Missouri College Students' Intentions Towards Initiating or Changing Cannabis Use in a Shifting Legal Landscape

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ABSTRACT

Background: With cannabis legal in nearly half of U.S. states, important concerns about the public health impact remain, particularly for states yet to legalize. The present study, using data collected in the initial phase of cannabis legalization in Missouri, examined predictors of the intention to initiate (in the cannabis naïve) and increase use (in those with past-year use) in a representative sample of Missouri college students. **Methods:** Data ($n_{\text{cannabisnaïve}}$ = 2,716; $n_{\text{cannabisuse}}$ = 1,591) were collected from 25 Missouri college campuses. Four pre-registered multilevel models examined the associations of theory-driven predictors with the intention to initiate cannabis use and to increase use. **Results:** 33.4% of all students surveyed reported past-year cannabis use, 9.9% of cannabis naïve students reported intending to initiate cannabis use, and 22% of those with previous cannabis use reported intending to increase cannabis use. Multilevel modes found that being gay or lesbian (*AOR* = 3.03; CI = [1.72, 5.34]), bisexual (*AOR* = 3.52; CI = [2.41, 5.14]), or queer (*AOR* = 2.51; CI = [1.71, 3.69]) was associated with intending to initiate use, while greater flourishing (*AOR* = 0.98; CI = [0.96, 0.99]) was associated with decreased odds of intending to initiate use. Endorsing more cannabis motives (*AOR* = 1.13; CI = [1.08, 1.19]), age of first use (*AOR* = 1.09; CI = [1.03, 1.15]), and being gay or lesbian (*AOR* = 2.19; CI = [1.27, 3.76]) were associated with intending to increase use. Endorsing more cannabis-related negative consequences was associated with intending to decrease use (*AOR* = 0.91; CI = [0.89, 0.94]). **Discussion:** Multiple theory-driven factors were associated with intending to initiate or increase cannabis use following legalization. Future research should examine how intentions to change cannabis use translate to actualized behavior following legalization and factors that may create increased risk for minoritized sexual identities.

Key words: = cannabis; cannabis legalization; motives; cannabis frequency; sexual orientation

To date, nearly half of the United States has legalized recreational cannabis use for adult use (24 states plus the District of Columbia; Reuters, 2023) and there is increasing public support for legalization (Chiu et al., 2022). Legalization has benefits, including increased tax revenue, reducing justice system burden, and offsetting black market sales (Gunadi & Shi, 2022; Kavousi et al., 2022). It also holds important public health considerations, such as concerns about increased

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use, cannabis use disorder (CUD), and related harms (e.g., intoxicated driving; Hall & Lynskey, 2016; Hopfer, 2014; Monte et al., 2015; Parnes et al., 2017). This is especially the case among young adults, an age group that already reports the highest rates of cannabis use and CUD (Center for Behavioral Health Statistics and Quality, 2023).

In states that have legalized recreational cannabis, studies have examined changes in cannabis use, CUD, cannabis beliefs, and intoxicated driving, among others. Cross-sectional studies on young adults in the United States have mostly found increased cannabis use, although results have been mixed regarding changes to frequency (Bae & Kerr, 2020; Kerr, Bae, Phibbs, et al., 2018; Kerr et al., 2017; Kerr, Ye, et al., 2018; Mennis et al., 2023; O'Grady et al., 2022; Parnes, Bravo, et al., 2018; Wallace et al., 2020). Longitudinal young adult studies have also documented increases in use, particularly among those with previous cannabis use; the extent of these changes have varied by state (Barker & Moreno, 2021; Smart & Pacula, 2019; Zellers et al., 2023). Studies also noted greater increases in young adult use among those with recent heavy alcohol use (Kerr et al., 2017) and past-year depression (Mennis et al., 2023), as well as women (Bae & Kerr, 2020) and those over the legal purchasing age (i.e., 21 years old; Bae & Kerr, 2020). More broadly, poor social relationships and Greek life affiliation are risk factors for young adult cannabis use (Kerr et al., 2017; Vidal et al., 2022). Beyond use, young adult research has also founded increases in acceptance of use and decreases in perceptions of risk (Barker & Moreno, 2021; Mennis et al., 2023; Wallace et al., 2020), despite post-legalization increases in negative cannabis-related consequences (Estoup et al., 2016; Parnes et al., 2017).

Given findings, policymakers and stakeholders in states that have yet to legalize likely want to know how legalizing would impact their state, especially among high-risk groups (e.g., young adults). One way to predict legalization's future impact is by examining intentions to initiate or increase use at the time of or closely following legalization. Given that intentions to use cannabis are associated with greater use in both the short (Waddell et al., 2023) and long term (Ito et al., 2015), identifying predictors of these intentions is crucial for determining who may be most impacted by cannabis legalization. Moreover, identifying risk-related intentions can inform targets for cannabis interventions (e.g., Marijuana eCHECKUP TO GO; Riggs et al., 2018).

Several factors are associated with greater intentions to use, including stronger cannabis-related social norms (i.e., acceptability and commonality of use in one's social network), greater past-month alcohol use, and younger age (Cohn et al., 2017; Sandhu et al., 2019). Greater current cannabis use frequency was also associated with intentions to increase use following legalization (Clarke et al., 2018; Cohn et al., 2017; Sandhu et al., 2019), though one study (Cui et al., 2023) did not find this association. Worse self-reported mental health was also related to greater intentions around cannabis use following legalization (Sandhu et al., 2019). Sexual minorities, especially bisexual individuals, often report higher rates of cannabis use (Parnes et al., 2017), though Cui et al. (2023) did not find that they reported greater intentions to use after legalization. Despite known sex and gender differences in cannabis use and consequences (e.g., Greaves & Hemsing, 2020), findings on intentions to use following legalization are more ambiguous with results varying by country (Cui et al, 2023; Sandhu et al., 2019).

The Current Study

As U.S. recreational legalization expands, initially resistant states have begun passing such laws. Compared to early adopting states, which often had pre-existing higher use rates and more permissive norms (Schuermeyer et al., 2014), the context and effects of legalization may differentially impact these more hesitant states. Given that the effects of legalization appear to vary across states (Bailey et al., 2023; Barker & Moreno, 2021; Smart & Pacula, 2019), it is a public health priority to continue examining the potential effects of legalization, particularly in less studied states. This large, cross-sectional study of Missouri college students examined factors related to intentions to initiate or change cannabis use with the recent legalization of cannabis in the state in 2023.

Descriptively, we will present a depiction of cannabis use presently and over the past decade. We calculate rates of use and non-use over the

past decade, frequency of use for students in the past year and month, rates of substance co-use with cannabis, and current perceived descriptive norms of cannabis use.

Beyond this, building from existing work, we had two sets of primary hypotheses, one set predicting the intention to initiate cannabis use following legalization, and the second set predicting, among those already using cannabis, the intention to change cannabis use following legalization. First, we hypothesized that, among cannabis-naïve college students, greater descriptive norms, greater recent alcohol use, prior binge drinking, and being over 21 years old would be associated with a greater likelihood of intention to initiate cannabis use following legalization. Second, we hypothesized that, among college students who previously used cannabis, greater descriptive norms, greater cannabis and alcohol use, prior binge drinking, more cannabis use motives, and greater cannabis consequences would positively predict intentions to increase consumption following legalization.

Additionally, we proposed two secondary models that examined factors previously associated with cannabis use, but less clearly linked to changes in use intentions. First, we examined whether not previously using cannabis due to illegality, level of self-perceived fulfillment (flourishing), self-report of mental health disorders, age, gender, race, sexual orientation, Greek life affiliation, and sports participation were related to intentions to initiate cannabis use following legalization among cannabis-naïve college students. Second, we examined whether age of cannabis initiation, methods of use, level of self-perceived fulfillment (flourishing), self-report of mental health disorders, age, gender, race, sexual orientation, Greek life affiliation, and sports participation were related to intention to increase cannabis use following legalization among students with prior use.

METHODS

Transparency and Openness

Hypotheses and analyses, including specific predictors and outcomes, unless labeled exploratory, were pre-registered (https://osf.io/97gb2). We report how we determined our sample size, all data exclusions, and all measures in the study.

Participants and Procedures

The Missouri Assessment of College Health Behaviors (MACHB) survey is administered by Partners in Prevention (PIP), a coalition of 25 public and private colleges and universities within Missouri (Takenaka & Greenwood, 2022). This retrospective, self-report survey is emailed to undergraduate students at participating schools at the beginning of each spring semester. The number of students emailed at each school depends on the size of the institution, with 25% of students contacted at schools with more than 4,000 students, 1,000 students at schools with between 1,000-3,999 students, and all students at schools with fewer than 1,000 students. Data were collected via CampusLabs from 2007 until 2022 and via Qualtrics starting in 2022. The annual sample size varied, ranging between 11,178 in 2015 and 5,817 in 2023 (M_n = 9,225.91). PIP targets a representative, proportional sample across most Missouri institutions of higher education each year (see Wray et al., 2021 for more information).

Due to limited resources, recruitment efforts focused on initial recruitment of a random sample and not on ensuring that actual respondents were representative of the Missouri college student population. However, demographics of the 2023 survey were similar to publicly available information on the population of Missouri college students (U.S. Department of Education, 2023). Based on aggregate data, respondents to the 2023 MACHB survey were 58.1% female, 41.8% male, 80% White, 8.6% Black, 7.5% Asian, and 6.1% Hispanic. In comparison, respondents to the 2019 survey were 59% female, 40% male, 84% White, 9.9% Black, 5.3% Asian, and 4.6% Hispanic. According to the Integrated Postsecondary Education Data System (IPEDS) from the National Center for Education Statistics (NCES), in 2022, the student body of Missouri institutions participating in the MACHB survey was 58.1% female and 41.9% male, 63.9% White, 9.7% Black, 4.2% Asian, and 5.9% Hispanic (U.S. Department of Education, 2023). While this suggests that the MACHB may have oversampled White students, note that the IPEDS reports race and ethnicity as mutually exclusive, such that students who were

considered Hispanic were not considered White or other races, and included categories such as "two or more races" and "U.S. non-resident."

Descriptive analyses used data from the 2012-2013 school year through the 2022-2023 school year. Primary analyses regarding intentions to use cannabis following legalization used 2022-2023 school year data. Data collection extended from February 1, 2023 to March 18, 2023, while the legislation took effect on December 8th, 2022, the first legal cannabis sale occurred on February 3, 2023 (Ballentine, 2023).[1] We used all available data (total N= 5,817; n = 2,716 cannabis naïve; n = 1,591 with prior use), excluding participants (n = 1,399; prior cannabis use = 346; cannabis naïve = 460; no data on any cannabis use = 593) that elected not to respond to our outcome variables and graduate students (n = 101), due to inconsistent inclusion and our focus on undergraduate students. Cannabis naïve participants were majority White (78.3%), 21.7% were students of color, majority female (61.0%), 36.3% male, and 4.3 gender minorities, with a mean age of 20.17 (SD = 1.85). Cannabis using participants were majority White (80.7%), 19.3% were students of color, majority female (58.2%), 35.3% male, and 9.6 gender minorities, with a mean age of 20.69 (SD = 1.99).

Intention to change cannabis consumption. Participants who had ever used cannabis responded to a single item about their intention to change their cannabis use following legalization. Five response options were provided: "Much less", "A little less", "The same amount", "A little more", and "Much more".

Independent Variables

Binge drinking. Participants were asked, "Think over the past 30 days. How many times have you binge drank?" and defined binge drinking as: "Male - 5 or more drinks within a 2-hour period; Female - 4 or more drinks within a 2-hour period." Participants responded with a number between 0 and 30. Due to infrequent endorsement, responses were dichotomized to either no binge drinking (0) or any binge drinking (1) in the previous 30 days.

Alcohol use frequency. Participants were asked "Please indicate the number of days you drank in the past 30 days." Response options were "I did not drink in the past 30 days" (i.e., 0 days), each integer between 1 and 20 days, or "20 or more days," and this was treated continuously.

Cannabis use frequency. Participants were asked, "How many days have you used cannabis (any type) in the past 30 days?" Response options were, "I did not use cannabis in the past 30 days," each integer between 1 and 20 days, and "More than 20," and this was treated continuously.

Descriptive cannabis use norms. Participants were asked "How often do you think the typical student on your campus uses marijuana/cannabis?" Response options were, "Never," "1-6 times a year," "1-2 times a month," "1-2 times a week," "3 or more times a week," or "Daily."

Cannabis use motives. Participants were asked, "Which of the following are contributing factors to your decision to use marijuana/cannabis?" and checked all options, a total of 16 potential options, that applied (see Supplemental Table 3). Although people may use cannabis for different reasons, we were primarily interested in the overall strength of participants' motivation to use cannabis. For this reason, we calculated a sum of the number of endorsed motives (α = .68). The 16 items were derived from previously validated measures and the factors of cannabis use motives identified in their research. These factors are enhancement, conformity, expansion, coping, and social (Zvolensky et al., 2007), and medical, relatively low risk, boredom, and experimentation (Lee et al., 2009).

Cannabis-related consequences. Participants were asked, "How often in the past 12 months have you experienced the following as a result of using marijuana/cannabis?" Eight items included were: "Been arrested for DUI/DWI," "Felt in a fog, sluggish, tired, or dazed the morning after using," "Felt very sick to my stomach or thrown up," "Performed poorly on a test or assignment," "Missed class," "Attended class after using marijuana/cannabis," "Had a blackout after using marijuana/cannabis heavily (i.e. could not remember hours at a time)," and "Had trouble sleeping." Response options ranged from 0 = 0 times, 1 = 1 times, 2 = 2 times, 3 = 3-5 times, 4 = More than 5 times. Responses were summed to create a count variable representing total

[1]Over the period of data collection, only existing facilities licensed to sell cannabis for medical reasons were allowed to sell recreational cannabis and could only do so after converting their license.

consequences experienced (α = .67). Items were derived from the CORE institute's survey on college student alcohol and drug use (Presley et al., 1994).

Methods of cannabis use. Participants were asked, "When you have used marijuana/cannabis in the past 12 months, how often have you used in the following ways?" Methods included smoked, edible, vaporized, and concentrate. Response options ranged from 0 = "I did not use in the past year," to 5 = "Daily." Scores for each item were dichotomized to represent any usage of that method, then summed to create a count variable representing the number of different ways in which an individual consumed cannabis.

Reasons not to use. Participants that reported no previous cannabis use were asked, "Which of the following are reasons that you choose not to use cannabis?" Given our focus on legalization, we only examined the option, "Because it is against the law/policy." Responses were dichotomous, indicating endorsement (1) or non-endorsement (0).

Flourishing. The flourishing scale (Diener et al., 2010) is an 8-item measure indicating self-perceived fulfillment (e.g., "My social relationships are supportive and rewarding"). Responses were measured on a 7-point Likert scale ranging from "Strongly disagree" to "Strongly agree" and summed to create a minimum score of 8 and maximum of 56 (α = .92).

Past year mental health disorders. Participants were asked to check all mental health disorders they had experienced in the previous 12 months that had been diagnosed by a mental health or medical professional. Diagnoses with an endorsement rate greater than 5% were included in analyses as dichotomous variables, indicating diagnosis (1) or non-diagnosis (0). Included disorders were depression disorders, eating disorders, sleeping disorders, post-traumatic stress disorder (PTSD), anxiety disorders, and panic disorders.

Age. Age was assessed with response options of integers from 18 through 24 and a final category of 25 or older. Two variables were created: one, a dichotomous variable representing below legal age (i.e., 20 or younger) or being of legal age (i.e., 21 or older), and a second continuous age variable.

Year in school. Response options ranged from 1 (Freshman) to 5 (Five or more years, i.e., super senior).

Sexual orientation. Sexual orientation was assessed with nine response options: bisexual/biromantic, gay, lesbian, straight/heterosexual, queer, questioning, asexual/aromantic, pansexual, and other (please specify). We generated dichotomous variables based on response rates and related identities: gay and lesbian; bisexual; queer (queer, questioning, asexual/aromantic, or pansexual); and straight/heterosexual.

Gender. Participants could check all that applied of five response options: woman, man, transgender, genderqueer/non-conforming (e.g., genderfluid, third-gender, agender), and self-identify. Due to limited endorsement of gender minority identities, we created dummy-coded dichotomous variables for: women, men, and gender minority (e.g., transgender, genderqueer).

Race and ethnicity. Due to the university's ethics board's constraints, we were only provided with whether a student identified as a person of color (1) or White (0).

Extracurricular activities. Students were asked, "In which of these campus activities or organizations are you currently involved? (Check all that apply)." Greek-life affiliation and sports participation were coded as dichotomous variables, indicating involvement (1) or non-involvement (0).

Data Analysis

Descriptive statistics were calculated using IBM SPSS Satistics (Version 28.0), all analyses were conducted in RStudio 4.2.2 (R Core Team, 2022). Multilevel models accounted for the nested structure of the data (i.e., students within schools). We used multilevel logistic models to predict intentions to initiate cannabis use using the "lme4" package (Bates et al., 2015) and multilevel ordinal models to predict intentions to change consumption using the "ordinal" package (Christensen, 2023). We estimated two separate models for each outcome, one examining our primary hypotheses and one examining our secondary hypotheses. In the multilevel logistic models estimating effects on intention to initiate cannabis the primary predictors were: greater perceived descriptive norms of cannabis use, endorsing binge drinking status, greater alcohol use frequency in the past 30 days, and legal age status (i.e., 21 or older). The secondary predictors were endorsing, "Because it is against the

law/policy" as a reason for not using cannabis, score on the Flourishing Scale, mental health diagnoses, age, gender, race, sexual orientation, greek life affiliation, and sports participation. In the multilevel ordinal model estimating effects on intention to change cannabis use, the primary predictors were greater frequency of cannabis use in the past 30 days, greater number of cannabis use motives endorsed, greater perceived descriptive norms of cannabis use, endorsing binge drinking status, greater alcohol frequency in the past 30 days, and cannabis related consequences. The secondary predictors were age of first cannabis use, methods of cannabis use, score on the Flourishing Scale, mental health diagnoses, age, gender, race, sexual orientation, greek life affiliation, and sports participation. In primary models, we considered $p \leq .05$ significant. Given less available evidence supporting secondary hypotheses, we considered $p \leq .01$ significant in secondary models to avoid Type 1 errors. Models were estimated using restricted maximum likelihood (REML). To examine the possible impact of missing data, models were repeated using full information maximum likelihood estimation in Mplus 8.7 (Muthén & Muthén, 1998-2023). As results did not meaningfully differ, we present findings from REML models. Parameter estimates were exponentiated to calculate adjusted odds ratios (AOR).

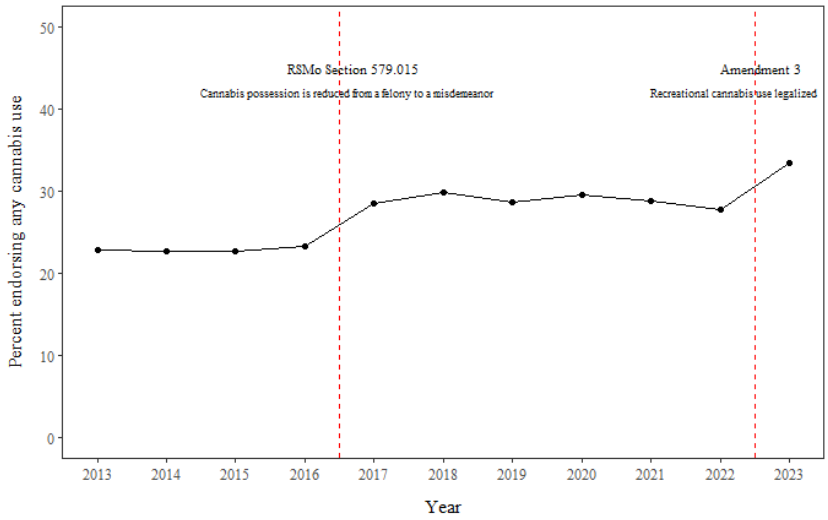
Intraclass correlations (*ICC*s; i.e., a ratio of between- and within-school variance) were low across each model (*ICC* = .01-.05), indicating minimal variance between schools. Nevertheless, we estimated random intercepts and slopes, as research indicates that *ICC*s as low as .01 can increase Type 1 error in nested data if nesting is not accounted for (Musca et al., 2011). For all models, we retained only significant random slopes. This led to the inclusion of random slopes in the secondary model predicting intention to increase use for gender identity, sexual orientation, race, and extracurricular participation. In all other models, results did not differ based on random slopes inclusion.

RESULTS

Descriptive Statistics (Trends Between 2013-2023)

To contextualize results for intentions to use cannabis following legalization, we present overall trends in cannabis use in the MACHB data going back to 2013. Past-year cannabis use by Missouri college students increased from 22.9% of students in 2013 to 34.5% in 2023 (Figure 1). Cannabis use prevalence increased most between 2016 and 2017 (Δ = 5.2%) and between 2022 and 2023 (Δ = 6.7%). Perceived descriptive norms generally increased from 2013-2023 (Supplemental Table 4). Data on the co-use of other substances with cannabis was collected beginning in 2020 (Supplemental Table 5). The most common substance that students reported co-using with cannabis was alcohol (63.8% endorsed).

Figure 1. *Past-Year Cannabis Use Prevalence in Missouri College Students from 2013 to 2023*



Note. Important dates in Missouri cannabis legal policy are presented as red dashed vertical lines.

Descriptive Statistics (Year 2023)

About one-third of the sample (33.4%, *n* = 1,591) endorsed past-year cannabis use, of which, 5.3% reported near daily use (*n* = 251). Past-year cannabis use frequencies were largely similar across demographic groups, although gender minority (e.g., 10.6%, *n* = 30 using daily), compared to cisgender (e.g., 4.8-5.5%, *n* = 231 using daily), and students over 21 (e.g., 7.3%, *n* = 143 using daily), compared to underage (e.g., 3.8%, *n* = 143 using daily) appeared to use more frequently (Supplemental Table 1). Among people who endorsed past-year cannabis use, about a third (30.8%, *n* = 485) did not use in the past month, about half (52.4% *n* = 826) used between 1-20 days (*M* = 5.56, *SD* = 5.55), and 16.8% (*n* = 265) used more than 20 days. Supplemental Table 2 shows past-month cannabis use frequencies by race, gender, and legal age status. The most endorsed cannabis motives were to relax (78.1%; *n* = 1,229) and to have fun with friends (59.7%; *n* = 939; Supplemental Table 3).

Among individuals who did not use cannabis, 9.9% (*n* = 269) endorsed intending to try cannabis following legalization, while 90.1% (*n* = 2,447) endorsed no intent. Intent frequency was similar across demographic groups (Table 1), though a higher proportion of gender minority students (27%, *n* = 31), when compared to cisgender, reported intent to initiate use

Table 1. *Endorsed Intentions to Initiate or Change Cannabis Use Following Legalization*

	Intention to initiate cannabis use *N (%)*		**Intention to change cannabis use** *N (%)*				
	Yes	**No**	**Much less**	**A little less**	**The same amount**	**A little more**	**Much more**
Total	269 (9.9)	2,447 (90.1)	75 (5.0)	51 (3.4)	1,042 (69.6)	273 (18.2)	57 (3.8)
Race							
Student of color	54 (9.3)	529 (90.7)	13 (4.6)	11 (3.9)	197 (70.1)	48 (17.1)	12 (4.3)
Not a student of color	212 (10.1)	1,896 (89.9)	60 (5.0)	39 (3.2)	842 (69.6)	224 (18.5)	45 (3.7)
Gender							
Male	99 (10.1)	882 (89.9)	23 (4.4)	20 (3.8)	371 (70.9)	85 (16.3)	24 (4.6)
Female	151 (9.2)	1,497 (90.8)	47 (5.4)	25 (2.9)	604 (69.6)	163 (18.8)	29 (3.3)
Gender minority	31 (27.0)	84 (73.0)	8 (5.6)	7 (4.9)	90 (62.5)	34 (23.6)	5 (3.5)
Legal age status							
Under 21	180 (10.1)	1,606 (89.9)	42 (5.4)	24 (3.1	542 (69.3)	148 (8.9)	26 (3.3)
Over 21	89 (9.6)	841 (90.4)	33 (4.6)	27 (3.8)	500 (69.8)	125 (17.5)	31 (4.3)

Note. Gender categories (female, male, gender minority) were coded as binary variables (yes/no) for analyses, and participants who endorsed multiple categories could be included in both (e.g., female and gender minority).

Among those who previously used cannabis, the majority (69.6%; *n* = 1,042) intended to continue using the same amount, 8.4% (*n* = 126) intended to use less, and 22% (*n* = 330) intended to use more in response to legalization. In contrast, students were also asked about their general intentions to change cannabis use. Of those with past-year cannabis use, 30.5% (*n* = 460) reported that they were either currently trying to use less cannabis (16.8%; *n* = 253), were ready to try using less cannabis (2.8%; n=43), or were thinking about trying to use less cannabis (10.8%; *n* = 164). The remainder, 69.5% (*n* = 1,050), reported that they saw no need to change their cannabis use. The number of participants reporting no need to change their cannabis use has increased from 59% in 2019, 61% in 2020, 64% in 2021, and 66% in 2022, to the present 69.6%.

Regression Analyses

Intention to initiate cannabis use. In the primary model (*n* = 2,716; Table 2), none of the predictors (perceived cannabis norms, binge drinking, alcohol use frequency, legal age) were associated with the intention to initiate cannabis use. In the secondary model (Table 3), being gay or lesbian (*AOR* = 3.03; CI = [1.72, 5.34]), bisexual (*AOR* = 3.52; CI = [2.41, 5.14]), or queer (*AOR* = 2.51; CI=[1.71, 3.69]) were associated with increased odds of intended initiation relative to being straight/heterosexual. Greater flourishing (*AOR* = 0.98; CI = [0.96, 0.99]) was associated with decreased odds of intended initiation. Other predictors were not significant.

Table 2. *Logistic Multilevel Regression Showing the Associations Between Primary Predictors and the Intention to Initiate Cannabis Use Following Legalization*

			Intention to initiate cannabis use		
	M (SD)	*N (%)*	*Odds Ratios*	*CI*	*p*
Cannabis descriptive norms	2.02 (1.33)	--	1.07	0.96 – 1.18	.237
Binge drinking	--	373 (14.3)[a]	1.34	0.89 – 2.03	.163
Alcohol frequency	1.43 (2.93)	--	1.04	0.99 – 1.09	.149
Legal age status	--	930 (34.2) [b]	1.08	0.81 – 1.45	.587

Note: CI = 95% Confidence Intervals; [a] *N (%)* of those meeting criteria for binge drinking; [b] *N* (%) of those meeting legal age status.

Table 3. *Logistic Multilevel Regression Showing the Associations Between Secondary Predictors and the Intention to Initiate Cannabis Use Following Legalization*

			Intention to initiate cannabis use		
	M (SD)	*N (%)*	*Odds Ratios*	*CI*	*p*
Cannabis' legal status	--	745 (28.1)[a]	0.82	0.59 – 1.15	.253
Flourishing	44.73 (9.13)	--	**0.98**	**0.96 – 0.99**	**.006**
Depression disorders	--	375 (14.2)	0.94	0.60 – 1.48	.794
Eating disorders	--	87 (3.3)	1.31	0.64 – 2.69	.457
Sleep disorders	--	117 (4.4)	0.78	0.38 – 1.60	.501
Anxiety disorders	--	656 (24.9)	1.22	0.83 – 1.80	.300

PTSD	--	98 (3.7)	1.07	0.53 – 2.17	.857
Panic disorders	--	113 (4.3)	0.78	0.39 – 1.54	.474
Age	20.17 (1.85)	--	1.03	0.95 – 1.12	.432
Female	--	1,648 (61.0)	0.74	0.54 – 1.01	.060
Gender minority	--	115 (4.3)	0.89	0.50 – 1.58	.685
Student of color	--	583 (21.7)	0.94	0.65 – 1.35	.735
Lesbian or Gay	--	91 (3.4)	**3.03**	**1.72 – 5.34**	**<.001**
Bisexual	--	223 (8.4)	**3.52**	**2.41 – 5.14**	**<.001**
Queer	--	282 (10.6)	**2.51**	**1.71 – 3.69**	**<.001**
Greek affiliation	--	276 (10.2)	1.44	0.88 – 2.38	.151
Athletic involvement	--	541 (20.3)	0.89	0.60 – 1.31	.546

Note. CI = 95% Confidence Intervals; *p*-values of less than .01 are considered significant to account for the more exploratory nature of the secondary analyses; [a] *N*(%) are not using cannabis due to its legal status.

Intention to increase cannabis use. In the primary model (*n* = 1,591; Table 4), endorsing more cannabis motives was associated with greater odds of intending to increase cannabis use (*AOR* = 1.13; CI = [1.08, 1.19]), and endorsing more consequences was associated with lower odds of intending to increase cannabis use (*AOR* = 0.91; CI = [0.89, 0.94]). In the secondary model (Table 5), age of first cannabis use (*AOR* = 1.09; CI = [1.03, 1.15]) and being gay or lesbian (*AOR* = 2.19; CI = [1.27, 3.76]) were associated with greater odds of intending to increase cannabis use. Other predictors were not significant.

Table 4. *Ordinal Multilevel Regression Showing the Associations Between Primary Predictors and the Intention to Increase Cannabis Use Following Legalization*

	Intention to increase cannabis use				
	M (SD)	*N (%)*	*Odds Ratios*	*CI*	*p*
Binge drinking	--	829 (52.1)[a]	0.93	0.71 – 1.21	.575
Cannabis descriptive norms	2.49 (1.16)	--	0.98	0.89 – 1.09	.732
Alcohol frequency	4.83 (4.61)	--	1.01	0.98 – 1.04	.576
Cannabis frequency	6.45 (8.06)	--	0.99	0.98 – 1.01	.385
Cannabis motives	5.13 (2.89)	--	**1.13**	**1.08 – 1.19**	**<.001**
Cannabis consequences	2.73 (4.36)	--	**0.91**	**0.89 – 0.94**	**<.001**

Note. CI = 95% Confidence Intervals; [a] *N*(%) of those meeting criteria for binge drinking.

Table 5. *Ordinal Multilevel Regression Showing the Associations Between Secondary Predictors and the Intention to Increase Cannabis Use Following Legalization*

			Intention to increase cannabis use		
	M (SD)	*N (%)*	*Odds Ratios*	*CI*	*p*
Age of first cannabis use	17.61 (2.29)	--	**1.09**	**1.03 – 1.15**	**.003**
Cannabis use methods	2.66 (1.14)	--	1.00	0.89 – 1.12	.988
Depression disorders	--	453 (29.0)	0.97	0.70 – 1.34	.856
Eating disorders	--	118 (7.5)	0.92	0.58 – 1.46	.721
Sleep disorders	--	134 (8.6)	0.82	0.52 – 1.28	.376
Anxiety disorders	--	629 (40.2)	1.29	0.96 – 1.73	.091
PTSD	--	136 (8.7)	0.67	0.43 – 1.05	.083
Panic disorders	--	145 (9.3)	1.00	0.64 – 1.55	.996
Flourishing	43.1 (9.15)	--	1.00	0.99 – 1.02	.767
Age	20.69 (1.99)	--	0.99	0.93 – 1.06	.769
Female	--	920 (58.2)	0.80	0.56 – 1.14	.217
Gender minority	--	152 (9.6)	0.64	0.37 – 1.11	.111
Student of color	--	305 (19.3)	0.96	0.68 – 1.37	.825
Lesbian or gay	--	120 (7.6)	**2.19**	**1.27 – 3.76**	**.005**
Bisexual	--	331 (21.1)	1.47	0.96 – 2.23	.074
Queer	--	335 (21.3)	1.68	1.13 – 2.51	.011
Greek affiliation	--	312 (19.6)	1.22	0.84 – 1.79	.298
Athletic involvement	--	306 (19.5)	0.99	0.70 – 1.42	.976

Note. CI = 95% Confidence Intervals; *p*-values of less than .01 are considered significant to account for the more exploratory nature of the secondary analyses.

DISCUSSION

The present study extends research on factors associated with intentions to initiate or increase cannabis use following recreational legalization. Descriptive findings indicate that cannabis use prevalence among a representative sample of Missouri college students increased 66.23% from 2013 to 2023 (Figure 1). Nearly 10% of cannabis naïve students reported intentions to initiate use following legalization, particularly students who identified as sexual minorities or were lower in flourishing. Additionally, 22% of students with prior cannabis use reported intending to increase their use. Greater intentions to increase use were reported among those with more cannabis use motives, fewer cannabis consequences, older age of first cannabis use, and a gay or lesbian sexual orientation.

Regression results indicated that sexual minority students were significantly more likely to intend to initiate use following legalization relative to straight students, and gay and lesbian and queer students were more likely than other students to intend to increase their cannabis use following legalization. While some previous

research has indicated that young adults' actual changes in cannabis use are not associated with sexual orientation (Bae & Kerr, 2020) and that the intentions to use of sexual minority young adults are similar to those of heterosexual individuals (Cui et al., 2023), others have indicated that some sexual minority identities use cannabis more frequently in recreational states (Parnes et al., 2019). Thus, this study adds to a somewhat mixed literature on the impact of legalization amongst sexual minority students.

The regression results for sexual minority status may potentially relate to the fact that our sample was drawn from Missouri, a state with historically lower support of and greater discrimination toward sexual minorities (Henrion, 2016; McElroy et al., 2015; Watson et al., 2021). Experiencing greater sexual minority-related stress (e.g., stigma, discrimination) is associated with cannabis and other substance use (Goldbach et al., 2015; Mereish et al., 2023), but sexual minorities living in less supportive places may also be less likely to engage in illicit activities due to disproportionate police contact (Rice et al., 2021; Schwartz et al., 2022). Thus, by reducing the possibility of legal consequences, legalization in a state like Missouri may result in a greater increase in intentions amongst sexual minority students than in other states. If accurate, the current findings may have implications for other states hesitant to legalize cannabis, as many of these states have lower support of sexual minority status (e.g., as indicated by lower support for gay marriage; Spetz et al., 2019). Particularly given the large effect sizes (*AOR* of 1.68 – 3.03), indicating not just a significant effect but an increased likelihood as much as three times greater than the usual odds, it is important for future research to better explicate the relationship between sexual and gender minority status with changes in cannabis use, and the more distal effects that changes in use have for these populations. Further, as more states legalize, intervention and prevention efforts in these states should ensure that they tailor content for sexual minority populations (e.g., addressing sexual minority-related discrimination and stress).

Cannabis motives are established predictors of greater frequency and quantity of cannabis consumption (e.g., Votaw & Witkiewitz, 2021). Our findings from regression models extend prior research, suggesting that having more reasons for using cannabis, regardless of the specific motives, is associated with greater intentions to increase use following legalization. Legalization-related increased acceptability and availability (Wallace et al., 2020) may ultimately promote increased use among individuals with more motivations to use cannabis. Although we focused on the overall number of motives endorsed, future research should differentiate the associations of unique motives and intentions to escalate use, particularly given prior research showing some motives (e.g., coping motives) are more strongly linked to consequences (Espinosa et al., 2023). Motivations for use can be modified and, as legalization continues, it may be particularly valuable for intervention efforts to focus on helping people find alternative positive activities to meet their needs (Correia et al., 2010). Given the effect size for cannabis motives (*AOR* = 1.13) indicating an increased likelihood of 13% relative to usual odds, interventions focused on cannabis motives may be advantaged by expanding to target other mechanisms in conjunction to motives.

Findings from regression models indicate that participants who endorsed more negative consequences were more likely to report planning to reduce their use. This potentially suggests that students who reported more consequences had some awareness that they might benefit from reducing their use, which may have had a particular link to legalization. This is a potentially encouraging finding for CUD prevention efforts, as it indicates that undergraduates experiencing greater harms from cannabis, which may reflect increased risk for CUD, do not see legalization as carte blanche to increase use. Even though legalization reduces the risk of certain consequences (e.g., misdemeanor charges for possession), others persist (e.g., missing class). Additionally, schools may continue to enforce policies against cannabis use on campus. Nevertheless, with the reduction in legal consequences, legalization may offer opportunities for prevention efforts to focus conversations around more personal experiences of both positives and negatives of use, which may ultimately be more effective than the specter of legal consequences (Urbanoski, 2010).

Descriptively, participants who reported an intention to change their cannabis use were largely more likely to intend to increase their use

compared to decrease (22% vs 8.4%). However, participants who intended to increase their use largely indicated they only intended to increase their use "a little" compared to "a lot" (18.2% vs 3.8%), while those who intended to decrease their use generally intended to use "much less" compared to "a little less" (5.0% vs 3.4%). Given the response scale, understanding exactly what these categories translate to in daily life and for each participant is unclear. However, nearly three times the number of people intended to increase their consumption, an additional 13.6%, which matches the rate of cannabis naïve people intending to initiate cannabis use. Future research might be well suited to explore profiles of cannabis use following legalization to better understand which factors explain different approaches to use change.

In contrast to previous research, regression results suggest that cannabis use frequency was not associated with intending to increase use (Cohn et al., 2017; Cui et al., 2023; Kerr et al., 2017; Wallace et al., 2020). Past research has had mixed findings on changes in use frequency following legalization (Bae & Kerr, 2020; Cohn et al., 2017; Kerr, Bae, Phibbs, et al., 2018; Kerr et al., 2017; Kerr, Ye, et al., 2018; Parnes, Smith, et al., 2018; Sandhu et al., 2019), and many students in our study intended to continue using cannabis at the same frequency. Combined, our findings suggest that many students who use cannabis may already be using at their desired use frequency, independent of legalization.

Older age of first cannabis use was associated with intentions to increase use in regression models. On the surface, this might seem to contradict findings that earlier first use is associated with more frequent use, consequences, and CUD (Han & Palamar, 2018; Millar et al., 2021; Richmond-Rakerd et al., 2017). Perhaps people who started at an older age are still considering their preferred use frequency, whereas people who started younger may have more experience and become more set in their use patterns. In contrast, being of legal age was a non-significant predictor of cannabis use intentions. Paired with our findings also indicating that endorsing legality as a reason to not use was not associated with an increased likelihood of intending to initiate cannabis use, it is possible that those who have not begun cannabis use by 21 have other reasons for that choice.

Contrary to hypotheses, although consistent with Cohn et al., (2017), binge drinking and alcohol use frequency were unrelated to intentions around cannabis use. Though alcohol-cannabis co-use is common and associated with problems and consequences (Subbaraman & Kerr, 2015), the legal status of cannabis may not be a major factor for why some people drink alcohol but do not use cannabis. More research is needed to understand what leads some young adults to use both substances versus only one. Perceived cannabis descriptive norms were also not associated with intentions, diverging from the findings of Cui et al. (2023). This may, in part, be due to the fact that we only had a single item gauging perceptions of typical student cannabis use. More proximal reference groups (e.g., friend rather than typical student) may have been more informative (Napper et al., 2016). A more fine-grained assessment might help elucidate associations between norms and cannabis intentions. Additionally, not using cannabis due to its illegal status was not a significant predictor of initiating cannabis use following legalization. It's possible that this is a result of non-users having a constellation of reasons, rather than a singular reason, for avoiding use. For example, they may also be worried about negative consequences on their professional or academic work. Thus, even with legalization imminent, they may have no plans to initiate cannabis use.

Strengths and Limitations

Missouri is part of a region historically hesitant toward cannabis legalization (Spetz et al., 2019) and, thus, the results, from a large representative student sample recruited from the breadth of Missouri institutions of higher education, may hold important insights for the future as legalization continues. Data collection was also timely, occurring immediately preceding and concurrent to the first recreational cannabis sales in Missouri and prior to wide availability of recreational cannabis.

There were also limitations. First, our data are cross-sectional. While this limits the ability to determine direction of effect for some variables (e.g., cannabis use motives), for others, such as sexual orientation, this limitation is of lesser importance. Second, the MACHB survey was initially designed to inform higher education

policy, and not for research purposes. However, available data suggest that the obtained sample was representative in terms of race, ethnicity, and sex when compared to the population of Missouri college students. Third, due to limits set by the IRB, specific racial and ethnic demographic information was unavailable (except in aggregate), and we were unable to assess differences across these groups, as was preregistered. As noted by Spetz and colleagues (2019), there are clear racial and ethnic differences between states with earlier legalization and those with later legalization, future research should examine this more thoroughly. While the political climate of Missouri as a largely conservative state with two mid-major democratic leaning cities makes these findings more generalizable to similar states, they may also be less generalizable to states or countries with dissimilar political environments. Due to limited endorsement rates, we collapsed pansexual, asexual, queer, and questioning identities into one category ("queer"), despite known differences in substance use among these identities (Scroggs et al., 2023).

Fourth, the survey design artificially constrained age above 24 to "25 and older," and cannabis and alcohol use frequency greater than 19 days to "20 or more days." These ceilings may have limited our ability to detect differences at the higher end of these scales, which limits generalizability for those groups. Fifth, while the items that make up the cannabis motives and consequences measures in the present study are derived from scales that have undergone validation (e.g., Lee et al., 2009), as constructed, the variables used in our analyses have not undergone psychometric testing and validation. Our purpose, rather than to measure a shared construct, was to create an inventory of possible reasons one might use cannabis. Given their reliability in the current sample was somewhat low, if one wanted to draw conclusions about constellations of motives, further research would require either validated measures to assess these constructs or a focus on the psychometric properties of the included items.

Sixth, given the cross-sectional nature of the data and the timing of data collection, we cannot determine the causality of legalization in behavior change. Likewise, it is possible that participants' answers about changing their cannabis use may have reflected reasons for behavior change beyond specifically those related to legalization. For example, it is developmentally normative for a portion of students to initiate or increase cannabis use during this time regardless of reason. It is possible that some participants reported their general intentions to use and not those specifically tied to legalization. Reducing, but not removing, this concern, an additional item included in the survey asked about general intention to change cannabis use among those who reported cannabis use. Among cannabis-using participants, 30.5% of participants reported either considering, planning, or having reduced their cannabis use, only 8.4% of the sample reported planning to use cannabis less due to legalization. Given the distinct difference in response rate, this suggests that participants reported on their legalization-specific intentions. Nevertheless, we cannot rule out the possibility that some participants, especially those who were cannabis-naïve, may have reported on their general intentions to use cannabis. Additionally, while intentions are a critical component of behavior and behavior change, we did not assess actual changes in cannabis use following legalization. Future research will be needed to fully explicate the relationship of the variables in this study with actual changes in cannabis use for Missouri college students. Finally, there was a large spike in cannabis prevalence in 2023. While recreational cannabis was not widely available during the 2023 survey, it is possible that the anticipation of legalization prompted an increase in cannabis use or willingness to disclose use. However, this large shift is also congruent with the general trend of increasing cannabis use (Hasin, 2018; SAMSHA, 2023). Further, a sizable minority of respondents reported intentions to initiate use or increase their use, suggesting that we captured a meaningful percentage of students who were contemplating, but had not yet, changed their cannabis use in response to legalization.

Conclusion

With the legalization of recreational cannabis, a meaningful percentage of Missouri college students reported an interest in increasing or initiating cannabis use. Multiple theory-driven factors were associated with either intending to initiate or increase cannabis use in the wake of

legalization. With expanding legalization, future research should seek to better understand how changing normative perceptions shift cannabis expectancies and motivations for use. Given that sexual orientation was associated with cannabis intentions, future work should prioritize understanding mechanisms driving the observed disparities. While our study focused on cannabis use intentions, future research is necessary to determine if and how these intentions translate to actual changes in cannabis use. As legalization continues, additional research is needed to determine the impacts in the lingering, "hesitant" states, inform public policy, and improve public health.

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