A Factor Analysis of the Marijuana Motives Measure in an Anxiety and Related Disorders Sample

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Yash M. Joshi[1,2], Spencer Metcalfe[1], Arij Alarachi[1,3], Andrew M. Scott[1], Mélise J. Ouellette[1], & Karen Rowa[1,4]

[1]Anxiety Treatment and Research Clinic, St. Joseph's Healthcare
[2]Department of Psychology, University of British Columbia
[3]Department of Psychology, Neuroscience, and Behaviour, McMaster University
[4]Department of Psychiatry and Behavioural Neurosciences, McMaster University

ABSTRACT

Objective: Motivational models of cannabis use, amongst other substances, suggest that individuals are driven to use it to achieve variable personally important outcomes. Understanding individuals' personal motivations for cannabis use is essential to screen for problematic use and intervene where appropriate. Importantly, more research is needed to understand how individuals transition from recreational to problematic use, as well as maintenance factors. As such, the use of psychometrically sound measures of motives for cannabis use is necessary, particularly in populations of individuals with anxiety and related disorders (ARDs), where there is a high rate of cannabis use. **Method:** We examined the factor structure of the Marijuana Motives Measure (MMM) to confirm its structural validity in a clinical sample. Treatment-seeking adults from an outpatient anxiety clinic in Canada (N = 253) completed the MMM and several symptom questionnaires. **Results:** Confirmatory factor analysis exhibited strong fit indices and good internal consistency across subscales ranging from .88-.93. Significant positive correlations were observed amongst most subscale pairs, the highest between expansion and coping (*cor* = 0.78). Scores on a measure of cannabis use disorder symptoms showed the strongest association with the coping subscale (τ = 0.54). **Conclusions:** The MMM demonstrated structural and convergent validity in this sample, adding evidence supporting its use in an adult, treatment-seeking population with ARDs.

Key words: = cannabis; anxiety disorders; factor analysis; treatment-seeking

Cannabis, a psychoactive substance derived from *cannabis sativa*, has been decriminalized or legalized in several regions across North America since 2012 (Health Canada, 2021; National Institute on Alcohol Abuse and Alcoholism, 2022). Since the legalization of recreational cannabis use, perceptions of cannabis as a potential medicinal treatment for psychiatric symptoms have been on the rise (Das et al. 2024). Common motives for cannabis use include medicinal (e.g., pain management, seizures, medication effects; 36%), anxiety (33%), arthritis (21%), and depression (8%; Health Canada, 2021; Simons et al., 1998). Other motives for cannabis include social enhancement, conformity, boredom, experimentation, and enjoyment (C. M. Lee et al., 2007). However, motives for using cannabis are not necessarily mutually exclusive; people who use cannabis recreationally may begin to use cannabis medicinally upon perceiving positive effects of cannabis use on health-related symptoms. Coinciding with changes in cannabis

Corresponding Author: Karen Rowa, PhD, C.Psych. Anxiety Treatment and Research Clinic, St. Joseph's Healthcare, 100 West 5th St. Hamilton, ON, Canada, L8N 3K7. Phone: (905) 522 – 1155, ext. 33656. Email: krowa@stjoes.ca

legalization and public perceptions of medicinal use, increased rates of cannabis use disorder have been documented (CUD; Aletraris et al., 2023). CUD is characterized by ongoing problematic cannabis use, leading to distress or impairment including, for example, continued use despite physical or psychological harm (American Psychiatric Association, 2022). Based on prevalence and the dependence potential of cannabis, 46% of United Nations countries report that cannabis is of most concern for substance use disorders (United Nations Office on Drugs and Crime, 2023), and global estimates put CUD prevalence at around 22.1 million people (GBD 2016 Alcohol and Drug Use Collaborators, 2018). Notably, specific motives for cannabis use (e.g., coping motives) have been associated with indicators of problematic cannabis use (Ouellette et al., 2023; Moitra et al., 2015). Further, the estimated prevalence of CUD in those who use cannabis medicinally is at 25% (Dawson et al., 2024), highlighting the need to explore this area further.

Given that problematic cannabis use is on the rise and motives for cannabis use may play an important role in problematic cannabis use, it is important to accurately measure motives for cannabis use to better understand use patterns and possible changes that may occur (e.g., occasional use to problematic use; Pearson, 2019; Cerdá et al., 2019; Bresin & Mekawi, 2019). The Marijuana Motives Measure (MMM; Simons et al., 1998) is a 25-item scale that was developed on a sample of undergraduate students to identify motives for cannabis use. These motives include enhancement (using for pleasure, e.g., MMM Item 7 "Because it's fun"), conformity (using to prevent rejection or social consequences, e.g., MMM Item 12 "To fit in with the group I like"), expansion (experiential awareness, e.g., MMM Item 22 "Because it helps me be more creative and original"), coping (using to alleviate negative affect, e.g., MMM Item 4 "Because it helps me when I feel depressed or nervous"), and social (using for social facilitation and approval, e.g., MMM Item 15 "Because I feel more self-confident and sure of myself"). Importantly, across the 5-factor model and an expanded 12-factor comprehensive version of the measure (C. M. Lee et al., 2009), results from a community sample suggest that independent of frequency of use, coping and conformity are most correlated to cannabis use problems as measured on the Cannabis Use Disorder Identification Test (CUDIT-R; C. M. Lee et al., 2009; Simons et al., 1998). These results indicate the value of measuring and understanding specific motives for cannabis use.

Previous psychometric validation studies have confirmed the factor structure, reliability, and validity of the MMM in a sample of young adults who consume cannabis (Zvolensky et al., 2007; Benschop et al., 2015), as well as between males and females in a community sample of adults who consume cannabis (Rochat et al., 2024). While Zvolensky et al. (2007) retained all items, four items were dropped from the models to achieve acceptable fit in the factor analysis in both of the other psychometric studies (Benschop et al., 2015; Rochat et al., 2024), with items 2, "Because my friends pressure me to use marijuana," and 9, "Because it's exciting," being removed from the model in both papers. The removal of these items indicate which items may potentially be of concern in the factor analysis. However, to our knowledge, there has been no research examining the factor structure of the MMM in psychiatric populations, despite the known link between problematic cannabis use and mental health concerns (Urits et al., 2020; Lowe et al., 2018). Moreover, psychiatric symptoms not only predict problematic cannabis use, but also the perception that cannabis use is harmless (Lowe et al., 2018).

In particular, individuals with anxiety and related disorders (ARDs; e.g., social anxiety disorder [SAD], generalized anxiety disorder [GAD], panic disorder [PD], agoraphobia, posttraumatic stress disorder [PTSD], and obsessive-compulsive disorder [OCD]) and those seeking services for ARDs use cannabis at an elevated rate compared to individuals without ARDs (Das et al., 2024; Feingold et al., 2016; Kedzior & Laeber, 2014; Ouellette et al., 2019; Spalletta et al., 2006). Understanding motives for cannabis use in this population has important clinical implications in the assessment and treatment of ARDs. For example, in chronic cannabis users, anxiety symptoms may be masked by the effects of cannabis, leading to underreporting (Lowe et al, 2018). Moreover, research suggests that individuals with ARDs are at risk of using cannabis as a false safety behaviour (e.g., a coping behaviour that temporarily reduces anxiety symptoms but

maintains clinical anxiety in the long term; Buckner et al., 2007; Mueller et al., 2021). Research specifically examining motives for cannabis use in this clinical population suggests that motives for use may differ between clinical and community samples, likely due to these clinical processes. For example, studies have found that coping motives are strongly endorsed in samples with clinically significant anxiety, especially among individuals who frequently use cannabis (Buckner et al., 2007; Ouellette et al., 2023). Social anxiety alone was a significant predictor of social motives for cannabis use as compared to other predictors like age or sex, in a clinical sample (Elsaid et al., 2023). Despite the importance of motives for cannabis use in ARDs, the MMM has not been specifically validated for use in this population, making this a critical step to support further research.

An important step is to examine the structural validity of the MMM for treatment-seeking individuals with ARDs. As such, the primary aim of this paper is to confirm that the MMM is a structurally valid measure of cannabis use motives in a treatment-seeking ARDs population. A secondary, exploratory aim is to assess if subscales from the MMM correlate with certain symptoms (depression, anxiety, stress, cannabis use, and specific anxiety-disorders) or age in predicted ways. It is hypothesized that the MMM will have an acceptable fit within our sample as it has with community samples. Prior research has also shown associations between cannabis use and coping motives (Comeau et al., 2001; Zvolensky et al., 2009; Knapp et al., 2021, which is an association we would expect to see. However, items from age-related motives such as conformity may have weaker factor loadings, given they are more relevant for younger individuals (Steinberg & Monahan, 2007). It was also hypothesized that age will be inversely related to the conformity subscale, because peer pressure and expectations to fit in decrease with age (Steinberg & Monahan, 2007).

METHODS

Participants

Participants were adults (N = 253) seeking services for ARDs at a specialized outpatient clinic in a Canadian hospital and were recruited for this study following ethics approval from the local research ethics board (see Table 1 for sample information). All participants underwent a diagnostic assessment by a clinical psychologist, psychiatrist, specialized nurse, or graduate-level clinical psychology student. Assessment results by graduate students or nurses were reviewed with a clinical psychologist to confirm diagnostic impressions. Principal diagnoses were available for 96% of the sample, and each participant exhibited clinically significant ARD symptoms relevant to the symptom-specific cognitive behavioural therapy (CBT) group they attended. All participants had self-reported cannabis use. Frequency and quantity of cannabis consumption were collected from participants, but quantity data were not used in analyses due to high inconsistencies and high level of missingness.

Procedure

Participants were referred to the specialized ARD clinic for assessment and treatment. Seventy percent were assessed using the Diagnostic Assessment and Research Tool (DART; McCabe et al., 2017; Schneider et al., 2022), 26% received a psychiatric consultation, and 4% were assessed by a nurse specializing in ARDs before being referred to a disorder-specific CBT group. Prior to starting CBT, participants completed questionnaires, including a symptom-specific measure corresponding to the CBT group to which they were referred. The collection and use of all information was approved by the institution's research ethics board, and all participants provided written and informed consent to participate in research.

Measures

Diagnostic Assessment and Research Tool (DART; McCabe et al., 2017; Schneider et al., 2022). The DART is a modularized, open-access, semi-structured interviewing tool that covers a broad range of psychiatric conditions that align with the Diagnostic and Statistical Manual of Mental Disorders. Preliminary psychometric research conducted to date has revealed strong interrater reliability, construct, convergent, and discriminant validity for many DART modules, including generalized anxiety, social anxiety, panic, agoraphobia, specific phobia, posttraumatic stress, obsessive-compulsive, major depression,

and substance use disorders (Schneider et al. 2022).

Marijuana Motives Measure (MMM; Simons et al., 1998). The 25-item MMM is a self-report measure that assesses motives for cannabis use based on five subscales: social, enhancement, coping, and expansion, conformity. Scale items are rated using a 5-point Likert scale ranging from 1 (almost never/never) to 5 (almost always/always). The MMM has shown good discriminant validity, and subscales have shown strong internal consistency with Cronbach alphas ranging from .84 to .94 (Simons et al., 1998). In the present sample, the subscales showed good to excellent internal consistency (enhancement: ω = .91, conformity: ω = .88, expansion: ω = .93, coping: ω = .93, and social: ω = .89). McDonald's Omega was reported as an internal consistency measure for the MMM rather than Cronbach's alpha because of the multidimensional nature of the measure, providing more accurate reliability estimates (McNeish, 2018).

The Cannabis Use Disorder Identification Test–Revised (CUDIT-R; Adamson et al., 2010). The 8-item CUDIT-R is a self-report screening tool for CUD in the past six months. Items focus on four domains: consumption, cannabis problems, dependence, and psychological features. Items are rated using a 5-point scale and then summed, with scores of 13 or higher indicating likely CUD (Adamson et al., 2010). The CUDIT-R showed good internal consistency (α = .80) in the current sample. The CUDIT-R has also shown good internal consistency, as well as discriminant and concurrent validity in previous studies (Adamson et al., 2010; Schultz et al., 2019).

The CUDIT-R was used to indicate frequency of cannabis use in our sample. On the first question related to frequency of cannabis use, participants who answered "Monthly or less" or "2-4 times a month" were considered under "Non-Frequent Current Use" category, and those who answered "2-3 times a week" or "4 or more times a week" were considered under the "Frequent Current Use" category. "Historical Use" was a category that included individuals who indicated they did not use cannabis in the past 6 months (i.e., using a screening question preceding the CUDIT-R) but reported cannabis use on the first question of the CUDIT-R, meaning they were reporting cannabis use prior to the last 6 months (including one-time cannabis use).

Depression Anxiety Stress Scales – 21 Items (DASS-21; Lovibond & Lovibond, 1995). The 21-item DASS-21 is a self-report instrument that is designed to measure depression, anxiety, and stress. Scale items are rated using a 4-point Likert scale, with greater scores indicating higher symptom severity for that subscale. The DASS-21 scales showed good internal consistency (DASS-D: α = .89; DASS-A: α = .83; DASS-S: α = .85) in the current sample. These scales have been reported to have high internal consistency (.87–.94) and good test-retest reliability (Antony et al., 1998), as well as good convergent and discriminant validity (Lovibond & Lovibond, 1995). The DASS-21 was included to measure transdiagnostic symptom severity for participants in the study.

Disorder Specific Measures

PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013). The 20-item PCL-5 is a self-report measure that assesses DSM-5 symptoms for PTSD. Each item is rated on a 5-point Likert scale where a total score of 33 or higher indicates clinically significant PTSD symptoms although newer data suggest that a much higher cutoff score might be necessary in psychiatric populations (Boyd et al., 2022). The PCL-5 showed good internal consistency (α = .87) in the current sample. It has also shown strong test-retest reliability, internal consistency, convergent and discriminant validity, as well as structural validity (Blevins et al., 2015; Bovin et al., 2016). The PCL-5 was included to measure symptom severity specifically for participants that endorsed PTSD symptoms as their primary concern.

Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990). The 16-item PSWQ screens for trait worry and symptoms of GAD. Each of the 16 items on the questionnaire is rated on a 6-point Likert scale, with total scores of 45 and above indicating clinically significant GAD symptoms. The PSWQ showed good internal consistency (α = .85) in the current sample. Validation studies report that it has good internal consistency and discriminant validity (Meyer et al., 1990, Brown et al., 1992). The PSWQ was included to measure symptom severity specifically for participants

that endorsed GAD symptoms as their primary concern.

Panic Disorder Severity Scale–Self-Report (PDSS-SR; Furukawa et al., 2009; Shear et al., 1997). The 7-item PDSS-SR is used to measure the severity of panic attacks and symptoms of PD and agoraphobia. Items are rated using a 5-point scale, with greater average scores indicating a higher severity of panic disorder symptoms. PDSS-SR showed good internal consistency (α = .82) in this sample and has previously shown adequate internal consistency, satisfactory validity, and excellent test–retest reliability (Houck et al., 2002; E.-H. Lee et al., 2009). The PDSS-SR was included to measure symptom severity specifically for participants that endorsed PD symptoms as their primary concern.

The Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). The 18-item OCI-R is a self-report measure of OCD symptoms. Items are rated using a 5-point Likert scale with total scores of 21 or higher indicating likely OCD. The OCI-R showed good internal consistency (α = .83) in the present sample, and validation studies also report that it has good internal consistency and convergent validity (Foa et al., 2002). The OCI-R was included to measure symptom severity specifically for participants that endorsed OCD symptoms as their primary concern.

Social Phobia Inventory (SPIN; Connor et al., 2000). The 17-item SPIN is a self-report measure that assesses avoidance, fear, and physiological symptoms of social anxiety. Scale items are rated on a 5-point Likert scale, with higher scores indicating higher social anxiety symptoms. The SPIN showed good internal consistency (α = .81) in this sample. The SPIN has also shown good test-retest reliability, convergent and divergent validity, as well as internal consistency (Antony et al., 2006; Connor et al., 2000). The SPIN was included to measure symptom severity specifically for participants that endorsed SAD symptoms as their primary concern.

Statistical Analysis

A CFA using R (v.4.3.0; R Core Team, 2023) and the lavaan package (Rosseel, 2012) was conducted. The parameters for the model were estimated using the weighted least squares mean and variance adjusted (WLSMV) estimator, which provides robust standard errors and scaled test statistics to protect against biases when working with smaller sample sizes (Rhemtulla et al., 2012). It also adjusts for violations of normality and heteroscedasticity, producing more reliable and valid results (Li, 2016; Brown, 2015).

The sample size for the present study was acceptable according to the guidelines for sample size requirements for CFA, which involves assessing the ratio of variables to factors, as well as the degree of communality (Mundfrom et al., 2005). The current study had a variable to factor ratio of five and demonstrated a high communality pattern. Based on this, the necessary minimum sample size for good-level criterion (0.92) was 130; the current study sample size of 251 was well above this minimum value. While the sample size passed this threshold, the WLSMV estimator was still used as an added measure against the small sample size. All MMM items were treated as ordinal.

To allow for correct identification of the models, the loading of the first indicator for each latent variable was constrained to one. To assess model fit of theoretical 5-factor model of the MMM, several goodness of fit indices were used (recommended cut-off values indicated in parentheses): chi-square test statistic (χ^2; Kline, 1998), the Tucker–Lewis index (TLI; >.90 acceptable, >.95 excellent; Tucker & Lewis, 1973), the comparative fit index (CFI; >.90 acceptable, >.95 excellent; Bentler, 1990), the standardized root mean square residual (SRMSR; <.08; Hu and Bentler, 1999), and the root mean square error of approximation (RMSEA; <.08 acceptable, <.05 excellent; Browne & Cudeck, 1993). Given that the non-frequent Current Use group had extremely low variability on some items, it was not possible to conduct separate CFAs for low-, infrequent-, and frequent-use groups.

Additionally, correlations between latent variables were estimated to show the degree to which the two latent factors vary together to note underlying relationships between constructs in the model. In a further analysis, zero-order correlations between MMM subscales, symptom severity measures, and age were also reported to investigate relationships between theoretically relevant variables. Symptom severity measure scores were standardized within groups and then across groups to create a single measure of symptom severity across all CBT groups. Kendall's Tau was used to report these

correlations due to the robustness and lack of assumptions about linearity and normality of the data.

RESULTS

Descriptives

Demographic information and diagnostic data for the present sample is noted in Table 1.

Table 1. *Demographic Information and Diagnostics for Study Sample (N = 253)*

Variable	*N*	%
Gender	253	
Woman	184	72.7
Man	64	25.3
Transgender	5	2.0
Relationship Status	250	
Single	102	40.8
In a relationship	148	59.2
Education Level	239	
Some or completed high school	46	19.3
Some or completed post-secondary education	170	71.1
Some or completed graduate school	23	9.6
Ethnicity	233	
White/European	216	92.7
Indigenous (First Nations, Metis, Inuit)	3	1.3
Black/Afro-Caribbean/African	1	0.4
South Asian, East Asian, Southeast Asian	5	2.1
Biracial/Multiracial	6	2.6
Other	2	0.9
Principal Diagnosis	188	
GAD	62	33.0
SAD	46	24.5
PTSD	39	20.7
PD/Agoraphobia	18	9.6
Other (e.g., anxiety and related disorders, mood disorders, personality disorders)	23	12.2
Frequency of Cannabis Use	253	100
Historical Use	135	53.3
Non-Frequent Current Use (4x or less per month)	45	17.8
Frequent Current Use (2-3x per week or more)	73	28.9

Note. Missing 3 responses for Relationship Status, 14 responses for Education Level, 20 responses for Ethnicity, and 11 responses for Principal Diagnosis

Due to the positive skew of the data, we reported median and interquartile range values, which are as follows: enhancement = 1 (1-3), conformity = 1 (1-1), expansion = 1 (1-2), coping = 1 (1-2), social = 1 (1-2). Means scores for each item and subscales are included in the supplementary materials.

Confirmatory Factor Analysis and Internal Consistency

Table 2 displays the measurement model and standardized item loadings for the MMM. All indicator variables were strongly associated (i.e., factor loadings >.40) with their respective latent factors. The scaled indices of fit for the current

model indicated acceptable to excellent overall model fit (see Table 1), $\chi^2 = 508.2$ ($df = 242$), $p < .001$, CFI = .988, TLI = .986, SRMSR = .088, RMSEA = .066 (90% CI .058 to .074). Observed omegas displayed good to excellent internal consistency (refer to Methods section). When investigating CFA models by frequency groups, a CFA for the Non-Frequent Current Use group could not be estimated due to extremely skewed responses and a lack of variability on item 8.

Table 2. *Standardized Item Loadings for the Marijuana Motives Five-Factor Model (N = 251)*

Items	Enhancement	Expansion	Social	Coping	Conformity
7. Because I like the feeling	0.955				
9. Because it's exciting	0.824				
10. To get high	0.894				
13. Because it gives me a pleasant feeling	0.973				
18. Because it's fun	0.923				
21. To know myself better		0.898			
22. Because it helps me be more creative and original		0.919			
23. To understand things differently		0.967			
24. To expand my awareness		0.966			
25. To be more open to experiences		0.941			
3. Because it helps me enjoy a party			0.921		
5. To be sociable			0.791		
11. Because it makes social gatherings more fun			0.951		
14. Because it improves parties and celebrations			0.950		
15. Because I feel more self-confident and sure of myself			0.899		
1. To forget my worries				0.952	
4. Because it helps me when I feel depressed or nervous				0.887	
6. To cheer me up when I am in a bad mood				0.942	
17. To forget about my problems				0.978	
2. Because my friends pressure me to use marijuana					0.827
8. So that others won't kid me about not using marijuana					0.827
12. To fit in with the group I like					0.963
19. To be liked					0.926
20. So I won't feel left out					0.960

Note. Item 16 on the MMM was not included as part of the original Five-factor theoretical model, and thus was not included. Although the initial sample included 253 participants, MMQ scores were only available for 251 participants. All subsequent analyses also include $N = 251$ participants. Each item loading had $p < .001$.

Subscale Correlations

Table 3 displays correlations between latent variables from the CFA model. Each of the five subscales had significant positive correlations with each other, except between the conformity and coping subscales (*cor* = 0.08, p = .28). The highest correlation was seen between the expansion and coping subscales (*cor* = 0.78, p < .001).

Table 3. *Correlations from CFA model between latent variables of the MMM*

	Enhancement	Expansion	Social	Coping	Conformity
Enhancement	-				
Expansion	0.765	-			
Social	0.805	0.750	-		
Coping	0.727	0.777	0.696	-	
Conformity	0.255	0.220	0.444	0.080	-

Note. Other than Conformity-Coping (p = .256), each zero-order correlation was significant (p < .001), except for Conformity-Expansion (p = .005).

Subscale Zero-Order Correlations

Table 4 displays zero-order correlations using Kendall's Tau between the MMM subscale means, symptom severity, DASS-21 subscales, CUDIT-R scores, and age. CUDIT-R scores were not significantly correlated with the conformity subscale (τ = -0.03, p = .68) but were positively and significantly correlated with each of the other MMM subscales, with the largest being with coping (τ = 0.54, p < .001). Age was negatively correlated with the enhancement (τ = -0.18, p < .001) and social (τ = - 0.15, p < .001) subscales, while symptom severity was positively correlated with the coping subscale (τ = 0.12, p < .001).

Table 4. *Kendall's Tau Correlations Between MMM Subscale Means, DASS-21 Subscale Scores, Symptom Severity, and CUDIT-R Scores*

	Enhancement	Expansion	Social	Coping	Conformity
Age (N = 253; M = 35.53.; *SD* = 11.80)	**-0.182***	-0.061	**-0.145***	-0.079	-0.036
DASS-D (N = 251; M = 20.86; *SD* = 10.74)	-0.004	0.073	0.007	**0.142***	-0.021
DASS-A (N = 251; M = 17.77; *SD* = 9.44)	-0.05	-0.016	-0.002	0.05	0.028
DASS-S (N = 251; M = 24.31; *SD* = 9.20)	-0.005	0.015	0.043	**0.102***	0.055
Symptom Severity**	-0.023	0.007	-0.01	**0.118***	-0.028
CUDIT-R (N = 131; M = 7.44; *SD* = 6.18)	**0.348***	**0.396***	**0.292***	**0.541***	-0.031

Note. *Significant correlation (p < .05) **Symptom Severity measures were standardized and then compared. The individual means for symptom measures are as follows: PSWQ (N = 112; M = 67.54; *SD* = 8.42), SPIN (N = 60; M = 46.27; *SD* = 8.45), PCL-5 (N = 49; M = 55.47; *SD* = 10.82), PDSS-SR (N = 20; M = 15.30; *SD* = 4.37), OCI-R (N = 12; M = 30.00; *SD* = 8.64).

DISCUSSION

To our knowledge, this is the first evaluation of the structural validity of the MMM in a clinical sample of treatment-seeking adults with ARDs. As hypothesized, the factor structure of the MMM was robust and demonstrated good to excellent fit in the current sample. The five-factor solution found in the current study converges with the original five-factor model developed by Simons and colleagues (1998) and repeatedly found in other studies (Benschop et al., 2015; Zvolensky et al., 2007; Rochat et al., 2024). All items loaded strongly onto their corresponding factors, and internal reliability for the total measure and the respective factors was good to excellent. Also, despite the MMM being developed with young adults, our results suggest that all items and subscales remain psychometrically sound when using the measure with adults. The good structural validity found in the current study refutes our initial hypothesis based on prior research (Steinberg & Monahan, 2007) that conformity motives are less pertinent to adults as compared to young adults. Instead, adults with anxiety symptoms who use cannabis may still experience social pressures or seek peer approval regarding cannabis use, highlighting the importance of all five subscales in clinical adult populations. Overall, the results suggest that the MMM is a structurally valid tool to assess motives for cannabis use in treatment-seeking adults with clinical anxiety.

Interestingly, the item loadings outperformed those in previous studies with non-clinical samples (Benschop et al., 2015; Zvolensky et al., 2007). One potential reason for these results could be the positive skew in item-level responses. Across most MMM items, participants responded "Never/Almost Never" or "Sometimes," which may be reflective of the "Historical Use" category in our sample or individuals who infrequently or casually use cannabis across our sample. These response patterns are expected, given that participants were treatment-seeking for primarily anxiety-related concerns rather than cannabis-related concerns. As such, motives for cannabis use were only highly endorsed amongst a subset of participants in the current study (i.e., reducing item-level variability), which may have led to stronger item loadings and a factor structure that was clearer than in previous research. Both the Zvolensky et al. (2007) and Benschop et al. (2015) studies included people who use cannabis frequently; however, item-level responses were not reported in either paper. In other CFA studies on positively skewed data, authors reported strong item loadings and models with acceptable to good fit indices (Haque et al., 2017; Jones et al., 2019; Jiang et al., 2023). Further work is necessary to determine the true impact of positively skewed data on CFA results.

CUD symptom severity was significantly associated with all subscales except for conformity. It was most strongly associated with the coping subscale, suggesting that coping-related motives for use may act as an important indicator of risk for problematic cannabis use in adults with clinical anxiety. This finding is consistent with several other studies where coping was significantly related to frequency, problematic use, and dependence across clinical and community samples (Benschop et al., 2015; Bonn-Miller & Zvolensky, 2009; Bujarski et al., 2012; Fox et al., 2011; Johnson et al., 2010; Ouellette et al., 2023; Simons et al., 2005).

Moreover, coping was the only subscale associated with anxiety, depression, and stress symptom severity. This finding converges with previous research in which an association between anxiety and coping was found in socially anxious men (Buckner et al., 2018; Buckner et al., 2012), individuals with PTSD (Bonn-Miller et al., 2010), and a community sample of young adults with reported trauma (Bonn-Miller et al., 2007). Moreover, work by Metrik and colleagues (2016) suggests that coping-related motives may mediate the effects of anxiety and depression on CUD. The consistency with how the coping scale performed in our sample compared to previous research supports the ongoing use of this scale to better understand nuances in how coping is related to symptom severity.

Clinical Implications

The MMM's strong structural validity in the current study provides further support for its use to supplement CUD screening in adults with ARDs. Firstly, the coping subscale of the MMM may act as a proxy for problematic or frequent cannabis use. For example, clients that deny problematic cannabis use and endorse mostly recreational motives may be deemed "lower risk"

for development of CUD. Alternatively, clients may deny problematic cannabis use during a psychodiagnostic assessment; however, endorse mostly coping-related motives on the MMM. This discrepancy could provide the clinician insight into the client's perspective on cannabis use and prompt further assessment.

Furthermore, motives for cannabis use may be integrated with information about the severity and frequency of use to guide case formulation. Importantly, coping motives may signal potential therapy-interfering behaviour such as avoidance. Some studies have found that occasional to frequent cannabis use is associated with an attenuated response to CBT for ARDs and clinical depression (Bricker et al., 2007; Buckner et al., 2021; Ouellette et al., 2022). As such, clients that endorse mostly coping motives in addition to frequent use may benefit from psychoeducation on the harms associated with using cannabis to manage anxiety and low mood, including information on perceptions of distress intolerance and maintaining factors such as safety behaviours. These hypotheses were not directly tested within the current study; however the MMM can provide valuable information on motives which, in conjunction with other components of a thorough assessment, may aid with clinical outcomes.

Limitations

There are several limitations to the current study. Firstly, although the five-factor structure of the MMM was supported, the relatively high correlation between the expansion and coping subscales suggests meaningful shared variance in this sample. While prior research has generally supported the separability of these factors, alternative model specifications may provide a more stringent test of subscale independence in clinical sample. One possible reason for this high correlation could be differences in frequency in use, as Ouellette et al. (2023) have previously found the frequent cannabis users reported using for coping and expansion motives (i.e., use to change one's thinking) significantly more than infrequent users. We were not able to evaluate the impact of frequency of use on factor structure, but this can be an avenue of future research. Additionally, although ARDs share core features like anxiety, fear, and avoidance, they also differ in important ways that may influence how well the MMM performs. For example, individuals with one principal diagnosis might consistently endorse certain items on the scale, while those with a different diagnosis might not—or might endorse entirely different items. This variability can affect the overall performance and interpretability of the MMM in a mixed-diagnosis sample like in the present study. One illustration of this is that frequent and problematic cannabis use has been identified as a predictor for SAD specifically, but not for other anxiety disorders (Feingold et al., 2016), suggesting that certain symptom patterns or behaviours may be more relevant to some disorders than others. Moreover, comorbid disorders such as depression and other alcohol and substance use disorders likely play a role in motives for cannabis use. Unfortunately, the sample size limited these between-disorder and comorbidity comparisons; future studies should investigate this further. Secondly, there are several considerations related to the sample composition that may limit the generalizability of these findings. The sample was homogenous with respect to gender and racial identity, as 84% reported being white and 73% reported being women. As a result, these findings may not generalize to more diverse populations. Many of the demographic variables were categorical and few were consistently reported by participants, which limited the use correlational methods and reduced the ability to assess trends. Moreover, the sample comprised of treatment-seeking individuals with clinical anxiety; the MMM may demonstrate variable psychometric performance in non-clinical or non-treatment-seeking samples with anxiety and related disorders.

Although the current study addresses the structural validity of the MMM within an ARDs sample, it does not examine other important psychometric properties of the tool, such as its discriminant validity. This limitation presents an area of future investigation to ensure the MMM is not erroneously capturing potentially overlapping variables such as other substance use motives and depressed mood. Future studies should also investigate anxiety sensitivity and intolerance of uncertainty when looking at discriminant validity for this scale as they may be particularly relevant in an ARDs population. Further, we were also unable to conduct multiple CFA models across frequency groups because several items showed

no variability or extremely skewed responses for the Non-Frequent Current Use group. Consequently, the present analyses did include this sample, which may limit the generalizability of our findings across the full spectrum of cannabis use. Future work should examine how variations in frequency of cannabis use might impact item loadings and scale reliability, how the scale would perform in specific anxiety disorder subgroups, as well as the potential influence of positively skewed data on CFA results.

It is also worth noting that at the treatment center where this research was conducted, severe and problematic CUD is screened out; these individuals are referred to treatment for CUD prior to being accepted to treatment for anxiety at the clinic. This means that the current sample does not include many people with high CUDIT-R scores or severe CUD. Another limitation of the study is that we did not investigate quantity of cannabis and if that had any associations with motives for use. While these data were collected, it was poor quality with high level of missingness, which rendered it unusable. This reflects a pattern in the field of challenges accurately capturing cannabis consumption quantity data (Prince et al., 2018; Lorenzetti et al., 2021). Lastly, the MMM used in the current study does not include other relevant motives which may be captured by the comprehensive MMM, such as using cannabis for sleep, due to boredom, or because it is available. Further, medical-related motives for use, such as managing pain (which tends to co-occur with clinical anxiety; Lerman et al., 2015) are not captured by the 5-factor MMM or the comprehensive MMM. As such, adapting the MMM to include medical-related motives may be necessary in an anxiety and related disorders population.

Acknowledging these limitations, the current study provides further evidence supporting the structural validity of the MMM for use in treatment-seeking adults with ARDs. Specifically, the MMM demonstrated a good to excellent fit in the current sample, converging with the five-factor solution derived by Simons et al. (1998), despite being originally developed using a non-clinical sample of young adults.

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Consent to Participate: Informed consent was obtained from all individual participants included in the study.

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