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Selective Changes in Medical Cannabis Use Early in the COVID-19 Pandemic: Findings from a Web-Based Sample of Adults in the United States

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Abstract

Background: The COVID-19 pandemic has had widespread impacts on mental health and substance use. While increases in nonmedical cannabis use during COVID-19 have been documented among people who use cannabis across a diversity of settings, changes in specific medical applications of cannabis during the COVID-19 pandemic have not been characterized. We sought to examine changes in the prevalence, frequency, and mode of use of medical cannabis for a range of commonly treated conditions and symptoms during COVID-19.

Methods: Data were obtained from an online survey of a sample of adults in the United States who use cannabis ($n = 1886$), administered in September 2020. This study was restricted to participants who self-reported past-year medical cannabis use ($n = 598$). Using data reported in a retrospective (pre-COVID) and current assessment period, we examined changes in cannabis use prevalence, frequency, and inhalation as the primary mode of administration for 11 commonly treated conditions.

Results: There were slight but statistically significant increases in weekly (from 21.4% to 23.4%) and daily (from 16.2% to 20.7%) self-reported medical cannabis use during COVID-19 ($p < 0.001$). Anxiety was the only specific therapeutic purpose for which daily cannabis use increased statistically significantly during COVID-19 (18.5% to 25.4%; $p = 0.004$). In multivariable logistic regression, the odds of increasing cannabis use for anxiety during COVID-19 were statistically significantly higher for women, respondents from Western states, and states with legal medical and nonmedical cannabis.

Discussion: We detected slight shifts toward higher frequencies of medical cannabis use during COVID-19. Disaggregated by therapeutic indication, daily cannabis use to manage anxiety increased during the pandemic. There is a need to assess whether changes in cannabis use that coincided with the pandemic will be sustained over time, and how these changes are connected to mental health outcomes, particularly among women.

Keywords: COVID-19; cannabis; medical cannabis; anxiety; United States; survey

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has had far-reaching negative health impacts beyond those directly caused by COVID-19 infection. A growing number of studies have documented increased

mental health problems linked with heightened stress and anxiety related to acquiring or transmitting COVID-19.¹⁻⁴ Adding to this, the declaration of a global pandemic from COVID-19 in March 2020 led governments around the globe to impose swift and

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widespread policy changes with direct and indirect impacts on individual health and behaviors. While shown to be highly effective in curbing transmission of COVID-19,⁵ social distancing regulations and known as “stay-at-home” orders also spurred job loss and increased boredom, loneliness, isolation, anxiety, and depression in many individuals.^{6,7} Several reports point to increases in the use of alcohol, tobacco, and some scheduled substances to cope with increased stress brought on by the pandemic.^{2,8-10}

In many U.S. states with medical and/or nonmedical cannabis regulatory frameworks, cannabis stores were considered essential businesses and remained open throughout “stay-at-home” orders.¹¹ Indeed, during the early and uncertain stages of the pandemic, legal cannabis sales were reported to spike in several jurisdictions, consistent with a stockpiling effect.¹²⁻¹⁴ Accordingly, increases in nonmedical cannabis use during COVID-19 have been documented among people who use cannabis across a diversity of settings.¹⁵⁻¹⁷ Similarly, sales of medical cannabis were reported to increase substantially at the beginning of the pandemic,¹⁸ but less is known about how patterns of medical cannabis have shifted since then. Boehnke et al. sampled 353 people using cannabis for therapeutic purposes in the United States and found that about 1 in 3 of them reported increasing their cannabis use during COVID-19,¹⁹ but changes in specific therapeutic applications of cannabis during the COVID-19 pandemic have not been characterized.

There are over 5.4 million state-legal medical cannabis patients across >30 states with medical and/or nonmedical cannabis regulatory frameworks.²⁰ Although states differ in qualifying conditions for which cannabis is medically authorized,²¹ research among people using cannabis for therapeutic purposes consistently points to a number of common and often overlapping conditions and symptoms for which cannabis is sought including insomnia, pain, anxiety, depression, and post-traumatic stress disorder (PTSD).²² The onset of the COVID-19 pandemic was followed by marked deteriorations in psychological and emotional wellbeing for large pockets of the population, potentially amplifying the number of individuals seeking relief from cannabis or the frequency with which they seek it. Yet, given rising concerns related smoking as a risk factor for severe COVID-19 symptoms and comorbidities,²³ COVID-19 may have also prompted shifts in cannabis use behaviors such as transitions to noninhalation modes of administration.

In this study, we sought to examine changes in the prevalence, frequency, and inhalation of medical cannabis during COVID-19 for a range of conditions and symptoms commonly self-managed with cannabis. We also sought to identify factors associated with shifts in cannabis use for selective therapeutic indications during COVID-19.

Methods

Study design and sample

Data for this study were derived from a web-based cross-sectional survey of adults in the United States who self-report using cannabis, including cannabis-based products (i.e., products derived from isolating cannabis constituents—most notably delta-9-tetrahydrocannabinol [THC] or cannabidiol [CBD]), for medical and/or non-medical purposes. Participants in this opportunistic sample were recruited through Reddit, Twitter, Craigslist, and Craigslist and completed the survey on the HIPAA-compliant Qualtrics online platform between August and September 2020. Respondents were eligible to complete the survey if they were aged ≥ 18 years, reported past-year use of cannabis and/or CBD products, and lived in the United States. All participants provided informed consent and received a \$5 incentive upon completing the survey. Ethics approval was granted by the Institutional Review Board at the University of California, Los Angeles.

We restricted the analytic sample to respondents who self-reported using cannabis to address one or more medical reasons in the past year. This definition includes people who are state licensed to access and use medical cannabis as well as people who use cannabis in a self-guided attempt to treat or manage a health condition or associated symptom. As respondents who use only CBD products (i.e., without concurrent use of cannabis containing THC) are likely to constitute a fundamentally different and unique population requiring a separate set of research objectives and analyses, we considered the use of CBD-only products to be outside of the scope of this study.

Measures

The two main measures of interest were frequency and route of administration of cannabis for medical purposes immediately before the COVID-19 pandemic and at the time of survey during the COVID-19 pandemic.

Frequency of use. All participants who reported past-year medical cannabis use were prompted to

identify which self-reported condition(s) or symptoms they had treated with medical cannabis: pain; sleep; anxiety/worry; depression/sadness; substance use disorder; seizures; nausea; attention/focus; PTSD; arthritis; and appetite stimulation; and other (with text box to specify). These categories were informed by common state-specific indications for medical cannabis authorization^{21,24} and previous survey-based research involving medical cannabis patients.^{22,25}

To assess for changes in frequency of medical cannabis use during COVID-19, we asked participants to report the approximate frequency of their medical cannabis use (overall and for each condition they specified) during two distinct 3-month periods: the first period referred to 3 months before the COVID-19 “Stay-at-home” guidelines were instituted in the United States (approximately December 15, 2020 to March 15, 2020); the second period referred to the previous 3-months during the COVID-19 pandemic (approximately June 1, 2020–September 1, 2020). Frequency of use during each period was captured by the following categories, consistent with the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST): “Never,” “Once or twice,” “Monthly,” “Weekly,” or “Daily or almost daily.”²⁶ Respondents who endorsed “Daily or almost daily” were further prompted to specify the average number of uses per day: 1–2, 3–5, 6–10, or > 10.

Self-reported reasons for cannabis use changes. Respondents were also asked to indicate why (if at all) their medical cannabis use changed “during the COVID-19 pandemic.” Those who did not perceive their medical cannabis use to change in any way during COVID-19 had the option to check a box signifying that their medical cannabis use had not changed for any reason. Otherwise, the response categories provided for this question included change in availability/access; cost; time at home; social distancing; and change in medical need, COVID-19 infection risk; COVID-19 symptom severity; suspected or confirmed COVID-19 diagnosis, and other (with text box to specify).

Mode of administration. At each 3-month period (i.e., before COVID-19 and during COVID-19) and for each applicable therapeutic purpose, respondents were asked to identify which mode of consumption they used most often. The response categories included smoking (i.e., joint, blunt, bong, pipe), vaporizing dried flower, vaporizing oil or concentrates, dabbing oil or

concentrates, ingesting cannabis-infused food products, ingesting another oral product (e.g., pill, tincture, beverage), applying cannabis-infused topical cream, and other (with text box to specify). To monitor for changes in inhalation-based modes of administration, we dichotomized the variable as inhalation (smoking, vapourizing, and dabbing) versus noninhalation (edible, other oral product, topical cream, other) in each 3-month period.

Statistical analysis

Changes in frequency of medical cannabis use overall. First, we examined the number of participants whose frequency of cannabis use increased or decreased from the pre-COVID recall period to the survey (i.e., during-COVID) period. We numerically ordered the 8 frequency categories from 0 to 7 (i.e., Never [0] to > 10 times/day [7]) in each recall period. We calculated a change score for each participant by subtracting their pre-COVID frequency from their during-COVID frequency. Respondents were then categorized as having increased, decreased, or not changed their cannabis use during COVID-19 (change scores of ≥ 1 , ≤ -1 , and 0, respectively). We used Pearson’s chi-square test to compare self-reported reasons for any medical cannabis use change during COVID-19 between respondents whose self-reported frequency increased (change score ≥ 1) and those whose self-reported frequency decreased (change score ≤ -1) between the two time periods.

To examine largescale shifts in the frequency of any medical cannabis from the pre-COVID to during-COVID assessments, participants were sorted into occasional (i.e., < weekly), weekly, and daily use groups at each assessment. Within-person discordance in group membership between assessment periods was checked with a McNemar-Bowker test. Pairwise changes (i.e., occasional-weekly; occasional-daily; weekly-daily) were checked with *post hoc* McNemar’s tests with Bonferroni *p*-value adjustment.

Changes in cannabis use for selected therapeutic purposes. For each medical condition of interest, we assessed for changes in the prevalence of any cannabis use, high-frequency (i.e., daily) cannabis use, and inhalation as the primary mode of administration from the pre-COVID period to the COVID-19 period. We used McNemar’s tests to test for significance of changes.

Exploratory model: increasing cannabis use frequency for anxiety. As the prevalence of high-frequency cannabis use for anxiety was found to increase during COVID-19, we conducted an exploratory analysis to examine correlates of increasing cannabis use for anxiety (vs. stable or decreasing frequency of use for anxiety) during COVID-19. This analysis was restricted to respondents who were eligible to initiate or increase their frequency of use for anxiety (i.e., those who were using cannabis < 10 times per day for anxiety in the pre-COVID period). Respondents were coded as having experienced the outcome if they had a cannabis frequency change score of ≥ 1 for anxiety. The following cannabis-related and sociodemographic measures were included in bivariable and multivariable logistic regression as potential correlates of the outcome: frequency of cannabis use for anxiety in the pre-COVID period (\geq weekly vs. < weekly); frequency of nonmedical cannabis use in the pre-COVID period (\geq weekly, < weekly vs. none), past-year CBD use (yes vs. no); sex (male vs. female); age (per 5-year increase); U.S. Census region (Northeast, South, West vs. Midwest); state cannabis regulatory status (fully regulated, medical-only vs. unregulated).²⁰

All analyses were conducted in R using RStudio (Version 1.4.1106). All *p*-values are two-sided. All reported significant changes refer to statistical significance at *p* < 0.05.

Results

Between August and September 2020, 1886 eligible respondents completed the survey. In total, 603 (32.0%) respondents reported past-year medical cannabis use, of whom 598 (99.2%) provided complete information on medical cannabis use frequency during each assessment period and were included in the present analysis.

Changes in frequency of medical cannabis use overall

Overall, 174 (29.1%) respondents increased and 106 (17.7%) decreased their medical cannabis frequency during COVID-19 (Table 1). Increased time at home was the most common reason reported for changing cannabis use among those who increased their frequency during COVID-19 (reported by 52.9% vs. 32.1% of those who decreased; *p* < 0.001). The two most common reasons for cannabis use changes among respondents who de-

Table 1. Self-Reported Reasons for Changing Cannabis Use Frequency Among Respondents Who Increased or Decreased Their Cannabis Use During COVID-19

Changed cannabis use frequency	Increase	Decrease	<i>p</i> ^a
	174 (29.1)	106 (17.7)	
Reason for frequency change			
Availability/access	54 (31.0)	35 (33.0)	0.729
Cost	57 (32.8)	41 (38.7)	0.314
Time at home	92 (52.9)	34 (32.1)	< 0.001
Social distancing	55 (31.6)	31 (29.2)	0.677
Change in medical need	61 (35.1)	34 (32.1)	0.609
COVID-19 infection risk	35 (20.1)	37 (34.9)	0.006
COVID-19 symptom severity risk	14 (8.0)	13 (12.3)	0.246
COVID-19 suspected or confirmed diagnosis	10 (5.7)	11 (10.4)	0.154
Other ^b	2 (1.1)	0 (0.0)	—
None reported (no perceived change)	8 (4.6)	4 (3.7)	1.000 ^c

^a*p*-Value from Pearson's chi-square test of independence.

^bBoth reasons specified under other were related to increased use after receiving benefit from switching to nonsmoking modes of administration.

^c*p*-Value from Fisher's test.

creased their cannabis use during COVID-19 were cost of cannabis (38.7%) and risk of COVID-19 infection (34.9%). Fewer respondents who increased their use reported these reasons, with a significant difference noted for COVID-19 risk (vs. 20.1%, *p* = 0.006) but not cost (vs. 32.8%, *p* = 0.314).

In the 3-month period preceding the COVID-19 pandemic, 373 (62.4%) respondents reported using medical cannabis less than once per week; 128 (21.4%) reported weekly use, and 97 (16.2%) reported using medical cannabis approximately once per day or more. As shown in Figure 1, the prevalence of occasional use decreased to 55.8% while the prevalence of weekly and daily use increased to 23.4% and 20.7%, respectively, during the COVID-19 period. A McNemar-Bowker test confirmed significant frequency changes over time in the sample (*p* < 0.001). The McNemar's pairwise tests demonstrated that these changes were related to increases among the respondents who reported occasional use in the pre-COVID period (*p* = 0.046 for increases to weekly; *p* < 0.001 for increases to daily) rather than the respondents who reported weekly use in the pre-COVID period (*p* = 0.385 for increases to daily).

Changes in cannabis use for selected therapeutic purposes

The top therapeutic applications of medical cannabis use before and/or during COVID-19 included pain (*n* = 343, 57.4%), sleep (*n* = 307, 51.3%), anxiety

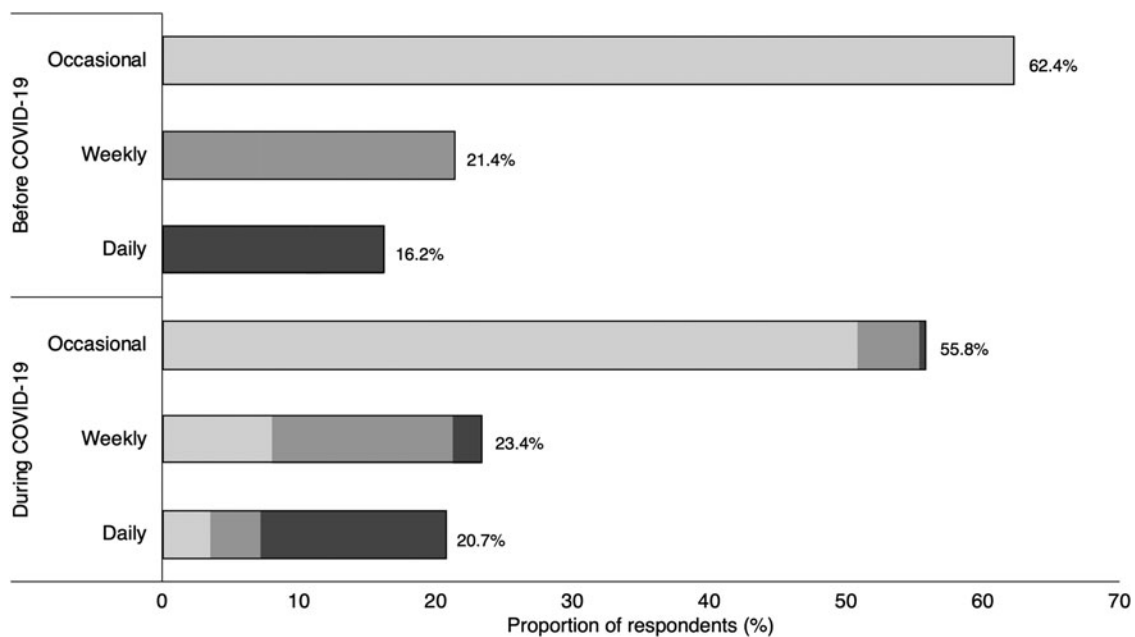


FIG. 1. Proportion of respondents using medical cannabis occasionally (< weekly), weekly, and daily before and during COVID-19 in a U.S.-based sample of medical cannabis users ($n = 598$). Shading in the lower panel corresponds with reported pre-COVID frequencies to demonstrate frequency changes during COVID-19: light gray = reported occasional cannabis use in the pre-COVID period; medium gray = reported weekly cannabis use in the pre-COVID period; dark gray = reported daily cannabis use in the pre-COVID period. McNemar-Bowker test of symmetry $p < 0.001$; McNemar *post hoc* pairwise comparisons: Occasional-Weekly: adjusted $p = 0.046$; Occasional-Daily: adjusted $p < 0.001$; Weekly-Daily: adjusted $p = 0.385$.

($n = 298$, 49.8%) depression ($n = 204$, 34.1%), and appetite ($n = 194$, 32.4%). As shown in Table 2, while the overall prevalence of using cannabis to manage anxiety did not change significantly during COVID-19 (40% to 37.8%, $p = 0.294$), the prevalence of daily cannabis use for anxiety increased significantly among respondents who used cannabis for anxiety (18.5% to 25.4%, $p = 0.004$). No significant changes in the prevalence of any or daily cannabis use corresponding with the COVID-19 pandemic were detected for any other therapeutic applications of interest. Inhalation as the primary mode of cannabis administration was not found to decrease significantly for any therapeutic application, including anxiety (83.0% to 77.6%, $p = 0.110$; Table 2).

Exploratory model: increasing cannabis use frequency for anxiety

Table 3 shows the results of the exploratory multivariable model to identify correlates of increasing cannabis use for anxiety during COVID-19. Among the 592 re-

spondents who were not using cannabis for anxiety at the maximum frequency in the pre-COVID period, the odds of initiating or increasing during COVID-19 were significantly higher among women compared to men (adjusted odds ratio [AOR]: 2.13, 95% confidence interval [CI]: 1.37–3.28) and among respondents living in a state with regulated cannabis including medical (AOR: 2.68, 95% CI: 1.35–5.31) and fully legal (AOR: 2.53, 95% CI: 1.11–5.78) frameworks, compared to respondents in states with no legal cannabis framework. Relative to respondents living in the Midwest, those living in the West census region had significantly lower odds of increasing cannabis use for anxiety (AOR: 0.36, 95% CI: 0.17–0.78, respectively). Older age, higher frequency of cannabis for anxiety in the pre-COVID period, and past-year CBD use were all significantly associated with the outcome in bivariable analysis but did not reach statistical significance in the full model. Frequency of nonmedical cannabis use before COVID-19 was not associated with the outcome in bivariable or multivariable analyses.

Table 2. Changes in Any Use (Left), Daily Use (Center), and Inhalation as the Primary Mode of Administration (Right) for Each Therapeutic Cannabis Use Purpose from Before COVID-19 to During COVID-19

Reason for use, <i>n</i> (%)	Any use (full sample, <i>n</i> =598)		Frequency of use: daily			Primary mode of consumption: inhalation		
	Before	During	Subsample, <i>n</i> (%) ^a	Before	During	Subsample, <i>n</i> (%) ^b	Before	During
Pain ^c	292 (48.8)	291 (48.7)	343 (57.4)	68 (19.8)	69 (20.1)	240 (40.1)	152 (69.4)	144 (65.8) ^e
Sleep ^c	237 (39.6)	233 (39.0)	307 (51.3)	65 (21.8)	73 (23.2)	163 (27.3)	125 (76.7)	118 (73.8) ^e
Anxiety ^c	239 (40.0)	226 (37.8)	298 (49.8)	55 (18.5)	76 (25.4) ^d	167 (27.9)	137 (83.0)	128 (77.6)
Depression ^c	158 (25.9)	147 (25.0)	204 (34.1)	48 (23.9)	53 (26.4)	101 (16.9)	82 (82.8)	80 (80.8) ^e
Substance use disorder ^c	33 (5.5)	35 (5.8)	55 (9.2)	8 (14.5)	4 (7.5) ^e	13 (2.2)	8 (72.7)	4 (36.4) ^e
Seizure	82 (13.7)	91 (15.2)	129 (21.6)	4 (3.1)	3 (2.3) ^e	44 (7.4)	37 (84.1)	36 (81.8) ^e
Nausea	149 (24.9)	137 (22.9)	201 (33.6)	10 (5.0)	8 (4.0) ^e	85 (14.2)	71 (83.5)	66 (77.6) ^e
Attention	82 (13.7)	77 (12.9)	122 (20.4)	24 (19.7)	26 (21.3) ^e	37 (6.2)	32 (86.5)	34 (91.9) ^e
Post-traumatic stress disorder ^c	80 (13.4)	80 (13.4)	105 (17.6)	28 (26.7)	28 (26.7) ^e	55 (9.2)	38 (77.6)	35 (71.4) ^e
Arthritis	84 (14.0)	77 (12.9)	105 (17.6)	33 (31.4)	38 (36.2) ^e	56 (9.4)	32 (57.1)	28 (50.0) ^e
Appetite ^c	138 (22.9)	132 (21.9)	194 (32.4)	23 (11.9)	22 (11.3) ^e	76 (12.7)	65 (87.8)	64 (86.5) ^e
Other ^f	7 (1.2)	13 (2.0)	19 (3.2)	—	—	9 (1.5)	—	—

^aFor each therapeutic purpose, the subsample analyzed for daily use is the number of respondents who reported using cannabis for that therapeutic purpose in at least one of the assessment periods.

^bFor each therapeutic purpose, the subsample analyzed for inhalation is the number of respondents who reported using cannabis for that therapeutic purpose in both assessment periods.

^cFor these conditions, a small number of respondents did not provide a primary mode of cannabis consumption. In these cases, the inhalation percentage is the cell count divided by the number of participants with complete data in both periods.

^d*p*-Value = 0.004.

^eBinomial exact test was used instead of McNemar’s chi-square test when discordant cell counts in McNemar’s test contingency table were low (< 5 per cell or sum of both cells < 25).

^fOther reported reasons for use: (1) before COVID: preglaucoma; (2) during COVID: digestive issues, glaucoma, irritable bowel syndrome, Vertigo, prevent COVID-19; (3) both periods: Crohn’s disease, glaucoma, high blood pressure, muscle spasms, obsessive compulsive disorder, spirituality.

Discussion

In this subsample of adults reporting cannabis use for medical purposes, there were slight yet statistically significant increases in the overall frequency of medical cannabis use during COVID-19. In par-

ticular, we observed significant shifts from occasional (i.e., <weekly) use to weekly or daily use during COVID-19. While the overall prevalence of cannabis use to address 11 different therapeutic conditions or symptoms did not change significantly

Table 3. Factors Associated with Initiating or Increasing Cannabis Use for Anxiety During the COVID-19 Pandemic Among 592 U.S. Adults Who Use Medical Cannabis

Characteristic	Odds ratio (95% CI)	<i>p</i>	Adjusted odds ratio (95% CI)	<i>p</i>
Sex				
Female (vs. male)	2.17 (1.45–3.33)	< 0.001	2.12 (1.37–3.28)	< 0.001
Age				
Per 5-year increase	1.13 (1.03–1.24)	0.014	1.10 (1.00–1.22)	0.062
U.S. census region				
Northeast (vs. Midwest)	0.76 (0.38–1.54)	0.444	0.50 (0.23–1.07)	0.076
South (vs. Midwest)	0.70 (0.36–1.39)	0.310	0.84 (0.39–1.78)	0.642
West (vs. Midwest)	0.54 (0.27–1.06)	0.074	0.36 (0.17–0.78)	0.009
State’s cannabis regulatory status				
Medical-only (vs. illegal or CBD-only)	1.93 (1.06–3.50)	0.032	2.68 (1.35–5.31)	0.005
Fully legal (vs. illegal or CBD-only)	1.48 (0.82–2.66)	0.189	2.53 (1.11–5.78)	0.028
Pre-COVID frequency of cannabis use for anxiety ^a				
< Weekly (vs. none)	1.68 (1.01–2.81)	0.046	1.64 (0.97–2.79)	0.067
≥ Weekly (vs. none)	2.07 (1.25–3.45)	0.005	1.52 (0.85–2.72)	0.161
Pre-COVID frequency of nonmedical cannabis use ^a				
< Weekly (vs. none)	1.08 (0.59–1.99)	0.795	1.34 (0.70–2.55)	0.373
≥ Weekly (vs. none)	1.48 (0.93–2.37)	0.100	1.11 (0.64–1.94)	0.713
CBD use ^b				
Yes (vs. no)	1.56 (1.03–2.38)	0.039	1.40 (0.89–2.21)	0.149

^aRefers to a 3-month period preceding COVID-19, spanning mid-December 2019 to mid-March 2020.

^bPast-year use.

CBD, cannabidiol; CI, confidence interval.

during COVID-19, we detected a statistically significant increase in the prevalence of daily cannabis use for anxiety during the COVID-19 period. We had hypothesized that noninhalation modes of consumption would be increasingly adopted during COVID-19 (i.e., as a behavioral strategy to prevent COVID-19 infection or reduce symptom severity). However, we did not observe significant changes in inhalation-based modes of cannabis administration for any therapeutic purpose, including anxiety, during COVID-19. Finally, in an exploratory multivariable model, we noted that women were more likely to increase their use of cannabis to manage anxiety during the COVID-19 pandemic, as were respondents living in a state with a regulatory framework for medical or nonmedical cannabis; respondents living in Western U.S. states had lower odds of initiating or increasing cannabis use to manage anxiety.

Nearly half of the U.S. population has reportedly struggled with mental health issues resulting from heightened pandemic-related worry and stress.²⁷ The findings of this study suggest that a small portion of past-year medical cannabis users relied on cannabis to manage ongoing or emerging mental health needs during the beginning of the COVID-19 pandemic. Our finding lends some individual-level data to support Ashby's population-level finding that cannabis sales increased significantly more during the start of the pandemic in communities at higher risk of mental distress.¹² Notably, we observed that women were about twice as likely as men to increase the frequency of their cannabis use to manage anxiety after COVID-19 was declared a global pandemic. Various studies monitoring the mental health impacts of the COVID-19 pandemic around the world show that women have experienced elevated mental health problems relative to their male counterparts.²⁸⁻³¹ Research conducted among medical cannabis patients also demonstrates that women tend to be over-represented among those using cannabis for anxiety,^{22,32,33} and significantly more women than men report therapeutic benefit for anxiety.³⁴ As more women turn to cannabis or cannabis-based products to manage anxiety, there is an urgent need to probe potential underlying societal and biological drivers of this trend.

While 20–50% of medical cannabis patients report reduction in anxiety symptoms with the use of canna-

bis,^{25,34-37} there is very limited evidence from clinical research to inform on the potential therapeutic and adverse effects of cannabis and cannabis-based product use among people with anxiety disorders. In particular, studies testing the effect of high-potency THC on anxiety symptoms are lacking; in our study, all respondents reported using THC-based products. Despite that few states list anxiety as a qualifying condition for authorized use of medical cannabis,²¹ we found that respondents who lived in a state with a regulatory framework for cannabis were significantly more likely to increase their cannabis use for anxiety. Recent research involving a sample of adults with mood or anxiety disorder shows that self-medication with cannabis is twice as high in states with a medical cannabis law,³⁸ suggesting that legal access to cannabis increases uptake for therapeutic purposes.

In our study, over half of respondents who increased their medical cannabis use reported that more time at home contributed to their changing cannabis use patterns during COVID-19. In contrast, about one in three respondents who decreased their cannabis use cited concerns about COVID-19 infection risk as a reason for changing cannabis use. While these reasons corresponded with any changes (not necessarily frequency) in cannabis use for any medical purpose (not necessarily anxiety), it is plausible that factors related to stay-at-home orders (e.g., isolation, boredom, and/or lack of repose from responsibilities at home) played a role in respondents' shifts to higher frequency (i.e., daily) cannabis use for anxiety. Indeed, research conducted among emerging adults in Canada during a timeframe similar to the current study found that self-isolation contributed to a 20% increase in cannabis use during COVID-19.³⁹

Our finding of only a 4.5% increase in the number of people using medical cannabis daily contrasts with the Canadian situation and with early predictions that cannabis use would increase drastically in the United States during the pandemic based on surges in cannabis sales.^{13,14,18} It is possible that underlying factors that differ across settings, including loss of income and other financial restraints during COVID-19, prevented many individuals from escalating their cannabis use in our study. Indeed, at \$2000 CAD (~\$1600 USD) per month beginning in March 2020,⁴⁰ emergency government aid for loss of employment in Canada during the pandemic far exceeded stimulus packages offered to eligible U.S. residents (i.e., a one-time payment of \$1200

USD per person at the time of data collection).⁴¹ It is worth noting that “cost of cannabis” was the most commonly reported reason for shifting medical cannabis use among those whose frequency decreased during COVID-19.

While we observed slight increases in cannabis use to manage anxiety during a period of time coinciding with documented increases in mental distress across the United States, the pre-post design of our study without an appropriate control group of people who did not experience the pandemic prevents us from confirming that any change we observed was directly related to COVID-19. Our finding may simply be a product of steadily rising rates of cannabis use, including for various therapeutic purposes, among adults in the United States as cannabis laws continue to be reformed.⁴² However, it is notable that we did not observe any increases in cannabis use to manage any other condition or symptom of interest. Interestingly, this included those that often co-occur with anxiety, including chronic pain, insomnia, depression, and PTSD—an observation that was somewhat surprising as depressive disorders and PTSD symptoms have also risen alongside anxiety in the U.S. population during the pandemic.² Future research investigating the impact of COVID-19 on complex mental health and substance use patterns should probe broader socioeconomic circumstances and selective uses of cannabis to manage one or more comorbid mental health concerns.

The findings of this study should be interpreted against certain limitations. Participants were a self-selected (i.e., nonprobabilistic), web-based sample of people in the United States who report using cannabis for medical purposes. Accounting for only a fraction of the U.S. population who use cannabis for therapeutic purposes, this sample does not necessarily generalize to the broader population. The assessed medical applications of cannabis are based on self-report (i.e., not a formal diagnosis). The self-reported nature of all variables introduces the possibility of recall inconsistencies and/or responding according to perceived social norms.

To help illuminate our findings, we relied on a survey question capturing self-reported reasons for a perceived change in medical cannabis use during COVID-19. These responses were collected separately from the frequency data and are open to a wider interpretation regarding any change in medical cannabis use at any

point since the onset of COVID-19. As such, they are only meant to guide discussion of possible underlying relationships. Relatedly, our survey did not capture certain additional contextual factors related to the pandemic that may have further illuminated our findings, including adherence to “stay-at-home” orders and level of concern related to COVID-19 transmission in each of the assessed timeframes. There is the potential for loss of information regarding changes in cannabis use that occurred within each 3-month period as participants reported an average frequency of use and primary mode of administration for each 3-month period and chose the category that most closely corresponded to this average.

There is high variability in cannabis’ subjective and pharmacodynamic effects between modes of consumption, including within this study’s broadly defined inhalation and noninhalation groups.⁴³ This study did not capture changes in specific modes of administration within these broad categories. Changes in the use of products containing only CBD were outside of the scope of this analysis and should be examined in future research, particularly as CBD is reportedly used more often by women to manage anxiety.⁴⁴ Besides limiting the sample to participants who self-reported the use of cannabis with THC, we were unable to capture information about the cannabis used including chemovar, dose, and strength. Finally, data for the COVID-19 period were captured before the peak of the COVID-19 pandemic in many U.S. jurisdictions and it will be important to re-evaluate changes in medical cannabis use, modes of administration, and self-reported reasons for change as the COVID-19 pandemic continued (and continues) to unfold.

In this sample of adults in the United States who report cannabis use for medical purposes, we observed slight but significant increases in the overall frequency of medical cannabis use after the declaration of a global COVID-19 pandemic. This finding was likely driven by an increase in the prevalence of daily cannabis use to address anxiety, and we found that women were more likely than men to increase their cannabis use for anxiety during COVID-19. The pandemic is likely to have widespread and long-lasting mental health impacts on the population; there is a need to monitor short- and long-term changes in cannabis use patterns for potential adverse and therapeutic impacts on mental health.

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Abbreviations Used

AOR = adjusted odds ratio
ASSIST = Alcohol, Smoking, and Substance Involvement
Screening Test
CBD = cannabidiol
CI = confidence interval
PTSD = post-traumatic stress disorder
THC = delta-9-tetrahydrocannabinol