicinal use (versus recreational use only); any medicinal use was higher in the West than the Northeast (AOR=2.67, 95% CI=1.10, 6.51).

Table 1. Prevalence of Ever and Current Marijuana Use Overall, and by Mode of Use, Among Adults Aged 18 Years and Older—Summer Styles, 2014

	Past month marijuana use,[a] Wt % (95% CI) (*n*=266)	Ever marijuana use,[b] Wt % (95% CI) (*n*=1,548)
Out of all adults (*n*=4,269)	7.2 (6.3, 8.3)	34.5 (32.8, 36.2)
Modes of use		
Joints	49.2 (42.1, 56.4)	88.7 (86.3, 90.7)
Bong, waterpipe, or hookah	21.7 (16.4, 28.2)	49.2 (46.2, 52.2)
Bowl or pipe	49.5 (42.3, 56.7)	47.5 (44.6, 50.5)
Edible or drink	16.1 (11.3, 22.5)	29.8 (27.2, 32.6)
Blunt	20.3 (14.8, 27.3)	24.8 (22.2, 27.6)
Vaporizer or other electronic device	7.6 (4.6, 12.2)	9.9 (8.2, 11.8)
Other	4.8 (2.4, 9.3)	6.2 (4.9, 7.8)
Number of ways used marijuana, past 30 days		
1	58.8 (51.6, 65.7)	36.2 (33.4, 39.2)
2	22.4 (16.9, 29.0)	19.9 (17.5, 22.5)
≥3	18.8 (13.7, 25.2)	43.9 (41.0, 46.8)

[a]Use of at least one marijuana mode on one or more of the past 30 days.
[b]Use of at least one marijuana mode on one or more days in your lifetime.
Wt%, weighted percent.

Overall, 34.5% of respondents reported ever using marijuana. Among these individuals (*n*=1,548), 88.7% used joints; 49.2% used a bong, water pipe, or hookah; 47.5% used a bowl or pipe; 29.8% consumed marijuana in edibles or drinks; 24.8% used blunts or cigars with marijuana in them; 9.9% used a vaporizer or other electronic device; and 6.2% used it in other ways. A total of 36.2% of ever users reported only one mode of marijuana administration, whereas 43.9% had tried three or more modes (Table 1).

Among ever users, a higher percentage of male participants than female participants reported ever use of blunts (Table 3). A higher percentage of adults

Table 2. Prevalence of Current Marijuana Use by Demographics, Overall, and Among Current Users, by Mode of Use—Summer Styles, 2014

	All adults (n=4,269)	Adults with past month marijuana use (n=266)		
	Past month marijuana use, Wt % (95% CI)	Joints,[a] Wt % (95% CI)	Bowl or pipe,[a] Wt % (95% CI)	Bong, waterpipe, hookah,[a] Wt % (95% CI)
Sex	8.9 (7.5, 10.6)	53.0 (43.8, 62.0)	50.4 (41.2, 59.5)	19.8 (14.0, 27.4)
Male				
Female	5.7 (4.5, 7.1)	43.7 (32.8, 55.3)	48.2 (37.0, 59.6)	24.5 (15.5, 36.4)
Age, years				
18–24	13.6 (9.8, 18.5)	45.1 (29.4, 61.9)	51.3 (34.7, 67.6)	29.7 (17.0, 46.6)
25–34	11.0 (8.2, 14.6)	38.7 (24.8, 54.7)	44.5 (30.5, 59.4)	18.8 (9.8, 32.8)
35–49	5.3 (3.8, 7.5)	47.1 (30.5, 64.3)	56.7 (38.5, 58.9)	19.8 (9.3, 37.4)
≥50	5.1 (4.2, 6.1)	61.2 (51.2, 70.2)	49.0 (39.1, 58.9)	19.4 (12.6, 28.6)
Race/ethnicity				
White, NH	6.3 (5.3, 7.4)	48.1 (39.7, 56.7)	65.0 (56.7, 72.5)	25.6 (18.8, 33.9)
Black, NH	8.6 (5.8, 12.4)	66.1 (45.3, 82.1)	23.8 (11.4, 42.9)	—[b]
Hispanic	11.4 (8.1, 15.8)	47.0 (30.0, 64.6)	29.0 (15.8, 47.0)	—[b]
Other, NH	5.2 (2.9, 9.3)	27.7 (10.2, 56.5)	39.3 (17.0, 67.2)	41.8 (17.0, 71.5)
Education				
<High school	13.0 (9.1, 18.4)	48.9 (30.7, 67.4)	49.1 (30.9, 67.5)	22.1 (10.2, 41.4)
High school	7.5 (5.9, 9.5)	46.1 (34.0, 58.7)	48.6 (36.4, 61.0)	29.3 (19.3, 41.7)
>High school	5.8 (4.9, 7.0)	51.4 (42.4, 60.4)	50.3 (41.2, 59.3)	16.6 (11.0, 24.3)
Region				
Northeast	6.4 (4.5, 9.0)	53.5 (35.7, 70.4)	55.8 (37.9, 72.4)	21.7 (9.9, 41.1)
Midwest	6.8 (5.0, 9.1)	56.8 (40.9, 71.5)	58.5 (42.8, 72.5)	24.0 (12.8, 40.3)
South	6.3 (4.9, 8.1)	50.8 (38.3, 63.3)	47.3 (35.1, 59.9)	18.1 (10.1, 30.3)
West	9.8 (7.6, 12.4)	40.6 (28.7, 53.7)	42.8 (31.0, 55.5)	24.0 (15.4, 35.4)

[a]Categories are not mutually exclusive.
[b]Estimates suppressed because of unreliability (relative SE>40%).
NH, non-Hispanic; Wt %, weighted percent.

aged ≥50 years reported ever use of joints than younger groups; a lower percentage reported ever use of bowls or pipes, or blunts. By race/ethnicity, a higher percentage of non-Hispanic whites reported ever use of joints (versus Hispanics); ever use of bongs, water pipes, or hookah (versus blacks); and ever use of bowls or pipes (versus all other racial/ethnic groups). A higher percentage of non-Hispanic blacks reported ever use of blunts than non-Hispanic whites. By education, a lower percentage of those with less than a high school degree reported ever use of joints than those with more education, and a higher percentage reported ever use of blunts compared with adults with more education. By region, use of joints was lower in the West than the Northeast or Midwest, and ever use of marijuana edibles or drinks was higher in the West than the Midwest or South (Table 3).

In multivariable analyses among ever users, being <50 years old (versus ≥50 years) was associated with a reduced odds of ever joint use, and being from the West (versus Northeast) was associated with lower odds of ever joint use. Being male and being <50 years old (versus ≥50 years) were associated with increased odds of bowl or pipe use; all race/ethnicities had lower odds of ever bowl/pipe use than non-Hispanic whites. Being aged 25–34 years or 35–49 years (versus ≥50 years) was associated with increased ever bong/water pipe/hookah use; being non-Hispanic black or Hispanic (versus white) was associated with lower odds of ever bong, water pipe,

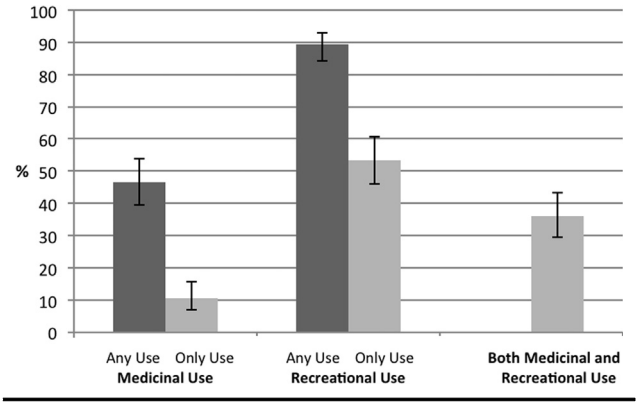

Figure 1. Medicinal versus recreational current marijuana use, among adults aged 18 years and older—Summer Styles, 2014.

or hookah use. Being multiracial or of other non-Hispanic race/ethnicity was associated with lower odds of ever eating or drinking marijuana. Being aged 18–24 years, 25–34 years, or 35–49 years (versus ≥50 years); being non-Hispanic black (versus non-Hispanic white); and having a high school education or less (versus more education) were associated with higher odds of past month blunt use.

Discussion

In this study, 89.5% of current adult marijuana users used marijuana in part or entirely for recreational reasons, and 46.6% used marijuana in part or entirely for medicinal purposes, with 10.5% of adults using solely for medicinal purposes. Combusted modes of marijuana use, including joints, bowls or pipes, and hookah or water pipes were the most prevalent among both ever and current users, with more than 90% of current users reporting combusted use. Because state-based policies may influence use patterns, and because the health benefits and harms of marijuana use are uncertain, continued surveillance of mode of use and reasons for use is warranted.

The finding that smoked forms of marijuana are the most prevalent is concerning given that marijuana smoke contains bronchial irritants and carcinogens similar to those found in tobacco smoke[25–27] and is associated with adverse respiratory effects like airway inflammation and pulmonary infection.[28,29] Additionally, smoking from devices with water filters, like bongs and hookahs, causes similar tar exposure to combusted marijuana without water filters (e.g., joints and bowls or pipes) and does not substantially reduce marijuana smoke risks.[30] The relative harm of other forms of non-combusted marijuana are not well established either.[18] Concern is growing about the potential for overdose and acute psychotic episodes associated with edible use; experiences in Colorado[31] led to efforts to ban edible marijuana sales in October 2014.[32] More research on the health risks of both smoked and non-smoked forms of marijuana is important.

Mode of marijuana administration differed by sociodemographics, particularly by age and race/ethnicity. For example, a higher proportion of adults aged ≥50 years reported ever use of joints than younger age groups, whereas adults aged 18–34 years reported greater use of blunts. Ever use of blunts was also higher among blacks, whereas whites were more likely to report ever use of joints, bongs, water pipes, hookahs, bowls, and pipes than other race/ethnicities. These findings align with previous research suggesting blunt use popularity among younger individuals and racial/ethnic minorities,[33–35] and findings from Australia about changes in mode of use by cohorts.[36] Although individuals may believe that smoking blunts is less harmful than smoking cigarettes because it is more "natural" or less addictive,[37] blunts may expose users to additional tobacco-related risks from the cigar wrapper, in addition to the risks of marijuana use.[2,10,38]

Findings that medicinal and recreational marijuana use overlap substantially and that only a small percentage of people report medicinal-only marijuana use are important, given that nearly half of U.S. states have medicinal marijuana laws.[4,6] As of 2014, both Washington and Colorado had separate medicinal and recreational marijuana marketplaces[39,40]; to date, medical marijuana dispensaries in states with recreational legalization have not been licensed or regulated like recreational marketplaces. Research on the frequency with which dual medicinal/recreational users consume marijuana for medicinal reasons; ways that marijuana users conceptualize and report medicinal use; specific medical reasons for use; whether they purchase recreational marijuana at state-sanctioned recreational outlets, through medical dispensaries, or in other ways; and whether they purchase different products for medicinal versus recreational use is important to inform policy making.

The public health impact of state policies legalizing marijuana remains unclear. Policies may have contributed to the increasing perception that marijuana use is harmless.[41] These perceptions, coupled with increased availability, could result in increased youth or young adult initiation. Having similar surveillance questions across states could facilitate research on the impacts of various marijuana legalization policies at a state level.

Policies legalizing marijuana could also result in new marijuana products as the market expands,[5] leading to potential changes in modes of use. Changes in mode of and reason for use could have harmful or beneficial effects on individual- and population-level health, but we

Table 3. Prevalence of Ever Marijuana Use, by Mode of Use and Demographics, Among Adults Aged 18 and Older—Summer Styles, 2014

	All adults (n=4,269)	Adults who ever used marijuana (n=1,548)					
	Ever marijuana use Wt % (95% CI)	Joints[a] Wt % (95% CI)	Bong, waterpipe, hookah[a] Wt % (95% CI)	Bowl or pipe[a] Wt % (95% CI)	Edible or drink[a] Wt % (95% CI)	Blunt[a] Wt % (95% CI)	Vaporizer or other electronic device[a] Wt % (95% CI)
Sex							
Male	39.8 (37.3, 42.3)	90.3 (87.3, 92.6)	50.6 (46.6, 54.5)	50.1 (46.1, 54.0)	30.4 (27.0, 34.1)	58.1 (51.6, 64.4)	11.5 (9.2, 14.2)
Female	29.5 (27.3, 31.8)	86.8 (82.8, 90.0)	47.5 (43.0, 52.0)	44.3 (39.9, 48.8)	29.0 (25.1, 33.3)	41.9 (35.6, 48.4)	7.8 (5.6, 10.9)
Age, years							
18–24	30.5 (24.9, 36.7)	70.0 (58.1, 79.6)	45.0 (34.0, 56.5)	54.7 (43.1, 65.9)	30.0 (20.8, 41.2)	37.4 (37.2, 48.9)	19.3 (12.2, 29.0)
25–34	38.0 (33.2, 43.0)	82.2 (75.0, 87.7)	57.1 (48.8, 65.0)	55.2 (47.0, 63.2)	32.5 (25.5, 40.4)	44.7 (36.8, 52.8)	16.3 (11.5, 22.7)
35–49	32.6 (29.2, 36.1)	87.5 (82.1, 91.4)	54.9 (48.6, 61.1)	51.3 (45.1, 57.6)	28.2 (22.9, 34.3)	27.6 (22.4, 33.5)	8.8 (5.7, 13.3)
≥50	35.0 (33.0, 37.1)	95.9 (93.8, 97.2)	44.9 (41.4, 48.5)	41.5 (38.0, 45.0)	29.3 (26.2, 32.7)	13.2 (10.8, 16.1)	5.7 (4.2, 7.7)
Race/ethnicity							
White, NH	34.5 (32.8, 36.2)	91.5 (89.0, 93.5)	54.3 (51.0, 57.6)	55.1 (51.7, 58.4)	31.9 (28.9, 35.0)	21.3 (18.5, 24.3)	10.0 (8.1, 12.2)
Black, NH	36.1 (31.0, 41.5)	89.8 (82.7, 94.2)	29.0 (21.5, 38.0)	27.1 (20.1, 35.5)	22.0 (15.6, 30.0)	37.3 (28.9, 46.5)	4.8 (2.1, 10.5)
Hispanic	38.9 (33.7, 44.4)	79.5 (70.9, 86.1)	45.1 (36.5, 54.0)	38.9 (30.6, 47.8)	30.6 (23.0, 39.5)	31.3 (23.5, 40.2)	13.1 (8.0, 20.7)
Other, NH	22.6 (16.9, 29.7)	79.6 (63.3, 89.9)	44.3 (29.9, 59.8)	25.5 (15.8, 38.4)	18.1 (10.1, 30.1)	19.1 (10.9, 31.2)	9.6 (4.3, 19.9)
Education							
<High school	33.7 (28.0, 40.0)	76.3 (65.1, 84.7)	44.1 (33.7, 55.0)	41.3 (31.0, 52.4)	22.2 (14.4, 32.6)	35.5 (25.8, 46.7)	9.7 (4.7, 18.9)
High school	32.4 (29.4, 35.4)	92.9 (88.9, 95.5)	48.1 (42.6, 53.7)	48.7 (43.2, 54.3)	27.4 (22.7, 32.7)	28.0 (23.0, 33.5)	7.7 (5.4, 11.1)
>High school	35.7 (33.6, 37.9)	89.3 (86.5, 91.6)	50.8 (47.2, 54.3)	48.2 (44.7, 51.8)	32.5 (29.2, 35.9)	21.1 (18.2, 24.3)	10.9 (8.7, 13.5)
Region							
Northeast	33.4 (29.5, 37.5)	93.0 (87.2, 96.3)	50.4 (43.1, 57.7)	51.4 (44.0, 58.6)	31.4 (25.0, 38.7)	27.5 (21.1, 34.9)	11.2 (7.6, 16.3)
Midwest	38.0 (34.6, 41.5)	90.8 (86.1, 94.0)	43.9 (38.3, 49.6)	51.2 (45.4, 57.0)	25.1 (20.6, 30.1)	21.7 (17.1, 27.1)	6.6 (4.3, 10.1)
South	31.3 (28.7, 34.1)	90.5 (86.6, 93.3)	46.2 (41.2, 51.4)	42.0 (37.1, 47.2)	25.9 (21.7, 30.6)	27.8 (23.2, 32.9)	7.0 (4.8, 10.3)
West	37.1 (33.5, 40.8)	81.3 (75.1, 86.3)	57.3 (51.2, 63.3)	48.7 (42.7, 54.7)	38.4 (32.7, 44.3)	21.7 (17.0, 27.3)	15.8 (11.6, 21.0)

[a]Categories are not mutually exclusive.
NH, non-Hispanic; Wt %, weighted percent.

know little about these potential outcomes. Monitoring mode of use and historic use patterns could help facilitate long-term studies correlating marijuana use patterns with morbidity and mortality, as has been done for tobacco use.[42,43] Additionally, research and surveillance of emerging marijuana products, such as butane hash oil dabbing and use of electronic vapor products, are also needed.

Limitations

This is the first nationally representative assessment of mode of and reasons for marijuana use among adults. However, this study is subject to limitations. First, though Styles draws from an existing panel with a nationally representative sample, it does not recruit using population-based probability samples, which may limit generalizability. Although past-month marijuana use was similar to other national surveys, ever use was lower,[3] possibly because a specific question about ever use was not asked. Instead, responses to the mode of use question were used (i.e., people who did not select any mode of use were considered never users). Individuals who had used marijuana a long time ago may not have recalled which mode they used, resulting in lack of a response and thus lower ever use prevalence. This difference may also be due to differences in sampling or survey administration. Nevertheless, Styles data are generally consistent with other national household surveys.[44] Second, small sample sizes for certain subpopulations resulted in wide confidence intervals and, in some cases, less precise estimates that could not be presented or had to be combined. Because of limited sample size, state-level estimates were not available, and estimates of mutually exclusive categories of use were unreliable. Third, survey questions are new and may require further refinement and standardization with formal cognitive testing before being used in other surveys. Questions were modified from existing fielded questions; however, some answer choices may not have fully captured the mode of use (e.g., *baked in food* may not have captured the complete spectrum of edible products). Additionally, even though it comprised $<5\%$ of current use, the "other" category did not allow participants to specify other modes of use; these modes may have included spliffs (marijuana joints that include tobacco), inhalation through gas masks, dabbing, oral pill formulations, or other new or emerging modes. Finally, these data may be subject to reporting bias, as marijuana is still an illicit substance in many states and federally.

Conclusions

This study finds that combusted marijuana use is the most prevalent mode of use, that mode of ever use of marijuana varies by sociodemographic characteristics, and that only 10% of all marijuana users report using it solely for medicinal purposes. Changing state policies related to marijuana use may lead to changes in the mode of use or reason for use, which could impact individual- and population-level health. Ongoing and improved surveillance systems that collect more-detailed information about patterns of marijuana use, including mode of and reasons for use, are important for enhancing understanding of the health consequences of marijuana use and for public health planning.

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References

1. Substance Abuse and Mental Health Services Administration. Results From the 2013 National Survey on Drug Use and Health: Sumary of National Findings, NSDUH Series H-48, HHS Publication No. (SMA) 14-4863. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2014.
2. Volkow ND, Baler RD, Compton WM, Weiss SR. Adverse health effects of marijuana use. *N Engl J Med*. 2014;370(23):2219–2227. http://dx.doi.org/10.1056/NEJMra1402309.
3. Substance Abuse and Mental Health Services Administration. *Results From the 2012 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-46, HHS Publication No. (SMA) 13-4795*. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2013.
4. Association of State and Territorial Health Officials (ASTHO). Legalization of medical marijuana: state laws, pending legislation, and ballot initiatives. www.astho.org/Public-Policy/State-Health-Policy/Medical-Marijuana-Legalization/. Published 2014. Accessed November 10, 2014.
5. Hickenlooper GJ. Experimenting with pot: the state of Colorado's legalization of marijuana. *Milbank Q*. 2014;92(2):243–249. http://dx.doi.org/10.1111/1468-0009.12056.
6. ProCon.org. 23 legal medical marijuana states and DC: laws, fees, and possession limits. http://medicalmarijuana.procon.org/view.resource.php?resourceID=000881. Published 2014. Accessed October 14, 2014.
7. Association of State and Territorial Health Officials (ASTHO). Legalization of recreational/medical marijuana and cannabidiol (CBD). www.astho.org/Public-Policy/State-Health-Policy/Marijuana-Overview/. Published 2014. Accessed November 10, 2014.
8. Ferner M. Voters change marijuana policy in 2014 midterms. Huffington Post. http://www.huffingtonpost.com/2014/11/05/marijuana-policy_n_6104636.html. November 5, 2014. Accessed July 22, 2015.
9. Pacula RL, Sevigny EL. Marijuana liberalization policies: why we can't learn much from policy still in motion. *J Policy Anal Manag*. 2014;33(1):212–221. http://dx.doi.org/10.1002/pam.21726.
10. Hall W. The adverse health effects of cannabis use: what are they, and what are their implications for policy? *Int J Drug Policy*. 2009;20(6):458–466. http://dx.doi.org/10.1016/j.drugpo.2009.02.013.
11. Hall W, Degenhardt L. Adverse health effects of non-medical cannabis use. *Lancet*. 2009;374(9698):1383–1391. http://dx.doi.org/10.1016/S0140-6736(09)61037-0.

12. Lamarine RJ. Marijuana: modern medical chimaera. *J Drug Educ*. 2012;42(1):1–11. http://dx.doi.org/10.2190/DE.42.1.a.
13. Li MC, Brady JE, DiMaggio CJ, Lusardi AR, Tzong KY, Li G. Marijuana use and motor vehicle crashes. *Epidemiol Rev*. 2012;34(1):65–72. http://dx.doi.org/10.1093/epirev/mxr017.
14. Lange P. Cannabis and the lung. *Thorax*. 2007;62(12):1036–1037. http://dx.doi.org/10.1136/thx.2007.084830.
15. Rezkalla S, Kloner RA. Recreational marijuana use: is it safe for your patient? *J Am Heart Assoc*. 2014;3(2):e000904. http://dx.doi.org/10.1161/JAHA.114.000904.
16. UN Office on Drugs and Crime. *World Drug Report, 2009*. Austria: UN: Vienna, 2009.
17. Loflin M, Earleywine M. A new method of cannabis ingestion: the dangers of dabs? *Addict Behav*. 2014;39(10):1430–1433. http://dx.doi.org/10.1016/j.addbeh.2014.05.013.
18. Mariani JJ, Brooks D, Haney M, Levin FR. Quantification and comparison of marijuana smoking practices: blunts, joints, and pipes. *Drug Alcohol Depend*. 2011;113(2-3):249–251. http://dx.doi.org/10.1016/j.drugalcdep.2010.08.008.
19. Kilmer B, Everingham SS, Caulkins JP, et al. *What America's Users Spend on Illegal Drugs*. Santa Monica, CA: RAND, 2014.
20. GfK. GfK Knowledge Networks. www.knowledgenetworks.com/ganp/. Published 2014. Accessed November 10, 2014.
21. Kilmer B, Caulkins JP, Midgette G, et al. Before the grand opening: measuring Washington State's marijuana market in the last year before legalized commercial sales. Santa Monica, CA: The RAND Corporation, 2015 2013 Accessed March 31.
22. Colorado Department of Public Health and Environment. Monitoring Health Concerns Related to Marijuana in Colorado: 2014. Changes in Marijuana Use Patterns, Systematic Literature Review, and Possible Marijuana-Related Health Effects. https://drive.google.com/folderview?id=0BxqXhstk92DbfnNfSURHd0VFZjEtRFpsVEg3bjM5QUJXOEd0VWZDOUNjSnpWWEFvTVdiUFU&usp=sharing. Published 2015. Accessed March 31, 2015.
23. Heinz AJ, Giedgowd GE, Crane NA, et al. A comprehensive examination of hookah smoking in college students: use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addict Behav*. 2013;38(11):2751–2760. http://dx.doi.org/10.1016/j.addbeh.2013.07.009.
24. Jawad M, McEwen A, McNeill A, Shahab L. To what extent should waterpipe tobacco smoking become a public health priority? *Addiction*. 2013;108(11):1873–1884. http://dx.doi.org/10.1111/add.12265.
25. Moir D, Rickert WS, Levasseur G, et al. A comparison of mainstream and sidestream marijuana and tobacco cigarette smoke produced under two machine smoking conditions. *Chem Res Toxicol*. 2008;21(2):494–502. http://dx.doi.org/10.1021/tx700275p.
26. Hoffman D, Brunneman DK, Gori BG, Wynder EL. On the carcinogenicity of marijuana smoke. *Recent Adv Phytochem*. 1975;9:63–81. http://dx.doi.org/10.1007/978-1-4684-0823-2_3.
27. Tashkin DP, Gliederer F, Rose J, et al. Effects of varying marijuana smoking profile on deposition of tar and absorption of CO and delta-9-THC. *Pharmacol Biochem Behav*. 1991;40(3):651–656. http://dx.doi.org/10.1016/0091-3057(91)90377-E.
28. Howden ML, Naughton MT. Pulmonary effects of marijuana inhalation. *Expert Rev Respir*. 2011;5(1):87–92. http://dx.doi.org/10.1586/ers.10.87.
29. Tetrault JM, Crothers K, Moore BA, Mehra R, Concato J, Fiellin DA. Effects of marijuana smoking on pulmonary function and respiratory complications: a systematic review. *Arch Intern Med*. 2007;167(3):221–228. http://dx.doi.org/10.1001/archinte.167.3.221.
30. Bloor RN, Wang TS, Spanel P, Smith D. Ammonia release from heated "street" cannabis leaf and its potential toxic effects on cannabis users. *Addiction*. 2008;103(10):1671–1677. http://dx.doi.org/10.1111/j.1360-0443.2008.02281.x.
31. Nicks D. Colorado takes another look at pot edibles after deaths. Time Magazine. http://time.com/80765/colorado-takes-another-look-at-pot-edibles-after-deaths. April 29, 2014. Accessed July 22, 2015.
32. Wyatt K. Colorado proposes edible pot ban, then retreats. Associated Press. news.yahoo.com/apnewsbreak-colorado-seeks-ban-most-edible-pot-171138961.html. Published October 20, 2014. Accessed July 22, 2015.
33. Compton WM, Grant BF, Colliver JD, Glantz MD, Stinson FS. Prevalence of marijuana use disorders in the United States: 1991-1992 and 2001-2002. *JAMA*. 2004;291(17):2114–2121. http://dx.doi.org/10.1001/jama.291.17.2114.
34. Golub A, Johnson BD, Dunlap E. The growth in marijuana use among American youths during the 1990s and the extent of blunt smoking. *J Ethn Subst Abuse*. 2005;4(3-4):1–21. http://dx.doi.org/10.1300/J233v04n03_01.
35. Timberlake DS. The changing demographic of blunt smokers across birth cohorts. *Drug Alcohol Depend*. 2013;130(1-3):129–134. http://dx.doi.org/10.1016/j.drugalcdep.2012.10.022.
36. Hall W, Swift W. The THC content of cannabis in Australia: evidence and implications. *Aust N Z J Public Health*. 2000;24(5):503–508. http://dx.doi.org/10.1111/j.1467-842X.2000.tb00500.x.
37. Sinclair CF, Foushee HR, Scarinci I, Carroll WR. Perceptions of harm to health from cigarettes, blunts, and marijuana among young adult African American men. *J Health Care Poor Underserved*. 2013;24(3):1266–1275. http://dx.doi.org/10.1353/hpu.2013.0126.
38. Lynskey M, Hall W. The effects of adolescent cannabis use on educational attainment: a review. *Addiction*. 2000;95(11):1621–1630. http://dx.doi.org/10.1046/j.1360-0443.2000.951116213.x.
39. Washington State Department of Health. Medical marijuana (Cannabis). www.doh.wa.gov/YouandYourFamily/Marijuana/MedicalMarijuanaCannabis. Published 2014. Accessed October 14, 2014.
40. Colorado Department of Public Health & Environment. Medical Marijuana. www.colorado.gov/pacific/cdphe/medicalmarijuana. Published 2014. Accessed October 14, 2014.
41. Johnston LD, O'Malley PM, Miech RA, Bachman JG, Schulenberg JE. *Monitoring the Future National Results on Drug Use: 1975-2013: Overview, Key Findings on Adolescent Drug Use*. Ann Arbor: Institute for Social Research, The University of Michigan, 2014.
42. Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observations on male British doctors. *BMJ*. 2004;328(7455):1519. http://dx.doi.org/10.1136/bmj.38142.554479.AE.
43. USDHHS. *The Health Consequences of Smoking—50 Years of Progress. A Report of the Surgeon General*. Atlanta, GA: USDHHS, CDC, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.
44. Regan AK, Promoff G, Dube SR, Arrazola R. Electronic nicotine delivery systems: adult use and awareness of the "e-cigarette" in the USA. *Tob Control*. 2013;22(1):19–23. http://dx.doi.org/10.1136/tobaccocontrol-2011-050044.