

Association Between Recreational Marijuana Legalization in the United States and Changes in Marijuana Use and Cannabis Use Disorder From 2008 to 2016

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IMPORTANCE Little is known about changes in marijuana use and cannabis use disorder (CUD) after recreational marijuana legalization (RML).

OBJECTIVES To examine the associations between RML enactment and changes in marijuana use, frequent use, and CUD in the United States from 2008 to 2016.

DESIGN, SETTING, AND PARTICIPANTS This survey study used repeated cross-sectional survey data from the National Survey on Drug Use and Health (2008-2016) conducted in the United States among participants in the age groups of 12 to 17, 18 to 25, and 26 years or older.

INTERVENTIONS Multilevel logistic regression models were fit to obtain estimates of before-vs-after changes in marijuana use among respondents in states enacting RML compared to changes in other states.

MAIN OUTCOMES AND MEASURES Self-reported past-month marijuana use, past-month frequent marijuana use, past-month frequent use among past-month users, past-year CUD, and past-year CUD among past-year users.

RESULTS The study included 505 796 respondents consisting of 51.51% females and 77.24% participants 26 years or older. Among the total, 65.43% were white, 11.90% black, 15.36% Hispanic, and 7.31% of other race/ethnicity. Among respondents aged 12 to 17 years, past-year CUD increased from 2.18% to 2.72% after RML enactment, a 25% higher increase than that for the same age group in states that did not enact RML (odds ratio [OR], 1.25; 95% CI, 1.01-1.55). Among past-year marijuana users in this age group, CUD increased from 22.80% to 27.20% (OR, 1.27; 95% CI, 1.01-1.59). Unmeasured confounders would need to be more prevalent in RML states and increase the risk of cannabis use by 1.08 to 1.11 times to explain observed results, indicating results that are sensitive to omitted variables. No associations were found among the respondents aged 18 to 25 years. Among respondents 26 years or older, past-month marijuana use after RML enactment increased from 5.65% to 7.10% (OR, 1.28; 95% CI, 1.16-1.40), past-month frequent use from 2.13% to 2.62% (OR, 1.24; 95% CI, 1.08-1.41), and past-year CUD from 0.90% to 1.23% (OR, 1.36; 95% CI, 1.08-1.71); these results were more robust to unmeasured confounding. Among marijuana users in this age group, past-month frequent marijuana use and past-year CUD did not increase after RML enactment.

CONCLUSIONS AND RELEVANCE This study's findings suggest that although marijuana legalization advanced social justice goals, the small post-RML increase in risk for CUD among respondents aged 12 to 17 years and increased frequent use and CUD among adults 26 years or older in this study are a potential public health concern. To undertake prevention efforts, further studies are warranted to assess how these increases occur and to identify subpopulations that may be especially vulnerable.

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Marijuana is one of the world's most widely used psychoactive substances. Approximately 183 million people, or 3.8% of the world's population, used marijuana in 2015.¹ Although occasional marijuana use is not associated with substantial problems, long-term, heavy use is linked to psychological and physical health concerns,²⁻⁴ lower educational attainment,⁵ decline in social class, unemployment,^{6,7} and motor vehicle crashes.^{8,9}

In the United States, 33 states and the District of Columbia have enacted medical marijuana legalization (MML), and 11 states and the District of Columbia have enacted recreational marijuana legalization (RML). Reducing racial/ethnic inequalities in marijuana-related arrests and convictions has been a key aim of legalization. At the same time, questions have arisen about the impact of legalization on marijuana use.¹⁰ Prior studies did not find any association between MML and adolescent marijuana use¹¹; however, they did find increases in adult past-month use and cannabis use disorder (CUD) after MML.¹²⁻¹⁹ Findings on MML may not apply to RML,²⁰ because RML could have a broader impact through changes in pricing,²¹ access, acceptability,^{22,23} and advertising.

Little is known about the association of RML with marijuana use and how it differs from that of MML with marijuana use. In school-based samples, one study found increased past-month adolescent use in Washington but not in Colorado after RML.²⁴ Another study found increases in use among college students in Washington,²⁵ while a third study found decreased marijuana use among adolescents.²⁶ At the national level, the association of RML with marijuana use, frequent use, and CUD across age groups remains unknown. Furthermore, whether RML leads to an expansion of the pool of new marijuana users or increases problematic use among existing marijuana users is unclear.

In this study, we addressed these gaps by comparing past-month marijuana use, frequent marijuana use, and CUD before and after RML enactment among adolescents, young adults, and adults, using data from 2008 to 2016. To distinguish the association of RML enactment with new marijuana users from that with problematic use among existing users, we examined changes in frequent marijuana use and CUD among the overall sample as well as among users. States that did not enact RML, regardless of whether they had enacted MML, were included in the analyses to control for nationwide trends in marijuana use.

Methods

Data

The National Survey on Drug Use and Health (NSDUH) collects data on more than 17 500 adolescents (aged 12-17 years), 17 500 young adults (aged 18-25 years), and 18 800 adults (aged ≥ 26 years) on a yearly basis.²⁷ The NSDUH uses a 50-state design and has an independent multistage area probability sample for each state, which produces state-representative estimates. Up to 2013, equal sample sizes (33%) were collected for all the age groups. Since 2014, adults 26 years or older were oversampled (25% for youth aged 12-17 years, 25% for young adults aged 18-25 years, and 50% for adults aged ≥ 26 years) to more accurately esti-

Key Points

Question How did marijuana use and cannabis use disorder change during 2008 to 2016 after the legalization of recreational marijuana in the United States?

Findings In this multilevel, difference-in-difference survey study with 505 796 respondents comparing marijuana use before and after the legalization of recreational marijuana in the United States, the proportion of respondents aged 12 to 17 years reporting cannabis use disorder increased from 2.18% to 2.72%, while the proportion of respondents 26 years or older reporting frequent marijuana use increased from 2.13% to 2.62% and those with cannabis use disorder, from 0.90% to 1.23%.

Meaning This study's findings suggest that possible increases in the risk for cannabis use disorder among adolescent users and increases in frequent use and cannabis use disorder among adults after legalization of recreational marijuana use may raise public health concerns and warrant ongoing study.

mate drug use among the aging, drug-using population. This sample redesign did not change the prevalence estimates of outcome variables or the precision of the estimates between states that did and did not enact RML equally.

In-person audio, computer-assisted self-interviews were conducted by professional field interviewers; response rates ranged from 55% to 75%,²⁸ depending on the year.^{29,30} Oral informed consent was obtained from study participants for screening and interviewing. This survey study was approved by the institutional review board at the Columbia University Mailman School of Public Health, New York, New York.

Measures

Our primary exposure variable was the state-level enactment of RML in Colorado, Washington, Alaska, and Oregon. The date that marijuana was legalized for recreational use was determined by a review of publicly available state policies³¹ used in previous work on MML^{17,20,24,32-34} and updated in 2017. Recreational marijuana legalization was enacted in Colorado and Washington in November 2012, in Alaska in February 2015, and in Oregon in October 2015. A 3-level variable was created for each state by year, coded as 0 (never enacted RML), 1 (before RML enactment), and 2 (after RML enactment). States were coded as "after RML enactment" if they enacted the law between January 1 and June 30; if they enacted the law between July 1 and December 31, they were coded as "before RML enactment" for that year and "after RML enactment" in the following years. States that enacted RML after our study period (ie, after July 1, 2016) were coded as "before RML enactment." Findings were unchanged when states that enacted RML after our study period were recoded as "never enacted RML."

Primary outcomes were past-month marijuana use, frequent use in the past month, past-year CUD overall, and past-month frequent use and past-year CUD among users in accordance with the time frames used in NSDUH. Frequent use was defined as 20 days or more of use in the past month. Respondents were classified as having CUD based on a structured instrument that assessed symptoms corresponding to *DSM-IV* criteria.³⁵ Outcomes were examined separately by age group

(12-17, 18-25, and ≥ 26 years) to examine the specific association between RML enactment and marijuana use in adolescence, young adulthood, and adulthood.

State-level covariates included the state proportions of males, individuals of white race/ethnicity, those aged 10 to 24 years, and those older than 25 years without a high school education. State demographic information was obtained from the American Community Survey.³⁶ Individual-level covariates included respondent age, sex, race/ethnicity, nativity (US-born or non-US-born), urbanicity, and total family income.

Statistical Analysis

Statistical analysis was performed between December 6, 2017, and March 14, 2019. In descriptive analyses, we calculated the prevalence of past-month marijuana use, past-month frequent marijuana use, and CUD for each year from 2008 to 2016, providing estimates of trends in marijuana use before any RML enactment (ie, 2008-2011) and after RML enactment (ie, 2013-2016 or 2015-2016, depending on the state of residence). We calculated the mean NSDUH-weighted, state-level prevalence estimates across 3 groups as follows: (1) states that never enacted RML or MML, (2) states that enacted MML but not RML during our study period, and (3) states that enacted RML and MML during our study period regardless of when legalization was enacted. Summaries were stratified by the following 3 age groups: 12 to 17, 18 to 25, and 26 years or older, consistent with the NSDUH sampling design. Missing data on demographic characteristics and substance use measures were imputed by NSDUH using the predictive mean neighbors procedure.³⁷ Missing data on the outcome variables ranged from 0.5% (CUD) to 0.8% of the sample (past-month marijuana use and frequent marijuana use among past-month users). Listwise deletion was used to address missing data on the outcomes.

We used a series of multilevel logistic regression models to obtain estimates of before-vs-after changes in marijuana outcomes associated with changes in RML enactment after controlling for contemporaneous trends in the entire country. This approach is similar to a difference-in-difference analysis but accounts for the varying years of RML enactment by state. Because NSDUH study participants were nested within states, a state-level random effect was included. Outcomes were measured at the individual level. State-level RML enactment was captured using our 3-level state variable (never enacted RML, before RML enactment, and after RML enactment) as a time-varying covariate, allowing for potential differences between states that never enacted RML and those that would eventually enact RML.

To examine whether the associations between RML enactment and marijuana use differed by age group, we included age as a 3-level variable (12-17, 18-25, and ≥ 26 years) and tested its interaction with our exposure variable. All models controlled for contemporaneous trends in marijuana use between 2008 and 2016 by using a piecewise cubic spline function of year with a knot at 2011.³⁸ In addition, all models controlled for individual- and state-level covariates to account for potential remaining differences in the NSDUH respondents and in the overall state population between RML and non-RML states. Odds ratios (ORs) and 95% CIs were calculated to esti-

mate associations. These did not include NSDUH sampling weights because the model directly incorporated all individual-level variables related to the sampling design.³⁹ Analyses were conducted at the 5% significance level, and the testing was 2-sided. The SAS statistical software, version 9.2 (SAS Institute Inc) was used for analyses, and figures were created in R software, version 3.6.0 (R Core Team).

Sensitivity Analysis

Unmeasured time-invariant state differences were accounted for in our tests for before-RML vs after-RML changes in marijuana outcomes. However, to evaluate the potential association of time-varying unmeasured confounding, we calculated E-values, a type of sensitivity analysis increasingly used in epidemiologic studies.⁴⁰⁻⁴² E-values indicate the minimum strength of unmeasured confounders' association with the exposure (eg, RML enactment) and the outcome (eg, marijuana use) that could artifactually produce the observed association and lower bound of the CI if the true association were null (eTable 2 and eTable 3 in the [Supplement](#)). Small E-values (lowest possible is a value of 1.0) suggest that unmeasured confounding may account for observed associations; larger E-values indicate results that are increasingly robust to unmeasured confounding. E-values were obtained using the *EValue* package in R software, version 3.6.0.

Results

This study included 505 796 respondents and comprised 51.51% females and 77.24% participants 26 years or older. Among the total, 65.43% were white, 11.90% black, 15.36% Hispanic, and 7.31% of other race/ethnicity. **Table 1** provides additional sample characteristics. eFigures 1 to 3 in the [Supplement](#) show the descriptive trends in the prevalence of past-month marijuana use, past-month frequent marijuana use, and CUD during 2008 to 2016. After 2012 (ie, the start of the post-RML period, when Washington and Colorado enacted RML), among states that enacted RML, the slopes of past-month marijuana use for respondents 26 years or older (eFigure 1 in the [Supplement](#)) and the slopes of past-month frequent marijuana use for respondents aged 18 to 25 years and 26 years or older (eFigure 2 in the [Supplement](#)) appeared steeper than the slopes among those that enacted only MML or those that did not enact either RML or MML. The slopes of CUD (eFigure 3 in the [Supplement](#)) did not appear to differ across the 3 groups.

Table 2 and **Table 3** present the primary findings for the overall population (Table 2) and for the subset of marijuana users (Table 3). Among the 12- to 17-year-old respondents, the prevalence of past-month marijuana use and past-month frequent use following state RML enactment did not change in the overall sample or among users. However, after RML enactment, past-year CUD prevalence increased slightly among all 12- to 17-year-old respondents (2.18% to 2.72%; OR, 1.25; 95% CI, 1.01-1.55). This increase was 25% higher than that for participants in the same age group in states with no RML enactment. Among the past-year users, CUD increased from 22.80% to 27.20% (OR, 1.27; 95% CI, 1.01-1.59).

Table 1. Demographic Characteristics, Self-reported Substance Use, and State Marijuana Legalization Among Study Participants, National Survey on Drug Use and Health, 2008-2016

Characteristic	%		No. (N = 505 796)
	Weighted	Unweighted	
Sex			
Male	48.49	47.82	241 856
Female	51.51	52.18	263 940
Age, y			
12-17	9.55	29.53	149 383
18-25	13.21	30.44	153 947
≥26	77.24	40.03	202 466
Race			
White	65.43	60.57	306 347
Black	11.90	12.81	64 771
Hispanic	15.36	17.14	86 711
Other	7.31	9.48	47 967
Marijuana use			
Past month			
No	92.49	89.17	451 015
Yes	7.51	10.83	54 781
Frequent			
No	97.00	95.78	484 468
Yes	3.00	4.22	21 328
Past-year cannabis use disorder			
No	98.38	96.99	490 591
Yes	1.62	3.01	15 205
Frequent marijuana use among past-month users^a			
No	60.05	61.07	33 453
Yes	39.95	38.93	21 328
Past-year cannabis use disorder among past-year users			
No	86.89	83.36	76 187
Yes	13.11	16.64	15 205
State marijuana legalization status			
Never passed MML/RML states	NA	47.05	237 977 ^b
Passed MML, not RML	NA	47.02	237 825 ^b
Passed RML states	NA	5.94	30 044 ^b

Abbreviations: MML, medical marijuana legalization; NA, not applicable; RML, recreational marijuana legalization.

^a Frequent use is defined as 20 days or more of use in the past month.

^b Estimated number (actual number unavailable owing to privacy restrictions of state-level information).

In the group aged 18 to 25 years, no difference was found after state RML enactment in past-month marijuana use, past-month frequent use, or past-year CUD in the overall sample (Table 2) or among users (Table 3).

Among respondents aged 26 years or older, past-month marijuana use after RML enactment increased from 5.65% to 7.10% (OR, 1.28; 95% CI, 1.16-1.40) (Table 2). Furthermore, past-month frequent use increased from 2.13% to 2.62% (OR, 1.24; 95% CI, 1.08-1.41) and past-year CUD increased from 0.90% to 1.23% (OR, 1.36; 95% CI, 1.08-1.71) (Table 2). Among users, past-month frequent use and past-year CUD did not increase (Table 3).

Variations by age (interactions; eTable 1 in the Supplement) were found for the association between RML enactment and past-month marijuana use ($F = 23.48$; $P < .001$), past-

month frequent marijuana use ($F = 11.17$; $P < .001$), and past-year CUD ($F = 5.19$; $P < .001$). Although the association of RML enactment with past-month frequent use and past-year CUD among users did not vary by age, age-group variations in the overall sample, the distinctly different levels of marijuana use in the 3 age groups (eFigures 1-3 in the Supplement), and differences in consequences associated with marijuana use by age warranted presentation of all findings stratified by age.

Sensitivity Analysis

eTables 2 and 3 in the Supplement present E-values. Among respondents aged 12 to 17 years old, the small E-values for the observed OR and the lower limit of the 95% CI for CUD (ie, lower CI E-values of 1.11 in the overall sample and 1.08 among past-year marijuana users) indicate that associations between unmeasured confounders and RML and between unmeasured confounders and CUD may explain the observed association between RML enactment and CUD. Among respondents aged 26 years or older, the larger E-values (ie, lower CI E-values, 1.37-1.59; eTables 2 and 3 in the Supplement) reduced the concern that unobserved confounding may explain the observed associations.

Discussion

In the present study, RML enactment during 2012 to 2015 was followed by a small increase in adolescent CUD and by an increase in past-month marijuana use, past-month frequent marijuana use, and past-year CUD among adults 26 years or older. Cannabis use disorder among adolescents and its associated long-term adverse health, economic, and social consequences^{2-6,8,9,43,44} have raised concerns about unintended consequences of legalization in this age group. The increase in past-month frequent marijuana use and CUD in the adult population is also an important public health concern because both frequent use and CUD are associated with considerable comorbidity and disability.^{7,45,46}

This study advances our understanding of the association of changing marijuana laws with marijuana use in 2 important ways. First, it is the first national study, to our knowledge, to examine the association of legalization of recreational marijuana use at the state level with marijuana use among adolescents, young adults, and adults. Prior studies on the consequences of RML enactment focused either on only adolescents^{24,26,47,48} or on single states without a comparison group.⁴⁷⁻⁵⁰ None examined the association of RML enactment with CUD, which is strongly associated with adverse health consequences.^{2-6,8,9,43,44} Second, this study's findings suggest that the change in marijuana use following RML enactment may differ by age group.

Adolescents did not exhibit increases in marijuana use or frequent use after RML enactment. Prior studies did not detect any post-MML increase in adolescent marijuana use.^{11,17,20,33} One study did find an increase in marijuana use after RML among 8th- and 10th-grade (but not 12th-grade) students in Washington, but not in Colorado.²⁴ Our study builds on this prior study by using state-representative samples of adolescents in and out of school, and by examining the

Table 2. Past-Month Marijuana Use, Frequent Marijuana Use, and CUD in the Past 12 Months Among 495 796 Respondents Before vs After RML Enactment From 2008 to 2016^a

Age Group, y	Marijuana Use						CUD in the Past 12 mo		
	Past Month			Frequent			% Who Met Criteria for CUD		
	% Who Reported Use			% Who Reported Frequent Use			% Who Met Criteria for CUD		
	Before RML ^b	After RML ^c	AOR (95% CI) ^d	Before RML ^b	After RML ^c	AOR (95% CI) ^d	Before RML ^b	After RML ^c	AOR (95% CI) ^d
12-17	4.76	5.28	1.12 (0.97-1.28)	1.07	1.19	1.12 (0.87-1.43)	2.18	2.72	1.25 (1.01-1.55)
18-25	13.06	14.03	1.09 (0.99-1.20)	4.64	5.08	1.10 (0.97-1.25)	3.62	3.48	0.96 (0.80-1.14)
≥26	5.65	7.10	1.28 (1.16-1.40)	2.13	2.62	1.24 (1.08-1.41)	0.90	1.23	1.36 (1.08-1.71)

Abbreviations: AOR, adjusted odds ratio; CUD, cannabis use disorder; RML, recreational marijuana law.

^a All models were adjusted for respondent age, sex, race/ethnicity, nativity, urbanicity, and total family income; overall contemporaneous trend across all US states; state percentage male; percentage white; percentage aged 10 to 24 years; and percentage older than 25 years without a high school education. Frequent use is defined as 20 days or more of use in the past month.

^b Estimated adjusted prevalence from model, RML states before the enactment of RML.

^c Estimated adjusted prevalence from model, RML states after the enactment of RML.

^d Adjusted odds ratio, comparing after vs before.

Table 3. Past-Month Frequent Marijuana Use Among Users and Past-Year CUD Among Users Before vs After RML Enactment From 2008 to 2016^a

Age Group, y	Frequent Marijuana Use Among Past-Month Users (n = 54 781)			CUD in the Past 12 mo Among Past-Year Users (n = 91 392)		
	% Who Reported Frequent Use			% Who Met Criteria for CUD		
	Before RML ^b	After RML ^c	AOR (95% CI) ^d	Before RML ^b	After RML ^c	AOR (95% CI) ^d
12-17	22.90	23.18	1.02 (0.76-1.35)	22.8	27.20	1.27 (1.01-1.59)
18-25	38.34	40.50	1.09 (0.93-1.29)	16.60	15.68	0.93 (0.78-1.11)
≥26	37.12	37.84	1.03 (0.87-1.22)	9.09	10.44	1.17 (0.93-1.47)

Abbreviations: AOR, adjusted odds ratio; CUD, cannabis use disorder; RML, recreational marijuana law.

^a All models were adjusted for respondent age, sex, race/ethnicity, nativity, urbanicity, and total family income; overall contemporaneous trend across all US states; state percentage male; percentage white; percentage aged 10 to 24 years; and percentage older than 25 years without a high school education.

^b Estimated adjusted prevalence from model, RML states before the enactment of RML.

^c Estimated adjusted prevalence from model, RML states after the enactment of RML.

^d Adjusted odds ratio, comparing after vs before.

consequences of RML enactment in 4 states over a longer time span. Our findings on use are consistent with the availability theory: because marijuana is legal only for people 21 years or older, we would expect new users to be concentrated among those for whom access increased the most (ie, adults) and not among adolescents.⁵¹

Among adolescent marijuana users, CUD prevalence increased slightly after RML enactment. E-value analyses suggested that unmeasured time-varying confounders hypothetically more prevalent in RML states that increase the risk of cannabis use slightly (1.08-1.11 times) may explain this finding. The extent to which such confounders exist is unclear because our difference-in-difference design accounted for unmeasured time-invariant sources of confounding and also adjusted for measured time-varying individual- and state-level demographic characteristics. However, the small E-values warrant a conservative interpretation of the increase in CUD among participants aged 12 to 17 years.

The seriousness of the long-term consequences of CUD in adolescents suggests the need for additional study when data for more years become available. A small increase in adolescent CUD, but not in frequent use among past-month users, suggests that RML enactment may affect adolescents who are particularly vulnerable owing to a history of psychiatric comorbidity, traumatic life events, or family history of sub-

stance use disorders⁵² or to the increased potency of marijuana products after legalization.⁵³

Among young adults, RML enactment did not result in changes in past-month marijuana use, past-month frequent marijuana use, or past-year CUD. Part of this finding may be related to a ceiling effect because young adulthood is the peak developmental age for risk of substance use, including marijuana⁵⁴ (eFigure 1 in the Supplement), and for several years, young adults have widely and consistently perceived marijuana to be readily available.³⁰ Furthermore, concerns about legal problems associated with accessing marijuana may be less salient during this risk-taking phase of young adulthood, before maturing into adult roles such as jobs, marriage, and child-bearing.⁵⁵ Finally, as RML allows legal access to marijuana for people 21 years or older, the lack of legal access for those aged 18 to 20 years may also partly explain the absence of an association between RML enactment and marijuana use in this age group.^{13,17}

In contrast, among adults 26 years or older, RML enactment resulted in increased past-month marijuana use, past-month frequent use, and past-year CUD. Mechanisms including increased availability and access to marijuana, a decrease in the price of marijuana,^{19,21} and changes in perceptions of risk associated with marijuana use¹⁷ may explain the increase in adult use following RML enactment, while the increased

potency of marijuana products available in the legal market⁵³ could potentially contribute to the increase in CUD. Findings are consistent with increased adult use after MML in the United States; prior studies found post-MML increases in the prevalence of marijuana use and CUD among adults.^{13,16,17}

The present study examined the mean of the association of RML enactment with marijuana use across the first 4 states to enact RML. Prior work on MML suggests that differences in forms of marijuana access (eg, availability and density of retail outlets), types of marijuana products available, possession limits, potency, price, and taxation regulations may moderate the association of legalization with marijuana use.^{51,56} As more states legalize recreational marijuana use, attention to variation by types of legalization approaches warrants analysis.

Limitations

This study has limitations. First, the study relied on self-reported marijuana use, and the social desirability to report use may change after legalization. However, the use of audio, computer-assisted self-interviews reduces these concerns because respondents provided confidential self-reports without interacting with an interviewer.²⁹ Second, frequency of use and CUD are only 2 of the important dimensions of marijuana use; future studies should examine additional measures, for example, frequency within days and tetrahydrocannabinol potency in marijuana products, to comprehensively examine how RML affects marijuana use. Third, this study examined

short-term changes in marijuana use after RML enactment; once data become available, future studies should examine longer-term changes in marijuana use, for example, after commercialization. Fourth, NSDUH uses *DSM-IV* criteria to measure CUD rather than the current *DSM-5* criteria. Hence, the CUD definition does not include cravings or cannabis withdrawal. Fifth, NSDUH excludes people who are homeless or residing in institutions, potentially underestimating the prevalence of marijuana use and related disorders.

Conclusions

We believe that this study offers a novel, major step forward in understanding the changes in marijuana use that may follow the legalization of recreational marijuana use in the United States. The study's many strengths included large, nationally representative samples across multiple years and major age groups, a survey design that produces accurate state-level estimates, and use of comprehensive measures and advanced statistical methods. Legalization of recreational marijuana use has the potential to provide important social benefits, particularly around issues of equity in criminal justice. However, the potential for frequent use and CUD is an important public health concern that warrants ongoing study and investment in substance use prevention and treatment to prevent unintended harm.

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