

# ***Cannabis and Alcohol: Will Cannabis Users Use More Alcohol and How Legalization of Cannabis Affect This Trend?***

**Yawen Zhang<sup>1,a,\*</sup>**

<sup>1</sup>*University of Michigan, Ann Arbor, MI, 48104, the United States*

*a. yawenzh@umich.edu*

*\*corresponding author*

**Abstract:** Health and Social risks related to marijuana and alcohol are a serious problem in the United States. This research tried to introduce OLS regression in order to figure out the correlation between use of alcohol and cannabis, and the trend before and after legalization of cannabis, which is a factor that has not been researched in previous literature of alcohol, while a lot of controls were added to the model. It finds out that there is higher likelihood for marijuana users to co-use alcohol, but people tend to consume less alcohol if marijuana is legal. This may be because of the booster effect of cannabis on alcohol. These results might be a sign for future policymakers to implement more demand-side policies to reduce potential cannabis and alcohol addiction risks, as supply-side policies such as legalization might work in the opposite direction. For example, higher taxation on cannabis and alcohol might help.

**Keywords:** Cannabis, Marijuana, Alcohol, Legalization, Addiction.

## **1. Introduction**

Alcohol use and abuse is always drawing researchers' attention. Alcohol use disorder and related risks (for example, death) has become more prevalent when more population has exposed to use of alcohol, though the extent differentiates by sex, race and socioeconomic status [1]. For instance, Cannabis (in this paper cannabis and marijuana is interchangeably used) has been brought into context of substance abuse and mental disorder by the National Survey of Drug Use and Health (NSDUS) by the Substance Abuse and Mental Health Services Administration (SAMHSA) since 1979. In 2014 the sale of recreational cannabis was finally legalized in Colorado, remarking a new era of cannabis use research.

A paper discussing factors affecting people to consume more alcohol during Covid-19 lockdown manifests possible causes of negative emotions, such as loneliness, stress and depression, also concerns about their health, plus the common differentials over different sex, age, race, education attainment, etc. [2]. Chartier et al. have addressed the alcohol problem from the side of ethnic groups in detail that White might have more positive attitude than Black and Hispanic, leading to an earlier age of alcohol drinking [3]. Another paper has examined the different impact of these demographic characteristics and acquiring sources on cannabis use deeply [4]. It shows that men, non-Hispanic white, age group from 26 to 34 years old, and higher income group are inclined to purchase cannabis from commercial dispensaries [4]. If the configured restriction of sources of cannabis is loosen, then

people with cannabis vaporizers and with experience of both alcohol and cannabis have a higher tendency to purchase cannabis [4].

Speaking of using cannabis and alcohol at the same time, research has reported that half of teenagers and young adults have co-used alcohol and cannabis, and adults who used cannabis consume more alcohol, maybe due to booster effect of cannabis on alcohol [5]. Some literature observed more frequent and bountiful use of both substances among young adults aged from 18 to 25 years old if they consumed both instead of just one substance [6]. Other researchers, however, found out either using cannabis or alcohol first will reduce the amount of use of the other substance over the next 30 days, given that the researched group is college students [7]. Nevertheless, co-use of alcohol and cannabis will bring out negative impacts such as substance dependence, mental issues, injuries risky driving and sex behaviors, for adolescents and young adults there may be cognitive impairment risks, and the effect of co-use of both substances are above and beyond just using alcohol [6].

Following up the increasing use of cannabis among teenagers [5], especially after legalization of recreational cannabis, Kerr, et al. also found out that among people aged from 18 to 25 years old who have used alcohol but no cannabis has reduced their amount of alcohol consumed [8]. For people of the same age group who used cannabis before legalization they might consume more or less cannabis, while for college students aged above 21 years old who used to commit binge drinking, they probably substitute alcohol for cannabis, increasing use of cannabis and withdrawing binge drinking behavior [8]. In this case age groups might be a salient factor determining cannabis use and alcohol use, with a strong correlation with legalization of cannabis, despite no significant relationship between legalization and alcohol use is found in Kerr, et al.'s research [8].

Drawing attention to potential risks of use of alcohol and cannabis and caring about public health, this research is curious about whether the use of cannabis will reduce or enhance use of alcohol, and whether legalization of cannabis will have a further influence on alcohol use. In section 2 studies of co-use of alcohol and cannabis will be reviewed; section 3 will introduce the models and variables used in this research; section 4 will show the regression results; section 5 will suggest possible explanations and point out future research improvements.

## **2. Methodology**

### **2.1. Data Source**

This paper extracts cross-sectional data of marijuana and alcohol use from the 2022's NSDUS. This database is the yearly collection of substance abuse and impact on mental health by the SAMHSA; and according to it, the survey is carried out at population above 12 years old, specific to sub-state level [9]. In this paper, 39600 observations in total are used.

### **2.2. Model and Variables**

The key method used in this paper is OLS regression about impact of marijuana use on alcohol use. The dependent variable is therefore defined by the database as ALCUS30D, which is how much alcohol per day is used over the past thirty days. The key dependent variables are MJDAY30A, which is how many days over the past thirty days a person has consumed marijuana and/ or cannabis products, and "legal", which is a dummy variable denoting whether the state the person lives in has legalized cannabis. The "legal" variable is used as policy changes of cannabis will affect access, costs, social acceptability, etc. of cannabis and therefore use pattern of certain age groups [6]. The MJDAY30A is used to match the time scale of ALCUS30D (past 30 days), and it is the best estimate since no variable of "daily used amount" is provided in the database. An interaction term of MJDAY30A and legal is also added. The basic regression model is shown below:

$$Alcohol_i = \beta_0 + \beta_1 * Cannabis_i + \beta_2 * Legal_i + \beta_3 * Cannabis_i * Legal_i \quad (1)$$

In addition, a number of demographic controls have been added to the model, procuring exogeneity. The first variable is age, categorized as groups of “below 20”, “from 20 to 30”, “from 30 to 50”, “from 50 to 65” and “above 65”, all dummies. The age variable is studied in Chiu, Chan, Hall, Hides & Leung’s paper as independent variable to probe into the relationship to potential marijuana use if Australia legalized recreational cannabis [10]. In other words, age groups might be related to cannabis use due to different perceptions and attitudes towards cannabis [10]. The second is a sex dummy variable “female”. Previous literature has proved that the difference in alcohol consumption between different sex has become less prevalent since 2000 [1], but it is still meaningful to test if this phenomenon holds in this model. The last is the education attained by the sample population, originally grouped as “12-17” (currently in high school), “below high school”, “graduated from high school”, “college and associate college diploma” and “graduated from college”, all dummies. However, the group “12-17” begot perfect collinearity with the group “below 20” so was dropped in the final model. The final model is therefore shown as:

$$Alcohol_i = \beta_0 + \beta_1 * Cannabis_i + \beta_2 * Legal_i + \beta_3 * Cannabis_i * Legal_i + \beta_4 * Female_i + \beta_5 * Age_i + \beta_6 * Educ_i + \varepsilon_i \quad (2)$$

### 2.3. Descriptive Statistics

Table 1 has concluded the descriptive characteristics of key variables:

Table 1: Key variables’ descriptive characteristics

Variable	Obs	Mean	Std. Dev.	Min	Max
ALCUS30D	39600	1.714	2.656	0	90
MJDAY30A	39600	3.531	8.656	0	30
below 20	39600	.127	.333	0	1
from 20 to 30	39600	.264	.441	0	1
from 30 to 50	39600	.387	.487	0	1
from 50 to 65	39600	.114	.318	0	1
above 65	39600	.108	.31	0	1
less high school	39600	.074	.261	0	1
high school grad	39600	.218	.413	0	1
coll or assoc	39600	.289	.453	0	1
college grad	39600	.359	.48	0	1
female	39600	.553	.497	0	1

### 3. Results

Four regressions have been run and their results (Table 2) are attached below. The sketchy result of model 1 is fitted with the assumption based upon Kim et al.’s research that consumption of cannabis might be complementary to that of alcohol, indicating marijuana use is statistically significantly ( $p = 0.001$ ) positively related to daily alcohol use [5]. When adding variable of “legal” and its intersection variable with MJDAY30A, the positive relationship between MJDAY30A does not change, and a new negative relationship between legalization of marijuana and use of alcohol, yet no interaction between marijuana use and legalization of it was detected. This is not coherent with conclusion by Kerr et al. that renders positive correlation of cannabis use and cannabis legalization [8].

When all control variables are added into model 4, the relationship between daily alcohol use and marijuana stabled at 0.04, and the negative relationship between legalization of marijuana and alcohol use is still significant (though the  $\alpha$  value falls from  $p = 0.001$  to  $p = 0.05$ ). It is also noticed that women is significantly less likely to drink alcohol. Speaking of age variations, setting people who are below 20 years old as the baseline, people aged from 20 to 30 years old are more prone to drink alcohol but after 50 years old there is a descending trend in alcohol use. Education attainment, compared to the baseline of high school students who are underage to alcohol use, is positively related to alcohol use among all groups.

Table 2: Empirical results

VARIABLES	(1) model1 ALCUS30D	(2) model2 ALCUS30D	(3) model3 ALCUS30D	(4) model4 ALCUS30D
MJDAY30A	0.0408*** (0.00153)	0.0410*** (0.00153)	0.0434*** (0.00349)	0.0361*** (0.00346)
legal		-0.0950*** (0.0310)	-0.0865*** (0.0331)	-0.0624* (0.0326)
MJDAY30A_legal			-0.00291 (0.00389)	-0.00309 (0.00384)
female				-0.476*** (0.0264)
from_20_to_30				0.330*** (0.0579)
from_30_to_50				0.0192 (0.0568)
from_50_to_65				-0.257*** (0.0652)
above_65				-0.774*** (0.0661)
less_high_school				0.850*** (0.0845)
high_school_grad				0.797*** (0.0762)
coll_or_assoc				0.864*** (0.0764)
college_grad				0.827*** (0.0787)
Constant	1.570*** (0.0143)	1.641*** (0.0273)	1.635*** (0.0286)	1.142*** (0.0600)
Observations	39,600	39,600	39,600	39,600
R-squared	0.018	0.018	0.018	0.044

#### 4. Conclusion

This research is trying to address the problem of the tendency of using both alcohol and cannabis, with the key factor of legalization of cannabis of different states, and with demographic characteristics

controlled. The result turns out a higher likelihood of alcohol consumption with consumption of cannabis, which accords with the prominent co-use status quo. The age group difference is also loosely fitted with previous literature. The most interesting part of this research reflects with the higher inclination of alcohol use with higher degrees earned.

The only drawback of this model is reflected in the R-square result, which is 0.044, not very high explaining in the model fitness. This can be explained from variables themselves: “how many days over the past thirty days consumed cannabis” is not perfectly matched with “daily amount of alcohol consumed over the last 30 days”, i.e. if a variable representing daily amount of cannabis used can replace the original independent variable used in this model in the future, the fitness of model will be enhanced.

What’s more, the negative relationship between legalization of cannabis and alcohol use provides research gap for future researchers, since given the complimentary correlation between the two substances, and a promotion of cannabis use provided by legalization of it, it is plausible to assume that legalization of cannabis should be positively related to consumption of alcohol. However, the empirical result is counter-intuitive, so it is worth to delve into in the future. For policymakers, they need to consider implementation of more demand-side policies than supply-side policies based upon that. If an accessible race variable can be created based on a similar data source, possible deviation referred in previous literature by ethnicity can also be included in the model.

## References

- [1] Carr, T., Kilian, C., Llamosas-Falcón, L., Zhu, Y., Lasserre, A. M., Puka, &K., Probst, C. (2024). *The risk relationships between alcohol consumption, alcohol use disorder and alcohol use disorder mortality: A systematic review and meta-analysis*. *Addiction*.
- [2] Hendriksen, P., Merlo, A., Bruce, G., &Verster, J.C. (2021). *Factors affecting alcohol use during COVID-19 lockdown: a critical review*. *European Neuropsychopharmacology*.
- [3] Chartier, K.G., Hesselbrock, M.N., &Hesselbrock, V.M. (2009). *Ethnicity and Adolescent Pathways to Alcohol Use*. *Journal Of Studies On Alcohol And Drugs*.
- [4] Myers, M.G., Dowling, M.A., &Bohnert, K.M. (2024). *Where Do Adults in the United States Obtain Cannabis? A Nationally Representative Study Examining the Relationships Between Sociodemographic Factors, Cannabis Use Characteristics and Sources of Cannabis*. *Journal Of Studies On Alcohol And Drugs*.
- [5] Kim, J. H., Weinberger, A.H., Zhu, J, Barrington-Trimis, J, Wyka, K., & Goodwin, R.D. (2021). *Impact of state-level cannabis legalization on poly use of alcohol and cannabis in the United States, 2004–2017*. *Drug And Alcohol Dependence*.
- [6] Arterberry, B. J., Goldstick, J. E., Walton, M. A., Cunningham, R. M., Blow F. C., &Bonar, E. E. (2021). *Alcohol and cannabis motives: differences in daily motive endorsement on alcohol, cannabis, and alcohol/cannabis co-use days in a cannabis-using sample*. *Addiction Research & Theory*.
- [7] Karoly, H. C., Conner, B. T., &Prince, M. A. (2022). *Associations between alcohol and cannabis use order, frequency, quantity, and consequences in a college sample of individuals who co-use alcohol and cannabis*. *The American Journal On Addictions*.
- [8] Kerr, D. C. R., Levy, N. S., Bae, H. Boustead, A. E., &Martins, S. S. (2023). *Cannabis and Alcohol Use by U. S. Young Adults, 2008–2019: Changes in Prevalence After Recreational Cannabis Legalization*. *American Journal Of Preventive Medicine*.
- [9] Substance Abuse and Mental Health Services Administration. *National Survey on Drug Use and Health (NSDUH)*. <https://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health>
- [10] Chiu, V., Chan, G., Hall, W., Hides, L., &Leung, J. (2022). *Trends in cannabis use intention around the period of cannabis legalisation in Australia: An age-period-cohort model*. *Drug And Alcohol Review*.