

Has COVID-19 Changed Marijuana Use in the United States?

Kayhan Koleyni
Eastern New Mexico University

Pandemic-related stress, depression, and anxiety might be important motivations for marijuana use. In this paper, we study the impact of the COVID-19 pandemic on the use of marijuana among people aged 12 and older in the United States. We use data from the National Survey on Drug Use and Health (NSDUH) and different econometric models to investigate this impact on national and state levels. We also consider the impact of the pandemic on the use of other illicit drugs such as heroin and methamphetamine. We find evidence that the COVID-19 pandemic has led to an increase in marijuana use at both state and national levels.

Keywords: marijuana, COVID-19, illicit drugs, United States, pandemic

INTRODUCTION

The U.S. coronavirus outbreak that started in 2020 had a huge impact on the everyday life of Americans. The U.S. reported more COVID-19 cases between January 1, 2020 and April 16, 2020 than polio cases between 1910 and 2010 (Ochmann and Roser 2020). Among many public health challenges, this study focuses on the impact of the coronavirus outbreak on marijuana use in the United States. Stay-at-home, work-from-home, and shelter-in-place orders along with pandemic-related stress, depression, and anxiety might be important motivations for marijuana use. Health care studies indicate that many people experienced elevated levels of loneliness, stressors, anxiety, and depression during the course of the pandemic (Brooks et al. 2020; Luchetti et al. 2020; Lee et al. 2020; Graupensperger et al. 2020).

Accordingly, this study investigates changes in marijuana use by using the National Survey on Drug Use and Health (NSDUH) and different models. We study the impact on both national and state levels. Surprisingly few studies have considered this impact and the few existing studies are limited to medicine and health care disciplines. These studies usually involve surveying a small community sample, analyzing the results, and making conclusions that are limited to that small community. For example, Graupensperger et al. (2021) used a community sample of 500 young adults in Washington State. By using a repeated-measures design, the authors collected data prior to the COVID-19 pandemic and again during the initial acute phase of the pandemic to examine changes in young adults' alcohol and marijuana use, norms, and motives. They found that young adults, on average, increased alcohol use frequency but decreased the amount consumed per drinking occasion. No changes in marijuana use were identified. Another study by Bochicchio et al. (2021) used qualitative in-depth interviews of 16 sexual minority women to understand their alcohol and marijuana use during the COVID-19 pandemic. Patrick et al. (2022) used a U.S. national sample of 1,244 young adults and asked them about their use of marijuana, vaping, drinking, and other drugs to cope with the COVID-19 pandemic. Their findings show that in Fall 2020, 15.7% reported using

marijuana, 8.9% increased vaping, and 8.2% increased drinking to cope with social distancing and isolation. Imtiaz et al. (2021) studied cannabis consumption during the COVID-19 pandemic in Canada using a repeated cross-sectional survey. They found that a large proportion of those who used cannabis increased their cannabis use during the pandemic. However, these medical- and health care discipline-based studies are different in nature, scope, and methodology than those in the social sciences such as economics.

This paper is the first study in economics to focus on national-level impacts of COVID-19 on marijuana use in the United States. Our data cover the 2014–2020 period of National Survey on Drug Use and Health (NSDUH) data with 381,484 observations. Every year, the NSDUH surveys almost 70,000 residents of the United States about their drug consumption and other health behaviors (Morton et al. 2013). The federal government uses these data to determine drug use prevalence in the United States at the national and state levels. NSDUH respondents are asked a series of questions about their use of tobacco, alcohol, marijuana, and illicit drugs, including prescription painkillers (Carpenter et al. 2017). We use the outcomes of this dataset to determine changes in marijuana consumption during the pandemic.

The rest of the paper is organized as follows. Section 2 provides some background information and statistics on marijuana consumption in the U.S. since 2014. Section 3 describes the methodology and data used in the paper. The results are presented in Section 4 and we conclude the paper in Section 5.

BACKGROUND

There is a substantial literature on drinking, smoking, and marijuana use, especially on the determinants of marijuana use, the effects of medical and recreational marijuana laws (Anderson et al. 2015; Pacula et al. 2015; Dilley et al. 2019; Anderson et al. 2019, Mathur et al. 2022), marijuana decriminalization (Dills et al. 2017), youth cohort size (Jacobson 2004), high school graduation requirements (Hao and Cowan 2019), and state education requirements for substance use prevention (Carpenter et al. 2019).

For instance, Compton et al. (2019) analyzed U.S. National Survey on Drug Use and Health (NSDUH) data and found that cannabis use among adults increased from 10.4% to 15.3% during 2002–2017. This increase in cannabis use was associated with increasing legal and social acceptance, greater cannabis availability, and declining risk perceptions of cannabis use (Compton et al. 2016). Meanwhile, another recent study using NSDUH data reported falling rates of cannabis dependence among daily or near daily users from 26.5% in 2002–2004 to 16.1% in 2014–2016 (Davenport 2018).

However, because the data for marijuana and other illicit drug use related to the pandemic were not released until recently, there is a gap in the pandemic-related literature for marijuana consumption; the purpose of this study is to fill this void. We start with some statistics extracted from NSDUH state-based reports to study recent changes in cannabis consumption.

Figure 1 shows marijuana use during the past year in percentage terms of population aged 12 years or older across different states in 2020. Darker states indicate higher marijuana consumption, ranging from 12.54% in Texas to 29.96% in the District of Columbia.

Figure 2 shows the change for the same indicator between 2019 and 2020. The greener the state the higher the increase in cannabis consumption and the highest increase in consumption is in Oklahoma. In Minnesota, Kentucky, West Virginia, and Alabama the change is small (white states), and in red states such as Nevada, New Mexico, Nebraska, Indiana, and Georgia, consumption decreased. Overall, most states are green, illustrating an increase in marijuana consumption.

Figure 3 plots the trends of cannabis consumption as a percentage of population in the period 2014–2020 for four U.S. regions compared to national levels. The national trend increased from 12.9% in 2014 to 17.73% in 2020. All four regions also follow the increasing trend of consumption. The West (green line) and Northeast (orange line) regions are above the national levels (dark blue line), and the West has the highest consumption among other regions. While the Midwest (gray line), which is below national levels in 2014–2019, reaches to the national level in 2020, the South (red line) stands below other regional and national levels.

FIGURE 3
MARIJUANA USE BY REGION AS A PERCENTAGE OF POPULATION, 2014–2020

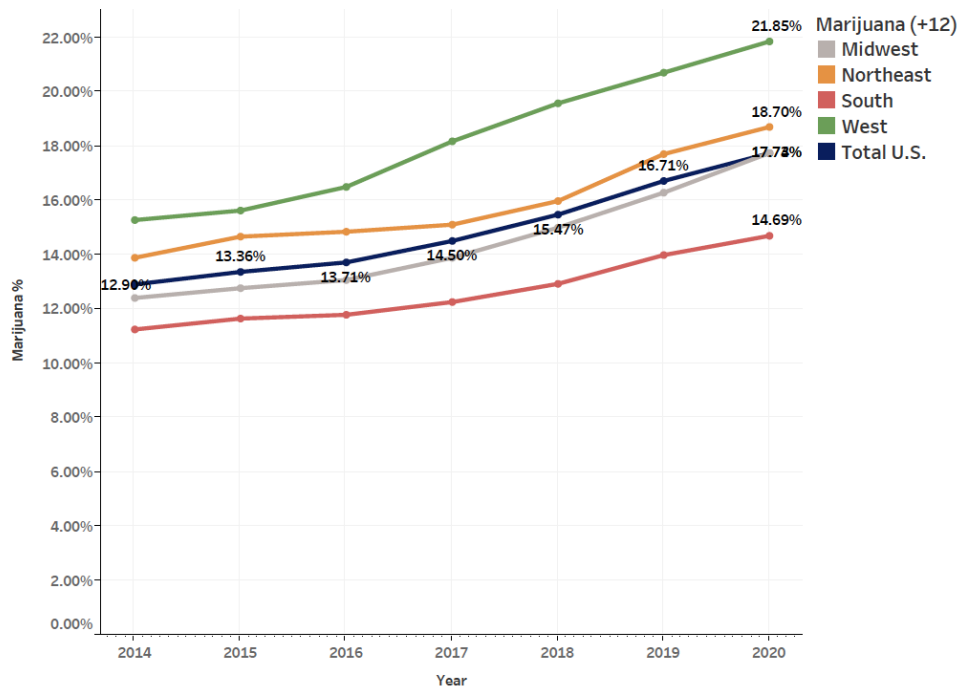


FIGURE 4
FIRST-TIME MARIJUANA USERS IN FOUR U.S. REGIONS AND IN TOTAL AS A PERCENTAGE OF POPULATION, 2016–2020

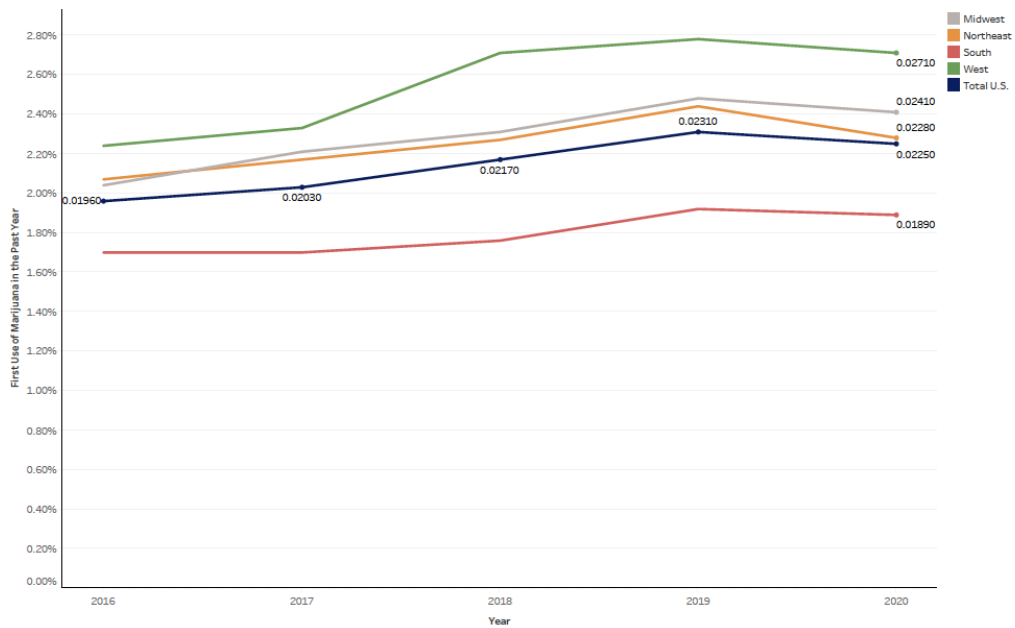


Figure 4 indicates the trends of first-time marijuana users during the 2016–2020 period. The West, Midwest, and Northeast regions have the highest levels of first-time users, respectively, and during the whole period they stand above the national levels. The South has the lowest trend, which is below the

national levels. Interestingly, the percentage of first-time users in all regions and even national levels dropped between 2019 and 2020.

EMPIRICAL APPROACH

As noted earlier, we use U.S. National Survey on Drug Use and Health (NSDUH) data. NSDUH is an annual survey of the U.S. civilian, non-institutionalized population aged 12 years or older (NSDUH 2022). For the first part of our analysis, we use state-level data for the period 2014–2020. The combined dataset for the whole period is not yet available; hence, the first step is to make a new dataset by combining the annual datasets. We utilize “marijuana use in the past year” in percentage terms for different states during this period from NSDUH. We also get the state-level unemployment rates from the BLS database and median household income and college enrollment in percentage terms as a proxy for education from the census database. Then, we form a panel dataset and estimate the following specification:

$$\ln y_{it} = \alpha_i + \alpha_t + \alpha_{it} + \beta Covid_{it} + \theta X_{it} + \varepsilon_{it}, \quad (1)$$

where y_{it} is marijuana use in state i at time t . $Covid_{it}$ is the dummy variable to capture the impact of COVID-19, X_{it} is the vector of state-level specifications such as unemployment rate, median household income, and state education level.

In addition, we collect the state-level total COVID-19 cases per 100,000 from the Johns Hopkins University database and then use this in the following specification:

$$\ln y_{i2020} = \alpha_0 + \ln Covid\ Cases_{i2020} + BX_{i2020} + \varepsilon_{i2020}, \quad (2)$$

where y_{i2020} is marijuana use in state i and $Covid\ Cases_{i2020}$ is the number of COVID-19 cases in state i during 2020. X_{i2020} is the vector of state-level specifications such as unemployment rate, median household income, and state education level.

Because the NSDUH provides only state-level data (at least publicly) that and does not include individual-level data, we cannot analyze further than this. Therefore, we move to study at the national level. Again, we need to combine the annual data from 2014–2020 at the national level; however, the advantage of the NSDUH at the national level is direct access to survey questions and demographic information such as health, education, and income of each individual. Accordingly, we estimate the following specification at the national level:

$$y_{jt} = \alpha_j + \alpha_t + \alpha_{jt} + \beta Covid_{jt} + \theta X_{jt} + \varepsilon_{jt}, \quad (3)$$

where y_{jt} is the substance use outcomes for individual j available in NSDUH, $Covid_{jt}$ is a COVID-19 dummy variable, and X_{jt} is a vector of individual characteristics available in the NSDUH dataset including gender, marital status, age, race, health, education, and income.

For y_{jt} , we use “ever used in past 12 months,” “total number of days used in past 12 months,” “year of first use,” and “number of days per week used during past 12 months.” To estimate the effects of COVID-19 on the outcomes described above, we estimate standard fixed effects models. The response to “ever used in past 12 months” is zero or one; therefore, for this dependent variable we estimate logistic regression models. “Year of first use” ranges from 2012 to 2020 and for estimation we use categorical models. Substances we study here are marijuana, alcohol, tobacco, cocaine, heroin, crack, and meth.

Moreover, we prepare a monthly dataset based on “month of first use” in NSDUH and utilize the event study approach to see the impact of COVID-19 on marijuana use for the period 2014–2020. We use the following specification:

$$\ln y_t = \alpha_t + \sum_{k=-3}^3 \beta_{0k} I(event_t = k) + \theta X_t + \varepsilon_t, \quad (4)$$

where y_t is the number of individuals who consumed marijuana for the first time in month t . March is the month the COVID-19 event started (according to the Johns Hopkins University database). X_{jt} is a vector of individual characteristics available in the NSDUH dataset including gender, marital status, age, race, health, education, and income.

RESULTS

Descriptive Statistics, Substance Use Outcomes, and Demographics

We begin our analysis by looking at the descriptive statistics of the dataset at national level. There are 381,484 observations in the dataset (52.88 percent females; 47.12 percent males). First, we present the descriptive statistics of the demographics in Table 1. The first part of Table 1 shows the marital status of individuals with gender classifications in percentage terms. Around 52.15 percent of the sample has never been married, comprising 26.21 percent males vis-à-vis 25.95 percent females. Around 36.05 percent are married (19.38 percent females; 16.67 percent males). Other categories are divorced/separated and widowed, with 9.26 percent and 2.54 percent, respectively. The second section in Table 1 reports the family income, where 35.36 percent have more than \$75,000 annual income with equal share for males and females. Around 30 percent of the sample report income between \$20,000 and \$49,999, which is the second largest category followed by 18.98 percent that earn less than \$20,000 and 15.59 percent that earn \$50,000–\$74,999. The third part of Table 1 indicates the sample age category. Subcategory 35 years or older is the largest with 36.21 percent, followed by 18–25-years-old and 12–17-years-old. The smallest subcategory is 26–34-years-old, which is around 15.67 percent.

TABLE 1
DESCRIPTIVE STATISTICS AND DEMOGRAPHICS, 2014–2020

	Male (%)	Female (%)	All (%)
Married	16.67	19.38	36.05
Widowed	0.64	1.89	2.54
Divorced or separated	3.60	5.67	9.26
Never been married	26.21	25.95	52.15
Less than \$20,000	8.08	10.90	18.98
\$20,000 - \$49,999	14.02	16.06	30.07
\$50,000 - \$74,999	7.56	8.03	15.59
\$75,000 or more	17.82	17.54	35.36
12-17 years old	12.06	11.55	23.61
18-25 years old	11.74	12.78	24.51
26-34 years old	7.14	8.53	15.67
35 or older	16.54	19.66	36.21
White	28.35	30.90	59.25
Black/Afr Am	5.61	6.74	12.35
Native Am/AK Native	0.70	0.73	1.43
Native HI/Other Pac Isl	0.25	0.25	0.50
Asian	2.24	2.40	4.63
More than one race	1.82	2	3.82
Hispanic	8.51	9.50	18.01

Health: Excellent	12.20	13.21	25.41
Very good	18.51	20.16	38.68
Good	12.47	13.84	26.31
Fair/Poor	4.30	5.31	9.61
Less high school	4.86	4.68	9.54
High school grad	10.15	9.73	19.88
Some coll/Assoc dg	10.95	14.50	25.46
College graduate	9.51	12.19	21.70
12–17 year old	11.99	11.45	23.44
N (%)	47.12	52.88	

Notes: Based on data from the 2014–2020 National Survey on Drug Use and Health. All numbers are in percentage terms. There are 381,484 observations in the dataset.

Section 4 describes the sample by race. Whites represent around 60 percent and Native Hawaiian/Other Pacific Islander 0.5 percent, the largest and smallest subcategories, respectively. Section 5 in Table 1 categorizes the health of surveyed individuals in four categories: excellent, very good, good, and fair/poor; the largest subcategory is very good with 38.68 percent. The last part of Table 1 indicates the education subcategories. Around 25 percent of the sample have taken some college-level courses or have an associate degree; the smallest group (9.54 percent) reports less than a high school education.

Table 2 shows substance use outcomes for the period 2014–2020. Columns 1–3 present “ever used the substance,” “total number of days used the substance in past 12 months,” and “number of days per week used the substance during past 12 months,” respectively, for each of the following substances: marijuana, alcohol, tobacco, cocaine, heroin, crack, and meth.

TABLE 2
SUBSTANCE USE OUTCOMES, 2014–2020

	Ever Used (%)	Total Number of Days Used in Past 12 Months	Number of Days per Week Used During Past 12 Months
Marijuana	43.06	124.06	4.52
Alcohol	72.37	82.13	2.97
Tobacco	48.55	NA	NA
Cocaine	11.83	29.38	2.39
Heroin	1.73	122.65	4.65
Crack	22.94	71.49	3.11
Meth	4.49	110.18	4.11

Notes: Based on data from the 2014–2020 National Survey on Drug Use and Health. Numbers in column 1 are in percentage terms while numbers in columns 2 and 3 are means at levels.

Column 1 of Table 2 shows in percentage terms that alcohol and tobacco are the most used substances followed by marijuana. Around two-thirds and half of the population consumed alcohol and tobacco, respectively. Marijuana consumption is 43.06 percent and the least consumed substance is heroin (1.73 percent). Columns 2 and 3, respectively, indicate frequency of substance use annually and weekly. For annual consumption, marijuana has the highest frequency with 124.06 days followed by heroin (122.65 days) and meth (110.18 days). Cocaine has the smallest annual frequency of consumption with 29.38 days. However, for weekly consumption, heroin has the highest frequency at 4.65 days with marijuana (4.52 days) and meth (4.11 days) at second and third place, respectively. Again, cocaine has the smallest frequency of use.

COVID-19 and Marijuana Use: State-Level Results

As noted in Section 3, first we form a panel dataset for the period 2014–2020 and then estimate Equation (1). Columns 1–4 in Table 3 present the results. Column 1 indicates that by controlling the state-specific fixed effects, the impact of COVID-19 on marijuana use is positive, statistically significant, and can increase the likelihood of marijuana consumption during the past year by 0.321. The coefficient for education is also statistically significant and negative, showing that a one percentage point increase in education (school enrollment) reduces the likelihood of marijuana consumption by 1.019 percent. For income, the sign is positive but it is only statistically significant at the 10 percent level. The unemployment rate is statistically significant but with a negative sign, showing that a one percentage point increase in unemployment reduces marijuana consumption by -0.283 . This is compatible with some studies in the literature for “past year marijuana use” such as Carpenter et al. (2017).

Adding a linear time trend in Specification (2) makes all the coefficients statistically insignificant and changes the income sign to negative. However, even if we drop the state-specific variables of education, income, and unemployment as shown in Specification (3), the COVID-19 coefficient remains positive and statistically significant. Specification (4) is almost analogous with (1) and dropping income cannot really help.

TABLE 3
IMPACT OF COVID-19 ON MARIJUANA USE

	(1)	(2)	(3)	(4)	(5)	(6)
	$\ln y_{it}$	$\ln y_{it}$	$\ln y_{it}$	$\ln y_{it}$	$\ln y_{it}$	$\ln y_{it}$
$Covid_{it}$	0.321*** (12.59)	0.0327 (0.33)	0.056*** (4.48)	0.329*** (13.03)		
$\ln(Covid\ Cases_{i2020})$					-0.14* (-2.00)	-0.17** (-2.47)
$\ln(Education_{it})$	-1.019*** (-4.77)	-0.097 (0.60)		-1.11*** (-5.32)	0.66* (1.90)	0.83** (2.56)
$\ln(Income_{it})$	0.079* (1.73)	-0.056 (-1.46)			0.197 (1.00)	
$Unemployment_{it}$	-0.283*** (-7.56)	-0.05 (-1.43)		-0.28*** (-7.54)	0.186 (1.50)	
Time Trend	No	Yes	Yes	No	No	No
State FE	Yes	Yes	Yes	Yes	No	No
R2	0.94	0.96	0.93	0.94	0.36	0.31

Notes: Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% level, respectively. Numbers in parentheses are *t*-statistics.

Specifications (5) and (6) illustrate the results of cross-sectional analysis and we find that the number of COVID-19 cases has had a negative impact on marijuana consumption during the past year. In Specification (5), it is only statistically significant at 10 percent level and none of the signs are compatible with what theory suggests. Specification (6) indicates the results without income and unemployment rate; the signs are still the same but the number of COVID-19 cases and education are statistically significant, this time at the 5 percent level. However, the sample size is small and these two specifications are not reliable.

COVID-19 and Marijuana Use: National-Level Results

To investigate the impact of COVID-19 on marijuana consumption at the national level, we form a large panel dataset with 381,484 observations from the NSDUH annual surveys for the period 2014–2020.

In addition to marijuana, here we expand our analysis to other substances such as alcohol, tobacco, cocaine, heroin, crack, and meth. As shown in Table 4, we use four different substance use outcomes for these seven substances. In Table 4, column 1 estimates the impact of COVID-19 on “ever used” the substances during the past year. The response to this question is either zero or one. Accordingly, we estimate Equation (3) in Section 3 by utilizing logistic regression models. As mentioned in Equation (3), we also estimate individual characteristics available in the NSDUH, i.e., gender, marital status, age, race, health, education, and income, but here we only report marginal effects for each substance. All coefficients are statistically significant and the signs for marijuana and alcohol usage are positive, which means COVID-19 increased the likelihood of their consumption. For tobacco, cocaine, heroin, crack, and meth, our results suggest the opposite.

TABLE 4
COVID-19 AND SUBSTANCE USE CONSUMPTION FOR MAJOR DRUG CLASSES AT NATIONAL LEVEL

	(1) Ever Used (%)	(2) Total Number of Days Used in Past 12 Months	(3) Year of First Use	(4) Number of Days per Week Used During Past 12 Months
Marijuana	0.063*** (5.937)	5.83*** (3.387)	2.67*** (49.670)	0.25*** (5.597)
Alcohol	1.799*** (102.260)	4.166*** (6.234)	2.58*** (61.807)	0.224*** (10.837)
Tobacco	-0.459*** (-47.103)	NA	2.747*** (35.584)	NA
Cocaine	-0.969*** (-99.555)	-4.876** (-2.058)	2.935*** (24.053)	-0.0049 (-0.021)
Heroin	-1.771*** (-111.957)	37.834*** (2.759)	3.577*** (6.662)	0.823** (2.421)
Crack	-0.945*** (-33.438)	1.808 (2.668)	3.281*** (6.555)	0.395 (0.866)
Meth	-1.405*** (-112.004)	25.857 (3.098)	2.67*** (10.625)	0.595** (2.404)

Notes: Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% level, respectively. In columns 1 and 3, numbers in parentheses are *z*-statistics and in columns (2) and (4) numbers in parentheses are *t*-statistics.

Columns (2) and (4), respectively, present the frequency of substance use annually and monthly. For annual frequency (column 2), all coefficients are statistically significant except for crack and meth. All coefficients have positive signs (except cocaine), suggesting that COVID-19 has increased the likelihood of frequency of consumption. The results for weekly frequency are presented in column (4). The only difference is that cocaine is not statistically significant and the magnitudes are different. Column (3) illustrates the impact of COVID-19 on the year of first use. To estimate this specification, we apply categorical regression models. All coefficients are statistically significant and have positive signs, which shows COVID-19 has increased the likelihood of initiating substance consumption.

TABLE 5
EVENT STUDY RESULTS

	(1)	(2)
	$\ln y_t$	$\ln y_t$
Covid(-3)	0.174*** (4.78)	0.172*** (4.42)
Covid(-2)	-0.030 (-0.69)	-0.027 (-0.59)
Covid(-1)	0.039 (0.89)	0.046 (0.98)
Covid	-0.004 (-0.09)	-0.014 (-0.31)
Covid(+1)	-0.020 (-0.45)	-0.013 (-0.29)
Covid(+2)	-0.29*** (-6.45)	-0.27*** (-5.77)
Covid(+3)	0.011 (0.35)	0.018 (0.52)
Time trend	Yes	No
R2	0.94	0.93

Notes: Statistical significance is denoted by *, **, and *** at the 10%, 5% and 1% level, respectively. Numbers in parentheses are *t-statistics*.

Next, we use an event study approach to investigate the impact of COVID-19 based on month of first use for marijuana. We prepare a dataset based on “month of first use” reported in NSDUH and then use Equation (4) in Section 3 to estimate the impact of COVID-19 on marijuana consumption while controlling for gender, marital status, age, race, health, education, and income. Table 5 presents the results.

Only Covid(-3) and Covid(+2) are statistically significant. Covid(-3) has a positive sign and Covid(+2) has a negative sign. However, being statistically significant for Covid(-3) is unexpected. We do not expect COVID-19 having any impact on marijuana consumption three months before it starts in U.S. This may suggest the impact of change in data collection that happened in 2020. Covid(+2) is a better estimate and suggests COVID-19 reduced marijuana consumption 2 months after it started in the U.S. based on month of first use data.

CONCLUSION

Pandemic-related stress, depression, and anxiety might be motivations for marijuana use. Here, we studied the impact of the COVID-19 pandemic on the use of marijuana among people aged 12 and older in the United States. We used National Survey on Drug Use and Health (NSDUH) and different econometric models to investigate this impact on the national and state levels. At the state level, our results suggest a positive impact, where COVID-19 increased the likelihood of marijuana consumption by 0.321. At the national level, in addition to marijuana, we studied other substances such as alcohol, tobacco, cocaine, heroin, crack, and meth. Again, COVID-19 increased the likelihood of consumption for marijuana and alcohol but not for tobacco, cocaine, heroin, crack, and meth.

REFERENCES

- Bochicchio, L.A., Drabble, L.A., Riggle, E.D., Munroe, C., Wootton, A.R., & Hughes, T.L. (2021). Understanding alcohol and marijuana use among sexual minority women during the COVID-19 pandemic: A descriptive phenomenological study. *Journal of Homosexuality*, 68(4), 631–646.
- Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G.J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *The Lancet*, 395(10227), 912–920.
- Carpenter, C.S., McClellan, C.B., & Rees, D.I. (2017). Economic conditions, illicit drug use, and substance use disorders in the United States. *Journal of Health Economics*, 52, 63–73.
- Compton, W.M., Han, B., Jones, C.M., & Blanco, C. (2019). Cannabis use disorders among adults in the United States during a time of increasing use of cannabis. *Drug and Alcohol Dependence*, 204, 107468.
- Compton, W.M., Han, B., Jones, C.M., Blanco, C., & Hughes, A. (2016). Marijuana use and use disorders in adults in the USA, 2002–14: Analysis of annual cross-sectional surveys. *The Lancet Psychiatry*, 3(10), 954–964.
- Dattani, S., Spooner, F., Ochmann, S., & Roser, M. (2020). *Polio*. Retrieved from <https://ourworldindata.org/polio>
- Davenport, S. (2018). Falling rates of marijuana dependence among heavy users. *Drug and Alcohol Dependence*, 191, 52–55.
- Graupensperger, S., Benson, A.J., Kilmer, J.R., & Evans, M.B. (2020). Social (un) distancing: Teammate interactions, athletic identity, and mental health of student-athletes during the COVID-19 pandemic. *Journal of Adolescent Health*, 67(5), 662–670.
- Graupensperger, S., Fleming, C.B., Jaffe, A.E., Rhew, I.C., Patrick, M.E., & Lee, C.M. (2021). Changes in young adults' alcohol and marijuana use, norms, and motives from before to during the COVID-19 pandemic. *Journal of Adolescent Health*, 68(4), 658–665.
- Imtiaz, S., Wells, S., Rehm, J., Hamilton, H.A., Nigatu, Y.T., Wickens, C.M., . . . Elton-Marshall, T. (2021). Cannabis use during the COVID-19 pandemic in Canada: A repeated cross-sectional study. *Journal of Addiction Medicine*, 15(6), 484.
- Lee, C.M., Cadigan, J.M., & Rhew, I.C. (2020). Increases in loneliness among young adults during the COVID-19 pandemic and association with increases in mental health problems. *Journal of Adolescent Health*, 67(5), 714–717.
- Luchetti, M., Lee, J.H., Aschwanden, D., Sesker, A., Strickhouser, J.E., Terracciano, A., & Sutin, A.R. (2020). The trajectory of loneliness in response to COVID-19. *American Psychologist*, 75(7), 897.
- Mathur, N.K., & Ruhm, C.J. (2022). *Marijuana legalization and opioid deaths* (No. w29802). National Bureau of Economic Research.
- Morton, K.B., Martin, P.C., Chromy, J.R., Shook-Sa, B.M., & Hirsch, E.L. (2013). *2012 National Survey on Drug Use and Health, Methodological Resource Book*. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Patrick, M.E., Parks, M.J., Fairlie, A.M., Kreski, N.T., Keyes, K.M., & Miech, R. (2022). Using substances to cope with the CoViD-19 pandemic: US national data at age 19 years. *Journal of Adolescent Health*, 70(2), 340–344.