Differentiating Medicinal and Recreational Cannabis Users via Cannabis Use Motives

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ABSTRACT

People who endorse using cannabis for medicinal vs. recreational purposes exhibit several important differences in terms of cannabis use quantity and frequency, cannabis-related problems, and other critical factors. However, there is currently little research on different motivations for use in these groups. The present study identifies specific cannabis use motives (using the Comprehensive Marijuana Motives Questionnaire) that distinguish medicinal (N = 283) from recreational (N = 462) users in a large, geographically-diverse sample recruited through Amazon's Mechanical Turk. Logistic regression analyses indicated that sleep, social anxiety, and coping motives were associated with greater odds of medicinal use. Conversely, motives related to boredom, enjoyment, simultaneous alcohol use, and celebration were associated with greater odds of recreational use. The results indicate that specific motives differentiate types of cannabis users such that positive reinforcement may primarily drive recreational use, and negative reinforcement may primarily drive medicinal use.

Key words: cannabis, motives, recreational, medicinal

Cannabis use has been linked to a number of harms and detrimental outcomes, including cognitive deficits (e.g., impaired short-term memory, impaired motor coordination), increased risk for mental health disorders (e.g., depression, anxiety, psychosis), and physical health problems (e.g., bronchitis, respiratory infections) (Volkow, Baler, Compton, & Weiss, 2014). Despite these potential negative consequences, cannabis is currently the most commonly used drug in the United States (aside from alcohol and tobacco), with an estimated 26 million Americans aged 12 and older reporting cannabis use in 2017 (Substance Abuse and Mental Health Services Administration, 2018). The legal status of cannabis in the United States is rapidly changing, with cannabis laws varying by state. Currently, the recreational use of cannabis by adults over the age of 21 is legal in 10 U.S. states and the District of Columbia (National Conference of State Legislature, 2019). While the majority of cannabis users use for solely recreational purposes (i.e., for enjoyment or for intoxication), estimates of cannabis users who report using for medicinal

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purposes (either concurrently with recreational use, or medicinal use alone) range from 9.8% to 17% (Compton, Han, Hughes, Jones, & Blanco, 2017; Lin, Ilgen, Jannausch, & Bohnert, 2016).

Medicinal and recreational users exhibit several important differences in terms of cannabis use, cannabis-related problems, and other key health and safety factors. For instance, medicinal users tend to use cannabis more frequently than recreational users (Lin et al., 2016). A recent study among U.S. veterans examined differences between medicinal and recreational cannabis users and showed elevated levels of post-traumatic stress disorder and worse physical and mental health functioning for medicinal users compared with recreational users (Metrik, Bassett, Aston, Jackson, & Borsari, 2018). Studies from primary care and emergency department settings have shown that medicinal users not only use cannabis more often than recreational users, they also tend to have lower income and experience poorer physical health (e.g., Furler, Einarson, Millson, Walmsley, & Bendayan, 2004; Lin et al., 2016; Roy-Byrne et al., 2015; Woodruff & Shillington, 2016).

Another potentially important factor that might differentiate these groups is specific motivations for using cannabis. Motives for using drugs or alcohol are commonly described as the particular reasons individuals engage in use of a substance, and often include positive reinforcement (e.g., to enhance mood, to facilitate social interaction) and negative reinforcement (e.g., as a coping mechanism for stress, to improve sleep) (Cooper, 1994; Cooper, Kuntsche, Levitt, Barber, & Wolf, 2016). In the case of cannabis, common motives for use include enjoyment, experimentation, boredom, conformity, social anxiety, sleep, and coping, among others (Lee, Neighbors, Hendershot, & Grossbard, 2009). A study by Metrik at al. (2018) comparing medicinal and recreational cannabis use among U.S. veterans found significant differences in cannabis use motives, with medicinal users reporting using cannabis to manage sleep to a greater extent than recreational users, and recreational cannabis users more likely to report concurrent alcohol use relative to medicinal users. In a follow-up study using prospective data to examine associations between cannabis and alcohol use among medicinal and recreational users, veterans who used cannabis recreationally were at greater risk for increased drinking when co-using cannabis at the daily level. Medicinal users, particularly those who endorsed motives for using cannabis as a substitute for alcohol, were found to be at lower risk for increased drinking on days when cannabis was also used (Gunn, Jackson, Borsari, & Metrik, 2019). The studies by Metrik and colleagues examined a specific group of cannabis users (i.e., veterans) and it is unclear if the findings generalize to a sample of community cannabis users (Gunn et al., 2019; Metrik et al., 2018). Apart from these studies, research comparing motives for use between medicinal and recreational users remains limited, particularly in general population samples. This is an important gap in the literature since motives for use have been shown to have clinical relevance. Differences in reasons for using cannabis can help predict when, where, and how often use will occur, and may have important implications for the efficacy of substance use disorder treatment (Blevins, Banes, Stephens, Walker, & Roffman, 2016). For instance, a study of treatment-seeking adolescent cannabis users found that several cannabis motives decreased following treatment, and the magnitude of this reduction predicted reduction in cannabis problems and frequency of use over time (Blevins et al., 2016). Similar findings also have been reported in adult samples, with greater reductions in coping motives associated with better treatment outcomes (Banes, Stephens, Blevins, Walker, & Roffman, 2014).

The present study sought to replicate and extend the findings of Metrik et al. (2018) by examining general cannabis use motives and medicinal-specific motives in a large sample of regular recreational and medicinal cannabis users who were recruited via an online crowdsourcing platform from U.S. states with legalized recreational cannabis use. This study also extends the work of Metrik et al. (2018) by examining which cannabis-related motives uniquely predict medicinal vs. recreational use in a comprehensive multivariate model. Consistent with the findings of Metrik et al. (2018), we predicted that people who use cannabis for medicinal purposes will report more salient sleep-related motives whereas recreational users will report elevated simultaneous alcohol-related motives.

METHOD

Participants

Participants for the study were recruited through the Amazon Mechanical Turk (MTurk) crowdsourcing portal (www.mturk.com). MTurk's platform allows for surveys and tasks to be posted by "requesters" (researchers) and completed by "workers" given that the "workers" (participants) meet certain criteria (Stewart, Chandler, & Paolacci, 2017). The survey was posted on MTurk between September and December, 2017. Participants had to be at least 18 years of age, geographically located in U.S. states with legalized recreational cannabis at the time of data collection, and have previously completed at least 100 MTurk surveys with minimum 95% approval rating on prior surveys to ensure valid data. Only one response per IP address was permitted. We recruited a large general sample of adults (N = 3,024) to complete the first survey. Participants from this sample who reported cannabis use in the past 6 months were identified (N = 778) and invited to participate in stage two of the study. Stage two consisted of another survey on MTurk focusing on recreational and medicinal cannabis use and reasons for use, among other variables. Excluding for missing data on the Comprehensive Marijuana Motives Questionnaire (CMMQ), the final sample consisted of 745 participants. These participants were divided into two groups based on their reasons for using cannabis on the cannabis use patterns questionnaire (see specific items below): (a) recreational use only (N = 463) and (b) any medicinal use, including co-occurring with recreational use or solely medicinal use (N = 283). The study was approved by the Hamilton Integrated Research Ethics Board (Project #3566) and all participants completed informed consent. Participants received $7 for completing both stages of the study.

Measures

Part one of the MTurk survey consisted of self-report questionnaires assessing substance use, personality, and other lifestyle behaviors. Part two specifically assessed cannabis use patterns, history, and motives.

Demographics. Demographic variables such as sex, age, race, years of education, and income were assessed using a self-report questionnaire.

Cannabis use patterns. A self-report questionnaire based on previous research (Cuttler & Spradlin, 2017; Metrik et al., 2009) was used to assess history of cannabis use, current quantity and frequency of cannabis consumption, and reason for cannabis use (i.e., recreational or medicinal). Cannabis use quantity was assessed by self-reported grams of cannabis consumed for personal use in a typical week. Cannabis use frequency was assessed using the first item of the Cannabis Use Disorder Identification Test-Revised (CUDIT-R) (Adamson et al., 2010). Specifically, participants reported how often they used cannabis in the last 6 months, with responses ranging from "never" to "4 or more times a week". Due to established validity issues with the CUDIT-R in medicinal users (Loflin, Babson, Browne, & Bonn-Miller, 2018), only the first item related to frequency was used as a covariate in the analyses; CUDIT-R total scores are reported for descriptive purposes. Finally, the following question was used to bifurcate the sample into the medicinal vs. recreational groups: "Are you currently taking marijuana for medicinal purposes?" Participants who responded "No" were classified as recreational use only; participants who responded "Yes" were classified as medicinal use. For inclusion in the medicinal group, it was not necessary that participants had been prescribed cannabis by a medical professional.

Motives and reasons for using cannabis. Motives for cannabis use were assessed using the Comprehensive Marijuana Motives Questionnaire (CMMQ) (Lee et al., 2009), on which participants rated how often they use cannabis for each of 36 reasons on a 1 = "almost never/never" to 5 = "almost always/always" scale. Composite scores were derived for 12 subscales (listed in Table 1; α's = .76 to .92). Medicinal cannabis users completed the Reasons for Medical Marijuana Questionnaire (RFUMM) (Reinarman, Nunberg, Lanthier, & Heddleston, 2011), a 25-item questionnaire assessing how often medicinal users use cannabis to improve, relieve, or prevent certain conditions (e.g., pain, sleep, seizures, etc.), with additional items on PTSD and how often cannabis is used as a drug substitute from the modified RFUMM used in the Metrik et al. (2018)

Table 1. *Sample Characteristics*

Variable	Overall Sample (*N*= 745) *n (%); M(SD)*	Recreational Only (*N*= 462) *n (%); M(SD)*	Medicinal Use (*N*= 283) *n (%); M(SD)*	χ^2/F	*p*	*FDR*	η^2
Sex (Female)	382 (48.7%)	210 (45.5%)	172 (60.8%)	16.49	<.001		
Race				3.91	.048		
White	546 (73.3%)	327 (70.8%)	219 (77.4%)				
Black/African American	38 (5.1%)	23 (5.0%)	15 (5.3%)				
Aboriginal	1 (.1%)	1 (.2%)	0 (.0%)				
Asian	67 (9.0%)	54 (11.7%)	13 (4.6%)				
Native Hawaiian/Pacific Islander	53 (7.1%)	36 (7.8%)	17 (6.0%)				
More than one race	38 (5.1%)	21 (4.5%)	17 (6.0%)				
Another race	2 (.3%)	0 (.0%)	2 (0.7%)				
Age	33.69 (10.06)	33.09 (10.25)	34.66 (9.70)	4.26	.039		.006
Education	15.16 (2.20)	15.32 (2.18)	14.90 (2.23)	6.37	.012		.009
AUDIT	7.12 (6.42)	7.52 (6.23)	6.46 (6.67)	4.78	.029		.006
Cannabis use per week (grams)	5.28 (12.55)	4.37 (12.18)	6.77 (13.01)	6.46	.011		.009
Use frequency (CUDIT-R item 1)				143.81	<.001		.162
4 or more times a week	285 (38.3%)	109 (23.6%)	176 (62.2%)				
2-3 times a week	82 (11.0%)	54 (11.7%)	28 (9.9%)				
2-4 times a month	116 (15.6%)	78 (16.9%)	38 (13.4%)				
Monthly or less	262 (35.2%)	221 (47.8%)	41 (14.5%)				
CUDIT-R Total	8.40 (6.12)	7.15 (5.79)	10.43 (6.12)	53.83	<.001		.068
PHQ-9	7.62 (6.51)	7.17 (6.18)	8.35 (6.97)	5.73	.008		.008
GAD-7	6.86 (5.79)	6.22 (5.46)	7.91 (6.17)	15.16	<.001		.020
CMMQ Subscales							
Enjoyment	7.52 (3.21)	7.72 (3.16)	7.19 (3.26)	18.03	<.001	sig.	.024
Conformity	1.15 (2.13)	1.42 (2.31)	.71 (1.71)	2.58	.109	n.s.	.003
Coping	3.30 (3.22)	2.98 (3.11)	3.82 (3.33)	3.12	.078	n.s.	.004
Experimentation	2.43 (2.70)	2.65 (2.72)	2.08 (2.63)	1.08	.297	n.s.	.001
Boredom	3.69 (3.19)	4.03 (3.23)	3.13 (3.05)	17.58	<.001	sig.	.023
Alcohol	1.60 (2.41)	2.01 (2.65)	.94 (1.78)	8.41	.004	sig.	.011
Celebration	4.06 (3.13)	4.29 (3.14)	3.70 (3.10)	4.23	.040	n.s.	.006
Altered Perceptions	4.70 (3.71)	4.45 (3.70)	5.11 (3.70)	.63	.428	n.s.	.001
Social Anxiety	3.12 (3.26)	2.57 (3.03)	4.00 (3.43)	14.51	<.001	sig.	.019
Relative Low Risk	5.13 (3.57)	4.88 (3.59)	5.55 (3.73)	0.81	.368	n.s.	.001
Sleep	4.79 (3.70)	3.80 (3.47)	6.41 (3.49)	39.94	<.001	sig.	.051
Availability	4.35 (3.13)	4.74 (3.15)	3.72 (3.01)	15.69	<.001	sig.	.021

Note. AUDIT = Alcohol Use Disorder Identification Test, CUDIT = Cannabis Use Disorder Identification Test, PHQ-9 = Patient Health Questionnaire-9 (depression symptoms), GAD-7 = Generalized Anxiety Disorder (anxiety symptoms). FDR = False Discovery Rate correction (q < .05).

study. Response options ranged from 1 = "almost never/never" to 4 = "most of the time" (α = .86).

Mental health symptoms and alcohol use related variables. Mental health symptoms and alcohol misuse were assessed for the purposes of including as covariates in analyses. Symptoms of depression and anxiety were assessed using the Patient Health Questionniare-9 (PHQ-9; α = .92)

(Spitzer, Kroenke, & Williams, 1999) and the Generalized Anxiety Disorder scale (GAD-7; α = .93) (Spitzer, Kroenke, Williams, & Lowe, 2006), respectively. Alcohol use and severity of associated problems over the past 12 months were assessed using the Alcohol Use Disorder Identification Test (AUDIT; α =.88) (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993).

RESULTS

Preliminary Analyses

Prior to analysis, the data were screened for outliers (zs > 3.29) (Tabachnick & Fidell, 2013). Only a small number of outliers were identified (0.4%), and these values were Windsorized. Sample characteristics for the overall sample and by group are presented in Table 1. Using a standard significance level of $p < .05$, significant group differences between recreational and medicinal users were noted for sex, race, age, and education. Groups were also different with respect to alcohol use (AUDIT; $p = .029$), depressive symptoms (PHQ-9; $p = .008$), and anxiety symptoms (GAD-7; $p < .001$). Medicinal cannabis users reported significantly greater frequency of cannabis use ($p < .001$), greater grams consumed per week ($p = .011$), and higher CUDIT-R total scores ($p < .001$). Mean ratings on the RFUMM in the medicinal group are presented in Table 2. Medicinal cannabis users reported using cannabis most frequently to improve relaxation and sleep, to relieve pain and anxiety, and as a substitute for prescription medication.

Cannabis Use Motives

Mean scores on the 12 CMMQ subscales for the recreational only and medicinal cannabis groups are presented in Table 1. Bivariate correlations among the CMMQ subscales are presented for recreational only users in Table 3 and medicinal users in Table 4, with r values ranging from .01 to .61 for recreational users and .09 to .70 for medicinal users. CMMQ subscale correlations for the total sample is presented in Supplemental Materials. Differences in cannabis use motives on the 12 CMMQ subscales were examined using separate analyses of covariance (ANCOVA) models controlling for demographic variables (sex, age, race [white/non-white], education) and quantity/frequency of cannabis use. To reduce the risk of type-I error due to multiple comparisons, the ANCOVA models were corrected using a False Discovery Rate of $q < .05$ (Benjamini & Hochberg, 1995). Significant differences between groups were found for six of twelve subscales of the CMMQ after FDR correction, $Fs = 4.23\text{-}39.94$, $\eta_p^2 = .006\text{-}.051$. The recreational use only group reported more often using cannabis for enjoyment, to counter boredom, simultaneous with alcohol, and because

Table 2. *Reasons for Using Medicinal Marijuana* (RFUMM; N = 283)

	M	*SD*
To Relieve:		
Pain	2.94	1.07
Muscle Spasms	1.93	1.18
Headaches	2.08	1.09
Anxiety	2.93	1.16
Nausea/Vomiting	1.94	1.12
Depression	2.61	1.22
Cramps	1.92	1.04
Panic Attacks	2.05	1.17
Diarrhea	1.28	.71
Itching	1.22	.65
Anger	1.92	1.08
PTSD	1.93	1.24
To Improve:		
Sleep	3.04	1.01
Relaxation	3.13	.96
Appetite	2.14	1.11
Concentration/Focus	1.92	1.06
Energy	1.75	.97
To Prevent:		
Medication Side Effects	1.67	1.01
Anger	1.81	.98
Involuntary Movements	1.35	.80
Seizures	1.19	.64
PTSD	1.76	1.10
As a Substitute for:		
Prescription Medication	2.69	1.19
Alcohol	1.85	1.08
Another drug	1.51	.98

Note. Mean scores can range from 1 to 4.

Table 3. *Bivariate Correlations Among Cannabis Motive Subscales – Recreational Only Use*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Enjoyment	-											
2. Conformity	.01	-										
3. Coping	.33	.32	-									
4. Experimentation	.17	.52	.34	-								
5. Boredom	.46	.36	.61	.33	-							
6. Alcohol	.02	.50	.20	.34	.22	-						
7. Celebration	.36	.29	.36	.34	.38	.16	-					
8. Altered Perceptions	.45	.20	.46	.36	.44	.11	.36	-				
9. Social Anxiety	.30	.37	.61	.43	.46	.25	.43	.46	-			
10. Relative Low Risk	.47	.25	.30	.30	.36	.09	.34	.43	.35	-		
11. Sleep	.27	.20	.45	.25	.42	.13	.33	.35	.56	.36	-	
12. Availability	.35	.36	.37	.34	.56	.38	.36	.26	.32	.33	.24	-

Note. N = 462.

Table 4. *Bivariate Correlations Among Cannabis Motive Subscales – Medicinal Use*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Enjoyment	-											
2. Conformity	.06	-										
3. Coping	.35	.35	-									
4. Experimentation	.31	.43	.28	-								
5. Boredom	.50	.44	.45	.43	-							
6. Alcohol	.14	.70	.34	.42	.44	-						
7. Celebration	.46	.31	.24	.53	.39	.29	-					
8. Altered Perceptions	.57	.18	.45	.42	.46	.20	.43	-				
9. Social Anxiety	.39	.17	.49	.29	.31	.18	.39	.49	-			
10. Relative Low Risk	.52	.11	.34	.28	.33	.11	.38	.50	.46	-		
11. Sleep	.28	.09	.29	.23	.27	.17	.26	.27	.39	.42	-	
12. Availability	.43	.32	.35	.36	.66	.36	.43	.38	.29	.39	.24	-

Note. N = 283.

of availability when compared to the medicinal use group. Conversely, the medicinal use group tended to report using cannabis more often for sleep difficulties and to relieve social anxiety when compared with the recreational use only group.

We then conducted a hierarchical binary logistic regression model to determine which of the 12 CMMQ subscales uniquely predicted group membership (recreational use only (0) vs. medicinal (1)) when the subscales were entered simultaneously. Specifically, demographic and cannabis use variables were entered in the first step of the model, followed by the 12 CMMQ subscales in the second step. Results of the logistic regression are presented in Table 5. The final model was significant, χ^2 (df = 18) = 280.71, $p < .001$, Nagelkerke $R^2 = .43$. The odds of being a medicinal cannabis user were significantly ($p < .05$) greater for participants with higher sleep, coping, and social anxiety motives. Conversely, the odds of being a recreational only user were significantly greater for participants with higher enjoyment, boredom, simultaneous alcohol, and

Table 5. *Binary Logistic Regression Analysis Predicting Medicinal or Recreational Cannabis Use*

Variable	*B*	*SE*	*OR*	95% *CI*	Wald Statistic	*p*	Model χ^2	R^2
Step 1							151.58***	.25
Sex (Female)	-0.37	0.20	0.69	[0.47, 1.01]	3.57	.059		
Race (White/Non-White)	0.11	0.22	1.12	[0.72, 1.73]	0.25	.614		
Age	0.01	0.01	1.01	[0.99, 1.03]	1.52	.217		
Education	0.00	0.04	1.00	[0.92, 1.09]	0.00	.995		
Frequency of use (CUDIT-1)	0.58	0.04	1.78	[1.51, 2.10]	46.52	<.001		
Use per week (grams)	0.00	0.01	1.00	[0.99, 1.02]	0.06	.811		
Step 2							280.71***	.43
CMMQ Subscales								
Enjoyment	-0.16	0.04	0.854	[0.79, 0.93]	14.06	<.001		
Conformity	-0.02	0.07	0.980	[0.86, 1.12]	0.09	.760		
Coping	0.08	0.04	1.087	[1.00, 1.18]	4.22	.040		
Experimentation	0.01	0.05	1.010	[0.92, 1.10]	0.05	.832		
Boredom	-0.17	0.05	0.844	[0.77, 0.93]	12.35	<.001		
Alcohol	-0.14	0.06	0.873	[0.78, 0.98]	5.48	.019		
Celebration	-0.08	0.04	0.924	[0.85, 1.00]	3.86	.049		
Altered Perceptions	0.06	0.03	1.065	[1.00, 1.14]	3.51	.061		
Social Anxiety	0.10	0.04	1.104	[1.02, 1.20]	5.76	.016		
Relative Low Risk	0.03	0.03	1.031	[0.97, 1.10]	0.91	.340		
Sleep	0.19	0.03	1.214	[1.14, 1.29]	35.94	<.001		
Availability	-0.04	0.04	0.962	[0.89, 1.04]	0.87	.350		

Note. Logistic regression coding: 0 = Recreational; 1 = Medicinal. CUDIT = Cannabis Use Disorder Identification Test.

celebration motives. Across all CMMQ subscales, the largest odds ratios were present for sleep, boredom, enjoyment, and simultaneous alcohol motives.

DISCUSSION

The current study investigated differences in cannabis use motives among individuals endorsing cannabis use for recreational or medicinal reasons. Relative to recreational only users, medicinal users tended to report more often using cannabis for reasons related to social anxiety and sleep. Recreational only users, however, reported more often using cannabis for enjoyment, boredom, simultaneous with use of alcohol, and because of availability relative to medicinal users. The combined logistic regression model results were largely similar to the group comparisons for individual motives, but with some notable differences. While social anxiety and sleep motives remained associated with greater odds of medicinal use, coping motives emerged as an additional significant predictor of medicinal use. For recreational use, enjoyment, boredom, and alcohol motives were once again associated with greater odds of recreational use, but availability was no longer significant in the combined model. Celebration also significantly uniquely predicted recreational use in the combined model. Importantly, motives related to conformity, experimentation, altered perceptions, or relative low risk did not differentiate groups in any of the analyses. Taken together, these results suggest that recreational and medicinal cannabis users report distinct reasons for use. Interestingly, these results replicate two important findings among veterans in Metrik et al. (2018) within a community sample – community recreational cannabis users were more likely to report alcohol-

related motives while medicinal cannabis users were more likely to report sleep-related motives.

The motives distinct to recreational cannabis users have several implications for potential negative outcomes and interventions for cannabis-related problems. First, alcohol-related cannabis use motives (e.g., using cannabis "because you were drunk") significantly predicted recreational cannabis use. Prior research has investigated motives for and outcomes of concurrent and simultaneous cannabis and alcohol use (i.e., concurrent users use both cannabis and alcohol but during separate episodes, simultaneous users use cannabis and alcohol during the same episode) (Subbaraman & Kerr, 2015). Patrick and colleagues (2018) characterized four primary motives for simultaneous alcohol and cannabis use: conformity, positive subjective effects, coping, and social motives. Elevated social and calm/coping motives for simultaneous use was found to be correlated with greater odds of simultaneous alcohol and cannabis use, a pattern of use that may be more dangerous or risky compared with use of either substance alone (Brière, Fallu, Descheneaux, & Janosz, 2011; Patrick, Fairlie, & Lee, 2018). Simultaneous use is associated with a number of negative outcomes, including unsafe driving, social consequences and harms to self, and substance-related problems (Brière et al., 2011; Subbaraman & Kerr, 2015; Terry-McElrath, O'Malley, & Johnston, 2014). Individuals who use alcohol and cannabis concurrently or simultaneously also report elevated motivation for alcohol on behavioral economic measures of alcohol demand relative to people who use alcohol only (Morris et al., 2018). This includes significantly greater overall purchases on alcohol (i.e., maximum expenditure) and continuing to consume alcohol despite higher costs. Taken together, an expanding body of research suggests that combined use of alcohol and cannabis is an especially problematic pattern. The present findings suggest that including a measure of alcohol-related cannabis use motives in treatment settings may help to identify individuals who are at increased risk of experiencing negative consequences of combined use. However, these findings must be interpreted with caution given that recreational users had significantly higher AUDIT scores than medicinal users. A future direction will be to investigate the impact of higher levels of alcohol use on alcohol-related cannabis use motives.

Second, when the other motives distinct to recreational users are examined collectively (i.e., boredom, enjoyment, availability), they appear to paint a picture of these individuals using cannabis when bored (e.g., "Because you had nothing better to do") and seeking stimulation, especially when cannabis is readily available. Behavioral economic theory indicates that consumption of a substance is predicated upon access and availability of the substance as well as the individual's subjective valuation of the substance (Bickel, Johnson, Koffarnus, MacKillop, & Murphy, 2014). This may be important when considering how to identify and tailor interventions for those individuals whose recreational cannabis use has reached a problematic level. In line with behavioral economic theory, one way to decrease cannabis use is to increase the cost of the drug, thereby reducing ease of access. Another potential avenue of intervention is promoting engagement in substance-free alternatives that are reinforcing for the individual. Currently, one supplemental intervention has been developed to encourage participation in these alternative activities (i.e., the Substance-Free Activity Session; SFAS) (Murphy et al., 2012; Yurasek, Dennhardt, & Murphy, 2015). Although initially developed as an intervention for problematic alcohol use in college drinkers (Murphy et al., 2012), the SFAS protocol has been demonstrated to significantly reduce cannabis use among college students. The current results suggest that motives may be useful to identify ideal candidates for a SFAS intervention (i.e., those individuals who report using cannabis due to enjoyment and availability may benefit from an intervention that specifically increases engagement in enjoyable substance-free alternatives). Ultimately, it may be useful for future research to consider recreational users' motives for use as predictors of intervention response to the SFAS or related programs.

In contrast to recreational users using cannabis as positive reinforcement, our data suggest that medicinal users tend to endorse use for negative reinforcement (i.e., to cope with various problems). First, medicinal users use cannabis for sleep-related motives more often than recreational users. This finding aligns with prior research reporting improvements in sleep as

a primary reason for medicinal use (e.g., Metrik et al., 2018). A recent systematic review of the effects of cannabis on sleep-related variables reported that many studies show subjective improvements in sleep; however, there is currently a lack of consistency between data on subjective (i.e., self-report) and objective measures of sleep quality (e.g., decreases in sleep disturbances; decreases in sleep onset latency) (Kuhathasan et al., 2019). Also in line with previous research is the reported medicinal use of cannabis for social anxiety – a number of studies have suggested that CBD, a major constituent of cannabis, may be useful in reducing anxiety symptoms in participants with social anxiety disorder (Bergamaschi et al., 2011; Crippa et al., 2011). Prior research has identified coping motives as potentially playing a mediational role between cannabis use/problems and anxiety (Buckner, Bonn-Miller, Zvolensky, & Schmidt, 2007; Johnson, Mullin, Marshall, Bonn-Miller, & Zvolensky, 2010). Of note, relief of anxiety was one of the most highly endorsed reasons for medicinal cannabis use in our sample.

Several limitations must be taken into consideration when interpreting the results of the current study. First, because assessments were administered using Amazon's MTurk and completed at the participants' convenience, data quality may have been impacted due to lack of experimental control. However, rigorous inclusion criteria commonly used in MTurk studies were implemented. Additionally, there has been an increasing body of literature supporting the validity of MTurk for behavioral science research in general (e.g., Hauser & Schwarz, 2016) and addictions research in particular (Kim & Hodgins, 2017). While our sample was geographically-diverse, the majority of the sample identified as White which limits the generalizability of our findings to other racial and ethnic groups. Moreover, our sample was only drawn from U.S. states with legalized recreational and medicinal cannabis – a future direction will be to collect data from U.S. states that currently only have legalized medicinal cannabis programs. An additional future direction is to collect data from other countries such as Canada, where recreational cannabis use was federally legalized in 2018. Another limitation involves the inclusion of both prescribed and non-prescribed medicinal cannabis users in the medicinal group. An area of future work is to investigate factors that differentiate medical cannabis card holders from those that self-report using cannabis for medicinal purposes. A final limitation is the relatively small number of individuals in this sample who reported solely medicinal use (5.8% of sample), which restricts our ability to draw comparisons between solely medicinal users and those who use for dual reasons (i.e., medicinal and recreational). This may also reflect a lack of precision in measurement of recreational and medicinal cannabis use that does not account for the multifaceted reasons someone might use cannabis (i.e., for both recreational and medicinal reasons).

In conclusion, the present study contributes to a relatively limited literature comparing cannabis motives between specific subgroups of users. Specifically, our results further illustrate differences in cannabis use motives between people who use cannabis recreationally vs. medicinally. Our results indicate that recreational use is primarily driven by positive reinforcing aspects of cannabis – including enjoyment, celebration, and co-use with alcohol – whereas medicinal use is primarily driven by negative reinforcing aspects such as sleep and social anxiety. Given that motives are important predictors of when, where, and how often cannabis use will occur, along with predicting the efficacy of substance use disorder interventions (Blevins et al., 2016), exploring specific motives for use among distinct subgroups of users has clear clinical relevance. Also considering the expanding role of behavioral economic-based interventions for substance use (e.g., SFAS), this study suggests that programs using those interventions might benefit from selectively screening clients based on specific profiles of cannabis use motives.

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