


Commentary on Jones J, Jones KN and Peil J (2018) The impact of the legalization of recreational marijuana on college students. *Addictive Behaviors* 77: 255–259, <https://doi.org/10.1016/j.addbeh.2017.08.015>

Substance Abuse: Research and Treatment
Volume 13: 1–4
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DOI: 10.1177/1178221819827603


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ABSTRACT: With the broadening legislative changes surrounding legalized recreational marijuana in the United States, tracking the impact of such changes is imperative. As such, in a recent article published in *Addictive Behaviors*, we identified several emerging trends in the first state to legalize recreational marijuana, Colorado. Since our publication, similar research from other states that have legalized recreational marijuana (Oregon and Washington) has emerged. Here, we attempt to expand on our findings and identify patterns across the research, by comparing and contrasting our results to research in other states with legalized recreational marijuana. We identified several trends including, but not limited to, the rates of marijuana use rising after decriminalization, but not the retail sale of recreational marijuana; recreational marijuana legalization leading to a decrease in the relationship between marijuana and alcohol use; and the identification of binge drinkers as a high-risk population for marijuana use after recreational legalization. We also explore the complicated relationship between marijuana use and academic performance, and point out areas where future research is needed.

KEYWORDS: marijuana, recreational, legalized, alcohol, binge drinking

RECEIVED: January 2, 2019. **ACCEPTED:** January 7, 2019.

TYPE: Commentary

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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COMMENT ON: Jones J, Jones NK, Peil J. The impact of the legalization of recreational marijuana on college students. *Addictive Behaviors*. 2018;77:255-259. doi:10.1016/j.addbeh.2017.08.015.

Introduction

With an ever increasing number of states legalizing the recreational sale of marijuana, and decriminalizing the possession of marijuana throughout the United States, tracking the impact of such a drastic change to the culture surrounding marijuana use is important. Early data on the public health effects of legalizing recreational marijuana provide the opportunity to learn from early legalization efforts, which can assist us in making educated decisions on future policy and public health practices. As such, in a recent article published in *Addictive Behaviors*, we identified several emerging trends among college students in the first state to legalize recreational marijuana, Colorado. These trends, when compared and contrasted to research from other states and countries that have legalized recreational marijuana, can give insight into the short-term effects of legalization and provide a basis for discourse on the potential long-term effects of legalizing recreational marijuana.

Marijuana Use Rates

In our study, spanning four data collections over 17 months, gathering information from 1413 participants via an electronic survey methodology (for more detailed description of the methodology of our research and all research reviewed, please see original articles), we found that the rates of marijuana use did not significantly increase after the opening of recreational marijuana retail shops in Colorado. Similarly, Miller et al¹ found no evidence that the legal selling of

recreational marijuana influenced the number of marijuana users in Washington; however, they did observe a significant increase in the proportion of undergraduate students using marijuana, a 12%–22% increase, when marijuana was decriminalized. Similarly, researchers in Oregon also saw an increase in college student's marijuana use around decriminalization, and before retail sales.² A similar pattern was found in Australia, where Damrongplisit et al³ found that marijuana decriminalization led to a 16.3% increase in the probability of smoking marijuana, despite no legal sales of marijuana in the country. In our study, we started collecting data on marijuana use in October 2013, 3 months prior to legal sales at retail shops in Colorado, but almost a full year after recreational marijuana was decriminalized (December 10, 2012). Thus, we were not able to measure the effects of decriminalization, but only the effects of recreational sales at retail shops. Indeed, the rates of marijuana use that we observed after decriminalization, but prior to retail sales, were already much higher in Colorado than the rest of the United States (70% versus 40.5%, respectively). Thus, the timing of data collection could explain why we did not find a significant increase in marijuana use after recreational sales began. It is probable that the increase had already happened over the course of the year between decriminalization and our data collection. Thus, a pattern emerges when comparing our results to the aforementioned studies, suggesting that decriminalization, but not legal sales, is associated with increased marijuana use. Nevertheless, all the aforementioned



research is correlational in nature, limiting the ability to make a cause-and-effect conclusion.

Two inferences can be made based on the assertion that use increases after decriminalization rather than legal sales. One of which is that the social and legal implications of legalizing recreational marijuana are stronger than accessibility and price. We have known for some time that social norms surrounding alcohol use (descriptive and injunctive) are very influential on alcohol consumption patterns. So much so, that agreeing with certain descriptive and injunctive alcohol norms, and the internalization of drinking subcultures, leads to more alcohol use and greater difficulties in the cessation of drinking.^{4,5} Kilmer et al⁶ applied these ideas to marijuana use and found a robust correlation between descriptive norms and marijuana use. Specifically, they found that 98% of college students overestimated the amount of marijuana use by friends and other students. These perceptions of marijuana use explained variance in one's own marijuana use, by making it more likely for students to use marijuana if they believe friends and fellow students are using. Thus, if you consider our findings (no increase after recreational sales in Colorado), Miller et al's¹ findings (legalization, not retail sale of marijuana increased use in Washington), Damrongplisit et al's³ findings (decriminalization without retail sales increased the probability of marijuana use in three Australian territories), and Kilmer et al's findings on the strong relationship between descriptive norms and marijuana use, a pattern begins to emerge that if you remove social and legal barriers to marijuana use (criminalization and social acceptability), use increases even before it is sold to the public through legal means. It is important to note, however, that it is reasonable to assume that people would be more truthful and more likely to report marijuana use after its legalization. Thus, some of the increase in rates of marijuana use may be an artifact of a greater willingness to report such use, since social and legal barriers were removed by legalization.

The second inference that can be drawn is that marijuana is easily accessed even when it is not sold in stores recreationally. Since use increased in Washington and Oregon after legalization despite no retail sale of marijuana, and rates of marijuana use in Colorado were already approximately 30% higher than other states after legalization but before retail sales, it appears marijuana may be easily obtained, even for non-users at the time of legalization. Miech et al⁷ also supported this notion in a review of the National Survey on Drug Use where they determined that marijuana has been easily obtainable for secondary students for at least a decade. Thus, it seems that current laws and enforcement of these laws may have little effect on the availability of marijuana. It would be expected that differences in rates of marijuana use would not increase until after recreational sales, and marijuana would not be easily obtained by secondary students if marijuana was difficult to attain.

Alcohol and Marijuana

A second finding of note from our study is that the relationship between alcohol and marijuana has been steadily weakening after recreational legalization in Colorado. The relationship between alcohol and marijuana has been studied for years with the vast majority of research pointing to a strong, positive relationship between the two.^{8,9} However, recently, a more nuanced picture of that relationship has been discovered, highlighting the complimentary and substitution effects of the use of the two drugs. Specifically, King et al¹⁰ hypothesized that lower dose alcohol consumption for happiness and relaxation is being substituted by marijuana use, while higher dose alcohol consumption for intense euphoria or alteration of consciousness is being accompanied by marijuana use.^{11,12} These ideas fit well within the context of our results. It would make sense that the relationship between marijuana and alcohol would be decreasing if people are starting to use marijuana instead of alcohol to create mild relaxation and happiness. In addition, when you take a closer look at the benefits of using marijuana to achieve mild relaxation and happiness over alcohol, this becomes a likely scenario. First, only extreme use of marijuana can cause a mild hangover effect,¹³ while even relatively mild-to-moderate alcohol consumption can cause debilitating hangover effects.¹⁴ Second, the amount of time to create mild relaxation and happiness is usually much shorter with marijuana when compared with alcohol. Inhaling marijuana smoke a few times takes significantly less time (approximately 1-2 minutes) and has an immediate effect,¹⁵ whereas drinking an alcoholic beverage or two takes more time (15-45 minutes) and has a delayed effect.¹⁶ Third, marijuana legalization advocates have promoted the idea that marijuana is safer than alcohol, and Schuermeyer et al¹⁷ demonstrated that Coloradoans perceptions of the "risks" of marijuana use have been declining in recent years. Thus, marijuana could be viewed as a more practical way to achieve relaxation and happiness than alcohol, because it takes less time, is perceived less harmful, and has less of a chance for a hangover the next day. Future research that focuses on people's motivations and patterns of marijuana and alcohol use could help further explain this interesting dynamic.

Despite the relationship between marijuana and alcohol weakening in our study, the relationship between binge drinking and marijuana use remained high. Similarly, Kerr et al¹⁸ found that rates of marijuana use in Oregon after recreational legalization were significantly higher for students reporting recent heavy alcohol use. Similarly, Wen et al¹² found that medical marijuana legalization was associated with a 10% increase in the frequency of binge drinking days, but was not associated with the total number of drinks for adults over the age of 21. Furthermore, the researchers also found a 22% increase in the probability of combining binge drinking with marijuana use after legalization. Revisiting King et al's¹⁰ research explaining motives for consuming alcohol, these results can be applied. For people wanting to alter their consciousness and achieve a higher sense of euphoria (binge drinkers), combining two easily accessible legal drugs

seems to be the most convenient and safest decision, especially if the other choice is engaging in illegal drug use. Also, if someone is drinking large amounts of alcohol, their inhibitions are lowered, decision-making is impaired, and they are more impulsive,¹⁹ which could lead to a higher likelihood of using marijuana, especially when it is more commonly found in recreationally legal states. Indeed, we found that participants in our study who reported binge drinking used cannabis at higher rates than other users of alcohol. These findings appear to support the notion that the objective of drug use for binge drinkers is to achieve a high level of euphoria and/or altered state of consciousness, which could be putting them at higher risk for marijuana use upon decriminalization. Future research focusing on the relationship between marijuana and illegal drug use could be very informative. Specifically, one would expect the relationship between marijuana and illegal drugs to be declining since there are two legal options to create a higher level of euphoria. In addition, future research that focuses on binge drinkers as a high-risk group for increased marijuana use after decriminalization may be of significance.

Marijuana and Academic Functioning

A third finding was the impact marijuana use has on academic functioning, measured by grade point average (GPA) in our study. In the March 2015 data collection of our research, we found significant differences between the “no use or never tried it” marijuana group and the “once a week or more often, but not daily” marijuana user group. The “no use or never tried it” group’s GPA was 0.429 points higher than the “once a week or more often, but not daily” group. Even though this difference was found, surprisingly, there was no significant difference between the GPA of the “no use group or never tried it” group and the “daily” use group. We explained this finding through the framework that daily users of marijuana have a higher tolerance, which could lead to less cognitive disruption and a greater ability to handle behavior disruptions caused by marijuana use,²⁰ whereas the “once a week or more often, but not daily” group could have less of a tolerance for the effects of marijuana, as research has demonstrated there is little tolerance to marijuana without persistent use.²¹

Another way to interpret this finding is to relate back to our previously mentioned binge drinking theory. The “once a week or more often, but not daily” group could fit into a category of “binge smoking,” using marijuana one or few times a week to achieve a high level of euphoria. For instance, we found that binge drinkers used marijuana at higher rates than other drinkers. Specifically, the odds ratio of a binge drinker smoking marijuana went from 2.012 in October 2013 (before retail sales) to 6.128 in March 2015 (approximately 1 year after recreational marijuana sales), clearly indicating that since recreational marijuana has been legalized in Colorado, binge drinkers are at a significantly higher risk for smoking marijuana. Thus, it could be that binge drinkers are using marijuana and alcohol together to achieve a high level of euphoria and altered

consciousness. This pattern of use would lead to the most intense and frequent level of cognitive disruption, becoming a detriment to academic functioning. Continuing to track this pattern of marijuana and alcohol use, along with academic functioning, could be an important future direction for research.

Summary

First and of the utmost importance is that the conclusions drawn in this commentary are based on observable patterns from correlational research, limiting conclusions of cause and effect. Even so, the goal of this commentary was to compare the results on the impact of the nascent industry of recreational marijuana in Colorado to the results of research conducted on the legalization of marijuana in other states and countries. This has garnered important insights into a number of aspects; however, in no way covers the full scope of the impact of legalizing recreational marijuana on a national or on a global scale. The first important insight is that rates of marijuana use seem to rise with decriminalization, but not recreational sales in stores. This leads us to believe that the social and legal barriers to marijuana use are a greater deterrent to use than the practical (i.e. access and price). Second, overall, the relationship between marijuana and alcohol use appears to decrease with recreational legalization. Specifically, the relationship seems to become weaker for casual and/or moderate drinkers, while the relationship remains strong for binge drinkers, with recreational marijuana legalization possibly putting them at higher risk for marijuana use than other populations of alcohol users. Furthermore, the relationship between marijuana use and academic functioning is similar to the relationship between alcohol and marijuana. It seems that using marijuana in a pattern similar to binge drinking, few times a week at high levels but not every day, is the most detrimental to academic functioning. In summary, as the legalization of recreational marijuana becomes more common in the United States, it is important to continue to track its impact, so we can make more informed policy and public health decisions.

Author Contributions

JJ researched and analyzed the data. NJ added content and edited the final manuscript.

REFERENCES

1. Miller AM, Rosenman R, Cowan BW. Recreational marijuana legalization and college student use: early evidence. *SSM Popul Health*. 2017;3:649–657.
2. Kerr DCR, Bae H, Koval AL. Oregon recreational marijuana legalization: changes in undergraduates’ marijuana use rates from 2008 to 2016. *Psychol Addict Behav*. 2018;32:670–678.
3. Damrongplisit K, Hsiao C, Zhao X. Decriminalization and marijuana smoking prevalence: evidence from Australia. *J Bus Econ Stat*. 2010;28:344–356.
4. Qi D, Pearson MR, Hustad JTP. Predictors of motivation to change in mandated college students following a referral incident. *Psychol Addict Behav*. 2014;28:524–531.
5. Reis J, Riley WL. Predictors of college students’ alcohol consumption: implications for student education. *J Genet Psychol*. 2000;16:282–291.
6. Kilmer JR, Walker DD, Lee CM, et al. Misperceptions of college student marijuana use: implications for prevention. *J Stud Alcohol*. 2006;67:277–281. <http://ezproxy.coloradomesa.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=20230270&login.asp&site=chost-live>

7. Miech RA, Johnston LD, O'Malley PM, Bachman JG, Schulenberg JG, Patrick ME. *Monitoring the Future National Survey Results on Drug Use, 1975–2015: Vol. I, Secondary School Students*. Ann Arbor, MI: Institute for Social Research, The University of Michigan; 2016.
8. Keith DR, Hart CL, McNeil MP, Silver R, Goodwin RD. Frequent marijuana use, binge drinking and mental health problems among undergraduates. *Am J Addict*. 2015;24:499–506.
9. Tzilos GK, Reddy MK, Caviness CM, Anderson BJ, Stein MD. Getting higher: co-occurring drug use among marijuana-using emerging adults. *J Addict Dis*. 2014;33:202–209.
10. King AC, De Wit H, McNamara PJ, Cao D. Rewarding, stimulant, and sedative alcohol response and relationship to future binge drinking. *Arch Gen Psychiatry*. 2011;68:389–399.
11. Lukas SE, Orozco S. Ethanol increases plasma delta-9-tetrahydrocannabinol (THC) levels and subjective effects after marijuana smoking in human volunteers. *Drug Alcohol Depend*. 2001;64:143–149.
12. Wen H, Hockenberry JM, Cummings JR. The effect of medical marijuana laws on adolescent and adult use of marijuana, alcohol, and other substances. *J Health Econ*. 2015;42:64–80.
13. Wadsworth EJ, Moss SC, Simpson SA, Smith AP. Cannabis use, cognitive performance and mood in a sample of workers. *J Psychopharmacol*. 2006;20:14–23.
14. Howland J, Rohsenow DJ, Allensworth-Davies D, et al. The incidence and severity of hangover the morning after moderate alcohol intoxication. *Addiction*. 2008;103:758–765.
15. National Institute on Drug Abuse. *What Are Marijuana Effects?* June 2018. National Institute on Drug Abuse. <https://www.drugabuse.gov/publications/research-reports/marijuana/what-are-marijuana-effects>
16. National Institute on Alcohol Abuse and Alcoholism. *Overview of Alcohol Consumption*. n.d. National Institute on Alcohol Abuse and Alcoholism. <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption>
17. Schuermeier J, Salomonsen-Sautel S, Price RK, et al. Temporal trends in marijuana attitudes, availability and use in Colorado compared to non-medical marijuana states: 2003–2011. *Drug Alcohol Depend*. 2014;140:145–155.
18. Kerr DCR, Bae H, Phibbs S, Kern AC. Changes in undergraduates' marijuana, heavy alcohol and cigarette use following legalization of recreational marijuana use in Oregon. *Addiction*. 2017;112:1992–2001.
19. Fillmore MT, Weafer J. Acute tolerance to alcohol in at-risk binge drinkers. *Psychol Addict Behav*. 2012;26:693–702.
20. Hart CL, Ilan AB, Gevins A, et al. Neurophysiological and cognitive effects of smoked marijuana in frequent users. *Pharmacol Biochem Behav*. 2010;96:333–341.
21. Ramaekers JG, Kauert G, Theunissen EL, Toennes SW, Moeller MR. Neurocognitive performance during acute THC intoxication in heavy and occasional cannabis users. *J Psychopharmacol*. 2009;23:266–277.