UC Irvine
UC Irvine Previously Published Works

Title

A study of self-reported personal cannabis use and state legal status and associations with engagement in and perceptions of cannabis-impaired driving.

Permalink

Journal

Traffic Injury Prevention, 23(sup1)

Authors

Brown, Timothy
Banz, Barbara
Schmitt, Rose
et al.

Publication Date

2022

DOI

10.1080/15389588.2022.2124803

Peer reviewed

A Study of Self-Reported Personal Cannabis Use and State Legal Status and Associations with Engagement in and Perceptions of Cannabis-Impaired Driving

Timothy Brown[1], **Barbara Banz**[2], **Rose Schmitt**[1], **Gary Gaffney**[3], **Gary Milavetz**[4], **Deepa Camenga**[5], **Kaigang Li**[6], **Ashley Brooks-Russell**[7], **Federico Vaca**[8]

[1]National Advanced Driving Simulator, University of Iowa, Iowa City, IA.

[2]Yale DrivSim Lab, Yale University School of Medicine, New Haven, CT.

[3]Carver College of Medicine, University of Iowa, Iowa City, IA.

[4]College of Pharmacy, University of Iowa, Iowa City, IA.

[5]Department of Emergency Medicine, Yale University, New Haven, CT.

[6]College of Health and Human Sciences, Colorado State University, Fort Collins, CO.

[7]School of Public Health, Colorado University Anschutz Medical Campus, Aurora, CO.

[8]UCI School of Medicine, University of California Irvine (UCI), Irvine, CA.

Abstract

Objective: The objectives of the current study were to 1) characterize predictors of perceived risk of driving within two hours of cannabis use and driving after cannabis use in a sample of adults who have used cannabis in the past year; and 2) determine whether the influence of these predictors vary by state legalizations status.

Methods: Data for this study were from online surveys. Study participants from Colorado, Iowa, and Illinois were included if they reported being between 25 and 40 years old and had a history of cannabis use. Outcome variables included 1) days of cannabis use per month, 2) reported driving within two hours of cannabis use (vs. not driving within two hours as reference), 3) proportion of driving after cannabis use days per month (days of driving a car within two hours of cannabis use per month/days of cannabis use per month), and 4) perception of safety of driving after cannabis use. Potential predictors included age of first use of cannabis, gender, education status, and state of residence. SAS GLMSelect Procedure was used for the analysis.

Results: Increased age of first use of cannabis was associated with decreased days of cannabis use per month (B = −0.51 days/month per year), a reduction in the proportion of driving after cannabis use days per month (B = −.02 per month), and decreased perception of safety of driving after cannabis use (B = −0.06 per year). Female gender was also associated with less use (B = −2.3 days per month), a lower proportion of driving following use (B = −0.06 days driving/days used), and decreased perception of safety (B = −0.29). In addition, residents of Colorado reported using

timothy-l-brown@uiowa.edu .

the most days, had the highest likelihood of driving within two hours of use, and had the most positive perceptions of being able to safely drive after cannabis use.

Conclusions: The delay in onset of cannabis use may mitigate its use among adults as well as driving after cannabis use. This has important implications for driver safety. Intervention programs for reducing cannabis effect on driving should focus on individuals with early onset of use, male drivers, and drivers in states where cannabis for adult recreational use is legalized.

INTRODUCTION

As more U.S. states move towards legalization of cannabis for recreational use among adults, the interest in the traffic injury prevention field to better understand factors contributing to cannabis-impaired driving continues to expand with urgency. As of February 2022, 18 states, 4 U.S. territories, and the District of Colombia have enacted measures to legalize cannabis for adult (21 years old) recreational use (National Conference of State Legislatures 2022). The percentage of motor vehicle crash fatalities involving a driver who tested positive for cannabis more than doubled between 2000 and 2018 (Lira et al. 2021). Further, data from experimental driving studies increasingly demonstrates that cannabis impairment is associated with lower speed and larger variations in lateral vehicle control measures (Simmons et al. 2022), both of which may increase risk of crash. As this evidence continues to accumulate, the potential public health impact of cannabis-impaired driving remains central to the policy decisions around recreational use legalization. Unfortunately, there is no widely accepted gold standard procedure for identifying cannabis-impaired driving during roadside testing, and debate exists as to whether law enforcement can accurately identify a driver's level of cannabis impairment (Downey et al. 2012). Given these complexities, it is important to understand drivers' perceptions of how safe it is to drive after cannabis use to effectively inform prevention activities related to reducing drug-impaired driving.

Several studies have examined adults' perceived risks of cannabis-impaired driving. A cross-sectional study of over 70,000 adults across the U.S. and Canada found that the majority of respondents (66–80%) perceived it was dangerous to drive after cannabis use (Goodman et al. 2022). Studies have reported conflicting findings as to whether individuals in states with legal recreational use of cannabis have different perceptions of risk than those in U.S. states without. Although cannabis-impaired driving has been shown to be correlated with younger age, being male, and more frequent cannabis use, it is unclear how these factors interact with state legalization status (Berg et al. 2018, Hasan et al. 2022). Providing greater clarity on these issues could inform ongoing policy discussions and prevention activities as more states move towards recreational legalization. The objectives of this study were to 1) characterize predictors of perceived risk of driving within two hours of cannabis use and driving after cannabis use in a sample of adults who have used cannabis in the past year; and 2) determine whether the influence of these predictors vary by state legalizations status.

METHODS

Data for this study were from two online surveys conducted from July 2018 to April 2019 in Colorado and from February to October 2020 in Iowa that extended to surrounding states

and included respondents from Illinois. The primary goal of these survey studies was to screen and recruit adult participants for a larger study on cannabis-impaired driving and driving simulation. Individuals 18 years old who used cannabis were invited to participate in the survey. Invitations from both survey institutions (University of Colorado, University of Iowa) were provided through social media posts, emails, and fliers.

Of the 3,282 (Colorado) and 1,426 (Iowa) surveys initiated, 1,999 and 1,068 individuals responded to most of the questions of interest respectively. During recruitment, the Colorado-initiated surveys only included residents of Colorado and the Iowa-initiated surveys included residents from Iowa, Illinois, Indiana, and Wisconsin. States with few respondents (e.g., Indiana, Wisconsin) were excluded resulting in 1,999 from Colorado, 1,003 from Iowa, and 43 from western Illinois. At the time of the survey studies, Colorado law allowed recreational adult (21 y/o) use, Iowa allowed limited medicinal use, and Illinois was transitioning to allow recreational adult (21 y/o) use. Both surveys included demographics, questions assessing cannabis use (including age of cannabis use onset, frequency of use), perceptions of safety related to cannabis-impaired driving, and frequency of driving within two hours of cannabis use. Study participants consented to the use of their survey data regardless of eligibility for the simulator studies. The survey was adapted from a survey of Colorado residents who use cannabis (Brooks-Russell et al. 2019). There was no monetary incentive for participating in the survey. The studies were approved by the Colorado Multiple Institutional Review Board and the University of Iowa Institutional Review Board.

Analyses

Outcome variables included 1) days of use (days of cannabis use per month), 2) driving after use (reported driving within two hours of cannabis use vs. not driving within two hours as reference), 3) proportion of days driving after use (days of driving a car within two hours of cannabis use per month/days of cannabis use per month), and 4) perception of safety of driving after cannabis use. Potential predictors included age of first use of cannabis (first use), gender, whether the respondent was aged 25–40 (yes vs. no), completion of high school, and state of residence. SAS GLMSelect Procedure was used for analysis 1, 3 and 5, and the SAS Logistic Procedure was used for analysis with statistical significance level set at p .05.

RESULTS

General summary statistics by state that include the mean and standard deviation of key variables and the distribution of age group and gender of residence are provided in Table 1.

First use, gender, and state of residence were significantly associated with both days of use ($F_{(4,2885)}=137.62$, $p<.0001$) and the proportion of days driving after use ($F_{(5,2487)}=54.82$, $p<.0001$). Additionally, completion of high school was associated with proportion of days driving after use. Increased age of first use was associated with decreased days of use ($B = -0.51$ days/month per year delay in cannabis use) and a reduction in the proportion of days driving after use ($B = -.02$ per year delay in cannabis use). Female gender was associated with less use and a lower proportion of driving after use ($B = -2.3$ days per

month, and B = −0.07 days driving/days used, respectively). In addition, state of residence was related to cannabis use and impaired driving behaviors. That is, residents of Colorado reported the most days of use (B=8.7 relative to Iowa) and most driving after use (B=0.18 relative to Iowa), whereas residents of Iowa and Illinois (B=2.0 relative to Iowa but not significant) reported similar days of use and driving after use (B=−0.07 relative to Iowa but not significant). Not completing high school was associated with increased driving after use (B=−0.12).

Age group, first use, and days of use were significant predictors (p=0.03, <0.0001, <0.0001, respectively) when examining whether individuals reported driving after use. The odds of driving after use were reduced with increased age of first use (OR=0.92) but were increased with more days of use (OR=1.12).

A significant association of the perception of safety of driving after cannabis use is shown with first use, gender, and state of residence (F(4,2864)=91.67, p<.0001). Increased age of first use was related to decreased perception of safety of driving after cannabis use (B = −0.06 per year delay in cannabis use), and being female was also associated with decreased perception of safety (B = −0.29) in driving after cannabis use. There were also differences by state with residents of Colorado reporting the most positive perceptions of being able to safely drive within two hours of cannabis use and Iowa reporting the least. Increased age of first use of cannabis was associated with reductions in the perception of the safety of driving while performing a secondary task (i.e., talking to other passengers, eating or drinking, using vehicle navigation system).

DISCUSSION

As U.S. state cannabis legislation continues to change, there continues to be a need to better understand factors, including perceptions and sentiments of drivers who use cannabis, that may lead to impaired driving in order to inform prevention efforts. Considering cannabis impairment is believed to affect driving-related cognitive skills for roughly 5 hours or more, driving within two hours of cannabis use can be considered cannabis-impaired driving (McCartney et al. 2021). Our findings show a relationship between age of onset of cannabis use and cannabis-impaired driving. Specifically, for every year onset of cannabis use was delayed, participants reported decreased likelihood to drive impaired and greater perceptions of risks (i.e., less safe) for driving within two hours of cannabis use. Adults from Colorado, a state with legalized adult recreational cannabis use starting at age 21, had greater likelihood of driving within two hours of cannabis use and reporting that it was safe to drive after consuming cannabis, compared to adults from Iowa and Illinois, states without legalized recreational use of cannabis.

In our study sample of adults who used cannabis, the legalization status within the state of residence was also related to likelihood of cannabis-impaired driving and perceptions of safe driving after use. These findings align with previous research that associates the legalization of adult recreational cannabis with decreased perceptions of risk and increased cannabis-related traffic injuries and fatalities (Chiu et al. 2021, Farmer et al. 2021). Findings also suggest that as more states move towards cannabis legalization, rates of driving after recent

cannabis when-driving is most impaired may increase on a national level. Delayed age of onset of cannabis use was related to decreased cannabis-impaired driving and perceptions of safe driving abilities after cannabis use. This supports youth alcohol and cannabis research that links earlier age of onset with broader health-risking behaviors (e.g., driving while impaired, substance use-related mental health outcomes, substance use disorders), although it should be noted that this could be the result of earlier use, or it could be related to overall greater risk taking in the group that uses earlier. In recent years public perceptions and sentiments of cannabis have changed and are becoming more accepting, including decreased views in perceived harmfulness (Chiu et al. 2021). In this time there has also been an increase in the use of cannabis among youth in states with legal adult recreational cannabis use, particularly among women (Lachance et al. 2022, Ladegard et al. 2020). Together this suggests that the legal and sociocultural shifts may contribute to compounding factors (e.g., less perceived harm and increased use among youth), potentially leading to more cannabis-impaired driving and related motor vehicle crashes, injuries, and fatalities.

We recognize this study has limitations. The current surveys did not include detailed demographic questions (e.g., race/ethnicity, age at date of survey completion) as they were designed to screen for eligibility for a larger driving simulation study. Therefore, we were unable to evaluate relationships based on these items. Further, the current surveys did not assess the behaviors and perceptions of interest in the context of alcohol use. As such, we are unable to draw conclusions about the potential increased risk among who use alcohol or use alcohol simultaneously or concurrently with cannabis. Although there are a large number of respondents who reported a history of cannabis use, the study was not designed to be representative, and the findings may not generalize to all people who use cannabis in the states included in the study.

Our findings suggest the delay in onset of cannabis use may mitigate cannabis use among adults as well as likelihood of driving after cannabis use and increase the safety of driving. Further, findings also suggest that adult recreational cannabis use status (i.e., non-legal recreational use) may lessen cannabis-impaired driving and perceptions of safety, particularly among males. With the ongoing changes to state-level cannabis legislation, we believe the need for tailored prevention and intervention programs for reducing cannabis is already evident. Considering the complexities and growing literature surrounding concerns for legalized recreational use of cannabis, our study provides insight into how cannabis legalization translates to real-world outcomes. Altogether, these data suggest that public health prevention programming should focus on delaying the onset of cannabis use, especially among male drivers, and drivers in states where cannabis for adult recreational use is legalized.

ACKNOWLEDGEMENTS

REFERENCES

Berg CJ, Daniel CN, Vu M, Li J, Martin K, Le L. Marijuana Use and Driving Under the Influence among Young Adults: A Socioecological Perspective on Risk Factors. Subst Use Misuse 2018;53(3):370–380. [PubMed: 28777692]

Brooks-Russell A, Brown T, Rapp-Olsson AM, Friedman K, Kosnett M. Driving after cannabis use and compensatory driving behaviors among current cannabis users in Colorado. Traffic Injury Prevention 2019;20(sup2):S199–S201.

Chiu V, Leung J, Hall W, Stjepanovi D, Degenhardt L. Public health impacts to date of the legalisation of medical and recreational cannabis use in the USA. Neuropharmacology 2021;193:108610. [PubMed: 34010617]

Downey LA, King R, Papafotiou K, et al. Detecting impairment associated with cannabis with and without alcohol on the Standardized Field Sobriety Tests. Psychopharmacology 2012;224(4):581–589. [PubMed: 22763669]

Farmer CM, Monfort SS, Woods AN. Changes in traffic crash rates after legalization of marijuana: results by crash severity 2021.

Goodman S, Hammond D. Perceptions of the health risks of cannabis: estimates from national surveys in Canada and the United States, 2018–2019. Health Educ Res 2022;37(2):61–78. [PubMed: 35311986]

Hasan R, Watson B, Haworth N, Oviedo-Trespalacios O. A systematic review of factors associated with illegal drug driving. Accident Analysis & Prevention 2022;168:106574. [PubMed: 35152044]

Lachance A, Bélanger RE, Riva M, Ross NA. A Systematic Review and Narrative Synthesis of the Evolution of Adolescent and Young Adult Cannabis Consumption Before and After Legalization. J Adolesc Health 2022.

Ladegard K, Thurstone C, Rylander M. Marijuana Legalization and Youth. Pediatrics 2020;145(Supplement_2):S165–S174. [PubMed: 32358207]

Lira MC, Heeren TC, Buczek M, et al. Trends in Cannabis Involvement and Risk of Alcohol Involvement in Motor Vehicle Crash Fatalities in the United States, 2000−2018. Am J Public Health 2021;111(11):1976–1985. [PubMed: 34709858]

McCartney D, Arkell TR, Irwin C, McGregor IS. Determining the magnitude and duration of acute 9-tetrahydrocannabinol (9-THC)-induced driving and cognitive impairment: A systematic and meta-analytic review. Neuroscience & Biobehavioral Reviews 2021;126:175–193. [PubMed: 33497784]

National Conference of State Legislatures. State Medical Cannabis Laws https://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx#:~:text=The%20Connecticut%20General%20Assembly%20passed,not%20regulate%20non%20medical%20sales). Published 2022. Accessed March 31 2022.

Simmons SM, Caird JK, Sterzer F, Asbridge M. The effects of cannabis and alcohol on driving performance and driver behaviour: a systematic review and meta-analysis. Addiction 2022.

Table 1.

Descriptive analysis of participant demographics and cannabis use and driving behaviors by state of residence.

	Age of First Cannabis Use Mean (SD)	Last 30 Days Mean (SD)		Descriptive Sample Summaries Mean (SD)		
		Number of Cannabis Use Days	Proportion of Days where Cannabis was Used and Drove within 2 Hours	Used Cannabis and Drove within 2 Hours during Last 30 Days	Gender: Female	Age Group: 25–45
Colorado	16.8 (4.2)	22.6 (11.0)	0.47 (0.40)	77.7%	44.3%	85.2%
Illinois	16.1 (1.6)	16.5 (11.4)	0.24 (0.24)	66.7%	32.6%	2.3%
Iowa	17.4 (3.6)	13.5 (11.8)	0.27 (0.32)	61.0%	48.9%	37.0%

Table 2.

Model parameters for predicting cannabis use and proportion of days driving after cannabis use.

		Number of Days per Month that Cannabis was Used	Proportion of Days on which Cannabis was Used with Report of Driving
Intercept		23.4	0.59
State (Reference: Iowa)	Colorado	8.7	0.18
	Illinois	2.1	−0.06
Gender (Reference: Male)	Female	−2.3	−0.07
Completed High School (Reference: Yes)	No		0.13
Age of First Cannabis Use (per year)		−0.51	−0.02