



HHS Public Access

Author manuscript

Mindfulness (N Y). Author manuscript; available in PMC 2020 June 01.

Published in final edited form as:

Mindfulness (N Y). 2019 June ; 10(6): 1062–1073. doi:10.1007/s12671-018-1054-5.

An open trial of rolling admission mindfulness-based relapse prevention (Rolling MBRP): feasibility, acceptability, dose-response relations, and mechanisms

Corey Roos^{1,2}, Megan Kirouac^{1,2}, Elena Stein^{1,2}, Adam Wilson^{1,2}, Sarah Bowen³, Katie Witkiewitz^{1,2}

¹Department of Psychology, University of New Mexico, MSC 03-2220, Albuquerque NM, 87131

²Center on Alcoholism, Substance Abuse, and Addictions, University of New Mexico, 2650 Yale Blvd SE, Albuquerque NM, 87106

³School of Graduate Psychology, Pacific University, 190 SE 8th Avenue, Hillsboro OR 97123

Abstract

Mindfulness-based relapse prevention (MBRP) is an effective treatment for substance use disorders (SUD). However, evidence is primarily based on studies of closed groups, and few studies support flexible formats of MBRP, such as rolling groups. This nonrandomized, open trial evaluated feasibility, acceptability, dose-response relations, and mechanisms of rolling admission MBRP (“Rolling MBRP”) offered as part of short-term residential treatment for SUD. Rolling MBRP was developed prior to the trial through an iterative process over several years. Participants included 109 adults (46% female, 74.3% racial/ethnic minorities, mean age=36.40). Rolling MBRP was offered to all patients in the program 2x/week and attendance was tracked. Outcomes were craving, self-efficacy, mental health, mindfulness, and self-compassion at discharge. Self-reported out-of-session mindfulness practice was examined as a mediator of attendance-outcome relations. Analyses involved multiple regression and mediation models. Feasibility was demonstrated by good attendance rates. Acceptability was demonstrated by high engagement in mindfulness practice and high satisfaction ratings. Total sessions attended did not predict outcomes at discharge. However, attending 2+ sessions (versus 1 or none) significantly predicted better mental health and higher mindfulness at discharge, and these effects were mediated by

Corresponding Author: Corey Roos, Department of Psychology, University of New Mexico, Albuquerque, NM 87131, cr449@unm.edu.

Compliance with Ethical Standards

The study was approved by the University of New Mexico Institutional Review Board. All procedures were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All participants enrolled in the study gave their informed consent prior to their inclusion in the study.

Conflicts of Interests

Drs. Bowen and Witkiewitz have conducted MBRP trainings for which they received monetary incentives, although the findings presented in this article have not yet been presented as part of these trainings. The current study is the dissertation of the first author, who led the data analysis and interpretation. The results and findings have been reported in the dissertation repository https://digitalrepository.unm.edu/psy_etds/260/. Drs. Bowen and Witkiewitz served on the dissertation committee and provided guidance throughout, but have not attempted to influence data interpretation or tone to highlight or overinterpret effectiveness of the program. No other authors have conflicts and there has been no significant financial support for this work that could have influenced its outcome.

informal and formal mindfulness practice. Total sessions attended had significant indirect effects on craving, self-compassion, mindfulness, and mental health, via mindfulness practice. Results support the feasibility and acceptability of Rolling MBRP and suggest mindfulness practice may be a key mechanism driving effects of MBRP on other key mechanisms during the recovery process, such as decreased craving and improved mental health.

Keywords

mindfulness-based relapse prevention; substance use disorder; rolling group adaptation; open trial; mindfulness practice

Substance use disorders (SUD) remain prevalent and account for a considerable proportion of global disease burden (Whiteford et al. 2014). SUD is a chronic relapsing condition in which substance use relapse following treatment and repeated admissions to treatment programs are common (Koob & Volkow, 2017; McLellan, McKay, Forman, Cacciola, & Kemp, 2005; McKay, 2009; McLellan, Lewis, O'Brien, Kleber 2000; Nunes et al., 2018). Hence, there is a continued need for developing and refining effective treatments for SUD that promote long-term recovery and reduce rates of relapse.

Mindfulness-based interventions for SUD hold promise for supporting long-term recovery. A meta-analysis of 33 studies on mindfulness-based interventions for substance misuse found significant effects for substance use (small effect size), craving (medium effect size), and stress (large effect size; Li, Howard, Garland, McGovern, & Lazar 2017). Mindfulness-based relapse prevention (MBRP; Bowen, Chawla, & Marlatt 2010) is one mindfulness-based intervention for SUD that integrates mindfulness training with cognitive-behavioral relapse prevention. The evidence base for MBRP is growing and numerous randomized controlled trials support the efficacy of MBRP for SUD (Grant et al. 2017; Li et al. 2017). In the largest randomized trial of MBRP, Bowen et al. (2014) compared MBRP to treatment-as-usual (TAU) and standard relapse prevention and found that MBRP resulted in the lowest rates of heavy drinking and drug use one year following treatment.

Further work on implementation strategies is needed to expand the reach of mindfulness-based interventions for SUD (Wilson et al. 2017). Most randomized trials of mindfulness-based interventions for substance misuse (Li et al. 2017) involve closed-group treatment delivery (i.e., same group of individuals complete treatment together and no new individuals enter the group during treatment). For MBRP specifically, most studies involve closed-group delivery, including the two largest randomized trials to date (Bowen et al. 2009; Bowen et al. 2014). Hence, there is a paucity of evidence on whether mindfulness-based interventions for SUD, such as MBRP, can be effectively delivered in more flexible formats, such as rolling groups, in which new participants can enter the group at any point. Moreover, closed-groups are not feasible in many settings, especially community SUD treatment settings, because patients cannot wait for treatment and agencies often do not have the resources to coordinate multiple closed groups (McHugh & Barlow 2010; Wilson et al. 2017). Developing rolling admission versions of mindfulness-based interventions for SUD has the potential to greatly expand treatment uptake in real-world treatment settings.

To date, there is limited data to support the feasibility and effectiveness of rolling admission versions of mindfulness-based interventions for SUD. In a small pilot study among 36 adults, Brewer et al. (2009) demonstrated the effectiveness of a partially rolling group version of mindfulness training for SUD (participants could enter the group at modules 1 or 4 out of 8 modules). Shorey et al. (2017) conducted a randomized trial of an adjunctive mindfulness and acceptance group, offered in rolling admission format, among 117 individuals in residential SUD treatment. Results showed no differences in craving or mindfulness at treatment discharge between those assigned to treatment-as-usual and those assigned to the adjunctive mindfulness and acceptance group. Witkiewitz et al. (2014) conducted a randomized trial comparing MBRP, offered in rolling admission format, to standard residential SUD treatment relapse prevention among 105 women convicted of criminal offences. At 15-weeks posttreatment, women who received MBRP reported fewer drug use days and fewer legal and medical problems. Hence, the evidence to date on the feasibility and effectiveness of rolling admission versions of mindfulness-based interventions for SUD has been mixed, and more research is needed.

The current authors focused on further developing and refining the rolling group format used in the Witkiewitz et al. (2014) study. The rolling admission version of MBRP used in the current study was developed through an iterative process over several years, which involved patient feedback, clinician feedback, and group discussion among the current authors. The current study was a preliminary open trial to evaluate feasibility, acceptability, dose-response relations, and mechanisms of the rolling admission version of MBRP, called “Rolling MBRP,” offered as part of a short-term (3–4 week) residential treatment program for SUD.

Method

Participants

Participants were 109 individuals engaged in a short-term residential SUD treatment program (approximately 21 to 28 days). Residential treatment consisted mostly of group sessions, including Alcoholics Anonymous and Narcotics Anonymous groups and other group sessions focused on key themes (i.e., anger management, nutrition, relapse prevention). Patients also received individual counseling during their treatment stay. Eligibility criteria for the current study were: 1) admitted to the residential treatment program, 2) able to read and write English, and 3) 18 years of age or older. Table 1 provides the descriptive statistics for the study sample.

Procedures

The current study was a non-randomized, open trial that recruited participants between July 2016 to May 2017. The study was approved by the University of New Mexico Institutional Review Board. One-hour “Rolling MBRP” groups were offered twice per week to all patients in the residential program. For patients who were enrolled in the study, attendance at the Rolling MBRP groups was tracked. Study participants were not required to attend Rolling MBRP and had the choice of attending other groups (e.g., Alcoholics Anonymous or Narcotics Anonymous groups) that were offered at the same time as Rolling MBRP. Patients were informed about the study through the posting and distribution of study flyers. Informed

consent was obtained for all participants enrolled in the study. Participants completed one survey at baseline upon entering the residential program, and second survey at discharge. Participants received a \$5 gift card for completion of the baseline assessment and a \$10 gift card for completion of the post-assessment.

To facilitate practice of formal meditation outside of the sessions, mp3 players with guided meditation recordings were made available to all participants. Each Rolling MBRP group was typically facilitated by one therapist, with occasional groups co-facilitated by two therapists. There were a total of five therapists who led the Rolling MBRP groups. All therapists were graduate students in a Ph.D. clinical psychology program who were formally trained in MBRP and received ongoing clinical supervision by Dr. Katie Witkiewitz, a licensed clinical psychologist and expert in MBRP. All therapists had personal mindfulness practices.

Development of Rolling Mindfulness-Based Relapse Prevention

Rolling MBRP is an adaption of the MBRP therapist manual (Bowen et al., 2010) and builds upon the rolling admission version of MBRP used in the Witkiewitz et al. (2014) study. The Witkiewitz et al. (2014) program was a preliminary rolling admission version of MBRP that included 8 modules delivered over 8 weeks, with each module split into two 50-minute sessions offered on separate days during a given week (about 13 hours total in programming). The Rolling MBRP program developed and evaluated in the current study included 8 modules, with each module offered in a single 1-hour session, and 2 sessions offered per week (8 hours total in programming). The Rolling MBRP program in this study differs from the preliminary rolling version in the Witkiewitz et al. (2014) study in that we sought to further distill MBRP (i.e., reduce from 13 to 8 total hours in programming), and designed the program to be suitable for continual, ongoing delivery in shorter-term residential treatment programs (e.g., 3–4 weeks) in which patients often rotate in and out of the program. Over the course of several years, the Rolling MBRP protocol was developed through an iterative process involving patient feedback, clinician feedback, and group discussion among the current authors. The final version of Rolling MBRP used in the current study consisted of eight 1-hour modules. Table 2 provides an overview of Rolling MBRP.

Here, we elaborate on several key features of the rolling protocol. Every session begins with the therapist guiding participants through the same core formal mindfulness practice, called “mindful check-in” (about 10 minutes). This practice involves “checking in” and observing one’s internal experience (first body sensations, followed by thoughts and emotions) and then focusing one’s attention on the breath for several minutes. The mindful check-in serves to orient newcomers to both open monitoring and focused attention. The mindful check-in was also chosen as core practice because a key focus of MBRP is noticing one’s *internal experience* (e.g., thoughts, emotions, craving) with openness and curiosity. Following the mindful check-in, therapists inquire about what participants noticed during the mindfulness practice. Engaging in this inquiry process early on in every session serves to orient newcomers to the inquiry process, which is a common element of MBRP. At every session, following inquiry, therapists pose key “orienting questions” to the group, such as “What

does mindfulness mean to you?” or “What does mindfulness have to do with recovery?” Therapists focus on engaging prior attendees during the discussion of orienting questions, which serves to keep prior attendees engaged during the process of orienting newcomers. To keep prior attendees continually engaged, a new core theme is covered in the second half of every session.

For Rolling MBRP, there is a consistent focus on the SOBER space (Stop, Observe, Breathe, Expand, Respond), which is thoroughly reviewed in three of the eight modules. Whereas the “mindful check-in” is the central formal meditation, the SOBER space is the central informal practice that is the “on-the-go” version of the “mindful check-in.” Having two central practices, the “mindful check-in” and the SOBER space, is intended to create consistency and clarity within the rolling admission format. Finally, practice review (discussion of outside mindfulness practice), is integrated throughout each module in a flexible manner that engages both newcomers and prior attendees. For example, after reviewing the steps of the SOBER space, the therapist often emphasizes the importance of regular outside practice, asks new attendees what specific situations or times they plan to practice the SOBER space, and then asks prior attendees to share recent experiences with the SOBER technique outside of sessions.

Therapist Fidelity

Therapist fidelity to the rolling MBRP treatment was assessed using the MBRP Adherence and Competence Scale (MBRP-AC; Chawla et al., 2010), a validated fidelity rating tool for MBRP. The Adherence section includes items assessing adherence to MBRP treatment components (e.g., leading a particular mindfulness practice) and adherence to discussion of key concepts (e.g., acceptance of current experience). The Competence section includes items assessing therapist competence in delivering specific components, and items assessing overall therapist competence during the session (e.g., rating of overall quality of session). The items in the competence section were measured on a Likert-type scale (0 = low ability/not satisfactory and 4 = high ability/excellent). Two independent raters simultaneously observed one session (in-person) for the MBRP therapists and completed independent fidelity ratings using the MBRP-AC. There were three independent raters total; one licensed clinical psychologist and two master’s level clinical psychology graduate students.

Measures

Cronbach alphas for study measures are provided in the diagonal of Table 3.

Treatment history items.—A single item was used to assess the total number of times participants had completed inpatient or intensive outpatient treatment for alcohol/drug or other mental health problems. Another single item was used to assess the total number of times participants had completed medical detoxification.

Days abstinent prior to treatment.—A single self-report item was used to assess days abstinent from substances prior to admission to the residential program.

Severity of dependence scale (SDS).—The SDS is a 5-item self-report questionnaire that was used to assess substance use disorder severity (Gossop et al., 1995). It has demonstrated good psychometric properties among individuals with SUD (Gossop et al., 1995).

Self-compassion Scale-Short Form (SCS-SF).—The SCS-SF is a 12-item self-report questionnaire that was used to assess self-compassion (Raes, Pommier, Neff, & Van Gucht, 2011). The SCS-SF includes items rated on a scale from 0 (almost never) to 4 (almost always). The SCS-SF has demonstrated good psychometric properties among community samples and is highly correlated with the long form of the SCS (Raes et al., 2011).

Cognitive and affective mindfulness scale-revised (CAMS-R).—The CAMS-R is a 10-item self-report questionnaire of dispositional mindfulness (Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007). It has demonstrated good psychometric properties among community samples (Feldman et al., 2007).

Short form health survey (SF-12).—Two items from the SF-12 (a widely used measure of mental health; Ware, Kosinski, & Keller, 1996) were used to assess mental health. The two items are Likert-type items (“How much of the time during the past week have you felt calm and peaceful?” and “How much of the time in the past week have you felt down-hearted and blue”) rated from 0 (none of the time) to 5 (all of the time).

Penn alcohol craving scale (PACS).—An adapted version of the PACS, a 5-item self-report questionnaire, was used to assess alcohol/drug craving (Flannery, Volpicelli, & Pettinati, 1999).

Self-efficacy item.—A single item was used to measure abstinence self-efficacy, or self-rated confidence to abstain from alcohol/drugs after treatment (Hoepfner, Kelly, Urbanoski, & Slaymaker, 2011). The single item is “How confident are you that you will be able to stay clean and sober in the next 90 days, or 3 months?” from 1 (not at all confident) to 10 (very confident).

Treatment length item.—A single item was used to measure length of treatment stay.

Mindfulness group follow-up questionnaire.—A questionnaire was administered as part of the discharge assessment to assess perceived helpfulness of the MBRP group and self-reported informal and formal mindfulness practice. This measure was based on a questionnaire that has been used in prior studies of MBRP (Bowen et al., 2009; 2014). Perceived helpfulness of the MBRP group was assessed with a single item (“Overall, how helpful has the mindfulness class been for you?”) on a scale from 0 = not at all helpful to 4 = very helpful. Frequency of informal mindfulness practice was computed from five items, each rated on a scale with 0 = almost never, 1 = two to three times total, 2 = one to two days per week, 3 = three to four days per week, 4 = five or more days per week. These items included: 1) “how often have you been practicing the SOBER technique?”, 2) “how often have you been using mindfulness to check-in with yourself?”, 3) “how often have you been using mindfulness to cope with stress and difficult emotions?”, 4) “how often have you been

using mindfulness to stay focused on your environment or the activity you were doing?”, and 5) “how often have you been using breathing to handle a difficult moment?”.

Frequency of formal practice was assessed with a single item: “how often have you been setting aside time when you are alone to practice mindfulness exercises?” The response options for this item were: 0 = almost never, 1 = two to three times total, 2 = one to two days per week, 3 = three to four days per week, 4 = five or more days per week. Typical duration of formal practice was assessed with the single item: “On days you set aside time to practice mindfulness exercises on your own, about how many total minutes do you typically practice?” The response options were: 0 = I don’t set aside time, 1 = two to five minutes, 2 = six to ten minutes, 3 = eleven to twenty minutes, and 4 = twenty-one or more minutes.

Statistical Analyses

Descriptive analyses, t-tests, chi-square tests, bivariate correlations, and reliability analyses were conducted in SPSS. Inter-rater reliability was tested using mean competence ratings across the two raters. Two-way mixed model intraclass correlation coefficients (ICCs) were examined. Multiple regression models and mediation analyses were conducted using Mplus version 8 (Muthén & Muthén, 1998).

To evaluate the feasibility of Rolling MBRP, we computed the mean number of sessions attended. To evaluate the acceptability of Rolling MBRP, we computed the mean for the perceived helpfulness item and self-reported mindfulness practice. To evaluate attendance-outcome relations, multiple regression analyses were conducted with Rolling MBRP attendance as the predictor. First, we conducted multiple regression models with a continuous attendance variable as the predictor (total number of sessions attended). Then we conducted multiple regression models with a binary attendance variable as the predictor (1 = attended \geq 2 sessions of Rolling MBRP, an “adequate dose”; 0 = attended 1 or no sessions of Rolling MBRP, “a minimal dose or no dose”). We chose at least two sessions as a cut-off primarily based on the distribution of the “number of sessions attended” (see Table 1), which indicated that 2 or more sessions was a reasonable cut off point. Additionally, prior studies have demonstrated that brief mindfulness interventions for substance misuse consisting of two sessions have resulted in positive treatment effects (de Dios et al., 2012; Mermelstein & Garske, 2015). To evaluate the role of informal and formal mindfulness practice in mediating the relations between Rolling MBRP attendance and outcomes, we conducted mediation analyses using the distribution of products of coefficients approach with bias-corrected bootstrapped confidence intervals (Hayes & Rockwood, 2017). We conducted separate mediation models for each mindfulness practice variable. We first conducted a set of models with the continuous attendance variable as the independent variable and another set of models with the binary attendance variable as the independent variable.

For all regression models, including the mediation models, the following covariates were included as predictors to control for potential confounding effects of other relevant factors: the baseline score of the particular dependent variable included in each model, baseline substance use disorder severity (total score on SDS), gender, age, race (0 = white, 1 = racial/ethnic minority), length of treatment, and days abstinent prior to baseline.

A total of 21 participants (19.3% of the full sample) were missing data on the discharge assessment. Four of these participants left the treatment program prematurely against medical advice. Exposure to Rolling MBRP versus no exposure was not related to leaving the program against medical advice. The 17 other participants with missing discharge data had planned discharges but ended up being discharged at a different date than the discharge date set at treatment entry (e.g., discharged one day earlier than the originally set discharge date) and research staff were not present at the treatment center to administer the discharge assessment. Attrition analyses revealed that baseline demographic variables were not related to missing data at discharge. In turn, parameters were estimated using full information maximum likelihood estimation with all available data for the intent-to-treat sample.

Results

Therapist Fidelity Ratings

On average, therapists adhered to 99% of intervention components. Inter-rater reliability for mean competence ratings was good (ICC = .857). The mean competence score across therapists was 3.8 ($SD = 0.26$); this score falls between 3 = good and 4 = excellent.

Feasibility

Descriptive analyses of Rolling MBRP session attendance (see Table 1) showed that the mean number of Rolling MBRP sessions attended was 3.69 ($SD = 2.12$). The median number of sessions attended was 4. Descriptive analyses demonstrated that the mean score on the perceived helpfulness item (which ranged from 0 = “not at all helpful” to 4 = “very helpful”) was 3.38 ($SD = 0.77$), indicating high satisfaction. Mean scores among the full sample for self-reported out-of-session mindfulness practice were as follows: frequency of informal practice (mean = 2.72, $SD = 0.89$, corresponding with response anchor 3 = three to four days a week); frequency of formal practice (mean = 2.53, $SD = 1.17$, in-between response anchors 2 = one to two days a week and 3 = three to four days a week); and typical length of time spent engaging in formal practice (mean = 2.06, $SD = 1.03$, corresponding with response anchor 2 = six to ten minutes).

Dose-Response Relations

Table 4 shows the mean scores at baseline and discharge for each outcome among those who attended two or more sessions (“adequate dose group”) versus those who attended only one or zero sessions (“minimal/no dose group”). Whereas the minimal/no dose group showed no significant changes on outcomes, the adequate dose group showed significant pre-post changes in craving, mental health, self-compassion, and mindfulness (ranging from medium to large pre-post effect sizes). Table 5 summarizes the results from regression models testing between-group differences (i.e., adequate dose group vs. minimal/no dose group) on discharge outcomes, while controlling for baseline values of the outcome. Attending two or more Rolling MBRP sessions (versus one or less) was not significantly associated with self-compassion, craving, or self-efficacy at discharge. Hence, although the adequate dose group (but not the minimal/no dose group) showed significant within-group pre-post changes on craving and self-compassion, there was not a significant between-group difference for these outcomes at discharge. However, attending two or more Rolling MBRP sessions (versus one

or less) significantly predicted higher mindfulness at discharge and better mental health at discharge (medium between-group effect sizes). Total number of Rolling MBRP sessions attended was not significantly associated with discharge outcomes (see Table 5).

Mechanisms of Change

Table 6 and 7 provide a summary of the results from mediation models. Across all mediation models, the model fit was acceptable based on CFI > 0.9 and RMSEA < .08. For models with total sessions as the independent variable, we found the following significant effects: a) frequency of informal practice (i.e., on-the-go practice) mediated the associations between total sessions and craving, mental health, self-compassion, and mindfulness at discharge, b) frequency of formal practice (i.e., setting aside time to meditate) mediated the associations between total sessions and mental health and mindfulness at discharge, c) typical duration of formal practice mediated the association between total sessions and mindfulness at discharge. For models with attending two or more sessions as the independent variable, we found the following significant effects: a) frequency of informal practice mediated the associations between attending two or more sessions and craving, mental health, and mindfulness at discharge, b) frequency of formal practice mediated the association of attending two or more sessions and mental health and mindfulness at discharge, and c) duration of formal practice mediated the association between attending two or more sessions and mental health and mindfulness at discharge.

Discussion

This study evaluated the feasibility, acceptability, dose-response relations, and mechanisms of a rolling admission version of mindfulness-based relapse prevention (Rolling MBRP) offered to adults ($N = 109$) with substance use disorders receiving short-term residential treatment. Feasibility was demonstrated by good attendance rates. Acceptability was demonstrated by high satisfaction ratings and high rates of out-of-session mindfulness practice. Total number of Rolling MBRP sessions attended was not related to discharge outcomes. However, attending two or more sessions (versus one or none) was significantly associated with better mental health and higher mindfulness at discharge. Other studies among young adult substance users have found positive effects of just two brief mindfulness training sessions (de Dios et al., 2012; Mermelstein & Garske, 2015). Our study provides preliminary evidence that just two sessions of Rolling MBRP could be beneficial for adults receiving residential SUD treatment. Given the similarities between MBRP and mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1990) and mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasdale, 2002), which have strong evidence for improving mental health outcomes (Khoury et al., 2013), it is not surprising that MBRP may also improve mental health. Our findings regarding mental health are also consistent with studies that have found that mindfulness-based treatments for SUD are related to improvements in stress and mental-health related outcomes (Garland et al., 2016; Glasner et al., 2016; Li et al., 2017; Zemestani & Ottaviani, 2016).

We found that frequency of informal practice (i.e., on-the-go practice), frequency of formal practice (i.e., setting aside time to meditate), and typical duration of formal practice each

mediated the abovementioned effects of attending two or more sessions on discharge mental health and mindfulness. Although total sessions did not have a main effect on discharge outcomes, several indirect effects also emerged when testing total sessions attended as the predictor. That is, mindfulness practice also significantly mediated the association between total sessions and several discharge outcomes, including craving, mental health, self-compassion, and mindfulness. To our knowledge, our study is the first to demonstrate a gradient effect showing that higher doses of MBRP may foster greater mindfulness practice, which in turn affects outcomes. Kazdin (2007) notes that providing evidence of a gradient effect offers additional support for a putative mechanism of change. Overall, results provide evidence for both informal and formal mindfulness practice as mechanisms of change in Rolling MBRP. Moreover, our findings suggest that mindfulness practice may be a key mechanism driving effects of MBRP on other important mechanisms during the recovery process, such as reductions in craving, and improved mental health, trait mindfulness, and self-compassion.

Our results regarding mindfulness practice are consistent with theorized mechanisms of how MBRP works. These results also add to existing literature, with some studies supporting both formal and informal mindfulness practice as mechanisms of change (Elwafi et al., 2013; Grow et al., 2015), and another recent study showing that formal practice in particular may reduce the link between craving and substance use (Enkema & Bowen, 2017). Overall, a key focus of MBRP is promoting both on-the-go practice of mindfulness in daily life and sustained formal mindfulness practice. Our findings provide evidence that practice is indeed important and reaffirms that it is vital for therapists to actively facilitate and reinforce outside practice.

The primary limitation of this study was that it was a non-randomized, open trial and causal conclusions regarding Rolling MBRP cannot be drawn from our design. Although we statistically controlled for several potentially confounding factors, it is possible that there were other important confounding factors that we did not account for in the analyses. Another key limitation is that study participants were only assessed after admission into the residential program and upon discharge. A follow-up assessment was not administered, and actual substance use behavior following treatment was not examined. Hence, it is still not known whether Rolling MBRP impacts long-term outcomes, including risk and severity of substance use relapse following treatment. The current study relied exclusively on retrospective self-report questionnaires, which have many limitations, such as recall biases and response biases. Most assessments in this study were relatively brief, which could have resulted in measurement error and affected the results. The study was conducted in a residential setting and may not generalize to other treatment settings. Finally, we did not control for other treatment options that participants engaged in while residing at the residential treatment center.

One key conclusion from this study is that delivering MBRP as a rolling admission group may be a viable and effective alternative to delivering MBRP in a closed-group format. However, it is important to note that collective research to date on rolling versions of mindfulness-based interventions for SUD is still mixed in regard to effectiveness, as some studies have found significant treatment effects for rolling groups (Brewer et al., 2009;

Witkiewitz et al., 2014) and some have not (Shorey et al., 2017). The current study also has mixed findings regarding effectiveness as attending 2 or more sessions was related to outcomes, but total sessions attended was not. Importantly, both our study and the Shorey et al. (2017) study did not include longer-term follow-ups after residential treatment and did not directly assess treatment's effect on substance use relapse or problems. To better understand the efficacy and effectiveness of rolling mindfulness-based interventions for SUD, it will be necessary to conduct well-designed randomized controlled trials with longer-term follow-ups that directly assess substance use relapse and problems.

Our study also contributes to the literature on mechanisms of change related to mindfulness-based interventions for addictive disorders. In particular, findings suggest that both informal and formal mindfulness practice may be key mechanisms MBRP that mobilize other important mechanisms in the recovery process, such as reduced craving, and improved mental health, trait mindfulness, and self-compassion. Our study is unique from prior studies of MBRP by shedding light on dose-response relationships (Garland & Howard, 2018). Our study shows that a relatively small dose of Rolling MBRP (e.g., two or more 1-hour sessions) may be beneficial for clients. However, further research is needed to confirm the benefits of small doses of MBRP. Importantly, clients benefiting from small doses of MBRP does not preclude the notion that clients may benefit more, especially in regard to long-term recovery, from larger doses or ongoing small doses over time. Altogether, future work on rolling adaptations of mindfulness-based interventions is warranted and has the potential to ultimately make mindfulness-based treatments for addictive disorders more accessible and available in a diverse range of treatment settings.

Acknowledgements

During study implementation and the preparation of this manuscript, Corey Roos was supported by a training grant through the National Institute on Alcohol Abuse and Alcoholism (grant number T32 AA0018108-01A1). We would also like to thank Dr. Kevin Vowles and Dr. Matthew Pearson for their feedback on this project.

References

- Bowen S, Chawla N, & Marlatt GA (2010). *Mindfulness-based relapse prevention for addictive behaviors: A clinician's guide*. Guilford Press.
- Bowen S, Chawla N, Collins SE, Witkiewitz K, Hsu S, Grow J, ... & Marlatt A (2009). Mindfulness-based relapse prevention for substance use disorders: a pilot efficacy trial. *Substance Abuse*, 30(4), 295–305. [PubMed: 19904665]
- Bowen S, Witkiewitz K, Clifasefi SL, Grow J, Chawla N, Hsu SH, ... Larimer ME (2014). Relative efficacy of mindfulness-based relapse prevention, standard relapse prevention, and treatment as usual for substance use disorders. *JAMA Psychiatry*, 71(5), 547–556. [PubMed: 24647726]
- Brewer JA, Sinha R, Chen JA, Michalsen RN, Babuscio TA, Nich C, ... & Rounsaville BJ (2009). Mindfulness training and stress reactivity in substance abuse: Results from a randomized, controlled stage I pilot study. *Substance Abuse*, 30(4), 306–317. [PubMed: 19904666]
- Chawla N, Collins S, Bowen S, Hsu S, Grow J, Douglas A, & Marlatt GA (2010). The mindfulness-based relapse prevention adherence and competence scale: development, interrater reliability, and validity. *Psychotherapy Research*, 20(4), 388–397. [PubMed: 20204916]
- de Dios MA, Herman DS, Britton WB, Hagerty CE, Anderson BJ, & Stein MD (2012). Motivational and mindfulness intervention for young adult female marijuana users. *Journal of Substance Abuse Treatment*, 42(1), 56–64. [PubMed: 21940136]

- Elwafi HM, Witkiewitz K, Mallik S, Thornhill IV TA, & Brewer JA (2013). Mindfulness training for smoking cessation: Moderation of the relationship between craving and cigarette use. *Drug and Alcohol Dependence*, 130(1), 222–229. [PubMed: 23265088]
- Enkema MC, & Bowen S (2017). Mindfulness practice moderates the relationship between craving and substance use in a clinical sample. *Drug & Alcohol Dependence*, 179, 1–7. [PubMed: 28734167]
- Feldman G, Hayes A, Kumar S, Greeson J, & Laurenceau JP (2007). Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment*, 29(3), 177–190.
- Flannery BA, Volpicelli JR, & Pettinati HM (1999). Psychometric properties of the Penn alcohol craving scale. *Alcoholism: Clinical and Experimental Research*, 23(8), 1289–1295.
- Garland EL, & Howard MO (2018). Mindfulness-based treatment of addiction: current state of the field and envisioning the next wave of research. *Addiction Science & Clinical Practice*, 13(1), 14. [PubMed: 29669599]
- Garland EL, Roberts-Lewis A, Tronnier CD, Graves R, & Kelley K (2016). Mindfulness-Oriented Recovery Enhancement versus CBT for co-occurring substance dependence, traumatic stress, and psychiatric disorders: Proximal outcomes from a pragmatic randomized trial. *Behaviour Research and Therapy*, 77, 7–16. [PubMed: 26701171]
- Grant S, Colaiaco B, Motala A, Shanman R, Booth M, Sorbero M, & Hempel S (2017). Mindfulness-based relapse prevention for substance use disorders: A systematic review and meta-analysis. *Journal of Addiction Medicine*, 11(5), 386. [PubMed: 28727663]
- Glasner S, Mooney LJ, Ang A, Garneau HC, Hartwell E, Brecht ML, & Rawson RA (2016). Mindfulness-based relapse prevention for stimulant dependent adults: A pilot randomized clinical trial. *Mindfulness*, 1–10.
- Gossop M, Darke S, Griffiths P, Hando J, Powis B, Hall W, & Strang J (1995). The Severity of Dependence Scale (SDS): psychometric properties of the SDS in English and Australian samples of heroin, cocaine and amphetamine users. *Addiction*, 90(5), 607–614. [PubMed: 7795497]
- Grow JC, Collins SE, Harrop EN, & Marlatt GA (2015). Enactment of home practice following mindfulness-based relapse prevention and its association with substance-use outcomes. *Addictive Behaviors*, 40, 16–20. [PubMed: 25218066]
- Hayes AF, & Rockwood NJ (2017). Regression-based statistical mediation and moderation analysis in clinical research: Observations, recommendations, and implementation. *Behaviour research and therapy*, 98, 39–57. [PubMed: 27865431]
- Himelstein S, & Saul S (2015). Mindfulness-based substance abuse treatment for adolescents: a 12-session curriculum. New York: Routledge.
- Hoepfner BB, Kelly JF, Urbanoski KA, & Slaymaker V (2011). Comparative utility of a single-item versus multiple-item measure of self-efficacy in predicting relapse among young adults. *Journal of Substance Abuse Treatment*, 41(3), 305–312. [PubMed: 21700411]
- Kazdin AE (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology*, 3, 1–27.
- Koob GF, & Volkow ND (2016). Neurobiology of addiction: a neurocircuitry analysis. *The Lancet Psychiatry*, 3(8), 760–773. [PubMed: 27475769]
- Li W, Howard MO, Garland EL, McGovern P, & Lazar M (2017). Mindfulness treatment for substance misuse: A systematic review and meta-analysis. *Journal of Substance Abuse Treatment*, 75, 62–96. [PubMed: 28153483]
- MacKinnon DP (2008). Introduction to statistical mediation analysis. Routledge.
- McHugh RK, & Barlow DH (2010). The dissemination and implementation of evidence-based psychological treatments: a review of current efforts. *American Psychologist*, 65(2), 73–84. [PubMed: 20141263]
- McKay JR (2009). Treating substance use disorders with adaptive continuing care. American Psychological Association.

- McLellan AT, McKay JR, Forman R, Cacciola J, & Kemp J (2005). Reconsidering the evaluation of addiction treatment: from retrospective follow-up to concurrent recovery monitoring. *Addiction*, 100(4), 447–458. [PubMed: 15784059]
- McLellan AT, Lewis DC, O'Brien CP, & Kleber HD (2000). Drug dependence, a chronic medical illness. *JAMA*, 284(13), 1689–1695. [PubMed: 11015800]
- Mermelstein LC, & Garske JP (2015). A brief mindfulness intervention for college student binge drinkers: A pilot study. *Psychology of Addictive Behaviors*, 29(2), 259–269. [PubMed: 25402833]
- Muthén LK, & Muthén BO (1998). *Mplus User's Guide*, 8th Edn. Los Angeles: Muthén & Muthén.
- Nunes EV, Gordon M, Friedmann PD, Fishman MJ, Lee JD, Chen DT, ... & O'Brien CP (2018). Relapse to opioid use disorder after inpatient treatment: Protective effect of injection naltrexone. *Journal of substance abuse treatment*, 85, 49–55. [PubMed: 28473233]
- Raes F, Pommier E, Neff KD, & Van Gucht D (2011). Construction and factorial validation of a short form of the self-compassion scale. *Clinical Psychology & Psychotherapy*, 18(3), 250–255. [PubMed: 21584907]
- Segal ZV, Williams JMG, Teasdale JD (2002). *Mindfulness-Based Cognitive Therapy for Depression: A New Approach to Preventing Relapse*. New York, NY: Guilford Press.
- Shorey RC, Elmquist J, Gawrysiak MJ, Strauss C, Haynes E, Anderson S, & Stuart GL (2017). A randomized controlled trial of a mindfulness and acceptance group therapy for residential substance use patients. *Substance Use & Misuse*, 52(11), 1400–1410. [PubMed: 28430015]
- Ware J Jr., Kosinski M, & Keller SD (1996). A 12-Item Short-Form Health Survey: Construction of scales and preliminary tests of reliability and validity. *Medical Care*, 34, 220–233. [PubMed: 8628042]
- Whiteford HA, Degenhardt L, Rehm J, Baxter AJ, Ferrari AJ, Erskine HE, ... & Burstein R (2013). Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *The Lancet*, 382(9904), 1575–1586.
- Wilson AD, Roos CR, Robinson CS, Stein ER, Manuel JA, Enkema MC, ... & Witkiewitz, K. (2017). Mindfulness-based interventions for addictive behaviors: Implementation issues on the road ahead. *Psychology of Addictive Behaviors*, 31(8), 888.
- Witkiewitz K, & Bowen S (2010). Depression, craving, and substance use following a randomized trial of mindfulness-based relapse prevention. *Journal of Consulting and Clinical Psychology*, 78(3), 362–74. [PubMed: 20515211]
- Witkiewitz K, Warner K, Sully B, Barricks A, Stauffer C, Thompson BL, & Luoma JB (2014). Randomized trial comparing mindfulness-based relapse prevention with relapse prevention for women offenders at a residential addiction treatment center. *Substance Use & Misuse*, 49(5), 536–546. [PubMed: 24611849]
- Zemestani M, & Ottaviani C (2016). Effectiveness of mindfulness-based relapse prevention for co-occurring substance use and depression disorders. *Mindfulness*, 7(6), 1347–1355.

Table 1

Descriptive Statistics for the Study Sample

Variable	N (%) or Mean (SD)	Variable	N (%) or Mean (SD)
Female Gender	50 (45.9%)	Number of Rolling MBRP Sessions Attended	3.69 (2.12)
Race/Ethnicity		Distribution of MBRP Sessions Attended	
African-American/B lack	7 (6.4%)	Attended 0 Rolling MBRP Sessions	5 (4.6%)
Non-Hispanic White	28 (25.7%)	Attended 1 Rolling MBRP Session	19 (17.4%)
American Indian/Alaskan Native	9 (8.3%)	Attended 2 Rolling MBRP Sessions	8 (7.3%)
Hispanic/Latino	57 (52.3%)	Attended 3 Rolling MBRP Sessions	20 (18.3%)
Asian/Pacific Islander	0 (0%)	Attended 4 Rolling MBRP Sessions	16 (14.7%)
Mixed	5 (4.6%)	Attended 5 Rolling MBRP Sessions	17 (15.6%)
Other	2 (1.8%)	Attended 6 Rolling MBRP Sessions	13 (11.9%)
Age	36.40 (9.4)	Attended 7 Rolling MBRP Sessions	9 (8.3%)
Married or in Committed Relationship	18 (16.7%)	Attended 8 Rolling MBRP Sessions	1 (0.9%)
Inpatient Treatment Episodes	1.27 (1.58)	Attended 9 Rolling MBRP Sessions	1 (0.9%)
Detoxification Episodes	1.77 (1.44)		
Primary Drug of Choice			
Alcohol	54 (49.5%)		
Cocaine/Crack	7 (6.4%)		
Methamphetamine	13 (11.9%)		
Marijuana	1 (0.9%)		
Heroin	14 (12.8%)		
Opioid Pills	3 (2.8%)		
Anti-anxiety Pills	1 (0.9%)		
Polysubstance Use	56 (52.8%)		
Substance Dependence Severity	10.82 (3.01)		
Length of Stay (weeks)	3.52 (0.71)		
Days Abstinent Before Baseline	12.21 (7.05)		

Table 2

Overview of Rolling MBRP

Common Components Covered at Every Module		
Module	Learning Objectives	Specific Practices and Content
<p>Components at the Beginning of Every Session:</p> <ul style="list-style-type: none"> • Brief introduction of the group and review of group rules • Mindful Check-in Meditation (~10 minutes) • Inquiry following the Mindful Check-in (e.g., therapist-led discussion about direct experiences during the practice) • Posing Orienting Questions (e.g., How does mindfulness relate to recovery) <p>Components Integrated Throughout Each Session:</p> <ul style="list-style-type: none"> • Emphasizing importance of regular practice and encouraging and supporting outside practice • Discussing participant experiences, observations, and challenges with outside practice 		
<p>General Learning Objectives related to Common Components:</p> <ul style="list-style-type: none"> • To understand what mindfulness is, how to practice it, and how it relates to recovery • To practice noticing present moment experiences with openness and curiosity • To practice anchoring one's attention on the breath • To practice staying with difficult or uncomfortable internal experiences • To practice describing in words one's direct experience 		
1. Stepping Out of Autopilot	<ul style="list-style-type: none"> • To practice bringing mindfulness to an activity (eating) that often involves autopilot mode • To understand the role of autopilot in substance use • To learn and practice the SOBER space, an on-the-go technique 	<ul style="list-style-type: none"> • Mindful Eating Meditation, plus postpractice inquiry • Discussion of autopilot vs. mindfulness • Review and practice of SOBER Space
2. Mindfulness and Thoughts	<ul style="list-style-type: none"> • To understand that thoughts are words or images that arise in the mind, rather than facts about reality • To practice noticing when the mind gets caught up in thoughts and returning one's attention to a focal point (e.g., the breath) • To understand how awareness of thoughts in challenging situations can create perspective and promote skillful responding 	<ul style="list-style-type: none"> • Discussion about the nature of thoughts • Mindful Breathing Meditation (with a focus on noticing when thoughts arise) plus postpractice inquiry
3. Mindfulness and Valued Living	<ul style="list-style-type: none"> • To learn and practice the SOBER space, an on-the-go technique • To understand how mindfulness relates to valued action and how actively living by one's values is part of the recovery process • To understand that mindfulness skills, particularly the SOBER space, are not just for <i>avoiding</i> substances but can be used for <i>approaching</i> valued goals 	<ul style="list-style-type: none"> • Review and practice of SOBER Space • Values Worksheet • Discussion of mindfulness, values, and the recovery process
4. Developing a Mindfulness Practice	<ul style="list-style-type: none"> • To practice paying attention to body sensations as a way to connect to present moment experience • To understand how mindfulness is practiced and how individuals develop and sustain a personal mindfulness practice 	<ul style="list-style-type: none"> • Body Scan Meditation, plus post-practice inquiry • Discussion about the process of developing and sustaining a personal mindfulness practice
5. Self-compassion	<ul style="list-style-type: none"> • To understand the role of self-compassion in the recovery process • To practice offering compassion or kindness to oneself and noticing what arises 	<ul style="list-style-type: none"> • Kindness Meditation, plus post-practice inquiry • Discussion about self-compassion and recovery
6. Mindfulness in Challenging Situations	<ul style="list-style-type: none"> • To learn and practice the SOBER space, an on-the-go technique • To learn how the SOBER space can be used in high-risk situations • To practice the SOBER space during an exercise that involves elicitation of distress 	<ul style="list-style-type: none"> • Review and practice of SOBER Space • SOBER Space in a Challenging Situation Exercise, plus post-practice inquiry • Discussion of using the SOBER space in challenging situations
7. Mindfulness and Emotions	<ul style="list-style-type: none"> • To understand how mindfulness involves being willing to experience emotions • To understand how acceptance and change go together in the recovery process • To practice noticing one's emotional experience with openness and curiosity 	<ul style="list-style-type: none"> • Brief Mindfulness of Emotions Practice, followed by reading of Guest House • Post-practice inquiry and discussion of poem • Discussion about being willing to experience emotions

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

8. **Checking in During Difficult Moments**

- To develop curiosity about direct experiences (thoughts, sensations, feelings) one has while “being upset or stressed” or having an “urge”
- To practice noticing one’s experience with openness and curiosity during an exercise that involves elicitation of distress

- Discussion about body sensations, emotions, thoughts, actions, and their differences and interconnections
- Checking-In During a Difficult Moment Meditation (a variant of urge surfing), plus post-practice inquiry
- Discussion about bringing mindfulness to urges and craving

Table 3
 Bivariate Correlations (Significant Correlations in **Bold**) and Internal Consistency Reliabilities (Underlined) for Key Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Number of Sessions Attended	--	.235	.294	.183	-.132	.071	-.281	.070	.264	-.048	-.021	-.051	-.161	.190	.037
2. Informal Practice-Frequency	<u>.891</u>	.778	--	.665	-.190	.090	.353	.300	.400	.104	-.049	-.213	-.003	.021	-.123
3. Formal Practice-Frequency	--	.812	--	.812	-.122	.071	.260	.247	.381	.086	-.165	-.222	-.032	-.011	-.074
4. Formal Practice-Typical duration		<u>.760</u>		<u>.760</u>	-.105	.129	.258	.294	.385	.186	-.193	-.160	.036	.003	.013
5. Craving-P		<u>.875</u>		<u>.875</u>	-.565	-.412	-.562	-.412	-.419	.212	-.025	-.128	.034	-.312	-.082
6. Self-Efficacy-P		--		--	--	--	.338	.476	.432	-.033	.054	-.049	-.185	.134	.152
7. Mental Health-P							<u>.721</u>	.453	.480	-.143	.017	-.038	.024	.224	.002
8. Self-compassion-P							<u>.803</u>	.572	.572	.090	-.066	-.023	-.046	.005	.179
9. Mindfulness-P							<u>.868</u>	.868	.868	-.064	-.119	-.090	-.132	.036	.140
10. Substance Dependence Severity							<u>.755</u>	.755	.755	.073	-.052	.046	-.266	-.053	
11. Gender							--	--	--	--	-.085	-.013	-.006	-.046	
12. Age							--	--	--	--	--	--	-.045	.156	.079
13. Race							--	--	--	--	--	--	--	-.140	.079
14. Length of Treatment							--	--	--	--	--	--	--	--	-.030
15. Days Abstinent Prior to Baseline							--	--	--	--	--	--	--	--	--

Note. Bolded font = $p < .05$. P = measured at the discharge post assessment; Underlined values on the diagonal are the Cronbach's alphas for multi-item measures.

Table 4
Baseline to Discharge Changes in Outcomes among Adequate Dose Group and Minimal/No Dose Group

	Craving	Self-efficacy	Mental Health	Self-Compassion	Mindfulness
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
“Minimal/No Dose Group” Attended Zero or One Session	Baseline: 8.31 (7.64) Discharge: 6.07 (5.36) Change: -2.23 (8.61); Cohen’s <i>d</i> = 0.25	Baseline: 7.77 (2.09) Discharge: 8.69 (1.97) Change: 0.92 (2.06); Cohen’s <i>d</i> = 0.44	Baseline: 6.47 (2.23) Discharge: 6.13 (2.17) Change: 0.33 (3.33); Cohen’s <i>d</i> = 0.09	Baseline: 22.33 (9.74) Discharge: 28.66 (8.18) Change: 6.33 (14.03); Cohen’s <i>d</i> = 0.45	Baseline: 14.57 (8.14) Discharge: 16.76 (6.36) Change: 2.21 (9.24); Cohen’s <i>d</i> = 0.24
“Adequate Dose Group” Attended 2 or More Sessions	Baseline: 10.50 (7.92) Discharge: 5.58 (5.02) Change: -4.91 (7.51)*; Cohen’s <i>d</i> = 0.65	Baseline: 8.52 (1.91) Discharge: 8.81 (1.47) Change: 0.29 (1.80); Cohen’s <i>d</i> = 0.16	Baseline: 5.67 (2.17) Discharge: 7.46 (1.50) Change: 1.79 (2.55)*; Cohen’s <i>d</i> = 0.70	Baseline: 20.78 (8.24) Discharge: 31.83 (6.74) Change: 11.08 (9.85)*; Cohen’s <i>d</i> = 1.12	Baseline: 15.41 (6.26) Discharge: 22.10 (4.17) Change: 6.69 (6.55)*; Cohen’s <i>d</i> = 1.02
Between-Group Effect Size for Difference in Change on Outcome	<i>d</i> = 0.33	<i>d</i> = 0.32	<i>d</i> = 0.49	<i>d</i> = 0.39	<i>d</i> = 0.56

Note.

* mean difference is significant at $p < .05$ from paired samples t-test;

M = Mean; SD = Standard Deviation.

Table 5 Summary of Results from Regression Models with Rolling MBRP Attendance as a Predictor of Outcomes at Discharge

	Craving	Self-efficacy	Mental Health	Self Compassion	Mindfulness
Total Number of Sessions Attended	B = -0.275 SE = 0.257 β = -0.114	B = -0.060 SE = 0.077 β = -0.081	B = 0.154 SE = 0.087 β = 0.198	B = 0.185 SE = 0.402 β = 0.055	B = 0.504 SE = 0.278 β = 0.222
Attended Two Sessions or More	B = -0.673 SE = 1.478 β = -0.048	B = -0.237 SE = 0.438 β = -0.055	B = 1.214* SE = 0.479 β = 0.277*	B = 0.461 SE = 0.323 β = 0.163	B = 4.391** SE = 1.461 β = 0.351**

Note.

* $p < .05$;

** $p < .01$.

B = unstandardized coefficient; β = standardized coefficient; SE = standard error.

Table 6
 Summary of Models Testing Indirect Effects of Number of Sessions on Outcomes via Mindfulness Practice Variables

	Craving	Self-Efficacy	Mental Health	Self-Compassion	Mindfulness
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Frequency of Informal Practice as Mediator	Effect of Number of Sessions on Mediator: 0.495 (0.260)	Effect of Number of Sessions on Mediator: 0.509 (0.264)	Effect of Number of Sessions on Mediator: 0.472 (0.244)	Effect of Number of Sessions on Mediator: 0.496 (0.241)*	Effect of Number of Sessions on Mediator: 0.500 (0.250)*
	Effect of Mediator on Outcome: -0.442 (0.133)**	Effect of Mediator on Outcome: -0.003	Effect of Mediator on Outcome: 0.163 (0.050)**	Effect of Mediator on Outcome: 0.520 (0.248)*	Effect of Mediator on Outcome: 0.486 (0.176)**
Frequency of Formal Practice as Mediator	Indirect Effect of Number of Sessions on Outcome: -0.219 (0.127) 95% CI [-0.540, -0.019]	Indirect Effect of Number of Sessions on Outcome: -0.001 (0.028) 95% CI [-0.08, 0.045]	Indirect Effect of Number of Sessions on Outcome: 0.077 (0.051) 95% CI [0.002, 0.206]	Indirect Effect of Number of Sessions on Outcome: 0.258 (0.183) 95% CI [0.004, 0.755]	Indirect Effect of Number of Sessions on Outcome: 0.243 (0.157) 95% CI [0.029, 0.678]
	Effect of Number of Sessions on Mediator: 0.185 (0.070)**	Effect of Number of Sessions on Mediator: 0.178 (0.072)*	Effect of Number of Sessions on Mediator: 0.148 (0.067)*	Effect of Number of Sessions on Mediator: 0.173 (0.065)**	Effect of Number of Sessions on Mediator: 0.146 (0.069)*
Typical Duration of Formal Practice as Mediator	Effect of Mediator on Outcome: -1.03 (0.618)	Effect of Mediator on Outcome: -0.081 (0.203)	Effect of Mediator on Outcome: 0.495 (0.208)*	Effect of Mediator on Outcome: 1.66 (0.993)	Effect of Mediator on Outcome: 1.78 (0.685)**
	Indirect Effect of Number of Sessions on Outcome: -0.191 (0.131) 95% CI [-0.537, 0.003]	Indirect Effect of Number of Sessions on Outcome: -0.014 (0.040) 95% CI [-0.119, 0.047]	Indirect Effect of Number of Sessions on Outcome: 0.073 (0.049) 95% CI [0.005, 0.202]	Indirect Effect of Number of Sessions on Outcome: 0.288 95% CI [-0.012, 0.839]	Indirect Effect of Number of Sessions on Outcome: 0.260 (0.179) 95% CI [0.016, 0.748]
Effect of Mediator on Outcome	Effect of Number of Sessions on Mediator: 0.076 (0.059)	Effect of Number of Sessions on Mediator: 0.097 (0.058)	Effect of Number of Sessions on Mediator: 0.086 (0.054)	Effect of Number of Sessions on Mediator: 0.085 (0.055)	Effect of Number of Sessions on Mediator: 0.075 (0.056)
	Effect of Mediator on Outcome: -1.12 (0.674)	Effect of Mediator on Outcome: 0.223 (0.180)	Effect of Mediator on Outcome: 0.538 (0.225)*	Effect of Mediator on Outcome: 2.628 (1.00)**	Effect of Mediator on Outcome: 2.34 (0.693)**
Indirect Effect of Number of Sessions on Outcome	Effect of Number of Sessions on Outcome: -0.086 (0.094) 95% CI [-0.374, 0.024]	Indirect Effect of Number of Sessions on Outcome: 0.022 (0.024) 95% CI [-0.006, 0.094]	Indirect Effect of Number of Sessions on Outcome: 0.046 (0.039) 95% CI [-0.154, 0.005]	Indirect Effect of Number of Sessions on Outcome: 0.223 (0.168) 95% CI [-0.019, 0.660]	Indirect Effect of Number of Sessions on Outcome: 0.176 (0.152) 95% CI [-0.047, 0.580]

Note. Bolded font = indirect effect is statistically significant based on 95% bootstrapped confidence interval. B = unstandardized coefficient; SE = standard error; CI = Confidence Interval.

* $p < .05$;

** $p < .01$.

Table 7
 Summary of Models Testing Indirect Effects of Attending 2 or More Sessions on Outcomes via Mindfulness Practice Variables

	Craving		Self-Efficacy		Mental Health		Self-Compassion		Mindfulness	
	B (SE)	Effect of 2+ Sessions on Mediator:	B (SE)	Effect of 2+ Sessions on Mediator:	B (SE)	Effect of 2+ Sessions on Mediator:	B (SE)	Effect of 2+ Sessions on Mediator:	B (SE)	Effect of 2+ Sessions on Mediator:
Frequency of Informal Practice as Mediator	4.860 (1.64)**	Effect of Mediator on Outcome: 0.473 (0.133)**	4.458 (1.774)*	Effect of Mediator on Outcome: -0.011 (0.058)	3.723 (1.620)*	Effect of Mediator on Outcome: -0.151 (0.051)**	4.237 (1.781)*	Effect of Mediator on Outcome: 0.468 (0.275)	3.587 (1.715)*	Effect of Mediator on Outcome: 0.425 (0.167)*
		Indirect Effect of 2+ Sessions on Outcome: -2.297 (1.016) 95% CI [-4.874, -0.777]		Indirect Effect of 2+ Sessions on Outcome: -0.047 (0.292) 95% CI [-0.668, 0.483]		Indirect Effect of 2+ Sessions on Outcome: -0.564 (0.354) 95% CI [-1.428, -0.054]		Indirect Effect of 2+ Sessions on Outcome: 1.983 (1.677) 95% CI [-0.096, 6.202]		Indirect Effect of 2+ Sessions on Outcome: 1.526 (1.001) 95% CI [0.130, 4.180]
Frequency of Formal Practice as Mediator	1.620 (0.446)**	Effect of 2+ Sessions on Mediator: 1.442 (0.483)**	1.442 (0.483)**	Effect of 2+ Sessions on Mediator: 1.088 (0.467)*	1.088 (0.467)*	Effect of 2+ Sessions on Mediator: 1.409 (0.488)**	1.409 (0.488)**	Effect of 2+ Sessions on Mediator: 1.073 (0.469)*	1.073 (0.469)*	Effect of 2+ Sessions on Mediator: 1.530 (0.645)*
		Effect of Mediator on Outcome: -1.142 (0.653)		Effect of Mediator on Outcome: -0.435 (0.215)*		Effect of Mediator on Outcome: 0.435 (0.215)*		Effect of Mediator on Outcome: 1.351 (1.132)		Effect of Mediator on Outcome: 1.641 (1.169) 95% CI [0.082, 4.827]
Typical Duration of Formal Practice as Mediator	1.018 (0.336)**	Effect of 2+ Sessions on Mediator: 1.135 (0.341)**	1.135 (0.341)**	Effect of 2+ Sessions on Mediator: 0.981 (0.295)**	0.981 (0.295)**	Effect of 2+ Sessions on Mediator: 0.085 (0.055)	0.085 (0.055)	Effect of 2+ Sessions on Mediator: 0.924 (0.294)**	0.924 (0.294)**	Effect of 2+ Sessions on Mediator: 2.072 (0.691)**
		Effect of Mediator on Outcome: -1.038 (0.689)		Effect of Mediator on Outcome: 0.439 (0.239)		Effect of Mediator on Outcome: 0.439 (0.239)		Effect of Mediator on Outcome: 2.628 (1.100)**		Effect of Mediator on Outcome: 1.916 (0.896) 95% CI [0.555, 4.226]
		Indirect Effect of 2+ Sessions on Outcome: -1.057 (0.777) 95% CI [-2.981, 0.112]		Indirect Effect of 2+ Sessions on Outcome: 0.215 (0.210) 95% CI [-0.141, 0.700]		Indirect Effect of 2+ Sessions on Outcome: 0.430 (0.263) 95% CI [0.012, 1.078]		Indirect Effect of 2+ Sessions on Outcome: 0.223 (0.168) 95% CI [-0.019, 0.660]		Indirect Effect of 2+ Sessions on Outcome: 1.916 (0.896) 95% CI [0.555, 4.226]

Note. Bolded font = effects that are statistically significant based on 95% bootstrapped confidence interval. B = unstandardized coefficient; SE = standard error; CI = Confidence Interval.