Attitudes about and correlates of cannabis legalization policy among U.S. young adults

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Abstract

Objective: Cannabis policies are rapidly evolving in the US. This study's purpose was to examine relationships between cannabis harm perceptions, substance use, and demographic characteristics on attitudes toward cannabis policies.

Participants: Participants were 619 undergraduate students in a Mid-Atlantic state where cannabis use was illegal.

Methods: In 2016, participants completed a cross-sectional survey. Multinomial logistic regressions tested associations between attitudes toward cannabis policies (recreational cannabis use, use in private, or public) while controlling for harm perceptions, substance use, and demographics.

Results: The majority (64%) of participants supported recreational cannabis legalization, while 78% supported private and 29% supported public use. Perceiving cannabis as less harmful and current cannabis use were positively associated with supporting all three cannabis policies.

Conclusions: Results highlight diversity of young adults' opinions regarding specific cannabis policies and underscore relationships between cannabis use behaviors, harm perceptions, and support for legalization that may inform policy making and prevention efforts.

Keywords

cannabis; marijuana; policy; young adults

Introduction

Cannabis policies are rapidly evolving in the United States (US). The federal government maintains an illegal stance on cannabis, meaning the use, possession, cultivation, and distribution is illegal for anyone of any age. However, since 1996, thirty-two US states and Washington, DC have legalized cannabis for medicinal purposes as of fall 2018, wherein people with qualifying medical ailments can possess and use cannabis.[1] Further, since 2012,

ten US states and Washington, DC have legalized cannabis for recreational purposes as of November 2018.[1] Policies which legalize the use of cannabis for recreational purposes allow the possession and use of cannabis for anyone over the age of 21.[2] Additionally, over the past four decades, twenty-two US states have decriminalized cannabis,[3] resulting in a minor offense for the possession of cannabis as opposed to a misdemeanor or felony. These shifts in US state cannabis policies are occurring due to myriad factors including changes in cannabis use behavior, harm perceptions, and public opinion regarding cannabis use.

According to data from the 2016 US National Survey on Drug Use and Health (NSDUH), past month cannabis use among adults (aged 18 and older) was 8.4% in 2015, which increased to 9.1% in 2016.[4] Young adults aged 18–25 used cannabis more than any other age group with past month cannabis use estimates increasing slightly from 19.8% in 2015 to 20.8% in 2016.[4] This increase in cannabis use coincides with decreased harm perceptions of cannabis.[4–7] Findings from the Monitoring the Future study, a nationally representative survey of US adolescents in grades 8–12, indicated that between 1975 and 1979, perceived risk of regular cannabis use decreased while past year cannabis use increased and between 1980 and 1992, perceived risk of regular cannabis use increased and past year cannabis use decreased.[5] More recent nationally representative data support a negative relationship between cannabis use patterns and harm perceptions among people aged 12 and older between 2012 and 2014.[6] Results from a cross-sectional survey of 10,000 US young adults indicated that past 30-day cannabis use significantly predicted more favorable perceptions about cannabis.[7] In sum, previous research has indicated a relationship between frequency of cannabis use and cannabis harm perceptions, such that when cannabis use increased, cannabis was perceived as less harmful.[4–7]

Along with this overall increase in cannabis use, support for the legalization of cannabis for recreational purposes increased from 31% in 2000 to 60% in 2016, according to a Gallup, Inc. poll conducted among US adults.[8] In this same sample, over three-quarters of young adults (77%) were supportive of recreational cannabis use.[8] Results from other studies of cannabis policy attitudes suggested wide approval for legalization among young adults despite their differences in US cannabis policy environments (e.g., living in an illegal policy environment vs. a legalized policy environment)[9,10] and cannabis use status.[11] Support for cannabis legalization is growing in the US, while beliefs and attitudes about cannabis are becoming more favorable, and cannabis use is increasing among young adults.

Although previous published work has addressed general opinions (legal vs. illegal) about cannabis legalization among young adults,[11] no known studies explore perceptions of cannabis use in public (e.g., hotels, banks, parks, city sidewalks) or private spaces (e.g., in cars, homes, backyards). This is particularly relevant to the current cannabis policy landscape as state policies on the legalization of cannabis for medicinal or recreational purposes primarily specify that cannabis may only be used privately, but there is some indication of pressure from industry and other sources to allow for cannabis use exceptions for specific indoor or public (i.e., "business") settings.[12] For example, in Denver, CO, Measure 300 (approved in 2016) allows for recreational cannabis use (including smoking and vaping) in approved "designated consumption areas" within existing businesses or as part of a "special event".[13] Considering most cannabis policies for recreational use in the US

have been passed by public ballot measures (excluding Vermont[14]), research to understand correlates of positive and negative attitudes towards public and private cannabis use may be useful in understanding changes in cannabis policy.

Cannabis use is increasing in the US and public opinion and harm perceptions regarding cannabis use have become more positive.[4–7] These changes have been associated with implementation of less restrictive cannabis policies.[15] Missing from the literature has been direct measurement of attitudes toward specific cannabis policies (beyond legal vs. illegal) and their correlates, especially among young adults. The purpose of this study was to examine relationships between cannabis harm perceptions, substance use (cannabis, tobacco, and alcohol), and demographic characteristics on attitudes of specific cannabis policies among young adult undergraduates, a population at high risk for cannabis use. We hypothesized that cannabis use and low perceptions of cannabis harm would be associated with policies in favor of cannabis legalization.

Methods

Study design and participants

During the 2016 fall semester, undergraduate students were recruited to participate via the university's online research management system (SONA) at a mid-Atlantic US university (Virginia) where recreational cannabis use in any form was illegal. SONA is an online research study system developed specifically for administering research studies which recruit undergraduate students (https://www.sona-systems.com/default.aspx). SONA allows researchers to post their research studies to the website, and undergraduate students can sign up to participate. This study was deemed exempt by the university's institutional review board due to the scope of measures and method of data collection that never linked survey responses to participant names. Inclusion criteria included current enrollment as an undergraduate student and at least 18 years old. Participants signed up for the study on SONA and clicked on a link which directed them to the study survey webpage. After viewing study information and confirming eligibility, participants completed all measures. After, participants were directed to a separate webpage that was not linked to the survey to leave their name/contact information to receive research credit as compensation. A total of 687 participants were eligible to complete the survey, yet 68 participants did not complete the survey in its entirety and were subsequently removed from the dataset. Of the 68 cases that were removed from the final dataset, 41 had no data at all and 27 had some demographic data. Of the cases with some demographic data (for age n = 27; for gender n = 25; for grades n = 21), most were 19 years or older (55.6%), had grades of mostly B's or lower (76.2%), and most identified as non-Hispanic White (40.7%), followed by non-Hispanic Black (33.3%), Asian (14.8%), and Hispanic/Other (11.1%). There were no unadjusted differences in these sample characteristics between participants with complete and incomplete data. The final sample included 619 participants with complete data.

Measures

Attitudes towards cannabis policy.—Three questions were asked about attitudes towards cannabis policy including the legalization of recreational cannabis use specifically

as well as policy toward general cannabis use (not specified as recreational or medicinal) in private and public settings.[16] These questions have been used in at least one previous study ([16]), and the first question was adapted for the current study to clarify that the question does not ask about medical marijuana. The first question asked "[T]here has been a great deal of public debate about whether marijuana use should be legal. Not counting 'medical marijuana' (with a doctor's prescription), which of the following policies would you favor?" The response options included "Using marijuana should be entirely legal", "It should be a minor violation – like a parking ticket – but not a crime", "It should be a crime", and "Don't know".[16] Support for policy prohibiting cannabis use in private and public settings was measured by asking "Do you think that people (who are 18 or older) should be prohibited by law from doing each of the following?": "Smoking marijuana (pot, weed) in private?" and "Smoking marijuana in public places?"[16] Response options included "No", "Not Sure", and "Yes". Responding "No" was characterized as supporting either private or public cannabis use.

Perceived harm of cannabis.—Each participant was asked "How harmful do you think that the following products are to your health?" for six different methods of cannabis use with a 7-point anchored Likert scale from "Not harmful at all" (1) to "Extremely harmful" (7) including a "Don't know" option (8) that was set to missing. This measure was adapted from a previous study ([7]) to probe for harm perceptions of more types of cannabis administration methods. A dichotomous perceived harm variable (low/high) was created by combining the response options from the three combustible marijuana products assessed, "Marijuana joint", "Marijuana used in a bowl or pipe", and "Marijuana used in a bong or waterpipe", as combustible use of marijuana is the most popular mechanism of use across studies.[7] The Cronbach's alpha for these three items was 0.97. If a participant selected "Somewhat harmful" (5), "Very harmful" (6), or "Extremely harmful" (7) for any of these three products, they were considered to have high perceived harm of cannabis use.

Current substance use.—Lifetime (yes/no), past 12-month (number of days), past 30-day (number of days) of cannabis was assessed by adapting questions from the Monitoring the Future questionnaire[17] and the NSDUH.[18] Participants who said "Yes" to ever, even once, using marijuana or hashish and had used marijuana at least one day in the last 12 months were asked "On how many days have you used marijuana (grass, pot, weed) or hashish (hash, hash oil) during the last 30 days?" Students who responded with at least one day to this question were considered to be current, or past 30-day, cannabis users.[5] Lifetime (yes/no) and past 30-day alcohol use was determined by adapting questions from the NSDUH.[18] Among those who reported ever alcohol use, participants were asked "Have you had any type of alcoholic beverage in the past 30 days?" Participants who responded with "Yes" were current alcohol users.[4] Similarly, lifetime and past 30-day use of various tobacco products including cigarette smoking was assessed using items from another young adult-focused cohort study (Truth Initiative Young Adult Cohort).[19,20] Among those who reported ever cigarette smoking, participants who responded that they had smoked cigarettes in the past 30 days ("even one puff") were considered current cigarette users.[20]

Demographics.—Four demographic variables (age, gender, race/ethnicity, and school grades) were also collected. Age (asked in years) was dichotomized as a median split to represent those aged "18" and "19 or older". Gender was defined as "Male" or "Female". Race/ethnicity was probed using two items "How would you describe your racial or ethnic background?" (White or European-American; Black, Afro-Caribbean, or African American; Asian American; American Indian or Alaska Native; Native Hawaiian or Other Pacific Islander; Middle Eastern or Arab American; Multiracial; and Other) and "Do you consider yourself Hispanic/Latino(a)?" (Yes, No). Responses were then categorized as non-Hispanic White, non-Hispanic Black, Asian, and Hispanic/Other. All students were asked "During the past 12 months, how would you describe your grades in school?" ("Mostly A's", "Mostly B's", "Mostly C's", "Mostly D's", "Mostly F's" "None of these grades", "Not Sure";[21]). Due to the distribution of responses, grades were dichotomized as "Mostly A's" and "Mostly B's or lower" (responses of "None of these grades" and "Not Sure" were set to missing).[22]

Statistical analysis

Univariate analyses were used to describe the overall sample. Pearson's chi-square test examined unadjusted associations between attitudes towards cannabis policy items and perceived harm of cannabis use, current cannabis, alcohol, and cigarette use, and demographics. Three multinomial logistic regression models tested associations between attitudes toward cannabis policy: 1) recreational cannabis use (legal, minor violation, crime, don't know), 2) cannabis use in private (support, not sure, oppose), and 3) cannabis use in public (support, not sure, oppose) and perceived harm of cannabis use while controlling for current cannabis, alcohol, and cigarette use, and demographics. Regardless of unadjusted association results, all variables were included in the regression models due to their relevancy to the research question. From these regression models, adjusted relative risk ratios were converted to predicted probabilities to ease interpretation. Analyses were conducted using Stata 12.0 (College Station, Texas, USA).

Results

Sample characteristics

In terms of attitudes toward recreational cannabis use, 64.3% percent of undergraduate students in this sample favored legalization of cannabis, while 23.2% thought cannabis use should be a minor violation and 4.4% a major crime. The majority of respondents (78.2%) supported private cannabis use, while only 29.4% supported public cannabis use (unspecified for recreational or medicinal purposes). In the past 30 days, 50.3% had used cannabis, 84.4% consumed alcohol, and 19.4% smoked cigarettes. Approximately forty-eight percent of the sample were at least 19 years of age, 73.5% were female, and 68.6% earned Mostly B's or lower grades. For race/ethnicity, 45.2% of the sample identified as non-Hispanic White, 25.7% non-Hispanic Black, 12.9% Asian, and 16.2% Hispanic/Other.

Unadjusted associations of cannabis policy attitudes, cannabis harm perceptions, current substance use and demographics

Table 1 displays bivariate associations for all measures for each cannabis policy attitude assessed. Cannabis harm perceptions was associated with all three cannabis policy attitude

items. Overall, those in favor of legalizing recreational use as well as using cannabis in private and in public spaces had lower harm perceptions (p<0.01, each). Current cannabis use status was also significantly associated with all three policy attitude items indicating current users were more likely to support less restrictive cannabis use policies (p<0.01, each). Current cigarette smoking was also significantly associated with two policy attitude items indicating current cigarette smokers had greater support for recreational and public cannabis use policies (p<0.05, each). Significant associations were also found for gender (p=0.04) and race/ethnicity (p=0.01) and recreational cannabis use policies, as well as between race/ethnicity and private cannabis use policy (p<0.01) and grades and public cannabis use policy (p=0.02). No significant associations with cannabis policy attitudes were observed for current alcohol use and age.

Adjusted associations of cannabis policy attitudes, cannabis harm perceptions, current substance use and demographics

Predicted probabilities estimated from the multinomial logistic regression coefficients for each cannabis policy attitude item that are adjusted for current substance use and demographics are displayed in Table 2. Adjusted correlates of attitudes towards legalizing recreational cannabis use are presented first, followed by legalizing cannabis use in private, and in public. Relative to low perceived harm of cannabis, high perceived harm was associated with a significantly lower probability of favoring of legalizing recreational cannabis use (−27.2 percentage points [PP], 95% CI −34.1, −20.2), yet significantly greater probability of supporting recreational cannabis use as minor violation (16.0 PP, 95% CI 8.7, 23.3), as a crime (5.8 PP, 95% CI 2.0, 9.5), and being unsure (5.5, 95% CI 1.7, 9.2 PP). For private cannabis use, students with high perceived harm of cannabis were significantly less likely to support private cannabis use (−15.7 PP, 95% CI −22.1, −9.2) and significantly more likely to be not sure about prohibiting private use policies (11.2 PP, 95% CI 6.2, 16.1). For public cannabis use, students with high perceived harm of cannabis were significantly less likely to support public use (−13.1 PP, 95% CI −23.7, −2.5) and significantly more likely to oppose public use (14.1 PP, 95% CI 4.8, 23.5). Students who currently used cannabis were significantly more likely to favor legalizing recreational cannabis use (13.3 PP, 95% CI 5.4, 21.3) and less likely to not know which recreational cannabis policy to support (−7.1 PP, 95% CI −12.6, −1.6). Current cannabis users also were significantly more likely to support private cannabis use (8.0 PP, 95% CI 1.0, 14.9); in addition, these individuals were significantly more likely to indicate "not sure" (10.2 PP, 95% CI 1.2, 19.3) and less likely to oppose public cannabis use (−13.2 PP, 95% CI −21.8, −4.5). Demographic results indicated that individuals who were 19 years or older were significantly more likely to oppose private cannabis use (6.1 PP, 95% CI 1.0, 11.2), and individuals who identified as Asian were significantly more likely to be not sure about prohibiting private cannabis use (8.5 PP, 95% CI 0.1, 17.0). Students with Mostly B's or lower grades were significantly more likely to support public cannabis use (8.7 PP, 95% CI 0.1, 17.4).

Discussion

This is the first known study that details young adult attitudes regarding a variety of cannabis policy measures and associated harm perceptions, substance use behaviors, and

demographic characteristics. As cannabis polices continue to evolve and young adults use cannabis at high rates, identifying correlates of cannabis policy attitudes among young adults can help guide future policy in this area as well as potentially inform our understanding of voting/ballot behavior. Using a convenience university-based sample in a mid-Atlantic US state with restrictive cannabis policies, we determined that the majority of young adults supported recreational cannabis legalization (64%) and private cannabis use (78%), while only 29% supported public cannabis use regardless of recreational/medicinal use status. Consistent with our hypothesis, lower levels of perceived harm of cannabis and past 30-day (current) cannabis use were associated with supporting all three cannabis policies (recreational legalization, private use, and public use).

Interestingly, support for legalizing recreational cannabis use in the current study was higher than has been reported in previous studies of adults aged 18–35 (35%)[11] and adolescents (33%).[16] Our adjusted results indicated that students who currently used cannabis were more likely to favor legalizing recreational cannabis use and private cannabis use compared to non-current cannabis users, while no significant association was observed for attitudes favoring public cannabis use. These findings are consistent with results from a 2017 study on young adults' attitudes of cannabis legalization, which found an increased likelihood to support cannabis legalization among current cannabis users compared to non-users.[11] The current study also indicated the sample had a higher prevalence of past month alcohol use (84.4%) compared to nationally representative samples of young adults in 2017 (56.3%).[23] The high prevalence of past month alcohol use in the current sample may have resulted in no differences seen in alcohol use across the three attitudes towards cannabis policies. Past 30-day cigarette use was associated with favoring recreational cannabis legalization and public cannabis use, which could be attributed to nearly a third of cannabis users were also cigarette smokers (30%). However, these associations were no longer statistically significant when controlling for other variables. These results indicate that current cannabis use may be a better predictor of cannabis policy attitudes among young adults compared to alcohol and cigarette smoking.

Over 73% of this sample had low harm perceptions about cannabis. Additionally, our study indicates that participants with high perceived harm of cannabis were less likely to favor the legalization of cannabis use. Importantly, greater harm perceptions about cannabis was associated with prohibition of private or public cannabis use. These findings illustrate how support or opposition to a variety of cannabis policies are related to cannabis harm perceptions. Among the only other published work examining cannabis-related voting behaviors among young adults in two US states,[10] voting behaviors regarding cannabis policies were predicted by positive attitudes toward cannabis. These results and our own suggest that cannabis harm perceptions (which can be influenced by a myriad of factors) may be a critical precursor or predictor of support for cannabis policy. As US cannabis policies evolve within individual US states, the perception that the use of cannabis is safe or less harmful may become a more salient public health concern more broadly.[11] Although there are medicinal benefits of cannabis use,[24,25] there are also adverse health effects associated with cannabis use, including decreased cognitive functioning, increased heart rate, immune system suppression, and impaired neuronal activity in young adults.[24–27] Further, several young adults in our sample were uncertain about supporting or opposing

cannabis policies, especially for public cannabis use where 31.8% of the sample responded "Not sure". Therefore, education about the harms and benefits of cannabis is essential for reducing the public health burden of this substance.

The current study also identified novel demographic associations with cannabis policy attitudes. Controlling for other variables, race/ethnicity, age, and grade status were significantly associated with private and public cannabis use policies. Specifically, Asian young adults were more likely to be unsure about policy regarding private cannabis use, and those who were 19 or older were more likely to oppose private cannabis use. Young adults earning B grades or lower in college were more likely to support public cannabis use. Certain demographic characteristics could be targeted to educate different young adult subgroups on cannabis and cannabis policies they could vote on via public ballot. Further understanding of specific sociodemographic characteristics of cannabis policy attitudes among young adults using longitudinal methods could help extend these findings as well as improve their utility for researchers, educators, and policymakers.

There were several limitations to the current study. The sample is comprised of a convenience sample of undergraduate students, which limits generalizability of these results to other populations. Of note is that the current study was conducted in a state where cannabis is illegal for recreational and medicinal use (at the time of data collection), while previous work in this area has included nationally representative samples. Future research could explore how US state of residence influences cannabis policy attitudes. Another limitation was the definition used to define support for cannabis use in public compared to private settings. These items assessed attitudes towards cannabis "smoking" under these conditions but not use of other consumption methods that are less detectable. These items also did not identify whether use included effects related to cannabis intoxication. Future research can expand and improve upon this work by defining the policy context and cannabis use conditions more specifically. In addition, the survey required 'marijuana' in the title, which could have attracted more cannabis users to complete this study. Another limitation is the reliance on self-reported data. Social desirability bias may have influenced responses to substance use questions (individuals may have been less likely to report such behaviors); however, use of a relatively anonymous survey administration method should have reduced this effect.[28,29] Cannabis harm perceptions across multiple cannabis forms and methods were collapsed into a single variable. Even though cannabis harm perceptions can vary by administration method, harm perceptions among the three cannabis administration methods (combustible in either a joint, blunt, or bong) did not vary in our sample. Future studies should consider examining how harm perceptions of different types of cannabis could influence policy attitudes.

The purpose of this study was to identify correlates associated with attitudes on cannabis policies in a convenience sample of young adults in an illegal cannabis policy environment. The support for recreational cannabis legalization and private cannabis use was high overall in this sample, while the support for public use was lower. Results also revealed race/ethnicity, age, and grade status were significantly associated with private and public cannabis use policies. Consistent with previous research, higher frequencies of cannabis use and lower cannabis harm perceptions were associated with supporting less restrictive

cannabis policies. Results from this study indicate a need for more cannabis education in young adult populations as well as highlight cannabis harm perceptions as a point of leverage to influence cannabis policy attitudes in potential ballot measures. Future research should explore longitudinal changes in opinions of cannabis policies among young adults, as well as other populations.

Funding details:

References

1. National Conference of State Legislatures. State Medical Marijuana Laws. 2018; http://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx. Accessed 12/10/2018, 2018.

2. Room R Legalizing a market for cannabis for pleasure: Colorado, Washington, Uruguay and beyond. Addiction. 2014;109(3):345–351. [PubMed: 24180513]

3. National Organization for the Reform of Marijuana Laws (NORML). States that have decriminalized. [Website]. 2018; http://norml.org/aboutmarijuana/item/states-that-have-decriminalized. Accessed 2/27/29018, 2018.

4. Center for Behavioral Health Statistics and Quality (CBHSQ). Results from the 2016 national survey on drug use and health: Detailed tables. In: Substance Abust and Mental Health Services Administration, ed. Rockville, MD, 2017.

5. Monitoring the Future national survey results on drug use, 1975–2015: Overview, key findings on adolescent drug use. [press release]. Ann Arbor: Institute for Social Research, The University of Michigan, 2016.

6. Hughes A, Lipari RN, Williams MR. Marijuana Use and Perceived Risk of Harm from Marijuana Use Varies Within and Across States. The CBHSQ Report. Rockville (MD), 2016.

7. Berg CJ, Stratton E, Schauer GL, et al. Perceived harm, addictiveness, and social acceptability of tobacco products and marijuana among young adults: marijuana, hookah, and electronic cigarettes win. Subst Use Misuse. 2015;50(1):79–89. [PubMed: 25268294]

8. Swift A Support for legal marijuana use up to 60% in the U.S. 2016. 2017; http://news.gallup.com/poll/196550/support-legal-marijuana.aspx. Accessed 10/10/2017, 2017.

9. Geiger A Support for marijuana legalization continues to rise. 2016; http://www.pewresearch.org/fact-tank/2016/10/12/support-for-marijuana-legalization-continues-to-rise/., 2017

10. Moreno MA, Whitehill JM, Quach V, Midamba N, Manskopf I. Marijuana experiences, voting behaviors, and early perspectives regarding marijuana legalization among college students from 2 states. J Am Coll Health. 2016;64(1):9–18. [PubMed: 26182234]

11. Cohn AM, Johnson AL, Rose SW, Rath JM, Villanti AC. Support for Marijuana Legalization and Predictors of Intentions to Use Marijuana More Often in Response to Legalization Among U.S. Young Adults. Subst Use Misuse. 2017;52(2):203–213. [PubMed: 27976988]

12. American Nonsmokers' Rights Foundation. Protecting Nonsmokers from Secondhand Marijuana Smoke. American Nonsmokers' Rights Foundation; 2018.

13. Denver City Council. Neighborhood Approved Cannabis Consumption Pilot Program Initiative. In: Office of the City Council and Office of the City Attorney, Denver, CO: Denver City Council; 2016.

14. National Conference of State Legislatures. Marijuana Overview. 2018. Accessed 12/14/2018, 2018.

15. Carliner H, Brown QL, Sarvet AL, Hasin DS. Cannabis use, attitudes, and legal status in the U.S.: A review. Prev Med. 2017.

16. Palamar JJ. An examination of opinions toward marijuana policies among high school seniors in the United States. J Psychoactive Drugs. 2014;46(5):351–361. [PubMed: 25364985]

17. Use of ecstasy, heroin, synthetic marijuana, alcohol, cigarettes declined among US teens in 2015 [press release]. Ann Arbor, MI: University of Michigan News Service2015.

18. Center for Behavioral Health Statistics and Quality (CBHSQ). Behavioral Health Trends in the United States: Results from the 2014 National Survey on Drug Use and Health. In: Substance Abuse and Mental Health Serices Adminsitration, ed. Rockville, MD: HHS Publication; 2015.

19. Cohn AM, Johnson AL, Rath JM, Villanti AC. Patterns of the co-use of alcohol, marijuana, and emerging tobacco products in a national sample of young adults. Am J Addict. 2016.

20. Rath JM, Villanti AC, Williams VF, Richardson A, Pearson JL, Vallone DM. Correlates of current menthol cigarette and flavored other tobacco product use among U.S. young adults. Addict Behav. 2016;62:35–41. [PubMed: 27310032]

21. Youth Risk Behavior Survey Questionnaire. In: Centers for Disease Control and Prevention, ed, 2015.

22. McCabe SE, West BT, Veliz P, Boyd CJ. E-cigarette Use, Cigarette Smoking, Dual Use, and Problem Behaviors Among U.S. Adolescents: Results From a National Survey. J Adolesc Health. 2017;61(2):155–162. [PubMed: 28391965]

23. Center for Behavioral Health Statistics and Quality (CBHSQ). Results from the 2017 National Survey on Drug Use and Health: Detailed Tables. In: Substance Abuse and Mental Health Serices Adminsitration, ed. Rockville, MD, 2018.

24. Ameri A The effects of cannabinoids on the brain. Prog Neurobiol. 1999;58(4):315–348. [PubMed: 10368032]

25. Holland ML, Panetta JA, Hoskins JM, et al. The effects of cannabinoids on P-glycoprotein transport and expression in multidrug resistant cells. Biochem Pharmacol. 2006;71(8):1146–1154. [PubMed: 16458258]

26. Franz CA, Frishman WH. Marijuana Use and Cardiovascular Disease. Cardiol Rev. 2016;24(4):158–162. [PubMed: 26886465]

27. Rieder SA, Chauhan A, Singh U, Nagarkatti M, Nagarkatti P. Cannabinoid-induced apoptosis in immune cells as a pathway to immunosuppression. Immunobiology. 2010;215(8):598–605. [PubMed: 19457575]

28. Welte JW, Russell M. Influence of socially desirable responding in a study of stress and substance abuse. Alcohol Clin Exp Res. 1993;17(4):758–761. [PubMed: 8214409]

29. Del Boca FK, Darkes J. The validity of self-reports of alcohol consumption: state of the science and challenges for research. Addiction. 2003;98 Suppl 2:1–12.

Table 1.

Bivariate associations between cannabis policy attitudes and cannabis harm perceptions, current substance use, and demographics among young adults

	% Total n=619	Recreational cannabis use					Private cannabis use				Public cannabis use			
		% Legal n=398	% Minor n=144	% Crime n=27	% DK n=50	p	% Support n=484	% Not Sure n=74	% Oppose n=27	p	% Support n=182	% Not Sure n=197	% Oppose n=239	p
Perceived harm of cannabis						<0.01				<0.01				<0.01
Low	73.2	86.2	58.2	11.5	40.0		80.6	36.9	54.2		83.4	78.0	61.6	
High	26.8	13.8	41.8	88.5	60.0		19.4	63.1	45.8		16.6	22.0	38.4	
Cannabis use						<0.01				<0.01				<0.01
Non-current	49.7	39.7	57.6	92.3	84.0		44.2	75.7	62.3		41.2	41.1	63.4	
Current	50.3	60.3	42.4	7.7	16.0		55.8	24.3	37.7		58.8	58.9	36.6	
Alcohol use						0.22				0.36				0.48
Non-current	15.6	14.4	15.1	29.4	22.2		14.6	19.3	20.8		14.8	13.8	18.0	
Current	84.4	85.6	84.9	70.6	77.8		85.4	80.7	79.2		85.2	86.2	82.0	
Cigarette use						0.03				0.20				0.04
Non-current	80.6	77.1	86.1	85.2	90.0		79.1	86.5	85.5		77.5	77.7	85.8	
Current	19.4	22.9	13.9	14.8	10.0		20.9	13.5	14.5		22.5	22.3	14.2	
Age						0.35				0.23				0.21
18	51.9	53.3	47.9	40.7	58.0		53.3	50.0	41.9		57.1	48.2	51.0	
19 or older	48.1	46.7	52.1	59.3	42.0		46.7	50.0	58.1		42.9	51.8	49.0	
Gender						0.04				0.28				0.35
Male	26.5	29.6	17.4	29.6	26.0		27.6	18.9	25.8		28.7	28.1	23.1	
Female	73.5	70.4	82.6	70.4	74.0		72.4	81.1	74.2		71.3	71.9	76.9	
Race/ethnicity						0.01				<0.01				0.78
White	45.2	49.1	42.3	37.1	28.0		48.4	27.0	42.0		44.2	46.7	45.2	
Black	25.7	25.0	25.0	33.3	28.0		25.1	27.0	29.0		29.3	23.4	25.1	
Asian	12.9	9.8	15.3	14.8	30.0		10.8	25.7	14.5		9.9	13.7	14.2	
Hispanic/Other	16.2	16.1	17.4	14.8	14.0		15.7	20.3	14.5		16.6	16.2	15.5	
Grades						0.33				0.52				0.02
Mostly A's	31.4	31.1	30.1	48.0	28.6		30.3	33.3	37.3		24.7	30.4	37.6	

| | Recreational cannabis use | | | | | | Private cannabis use | | | | Public cannabis use | | | |
	% Total n=619	% Legal n=398	% Minor n=144	% Crime n=27	% DK n=50	p	% Support n=484	% Not Sure n=74	% Oppose n=27	p	% Support n=182	% Not Sure n=197	% Oppose n=239	p
Mostly B's or lower	68.6	68.9	69.9	52.0	71.4		69.7	66.7	62.7		75.3	69.6	62.4	

Note: DK=don't know; **bolded** *p* indicate statistical significance less than 0.05 using Pearson's Chi-square test.

Table 2.

Predicted probabilities of perceived harm, current substance use, and demographics from marginal effects of cannabis policy attitudes among young adults

	Recreational cannabis use				Private cannabis use			Public cannabis use		
	% (CI) Legal (n=398)	% (CI) Minor (n=144)	% (CI) Crime (n=27)	% (CI) DK (n=50)	% (CI) Support (n=484)	%, (CI) Not Sure (n=74)	% (CI) Oppose (n=62)	% (CI) Support (n=182)	% (CI) Not Sure (n=197)	% (CI) Oppose (n=239)
High perceived harm of cannabis	**−27.2** (**−34.1, −20.2**)	**16.0** (**8.7, 23.3**)	**5.8** (**2.0, 9.5**)	**5.5** (**1.7, 9.2**)	**−15.7** (**−22.1, −9.2**)	**11.2** (**6.2, 16.1**)	4.5 (−0.6, 9.6)	**−13.1** (**−23.7, −2.5**)	−1.0 (−11.4, 9.4)	**14.1** (**4.8, 23.5**)
Current cannabis use	**13.3** (**5.4, 21.3**)	−2.3 (−10.1, 5.4)	−3.8 (−8.2, 0.5)	**−7.1** (**−12.6, −1.6**)	**8.0** (**1.0, 14.9**)	−5.0 (−10.4, 0.4)	−3.0 (−8.3, 2.4)	2.9 (−5.7, 11.6)	**10.2** (**1.2, 19.3**)	**−13.2** (**−21.8, −4.5**)
Current alcohol use	−1.1 (−11.8, 9.5)	2.8 (−7.7, 13.3)	−1.3 (−4.7, 2.2)	−0.5 (−5.0, 4.1)	3.3 (−5.1, 11.8)	0.3 (−6.0, 6.6)	−3.6 (−9.9, 2.6)	0.3 (−11.2, 11.8)	−0.9 (−13.1, 11.2)	0.6 (−10.9, 12.2)
Current cigarette use	4.8 (−6.3, 15.9)	−3.6 (−13.8, 6.7)	3.4 (−0.8, 7.6)	−4.6 (−14.4, 5.2)	1.6 (−8.2, 11.3)	−4.1 (−12.6, 4.4)	2.6 (−3.9, 9.1)	4.8 (−5.2, 14.7)	0.2 (−10.2, 10.7)	−5.0 (−16.0, 6.0)
19 or older	−2.5 (−9.8, 4.8)	5.4 (−1.6, 12.4)	1.0 (−1.7, 3.7)	−3.9 (−7.9, 0.1)	−4.7 (−11.2, 1.7)	−1.4 (−6.0, 3.3)	**6.1** (**1.0, 11.2**)	−7.1 (−14.7, 0.6)	5.9 (−2.1, 13.8)	1.2 (−6.8, 9.2)
Female	−8.0 (−16.9, 0.9)	7.9 (−0.9, 16.8)	−1.7 (−4.7, 1.3)	1.7 (−3.2, 6.6)	−5.6 (−13.4, 2.3)	4.1 (−2.2, 10.3)	1.4 (−4.3, 7.2)	−1.2 (−10.1, 7.7)	−1.2 (−10.5, 8.0)	2.4 (−7.0, 11.8)
Race/Ethnicity										
Black	2.4 (−6.7, 11.5)	−2.8 (−11.5, 5.9)	−0.5 (−4.2, 3.2)	0.9 (−3.7, 5.5)	−5.4 (−13.5, 2.8)	4.6 (−1.3, 10.4)	0.8 (−5.7, 7.2)	9.2 (−1.0, 19.4)	−3.1 (−13.3, 7.1)	−6.1 (−16.1, 3.9)
Asian	−3.5 (−16.1, 9.2)	0.3 (−11.6, 12.2)	−0.7 (−4.6, 3.1)	3.9 (−2.9, 10.6)	−7.7 (−18.5, 3.1)	**8.5** (**0.1, 17.0**)	−0.8 (−8.6, 6.9)	−2.1 (−15.3, 11.0)	−0.2 (−14.1, 13.8)	2.3 (−11.6, 16.3)
Hispanic/Other	−3.1 (−13.8, 7.5)	4.0 (−6.4, 14.5)	0.1 (−4.1, 4.0)	−0.8 (−5.9, 4.3)	−5.0 (−14.2, 4.2)	7.3 (−0.4, 15.0)	−2.3 (−8.5, 3.9)	−1.9 (−12.4, 8.5)	1.4 (−10.1, 13.0)	0.5 (−11.1, 12.1)
Earn mostly B's or lower grades	−4.8 (−12.9, 3.3)	4.1 (−3.7, 11.9)	−1.1 (−3.9, 1.7)	1.8 (−2.2 – 5.9)	0.1 (−6.6, 6.9)	−0.9 (−5.8, 4.1)	0.7 (−4.5, 6.0)	**8.7** (**0.1, 17.4**)	−2.8 (−11.6, 5.9)	−5.9 (−14.5, 2.7)

Note: CI = 95% confidence interval; DK=don't know; **bold** indicates statistical significance less than 0.05.