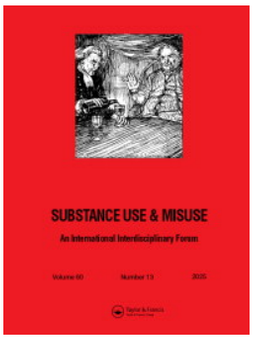

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ORIGINAL ARTICLE

Mindfulness-Oriented Recovery Enhancement Reduces Illicit Substance Craving Among People with Alcohol Use Disorder and Polysubstance Use

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ABSTRACT

Background: Polysubstance use is common in alcohol use disorder (AUD) and associated with poor treatment outcomes. Cannabis and cocaine often co-used with alcohol, have no approved medication treatments and respond poorly to common behavioral treatments. Thus, treatments that can reduce use of these substances alongside AUD are critically needed. *Objectives*: We tested whether Mindfulness-Oriented Recovery Enhancement (MORE), an evidence-based group therapy approach combining mindfulness, cognitive-behavioral techniques, and savoring natural rewards could simultaneously reduce cravings for cannabis and/or cocaine. Given MORE's demonstrated efficacy for treating other addictive behaviors, we hypothesized it would reduce craving for cannabis and/or cocaine in people with AUD. *Methods*: Participants (N = 50) were adults with AUD who also used cocaine and/or cannabis. Participants were randomly assigned to ten-sessions of either MORE or supportive group (SG) psychotherapy control condition, both targeting at AUD. Illicit substance craving was assessed before and after treatment during a cue reactivity protocol consisting of a resting baseline, 5-min stress imagery exposure, 5-min alcohol image exposure, and 5-min recovery period. *Results*: Results revealed a significant Group-X Time interaction, F = 7.06, p=.008, indicating that patients randomized to MORE reported significantly greater reductions in illicit substance craving across the entire cue-reactivity protocol from pre- to post-treatment. However, the Group-X Time-X Condition interaction was nonsignificant (p=.61), indicating that the effect of MORE did not significantly vary by condition. *Conclusion*: Results from this pilot study suggest that MORE may reduce illicit substance craving in patients with polysubstance use and AUD. MORE should be further evaluated in full-scale randomized clinical trials for cannabis and cocaine use disorder.

KEYWORDS

Alcohol use disorder; treatment; polysubstance; cocaine; cannabis; mindfulness

Introduction

Polysubstance use and comorbid substance use disorders (SUDs) are common in people with alcohol use disorder (AUD) (Falk et al., 2008), and are a poor sign for treatment (Brown et al., 1993; Hersh et al., 1998; Stephenson et al., 2022; Yurasek et al., 2017). Two substances of particular concern are cannabis and cocaine. Co-use of these illicit substances leads to worse treatment outcomes in AUD (Brown et al., 1993; Falk et al., 2008; Hersh et al., 1998; Rittenberg et al., 2020), and effective treatments for these illicit substances are scant—there are no FDA-approved medications for either, and psychosocial treatments show only limited benefits (Bentzley et al., 2021; Connor et al., 2021). Consequently, to improve AUD outcomes, it is critical to develop interventions that effectively address co-morbid use of cannabis and cocaine.

In principle, interventions that act on common mechanisms of substance use could produce improvements across substances simultaneously. One such mechanism is craving, which plays a significant role in addiction treatment outcomes (Vafaie & Kober, 2022). Interventions that mitigate illicit substance cravings in individuals with AUD hold strong promise for enhancing AUD outcomes as illicit substance cravings is key risk factor for illicit substance relapse among individuals with AUD (Cavicchioli et al., 2020). Mindfulness-Oriented Recovery Enhancement (MORE) (Garland, 2013, 2024) is an intervention that integrates training in mindfulness, reappraisal, and savoring to target the cognitive-affective mechanisms and reward dysregulation underpinning craving and addictive behavior. Although these elements have parallels in existing therapies for AUD and SUD, the use of savoring for addictions treatment is wholly novel and the combination of these three elements is unique, and MORE has shown superiority to strong controls that contain only some of these components (Garland, 2023; Garland et al., 2016). MORE has shown positive effects in AUD (Garland et al., 2010), but also in complex comorbid psychiatric and substance use disorders (Garland et al., 2016), and in multiple randomized controlled trials (RCTs) for opioid misuse (Garland et al., 2022, 2024) and opioid use disorder (Cooperman et al., 2024). Meta-analyses demonstrate

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Table 1. Session-specific description of MORE and ASG interventions.

Session	MORE	SG
1	Discussion of mindfulness and automatic drinking; mindfulness of craving; mindful breathing and body scan	Discussion of triggers for alcohol dependence relapse
2	Discussion of cognitive reappraisal; practice of mindful decentering and mindful breathing	Discussion of justifications for relapse and using alcohol to mask one's emotions
3	Discussion of attentional re-orienting as means of coping with negative emotions and craving; mindful breathing; mindfulness of perceptions & sensations	Discussion of how participants cope with emotions of anger and sadness
4	Discussion of craving; practice of "urge surfing," mindfulness of craving, and contemplation of negative consequences of drinking; imaginal alcohol cue-exposure; mindful breathing practice	Discussion of how participants cope with craving and managing compulsive behavior
5	Discussion of the relationship of the stress response to craving; imaginal stress exposure; mindful breathing	Discussion of stress and methods participants use to relax without alcohol
6	Discussion of thought suppression, aversion, and attachment; exercise in the futility of thought suppression; mindful breathing and acceptance	Discussion of the attempt to maintain control and loss of control
7	Discussion of the deleterious effects of alcohol on the body; mindful interoceptive awareness; mindful walking	Discussion of physical health promotion and ways to recreate without alcohol
8	Discussion of relational triggers for relapse; mindful communication; compassion meditation	Discussion of codependence relationships and the challenge of forming friendships without alcohol
9	Discussion of interdependence, meaning, and spirituality; meditation on interdependence; mindful breathing	Discussion of spirituality
10	Review; discussion of how to maintain mindfulness practice; development of mindful relapse prevention plan; imaginal rehearsal of mindful relapse prevention; mindful breathing	Reflection on the support group experience; discussion of the recovery process

that MORE reduces craving to a greater extent than active control conditions (Li et al., 2017; Parisi et al., 2022). Yet no study to date has examined whether MORE can reduce illicit substance craving in patients with AUD. Here we test the hypothesis that MORE can reduce illicit substance craving in patients with AUD who also used cannabis and/or cocaine by conducting secondary analysis of previously unpublished data from an RCT of MORE for AUD (Garland et al., 2010).

Materials and methods

Participants

The parent study recruited 53 people with AUD in a residential treatment center (TC) for substance use disorders in the Raleigh-Durham-Cary area of North Carolina *via* presentations, flyers, and referrals. In this geographical area when the data was collected, 7.4% of the population aged 12 or older was classified as having a substance use disorder in the past year. Of note these rates were similar to rates in North Carolina and the Nation as a whole (SAMHSA, 2014). The Alcohol Use Disorders Identification Test (Saunders et al., 1993) and a diagnostic interview confirmed DSM-IV alcohol use disorder and the Drug Abuse Screening Test (Skinner, 1982) and Addiction Severity Index (McLellan et al., 1992) assessed use of other illicit substances. All participants met lifetime criteria for DSM-IV alcohol dependence, and had resided in the TC for >= 18 months. Please see original article for description of the TC environment (Garland et al., 2010). This secondary analysis examines the $n = 50$ participants who also reported lifetime use of either cannabis or cocaine use on the ASI. The University of North Carolina Institutional Review Board approved all study procedures.

Interventions

Participants were randomized to MORE ($n = 24$) or a supportive psychotherapy group (SG, $n = 26$) (Rawson & McCann, 2006). Session in both groups were led by a master's level social worker (MSW) with experience in mindfulness. The MORE intervention was a ten- session manualized treatment incorporating psychoeducation and training in mindfulness meditation to decrease attentional bias and craving, training in cognitive reappraisal to regulate negative emotions, and training in savoring to increase positive emotions and natural reward responsiveness. The 10-session SG condition was designed to match the MORE intervention in terms of session duration, attention, and group process. Both interventions were administered weekly over a 10-week period. Each session lasted 2 h and with 6-12 participants per session. Further, the SG interventions also matched the themes of the MORE intervention (see Table 1). In the SG condition, participants were prompted to share their emotions and thoughts, but did not receive specific training in techniques. MORE participants also did 15-min of daily mindfulness exercises, whereas SG participants completed 15-min of journaling instead. See original article for more detailed intervention descriptions (Garland et al., 2010).

Procedures and measures

The cue reactivity protocol is a standardized psychophysiological procedure designed to measure responses to specific environmental cues—such as stressors, substance-related stimuli, or emotionally charged images. All data for this measure were called by an RA blinded to study condition. In the present study, Participants completed a cue-reactivity protocol (Garland et al., 2010) before and after the intervention (10 wk). First, participants completed a 5-min motionless baseline, with illicit substance craving assessed immediately afterwards. Then, they completed a stress exposure block, in which 30 aversive photographs from the International Affective Picture System (IAPS) were presented for 10 s each, and an alcohol exposure block in which 30 alcohol-related images were presented for 10 s each (total duration: 5 min for each exposure type). Illicit substance

craving ratings were re-rated after each exposure. Following the alcohol exposure, there was a 5-min silent recovery period, where participants were instructed to employ coping methods of their own choice. Illicit substance craving levels were re-rated post-recovery. The illicit substance craving measure consisted of two items: "How strong of an urge to use drugs would you feel?" and "How hard would you have to try to avoid the drug so that you wouldn't take it?" rated on 0–10 numeric rating scales (0 = not at all, 10 = extremely). Note, these questions were separate from the alcohol craving ratings presented in the original article. Given the high correlation between these items ($r = 0.84$, $p < 0.001$), we used the average as our measure of illicit substance craving.

Data analysis

Analyses consisted of a linear mixed model conducted in Jamovi by E.L.G. with illicit substance craving as dependent variable and group (MORE vs. SG), time (pre vs. post intervention) and condition (baseline, stress exposure, alcohol exposure, recovery) as fixed effects. The group X time and group X time X condition interactions were primary fixed effects of interest. The group X time interaction tests whether intervention groups (MORE vs. SG) differ in their craving levels over time. A significant interaction indicates that the effect of time on drug craving is not the same across intervention groups. The group X time X condition interaction explores whether the change in craving (group × time interaction) depends on condition (baseline, stress cue exposure, etc.). A significant interaction indicates that the intervention's efficacy varies across contextual conditions. The linear mixed model included a random intercept to account for variability between individuals, allowing each participant to have their own baseline level of drug craving. This random effect captured the dependency of repeated measures within individuals. Degrees of freedom were estimated using the Satterthwaite approximation, which adjusts degrees of freedom based on the random effect structure and sample size. The model was estimated with restricted maximum likelihood estimation (REML).

Results

Participants

Participants were predominantly male (78%, 22% female) and African American (54%), their mean age was 40.7 and had spent an average of 22.4 months in the TC (SD = 3.7). Fifty participants reported co-use of cannabis ($M = 8.9$, SD = 12.2 days in the month prior to entry), and fifty reported co-use of cocaine ($M = 17.1$, SD = 12.5 days in the month prior to entry). Because other illicit substance use was not the study focus, participants were not diagnostically assessed for cannabis or cocaine use disorder, but average scores ($M = 21.1$, SD = 5.2) on the DAST indicated most participants met screening criteria for other SUDs. There were no baseline differences between treatment groups on any demographic or substance use variables presented in Table 2.

Table 2. Sample demographics and substance use characteristics.

Variable	MORE ($n = 24$)	SG ($n = 26$)	Total ($n = 50$)
Length of Stay M(SD)	22.4 (2.4)	22.4 (4.6)	22.4 (3.7)
Gender Male N (%)	19 (80%)	20 (77%)	39 (78%)
Gender Female N (%)	5 (20%)	6 (23%)	11 (22%)
Race N (%)			
Black	15 (62.5%)	12 (46%)	27 (54%)
White	6 (25%)	14 (54%)	20 (40%)
Native American	1 (4%)		1 (2%)
Pacific Islander	2 (8%)		2 (4%)
Age M (SD)	40.7(8.9)	40.6 (9.9)	40.7 (9.3)
DSM-IV Dependence Criteria M(SD)	6.5 (1.0)	6.6 (0.9)	6.6 (0.9)
Income N (%)			
<$20,000	13 (54.1%)	15 (57.7%)	28 (56%)
$20,000–40,000	8 (33.3%)	7 (27%)	15 (30%)
$41,000–60,000	1 (4.2%)	3 (11.5%)	4 (8%)
$61,000–80,000	1 (4.2%)	0	1 (2%)
>$80,000	1 (4.2%)	1 (3.8%)	2 (4%)
Drinks per day prior to TC M(SD)	21 (12.1)	16.6 (9.7)	18.7 (10.9)
Days of cannabis use month prior to TC M(SD)	8.0 (11.2)	9.1 (13.1)	8.6 (12.0)
Days of cocaine use month prior to TC M(SD)	17.7 (12.2)	15.8 (13.3)	16.7 (12.7)
AUDIT M(SD)	32.5 (6.2)	32.1 (5.3)	32.3 (5.7)
DAST M(SD)	20.6 (4.9)	21.3 (5.7)	21.0 (5.3)

Illicit substance craving

Pre-intervention there were no significant group differences in illicit substance craving; $F_{1,48}=1.41$, $p=.24$. Linear mixed modeling revealed a significant Group X Time interaction, $F_{1, 289.56}=7.06$, $p = 0.008$, indicating that patients randomized to MORE showed significantly greater reductions in illicit substance craving across the entire cue-reactivity protocol from pre- to post-treatment than the SG (B= −0.92, SE = 0.35, 95% CI −1.60, −0.24). However, the Group X Time X Condition interaction was nonsignificant ($F_{1, 282.63}=0.60$, $p = 0.61$), indicating that the effect of MORE did not significantly vary by cue condition (see Figure 1). As some individuals had lifetime use of cannabis and cocaine but had not used these illicit substances in the month before treatment, we conducted a sensitivity analysis, testing the same model in the $n = 40$ participants with more recent use of either cannabis or cocaine. The Group X Time interaction remained significant ($p = 0.02$).

Discussion

This study investigated whether MORE reduced illicit substance craving in individuals with AUD who also used cannabis and/or cocaine. Participants in MORE showed decreased illicit substance cravings after treatment, unlike those receiving supportive psychotherapy. This decrease was evident across all conditions of a cue-reactivity protocol, rather than specifically in response to stress or alcohol cues.

In the parent study, MORE reduced stress, decreased suppression of alcohol-related thoughts, decreased attentional bias to alcohol cues, and improved heart rate variability recovery from alcohol cues, all of which are linked to cravings and relapse risk (Garland et al., 2012). The current secondary analysis additionally shows significant reductions in illicit substance craving. Our findings are consistent with a meta-analysis of effects of MORE on craving across

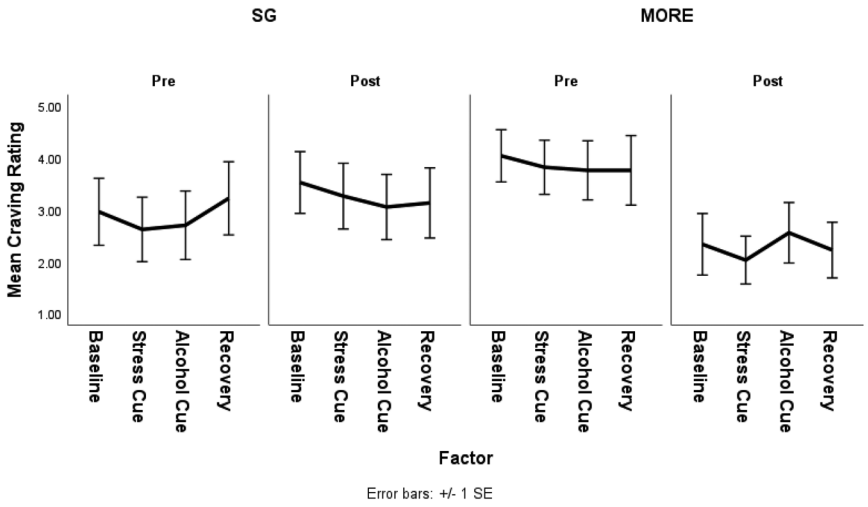

Figure 1. Patients randomized to MORE showed a significantly greater decrease in illicit substance craving from pre- to post-treatment. This was not specific to the cue-reactivity condition (i.e. baseline, stress, alcohol or recovery).

substances (Parisi et al., 2022) and a large study showing MORE reduced craving for opioids compared to control conditions in veterans in long-term opioid treatment (Garland et al., 2024). Our results extend these effects to cannabis and cocaine use, which have been less often targeted in mindfulness interventions. Indeed, to date there have been only small pilot studies of mindfulness for cocaine and cannabis use (Dakwar et al., 2019; Shurtleff, 2019). These results highlight MORE's potential in treating cannabis and cocaine use comorbid with AUD and suggest testing MORE for cannabis and cocaine use disorder without AUD.

Limitations of this study include the lack of specific measures of cannabis and cocaine use and craving. We did not perform diagnostic interviews for cannabis or cocaine use disorder; however, participants showed significant use and likely met criteria for these disorders based on DAST scores. Similarly, the craving measure referred generically to "drugs," with co-use patterns suggesting cocaine and cannabis as by far the most likely illicit substances of concern. Additionally, the use of convenience sampling, as participants were recruited from a residential facility, might limit the generalizability of our findings as the participants might not reflect the diversity or variability of the larger population of poly-substance users. Further, since this study was conducted in a residential facility, the structured support might have enhanced the efficacy of MORE. In outpatient settings, individuals might face greater exposure to triggers and fewer structured supports, which could impact engagement and outcomes. Future studies should directly assess MORE's effects on cannabis and cocaine cravings and use as well as its feasibility in outpatient settings. Finally, the sample was small. Replication and expansion with larger samples is needed, given the urgent need for effective treatments for comorbid and independent cannabis and cocaine use.

Despite these limitations, this result is still notable because cocaine and cannabis use are difficult to treat using current interventions. Thus, MORE has potential not only for managing illicit substance use in the context of AUD but also for addressing cocaine and cannabis use disorders, an important indication given the limited effectiveness of current treatments for these disorders.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

Data may be obtained from the corresponding author (egarland@health.ucsd.edu) *via* a signed data access agreement.

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