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Changes in Secondary Substance Use After the Onset of the COVID-19 Pandemic Among People Who Use Cannabis: Findings From a Web-Based Sample of Adults in the United States

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Abstract

The coronavirus disease 2019 (COVID-19) pandemic has had widespread impacts on mental health and substance use. Increases in cannabis use have been documented in the United States, but little is known about how other substance use has changed among people who use cannabis. We sought to examine changes in alcohol, tobacco, opioid, and stimulant use during COVID-19 and explore how these changes relate to patterns of cannabis use. Data were obtained from a web-based survey of adults in the United States who use cannabis ($n = 1,471$) administered in September 2020. Using data reported in retrospective (prepandemic) and time-of-survey assessment periods, we explored changes in the prevalence of regular (weekly) alcohol, tobacco, opioid, and stimulant use during COVID-19 among respondents who used medical and nonmedical cannabis. We used modified Poisson regression to examine cannabis-related correlates of increasing or decreasing secondary substance use during the pandemic. There was a slight but significant increase in weekly alcohol use in the medical use group only (41.4%–47.0%, $p = .034$). Weekly tobacco, opioid, and stimulant use did not change significantly. Pandemic-concurrent shifts in secondary substance use depended on interacting cannabis-related factors including medical cannabis use, prepandemic cannabis frequency, and pandemic-concurrent frequency changes. For example, weekly prepandemic cannabis use was significantly and positively associated with decreasing opioid use frequency among the medical cannabis use group only. Assessments of the pandemic's effects on substance use should consider

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relationships between cannabis and other substances, which may differ according to cannabis-specific behaviors, motives, and contexts of use.

Keywords

COVID-19; cannabis; alcohol; polysubstance use; survey

The declaration of a global pandemic from coronavirus disease 2019 (COVID-19) led to prompt policy actions across the United States to curb community transmission of the virus. Measures to prevent respiratory contact, including stay-at-home orders, restrictions on in-person gatherings, closure of daycares and schools, and nonessential businesses (Kaiser Family Foundation, 2021), had secondary impacts on quality of life for many individuals. Adding to heightened fears around COVID-19 transmission (Holingue et al., 2020), social isolation and loneliness, loss of structure, boredom, restlessness, and financial and material insecurity contributed to marked increases in psychological distress in the U.S. and countries around the world (Horigian et al., 2021; Kim & Laurence, 2020; Niedzwiedz et al., 2021; Williams et al., 2020).

For many people, the pandemic created new social and economic landscapes and emotional states that set the stage for shifting substance use contexts and motives. The impact of the pandemic on substance use appears to have had heterogeneous effects across different substances and demographic groups. For example, despite documented rises in stress-motivated alcohol consumption during COVID-19 (Callinan et al., 2021; McPhee et al., 2020; Prestigiacomo et al., 2021), several studies have observed reductions in the overall number of drinks consumed—A finding that seems to be propelled by fewer social opportunities for binge drinking, particularly among younger demographics (Benschop et al., 2021; Callinan et al., 2021; Clare et al., 2021; Kilian et al., 2021; Minhas et al., 2021). The use of certain unregulated substances also dropped in many settings, likely resulting from reduced social opportunities and interruptions to international drug markets during the pandemic (Benschop et al., 2021; European Monitoring Centre for Drugs & Drug Addiction, 2021; Palamar et al., 2021).

COVID-concurrent increases in cannabis use have been detected among people who use cannabis (Boehnke et al., 2021; Imtiaz et al., 2021; Palamar et al., 2021; van Laar et al., 2020; Vidot et al., 2021), but shifts in secondary (i.e., noncannabis) substance use patterns among people who use cannabis have not been fully elucidated. Studies exploring how cannabis policy impacts other substances lean toward the suggestion that cannabis may substitute other commonly used substances when the availability of other substances is reduced or the availability of cannabis is increased (Chu, 2015; Risso et al., 2020); however, a smaller but substantial number of policy studies suggest that cannabis may act as a complement to other substance use (Risso et al., 2020). At the individual level, these trade-offs appear to be highly context- and subgroup-specific, with many substitution observations derived from surveys of people using cannabis with therapeutic intent (Corroon et al., 2017; Lucas et al., 2013; Reiman, 2009; Reiman et al., 2017), and observations of overlapping and/or complementary use of cannabis and other substances derived from people using

cannabis in social, nonmedical contexts (Gunn et al., 2021; Ito et al., 2021; O'Hara et al., 2016). However, much of this research is also limited to alcohol as the secondary substance.

In a sample of people who use cannabis, we sought to (a) understand how the prevalence of regular (i.e., weekly) alcohol, tobacco, opioid, and stimulant use shifted after the onset of the pandemic and (b) explore individual-level relationships between cannabis-specific factors (including purpose of use, frequency, and COVID-concurrent changes) and COVID-concurrent shifts to other substance use. We hypothesized that, overall, weekly use of alcohol and tobacco would increase, whereas weekly use of unregulated opioids and stimulants would decrease after the onset of the pandemic. We hypothesized that the relationship between COVID-concurrent increases in cannabis use and secondary substance use would depend on the purpose of cannabis use (i.e., medical vs. nonmedical) such that a substitution effect would be evident among the medical group and a complementary effect would be observed among the nonmedical group.

Method

Transparency and Openness

Below, we report how we determined our sample size, restricted our sample, handled data, and obtained all measures of interest for the study. All analyses were conducted in *R* using RStudio (Version 1.4.1106). This study's design and analysis were not preregistered. Materials and analysis code for this study are available by emailing the corresponding author.

Study Design

Data for this study were derived from an online anonymous cross-sectional study of adults who use cannabis for medical and/or nonmedical purposes (Assaf et al., 2022). Respondents were considered eligible for the survey if they were aged 18 years, lived in the United States, reported any past-year use of cannabis or cannabis-based products (including delta-9-tetrahydrocannabinol [THC]- and cannabidiol [CBD]-based products), and provided informed consent. Respondents were recruited through Reddit, Twitter, Bluelight, and Craigslist and completed the survey on the Healthcare Insurance Protection and Accountability Act (HIPAA)-compliant Qualtrics online platform between August and September 2020. A $5 honorarium was provided upon study completion. Ethics approval was granted by the Institutional Review Board; IRB at the University of California, Los Angeles (IRB No. 20–001164, "Survey of cannabis use during COVID-19").

Measures

The primary measures of interest for this study were frequency of nonmedical cannabis, medical cannabis, alcohol, tobacco, unregulated, or nonprescribed opioids (i.e., heroin, fentanyl, nonprescribed use of pharmaceutical opioids), and unregulated stimulants (methamphetamine or cocaine) in the 3-month period preceding the COVID-19 pandemic (i.e., approximately December 15, 2020–March 15, 2020) and the 3-month period preceding survey participation (i.e., approximately June 1, 2020–September 1, 2020, during the COVID-19 pandemic). For each 3-month period, the frequency of each substance was

captured in accordance with the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) as: "Never," "Once or twice," "Monthly," "Weekly," or "Daily or almost daily" (WHO ASSIST Working Group, 2002). Additionally, participants who reported daily medical or nonmedical cannabis use also reported the average number of medical or nonmedical uses per day: 1–2, 3–5, 6–10, and ≥10.

For each secondary substance (alcohol, tobacco, opioids, and stimulants), the outcome of interest was a change in frequency of use (increase, decrease, or stable). We obtained these measures by numerically ordering each respondent's self-reported frequency categories described above, that is, *never* [0] to *daily or almost daily* [4], and subtracting their pre-COVID frequency from their during-COVID frequency to calculate a change score. On the basis of these scores, respondents were categorized as having increased, decreased, or not changed their substance use during COVID-19 (change scores of ≥1, ≤−1, and 0, respectively).

Three cannabis-related variables of interest were examined as potential correlates of changing substance use patterns: Frequency of cannabis use in the pre-COVID period (obtained from the nonmedical and medical cannabis frequency questions and categorized as ≥ weekly versus <weekly; for respondents who used medical and nonmedical cannabis, we took the higher of the two reported frequencies); change in cannabis use during COVID-19 (calculated as described for the secondary substances, but with additional inclusion of number of uses per day for respondents who used cannabis daily; categorized as increase vs. stable or decrease); and self-reported past-year medical cannabis use status (any medical vs. only nonmedical). We hypothesized a minimal set of sociodemographic factors to include as confounders: Age (measured as a continuous variable, expressed in 10-year increments), sex (male vs. female), and highest level of education (≥ high school vs. <high school completion). As an indicator of legal access to cannabis, we also included a variable for the regulatory status of cannabis in each participant's state (nonmedical, medical-only, vs. unregulated).

Statistical Analysis

First, in each assessment period (i.e., pre- and during-COVID), we used Pearson's chi-square test to compare the prevalence of ≥ weekly alcohol, tobacco, opioid, and stimulant use between people who reported any cannabis use for medical purposes in the past year versus those who reported strictly nonmedical cannabis use. Then, we used McNemar's tests to compare changes in the prevalence of ≥ weekly secondary substance use from the pre-COVID to the during-COVID period within each cannabis use group (nonmedical and medical).

We then constructed a series of multivariable models to examine cannabis-related factors associated with increasing (model Series 1) and decreasing (model Series 2) secondary substance (vs. stable use) use during COVID-19. Model Series 1 excluded respondents who decreased their use and model Series 2 excluded participants who increased their use. The analytic sample for each model was further restricted to participants who were eligible to experience the outcome; for example, respondents who reported the highest frequency of alcohol use in the pre-COVID period were not eligible to record an increase during

COVID-19. We used modified Poisson regression with robust estimator, as described by Zou (2004), to calculate an adjusted prevalence ratio (aPR) of the outcome associated with each independent variable. We included an interaction term for increasing frequency of cannabis use during COVID-19 and medical cannabis status and checked significance with a likelihood ratio test. We also tested for interactions between the other cannabis variables (i.e., increasing cannabis use by pre-COVID frequency of use; pre-COVID frequency of use by medical cannabis status).

Results

Between August and September 2020, 1,471 respondents (mean age: 33.6 years; 34.5% women; Table 1) self-reported using THC-based cannabis and were included in this analysis. Of them, 868 (59.0%) reported cannabis use strictly for nonmedical purposes and 603 (41.0%) reported using cannabis for medical purposes. Within the medical cannabis use group, 358 (59.4%) reported using cannabis strictly for medical purposes and 245 (40.1%) reported also using cannabis for nonmedical purposes. Almost all respondents ($n = 1,334$, 90.7%) reported past 3-month use of at least one additional substance before and/or during COVID-19, including tobacco ($n = 914$, 62.1%), alcohol ($n = 808$, 54.9%), nonmedical stimulants ($n = 414$, 28.1%), and nonmedical opioids ($n = 373$, 27.2%).

Changes in Weekly Use of Secondary Substances During COVID-19

Table 2 summarizes the results of chi-square tests comparing the prevalence of weekly secondary substance use between the medical and nonmedical use groups, and McNemar's tests for within-group changes over the two recall periods. As shown, the medical cannabis use group had significantly lower prevalence of weekly alcohol and tobacco use in both periods (all $p < .05$). However, the prevalence of weekly alcohol use increased significantly during COVID-19 in the medical cannabis use group (41.4%–47.0%; $p = .034$). This was the only significant COVID-concurrent shift detected among either group. Notably, the medical cannabis group had a significantly lower prevalence of weekly opioid use relative to the nonmedical group in the pre-COVID period (13.7% vs. 30.2%, $p < .001$), but not during-COVID (19.6% vs. 24.3%, $p = .278$). This contrast resulted from a simultaneous nonsignificant COVID-concurrent increase in weekly opioid use among the medical group (from 13.7% to 19.6%, $p = .112$) alongside a nonsignificant decrease in the nonmedical use group (30.2%–24.3%, $p = .185$).

A sensitivity analysis showed that, after the removal of respondents who reported both medical and nonmedical cannabis use from the medical cannabis use group ($n = 245$), the weekly secondary substance use prevalence estimates were lowered slightly, strengthening the results of previously significant chi-square comparisons, and yielding a newly significant finding for weekly stimulant use in the pre-COVID period (23.2% in the medical group vs. 34.1% in the nonmedical group, $p = .046$). The significant increase in weekly alcohol use noted among the medical cannabis group was also robust to the removal of respondents who also reported nonmedical cannabis use (33.9%–43.0%, $p = .018$).

Associations Between Cannabis Use and Increasing Secondary Substance Use During COVID-19

The results of the first multivariable model series exploring cannabis use patterns associated with increasing use of each secondary substance class are summarized in Table 3. For alcohol and tobacco, a significant interaction between increasing frequency of cannabis use and medical cannabis use was detected, such that the magnitude of the positive association between increasing cannabis use and the outcome was higher in the nonmedical cannabis group. For example, increasing cannabis frequency was significantly and positively associated with increasing alcohol frequency among people who used cannabis for strictly nonmedical purposes, aPR = 3.37, 95% CI [2.45, 4.64], but not among people who used cannabis for medical purposes (aPR = 1.36, 95% CI [0.95, 1.95]. Table 2 provides the estimates for each possible combination of the two factors against a common reference (nonmedical use, no increase in cannabis frequency). Notably, each factor (i.e., increasing cannabis use and medical cannabis use) was associated with the outcome in the absence of the other. In the case of alcohol, exposure to both factors together still yielded significant and positive association with the outcome when compared against this reference. At least weekly use of cannabis in the pre-COVID-19 period was also significantly negatively associated with increasing tobacco use during COVID-19, aPR: 0.78, 95% CI [0.60, 1.00]. For the models of increasing opioid and stimulant use, a different pattern of interaction emerged whereby the relationship between increasing cannabis use during COVID-19 and the outcome depended on the frequency of cannabis use before COVID-19. Increasing cannabis use was significantly and positively associated with each outcome among respondents who used cannabis <weekly before COVID-19, aPR for opioid increase: 1.58, 95% CI [1.07, 2.33]; aPR for stimulant increase: 1.58, 95% CI [1.08 – 2.31], but not among those who used cannabis ≥ weekly, aPR for opioid increase: 0.46, 95% CI [0.20, 1.02]; aPR for stimulant increase: 0.79, 95% CI [0.39, 1.63]. The estimates for each possible combination of the two factors against a common reference (≥ weekly pre-COVID frequency, no increase in cannabis frequency) are displayed in Table 3.

Associations Between Cannabis Use and Decreasing Secondary Substance Use During COVID-19

No significant cannabis-related correlates were recorded for decreasing alcohol or stimulant use. As shown in Table 4, medical cannabis use was significantly and positively associated with decreasing tobacco use during COVID-19, aPR: 1.60, 95% CI [1.25, 2.06]. Increasing cannabis use during COVID-19 was significantly and positively associated with decreasing opioid use during COVID-19, aPR: 1.28, 95% CI [1.03, 1.60]. There was also significant interaction between pre-COVID cannabis frequency and medical cannabis status, such that ≥ weekly cannabis use was significantly and positively associated with decreasing opioid use among the medical cannabis use group only, aPR: 1.49, 95% CI [1.14, 1.95]. The estimates for each possible combination of the two factors against a common reference (≥ weekly pre-COVID frequency, nonmedical cannabis use) are displayed in Table 4.

Discussion

In this survey of over 1,400 adults who report cannabis use, we examined the use of alcohol, tobacco, opioids, and stimulants by cannabis use patterns and monitored changes in the use of these secondary substances over two periods separated by the onset of the global COVID-19 pandemic. We did not observe significant increases in weekly tobacco use or significant reductions in weekly unregulated opioid or stimulant use, as was hypothesized. We observed a small but significant increase in the prevalence of weekly alcohol use, but only among respondents using cannabis for medical purposes. This observation is consistent with reports of increasing alcohol use in another smaller survey U.S. adults who use medical cannabis (Boehnke et al., 2021). The divergent alcohol observations between medical and nonmedical cannabis use groups raise the possibility of different distributions of underlying alcohol drinking motives between the two groups. This question should be addressed in future research examining the relationship between cannabis use and secondary substance during COVID-19. It is also difficult to rule out the possibility that inconsistencies in retrospective reporting between the two recall periods account for the relatively small magnitude of change observed here. However, it is reassuring that studies comparing recall consistency between recent past 30-day (Janssen et al., 2017) or past 3-month (Napper et al., 2010 with past 6-month reporting of drug use show good interperiod recall reliability, and there is no clear reason to suspect that recall of alcohol use would differ systematically between people who use cannabis for medical versus nonmedical purposes.

Some notable findings related to cannabis use patterns emerged in the multivariable analyses of factors associated with increasing secondary substance use during COVID-19. Our hypothesis of a different relationship between increasing cannabis use and increasing secondary substance use depending on medical cannabis status was supported for increasing alcohol and tobacco use, but not opioid or stimulant use. Specifically, among the nonmedical cannabis group, increasing cannabis frequency was significantly and positively associated with increasing alcohol or tobacco frequency. In contrast, among the medical cannabis use group, increasing cannabis frequency was not significantly associated with the outcome. These findings raise the possibility of differing motives underlying increases in cannabis, alcohol, and tobacco use between cannabis use groups. We previously reported a significant increase in daily cannabis use for anxiety after the onset of the pandemic among the medical cannabis subset of this sample (Lake et al., 2022) and similar findings have been reported in other surveys (Vidot et al., 2021). It is possible that these cannabis increases cut into the urge to increase alcohol or tobacco use for similar purposes, whereas nonmedical users may have exhibited a separate nonmedical motive for increasing both cannabis and alcohol or tobacco use during COVID-19 (e.g., more time at home, boredom). However, as we did not compare underlying substance use motives between medical and nonmedical groups, future research exploring the impact of COVID-19 on substance use should include measures to assess these potential underlying differences.

Second, medical cannabis use was significantly associated with increasing the frequency of opioid and stimulant use during COVID-19. Medical cannabis patients often report complex comorbidities with overlapping symptomologies (Azcarate et al., 2020; Walsh et al., 2013). The pandemic led to interruptions in many non-COVID-related health services and may

have prevented individuals from seeking medical care (Hartnett et al., 2020; Maringe et al., 2020; Pifarré et al., 2021). Our finding could reflect attempts to self-medicate health needs that went unmet during COVID-19 with opioids or stimulants, especially for respondents with restricted access to medical cannabis during the pandemic via temporary store closures, and/or exclusion of medical cannabis consultations from telemedicine expansion. However, in most states with legal cannabis retail, cannabis businesses were deemed "essential" and exempt from closing (Marijuana Policy Project, 2021), prompting the need to probe the drivers of this relationship.

Although we did not find evidence to support our hypothesis that medical cannabis use would modify the association between increasing cannabis frequency and increasing opioid or stimulant use, we did identify another notable interaction: For both opioids and stimulants, the relationship between increasing cannabis use and increasing the secondary substance during COVID-19 depended on the respondent's prepandemic cannabis use frequency, such that increasing cannabis use frequency was positively associated with increasing opioid or stimulant frequency only among those who used cannabis <weekly before COVID. The underlying driver of this finding is not clear. One possibility is that respondents who engage in high-frequency cannabis use have a lower preference for noncannabis drugs through an attachment or devotion to cannabis as part of their identity (known as cannabis "self-concept"; Blevins et al., 2018), which could prevent them from escalating use of these drugs in periods where they may be more vulnerable to distress. Another possibility is that escalation to using cannabis almost daily, daily, or multiple times per day may have fulfilled a coping-oriented need that others met with opioids or stimulants, possibly resulting in a sort of preventative effect rooted in the substitution of one drug for another (Lau et al., 2015; Lucas et al., 2013). These hypotheses can only be tested in future research assessing underlying motives for use and potential differences based on cannabis use characteristics.

Finally, we also observed a significantly higher prevalence of opioid frequency reduction among people who increased their cannabis use during the pandemic. Although the self-reported use of cannabis to reduce or stop the use of unregulated or nonprescribed opioids and stimulants has been documented across samples of medical cannabis patients (Lucas et al., 2013, 2016), people who use drugs (Mok et al., 2021), and a representative sample of the U.S. population (Ishida et al., 2019), we hesitate to interpret our finding as being consistent with these observations as our study did not capture information about the intention to reduce a secondary substance with cannabis.

There are several limitations that should be considered when interpreting the findings of this study. First, data were derived from an online survey; although respondents were restricted to prevent "ballot stuffing" by IP address, the survey did not incorporate questions to rule out careless reporting. Second, the sample was recruited through social media and online forums, but there is also the possibility of snowballing leading to similar characteristics and patterns of use between respondents. Importantly, as a self-selected sample, the data do not represent all adults who use cannabis in the U.S. Notably, past-year medical cannabis use was self-reported and not restricted to state-licensed use. Third, we relied on self-reported measures for both 3-month periods of interest, and these accounts are subject to possible

recall issues or responding according to perceived social norms. The variables assessing a frequency change (i.e., increases, decreases) rely on two self-reported average categorized frequencies, meaning incremental or short-term changes within these periods are unlikely to be captured. Using the conventional WHO ASSIST frequency categories, we were unable to measure frequency increases among people who were using at the highest frequency (i.e., daily) in the pre-COVID period; as such, regression results for increasing secondary substance use should be interpreted for those who engaged in <daily use of that substance in the pre-COVID period. Fourth, our questionnaire was limited to the use of alcohol, tobacco, and unregulated/non-prescribed opioids and stimulants; we did not assess for changes in the use of prescription drugs, including benzodiazepines, which are reported to have increased in some populations throughout the pandemic (Boehnke et al., 2021; European Monitoring Centre for Drugs & Drug Addiction, 2021; Gili et al., 2021), or certain drugs common to the nightlife economy, including 3,4-methylenedioxymethamphetamine (MDMA), which are reported to have decreased (European Monitoring Centre for Drugs & Drug Addiction, 2021; Gili et al., 2021; Palamar et al., 2021). Finally, as discussed above, our data reflect changes in patterns of secondary substance use but do not assess intended motives for these substances. Future research exploring the relationship between cannabis use and other substance use in the context of COVID-19 will benefit from obtaining this information from respondents.

In this U.S.-based sample of over 1,400 adults who use cannabis, there were few changes in the regular (i.e., weekly) use of secondary substances early after the onset of the COVID-19 pandemic; the increase in weekly alcohol use, we noted for the medical cannabis use group was minor in magnitude. It will be important to assess the sensitivity of these secondary substance use trends to subsequent phases of the pandemic. Escalation of secondary substance use early in COVID-19 appears to differ based on several cannabis use behaviors occurring before and throughout the pandemic. In assessing the pandemic's long-term mental health and substance use impacts in people who use cannabis, it will be important to consider a host of cannabis-specific behaviors, including the context of cannabis use during COVID-19, shifting motives for use and frequency patterns, medical usage status, and specific therapeutic applications in medical patients.

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Public Health Significance

This study suggests that, overall,   weekly use of tobacco, opioids, and stimulants did not change substantially early after the onset of the coronavirus disease 2019 (COVID-19) pandemic in a sample of people who use cannabis. Modest group-level changes in alcohol use were detected among people who use medical cannabis. On an individual level, interaction between purpose, frequency, and COVID-concurrent changes in cannabis use influenced the likelihood of increasing or decreasing alcohol, tobacco, opioid, or stimulant use, highlighting cannabis-specific indicators of heightened vulnerability to the pandemic's effects on mental health and substance use.

Table 1

Demographic Characteristics of the Sample (n = 1,471)

Demographic characteristic	Overall (*n* = 1,471)	Nonmedical cannabis use (*n* = 868)	Medical cannabis use (*n* = 603)
Age *(M, SD)*	33.6 (9.1)	35.2 (10.1)	32.4 (8.2)
Sex (% female)	501 (34.5)	286 (33.4)	215 (36.1)
Race (% White)	1,039 (72.7)	622 (74.0)	417 (70.9)
Education (% high school completion)	1,318 (91.0)	761 (89.1)	557 (93.8)
Census region			
% West	547 (37.2)	328 (37.7)	219 (36.3)
% Midwest	176 (12.0)	113 (13.0)	63 (10.4)
% Northeast	288 (19.6)	146 (16.8)	142 (23.5)
% South	460 (31.3)	281 (32.4)	179 (29.7)
Home state's cannabis regulatory status			
% CBD only or unregulated	331 (22.5)	197 (22.7)	134 (22.2)
% Medical use	452 (30.7)	254 (29.3)	198 (32.8)
% Adult use	688 (46.8)	417 (48.0)	271 (44.9)

Note. Self-reported medical cannabis use defines mutually exclusive groups. All respondents in the nonmedical cannabis use group (*n* = 868) reported nonmedical cannabis and none reported medical cannabis; some (*n* = 245) respondents in the medical cannabis use group reported past-year nonmedical cannabis use and all (*n* = 603) reported medical cannabis use. Denominator used for percentages was the total number of respondents who answered the question. CBD = cannabidiol.

Table 2

Weekly Use of Secondary Substances Self-Reported by Medical and Non-Medical Cannabis Use Groups Before and During COVID-19

	Weekly use of secondary substance			
Secondary substance	**Total, n (%)**[a]	**Before, n (%)**	**During, n (%)**	**p value**[b]
Alcohol				
Nonmedical cannabis use	487 (56.1)	278 (57.1)	280 (57.5)	.925
Medical cannabis use	321 (53.2)	133 (41.4)	151 (47.0)	**.034**
p value[c]		**<0.001**	**0.004**	
Tobacco				
Nonmedical cannabis use	583 (67.1)	344 (59.0)	340 (58.3)	.731
Medical cannabis use	331 (54.9)	151 (45.6)	158 (47.7)	.464
p value[c]		**<0.001**	**0.002**	
Opioids				
Nonmedical cannabis use	169 (19.5)	51 (30.2)	41 (24.3)	.185
Medical cannabis use	204 (33.8)	28 (13.7)	40 (19.6)	.112
p value[c]		**<0.001**	0.278	
Stimulants				
Nonmedical cannabis use	185 (21.1)	63 (34.1)	65 (35.1)	.890
Medical cannabis use	229 (38.0)	63 (27.5)	69 (30.1)	.512
p value[c]		0.150	0.279	

Note. "Before" refers to the past 3-months before the onset of the COVID-19 pandemic, approximately December 15, 2020–March 15, 2020; "During" refers to the past 3-months at time of survey completion, approximately June 1, 2020–September 1, 2020. COVID-19 = coronavirus disease 2019.

[a] Denominator is the number of respondents in the nonmedical and medical use groups who reported using the relevant substance at least once during the study (pre-COVID and/or during-COVID).

[b] Chi-square test used for between-group comparisons (any medical vs. no medical use).

[c] McNemar's test used for within-group comparisons (before- vs. during-COVID for medical and nonmedical groups).

Statistically significant ($p < .05$) comparisons are bolded.

Table 3

Cannabis Use Factors Associated with Increasing Frequency of Secondary Substance Use

	Increase in use during COVID			
	Alcohol (n = 1,226)	Tobacco (n = 1,028)	Opioids (n = 1,297)	Stimulants (n = 1,292)
Cannabis use characteristics	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)
Medical cannabis use				
No	—	—	1.00 (reference)	1.00 (reference)
Yes	—	—	2.38 (1.71–3.33)**	1.91 (1.38–2.63)**
Pre-COVID cannabis use frequency				
< Weekly	1.00 (reference)	1.00 (reference)	—	—
Weekly	1.14 (0.89–1.45)	0.78 (0.60–1.00)*	—	—
Increase in cannabis use during COVID				
No	—	—	—	—
Yes	—	—	—	—
Increase in cannabis use by medical use status				
Medical: No Increase: No	1.00 (reference)	1.00 (reference)		
Medical: No Increase: Yes	3.37 (2.45–4.64)**	1.71 (1.23–2.39)*		
Medical: Yes Increase: No	1.72 (1.22–2.41)*	1.55 (1.14–2.09)*		
Medical: Yes Increase: Yes	2.34 (1.62–3.37)**,a	1.39 (0.96–2.02)b		
Increase in cannabis use by pre-COVID frequency				
Weekly: No Increase: No	—		1.00 (reference)	1.00 (reference)
Weekly: No Increase: Yes	—		1.58 (1.07–2.33)*	1.58 (1.08–2.31)*
Weekly: Yes Increase: No	—		0.97 (0.65–1.43)	0.64 (0.42–0.98)*
Weekly: Yess Increase: Yes	—		0.44 (0.20–0.97)*,c	0.51 (0.25–1.01)d

Note. Analytic sample for each analysis is the number of people who were eligible to report an increase in frequency of the secondary substance between assessment periods. aPR = adjusted prevalence ratio; estimates are adjusted for sex, age, education level, and state cannabis regulatory status; 95% CI = 95% confidence interval; COVID-19 = coronavirus disease 2019.

[a] aPR for increasing cannabis use versus stable cannabis use among the medical cannabis group: 1.36, 95% CI [0.95, 1.95].

[b] aPR for increasing cannabis use versus stable cannabis use among the medical cannabis group: 0.90, 95% CI [0.62, 1.30].

[c] aPR for increasing cannabis use versus stable cannabis use among those who used cannabis weekly before COVID: 0.46, 95% CI [0.20, 1.02].

[d] aPR for increasing cannabis use versus stable cannabis use among those who used cannabis weekly before COVID: 0.79, 95% CI [0.39, 1.63].

[*] $p < .05$.

[**] $p < .001$.

Table 4

Cannabis Use Factors Associated with Decreasing Frequency of Secondary Substance Use

		Decrease in use during COVID			
Cannabis use characteristics		Alcohol (*n* = 566) aPR (95% CI)	Tobacco (*n* = 692) aPR (95% CI)	Opioids (*n* = 229) aPR (95% CI)	Stimulants (*n* = 277) aPR (95% CI)
Medical cannabis use					
No		1.00 (reference)	1.00 (reference)	—	1.00 (reference)
Yes		1.24 (0.95–1.61)	1.60 (1.25–2.06)**	—	1.18 (0.92–1.51)
Pre-COVID cannabis use frequency					
<Weekly		1.00 (reference)	1.00 (reference)	—	1.00 (reference)
Weekly		1.10 (0.84–1.43)	0.95 (0.73–1.24)	—	0.78 (0.60–1.02)
Increase in cannabis use during COVID					
No		1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes		1.27 (0.96–1.70)	1.14 (0.86–1.50)	1.28 (1.03–1.60)*	1.16 (0.91–1.47)
Pre-COVID frequency by medical cannabis status					
Medical: No	Weekly: No	—	—	1.00 (reference)	—
Medical: No	Weekly: Yes			1.07 (0.69–1.64)	
Medical: Yes	Weekly: No			0.90 (0.59–1.38)	
Medical: Yes	Weekly: Yes			1.34 (0.88–2.04)[a]	

Note. Analytic sample for each analysis is the number of people who were eligible to report a decrease in frequency of the secondary substance between assessment periods. aPR = adjusted prevalence ratio; estimates are adjusted for sex, age, education level, and state cannabis regulatory status; 95% CI = 95% confidence interval; COVID-19 = coronavirus disease 2019.

[a] aPR for pre-COVID weekly versus <weekly cannabis use among the medical cannabis use group: 1.49, 95% CI [1.14, 1.95].

*
$p < .05$.

**
$p < .001$.