Original Investigation

Relative Efficacy of Mindfulness-Based Relapse Prevention, Standard Relapse Prevention, and Treatment as Usual for Substance Use Disorders
A Randomized Clinical Trial

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IMPORTANCE Relapse is highly prevalent following substance abuse treatments, highlighting the need for improved aftercare interventions. Mindfulness-based relapse prevention (MBRP), a group-based psychosocial aftercare, integrates evidence-based practices from mindfulness-based interventions and cognitive-behavioral relapse prevention (RP) approaches.

OBJECTIVE To evaluate the long-term efficacy of MBRP in reducing relapse compared with RP and treatment as usual (TAU [12-step programming and psychoeducation]) during a 12-month follow-up period.

DESIGN, SETTING, AND PARTICIPANTS Between October 2009 and July 2012, a total of 286 eligible individuals who successfully completed initial treatment for substance use disorders at a private, nonprofit treatment facility were randomized to MBRP, RP, or TAU aftercare and monitored for 12 months. Participants medically cleared for continuing care were aged 18 to 70 years; 71.5% were male and 42.1% were of ethnic/racial minority.

INTERVENTIONS Participants were randomly assigned to 8 weekly group sessions of MBRP, cognitive-behavioral RP, or TAU.

MAIN OUTCOMES AND MEASURES Primary outcomes included relapse to drug use and heavy drinking as well as frequency of substance use in the past 90 days. Variables were assessed at baseline and at 3-, 6-, and 12-month follow-up points. Measures used included self-report of relapse and urinalysis drug and alcohol screenings.

RESULTS Compared with TAU, participants assigned to MBRP and RP reported significantly lower risk of relapse to substance use and heavy drinking and, among those who used substances, significantly fewer days of substance use and heavy drinking at the 6-month follow-up. Cognitive-behavioral RP showed an advantage over MBRP in time to first drug use. At the 12-month follow-up, MBRP participants reported significantly fewer days of substance use and significantly decreased heavy drinking compared with RP and TAU.

CONCLUSIONS AND RELEVANCE For individuals in aftercare following initial treatment for substance use disorders, RP and MBRP, compared with TAU, produced significantly reduced relapse risk to drug use and heavy drinking. Relapse prevention delayed time to first drug use at 6-month follow-up, with MBRP and RP participants who used alcohol also reporting significantly fewer heavy drinking days compared with TAU participants. At 12-month follow-up, MBRP offered added benefit over RP and TAU in reducing drug use and heavy drinking. Targeted mindfulness practices may support long-term outcomes by strengthening the ability to monitor and skillfully cope with discomfort associated with craving or negative affect, thus supporting long-term outcomes.

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espite decades of research, the high prevalence of and relapse to substance use disorders (SUDs) continues to challenge the field. Approximately 10.6% of US individuals with SUDs seek treatment,[1] and 40% to 60% relapse within 1 year.[2] This lack of treatment engagement and chronic relapsing nature[3] highlight the need for further attention to and options for treatment of SUDs.

Relapse prevention (RP) therapy,[4] a widely studied and implemented approach,[5] posits that interactions between individual factors (eg, motivation and coping) and environmental factors (eg, social influences and access to substances) increase relapse risk.[6] Relapse prevention offers a framework for identifying situations that precipitate relapse and teaches cognitive and behavioral skills to reduce risk. Reviews and meta-analyses[7-12] show evidence for effectiveness relative to no-treatment control conditions.

Despite supporting evidence, potential shortcomings of RP have been identified, including focus on avoidance-based goals (ie, avoiding high-risk situations)[13] vs approach-based goals[14] and on controlling causes of negative affect or craving vs learning to tolerate these states.[15] The latter point may be particularly disadvantageous because negative affect has been shown[3,14] to be a primary predictor of relapse, and exposure to and acceptance of such states may be mechanisms of behavioral change.[15-19] Finally, RP places relatively little emphasis on individual needs, values, and issues that may underlie problematic behavior.[14,20] It has thus been proposed that to increase effectiveness, treatment must address avoidance of affective or cognitive discomfort,[20] provide skills to tolerate these states, and identify underlying functions of substance use.[21]

Mindfulness-Based Treatment

Mindfulness involves attending to experiences on a moment-to-moment basis with intention to cultivate nonjudgmental, nonreactive states of awareness.[22] Mindfulness-based treatments teach patients to remain in contact with and relate differently to challenging affective or physical states,[23] use alternatives to avoidant-based coping, recognize underlying reasons for maladaptive behaviors, and identify and increase contact with natural contingencies.[21]

Mindfulness training has been associated with reductions in anxiety,[24-26] disordered eating,[27,28] and depressive relapse,[29-31] and a growing body of literature[23,32-36] supports its efficacy for SUD treatment. Complementing previous theory,[20] integrating mindfulness practices into treatment may not only provide an alternative to standard RP, it may also enhance its efficacy. Mindfulness-based practices offer incremental training in awareness of environmental cues and internal phenomena, including cognitive and affective states that have previously triggered relapse,[37-39] interrupting the habitual response of substance use.[40] These practices may also function as exposure to internal experiences[41] that often precipitate relapse, such as negative affect and craving. The resultant habituation may generalize to discomfort associated with a broader class of triggers. In contrast, RP practices often identify specific situations to avoid or present alternative coping strategies. Focus on internal experience vs external cues, however, may increase acceptance and tolerance of substance use cues and associated internal distress, decrease subjective urgency to alleviate discomfort via substance use,[32,42,43] and decouple negative affect and substance use.[23]

Mindfulness-Based Relapse Prevention

Mindfulness-based relapse prevention (MBRP)[44] integrates evidence-based practices to decrease the probability and severity of relapse for patients in SUD aftercare. The program draws on select components of RP, such as identifying individual risk factors and common antecedents of relapse.[4,45] However, based on mindfulness-based stress reduction[46] and mindfulness-based cognitive therapy for depression,[30] at its foundation are formal practices, such as sitting meditation, which increase awareness of and exposure to emotional and cognitive experience, and briefer informal mindfulness practices to increase awareness and behavioral flexibility in daily life.

Previous research[32] has shown that, compared with 12-step and psychoeducation-based treatment as usual (TAU) for SUDs, MBRP is associated with decreased craving and increased acceptance and awareness during a 4-month follow-up period and with decreased substance use during a 2-month follow-up period.
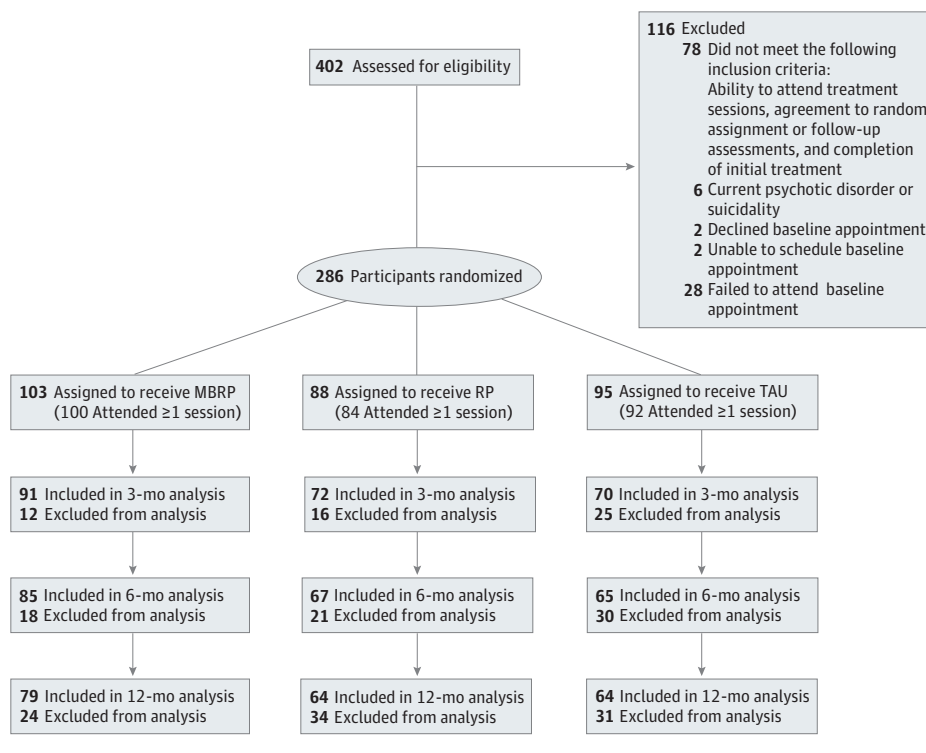
Aims and Hypotheses

Although supported by similar studies[33,47] of mindfulness-based SUD treatment, the present study is, to our knowledge, the first randomized clinical trial to assess the relative efficacy of MBRP, RP, and TAU on 12-month SUD outcomes. Given prior research,[32,35,48] we hypothesized that participants in MBRP and RP would show significant improvement on main outcomes compared with those in TAU, and MBRP participants would better maintain treatment gains over time compared with those in TAU or RP.

Methods

Participants

The study was conducted between October 2009 and July 2012. Participants (N = 286) were recruited from a 2-site private, nonprofit chemical dependency treatment agency offering medically supervised detoxification, inpatient treatment, intensive outpatient treatment, and standard aftercare (Figure). Patients at the agency typically attend approximately 1 year of aftercare after completing 28-day inpatient (60.3%) or 90-day intensive outpatient (39.7%) treatment. Study inclusion criteria were age 18 years or older, English fluency, medical clearance, ability to attend treatment sessions, agreement to random assignment and follow-up assessments, and completion of initial intensive outpatient or inpatient care. Exclusion criteria were current psychotic disorder, dementia, suicidality, imminent danger to others, or participation in previous MBRP trials. Individuals ineligible for (n = 84) or declining (n = 32) participation were excluded from study procedures and analyses (Figure).

Figure. Study Flow From Screening to Analysis

116 Excluded
- **78** Did not meet the following inclusion criteria: Ability to attend treatment sessions, agreement to random assignment or follow-up assessments, and completion of initial treatment
- **6** Current psychotic disorder or suicidality
- **2** Declined baseline appointment
- **2** Unable to schedule baseline appointment
- **28** Failed to attend baseline appointment

402 Assessed for eligibility

286 Participants randomized

103 Assigned to receive MBRP (100 Attended ≥1 session)
88 Assigned to receive RP (84 Attended ≥1 session)
95 Assigned to receive TAU (92 Attended ≥1 session)

91 Included in 3-mo analysis
12 Excluded from analysis

72 Included in 3-mo analysis
16 Excluded from analysis

70 Included in 3-mo analysis
25 Excluded from analysis

85 Included in 6-mo analysis
18 Excluded from analysis

67 Included in 6-mo analysis
21 Excluded from analysis

65 Included in 6-mo analysis
30 Excluded from analysis

79 Included in 12-mo analysis
24 Excluded from analysis

64 Included in 12-mo analysis
34 Excluded from analysis

64 Included in 12-mo analysis
31 Excluded from analysis

Reasons for exclusion from analysis across all follow-up assessments for (1) mindfulness-based relapse prevention (MBRP): withdrew from the study, enrolled as inpatient, incarcerated, refused, and unable to contact; (2) standard relapse prevention (RP): withdrew from the study, enrolled as inpatient, incarcerated, refused, unable to contact, and died; and (3) treatment as usual (TAU): withdrew from the study, incarcerated, and unable to contact.

Design and Procedures

Recruitment and Screening

Participants were recruited through posted advertisements at the treatment facilities and information/recruitment sessions conducted by research staff. Interested individuals were screened via telephone or in person.

Measures and Assessment Procedures

Eligible individuals provided written informed consent, completed baseline assessment, and were randomly assigned to the treatment condition. When the requisite number was enrolled, a new cohort began. Treatment groups typically began within 2 weeks of baseline assessment. The MBRP and RP participants were removed from primary aftercare groups during the study intervention and returned following completion of the 8-week program. The TAU participants remained in standard aftercare alongside individuals not enrolled in the study.

All assessments were conducted in private sessions with research staff. Participants unable to attend onsite posttreatment assessments could complete all assessments online, with the exception of the Timeline Follow-back,[49] which was administered via telephone with study staff. At baseline, participants reported for the 30 days before initial treatment admission and, for follow-up assessments, the period between the current and most recent assessment. Participants completed remaining web-based measures with research staff assistance available. All participants, including those in the TAU group, received $40 gift cards for each completed assessment, an additional $40 bonus for completion of all assessments, and $20 to $30 attendance bonuses. The TAU

assessment windows were yoked to active treatment assessments. No adverse events were reported during the study. All study procedures were approved by the University of Washington Institutional Review Board.

Measures

Screening

Select sections of the Structured Clinical Interview for *DSM-IV*,[50] a widely used diagnostic measure with demonstrated reliability and validity, were used to assess the presence of a psychotic disorder. The suicide assessment item from the Hamilton Depression Inventory,[51] shown to be reliable and valid,[52] was used to assess suicidality.

Individual and Treatment Characteristics

Age, sex, educational level, race, ethnicity, socioeconomic status, primary substance of abuse, prior treatment episodes,[53] and total treatment hours attended during the study were assessed at baseline (**Table 1**). A total of 71.5% of the participants were male, 42.1% were of ethnic/racial minority, and the age ranged from 18 to 70 years. Abstinence (defined as no drug use and no drinking) at baseline and the end of treatment was assessed using the Addiction Severity Index.[54] Substance dependence was measured using the Severity of Dependence Scale[55] (SDS), validated across a wide range of substances (present study, α = .85-.91).

Outcome Measures

Substance use was assessed with the calendar-formatted Timeline Follow-back,[49] which has demonstrated good reliability

Table 1. Descriptive Statistics at Baseline and During Treatment

Characteristic	No. (%)			P Value
	TAU (n = 95)	RP (n = 88)	MBRP (n = 103)	
Male sex	69 (72.6)	56 (63.6)	76 (73.8)	.16
Race/ethnicity				
Non-Hispanic white	46 (48.4)	43 (48.9)	57 (55.3)	
Black or African American	22 (23.2)	13 (14.8)	26 (25.2)	
Native American	4 (4.2)	8 (9.1)	6 (5.8)	
Asian	1 (1.1)	0	1 (1.0)	.38
Native Hawaiian/Pacific Islander	1 (1.1)	1 (1.1)	0	
Mixed	9 (9.5)	12 (13.6)	6 (5.8)	
Other, not specified	2 (2.1)	3 (3.4)	0	
Hispanic or Latino/Latina	13 (13.7)	10 (11.4)	9 (8.7)	
Unemployed	62 (65.3)	53 (60.2)	67 (65.0)	.69
Educational level				
Did not complete high school	12 (12.6)	7 (8.0)	7 (6.8)	
High school graduate/GED	45 (47.4)	33 (37.5)	52 (50.5)	.27
Some college	22 (23.2)	24 (27.3)	23 (22.3)	
College degree	16 (16.8)	24 (27.3)	21 (20.4)	
Age, mean (SD), y	37.2 (10.8)	38.9 (10.9)	39.1 (10.9)	.42
Alcohol use only	14 (14.7)	9 (10.2)	16 (15.5)	.08
Polysubstance use	79 (83.2)	75 (85.2)	81 (78.6)	.48
Treatment hours completed, mean (SD)	11.0 (7.5)	12.4 (7.0)	12.0 (6.6)	.40
Treatment sessions attended, %				
≥75	44 (46.3)	43 (48.9)	48 (46.6)	.35
≥50	17 (17.9)	18 (20.5)	16 (15.5)	.29
≥25	14 (14.7)	13 (14.8)	17 (16.5)	.76
No. of prior treatment episodes, mean (SD)	1.28 (1.18)	1.72 (1.69)	1.58 (1.52)	.14
SDS baseline, mean (SD)	8.52 (4.43)	10.27 (3.67)	9.52 (4.23)	.20
Abstinence at baseline, ASI	29 (30.5)	32 (37.2)	41 (41.6)	.35
Abstinence during treatment, ASI	44 (46.3)	52 (59.1)	65 (63.1)	.24

Abbreviations: ASI, Addiction Severity Index; GED, General Educational Development; MBRP, mindfulness-based relapse prevention; RP, relapse prevention; SDS, Severity of Dependence Scale; TAU, treatment as usual.

and validity[56] (present study, α = .99). Urinalysis drug and alcohol screenings were obtained by the treatment agency from a subset of participants (n = 199) court mandated or otherwise indicated for testing (per agency policy) and showed 74.2% overall agreement with self-report. (The results showed that 20.8% were false-negatives [substance use endorsed and negative urinalysis], and 5.0% were false-positives [substance use denied and positive urinalysis test]. False-negatives may be explained by assessment timing; urinalyses did not necessarily immediately follow substance use occasions and thus may not have detected substances, although use was still reported by participants.)

Interventions

Treatment Conditions | All conditions were group format and held at the agency sites. Participants who lapsed during the intervention could remain in their groups and received additional support as needed.

The TAU program was abstinence based, primarily process oriented, and based on the Alcoholics/Narcotics Anonymous 12-step program.[57,58] Weekly groups (n = 95) included facilitated recovery-oriented discussions in an open-group format (eg, communication and stress management). The TAU groups met 1 to 2 times weekly for 1½ hours.

The MBRP intervention was composed of 8 weekly, 2-hour sessions with 6 to 10 participants (n = 103) and 2 therapists. Each session had a central theme, such as the role of "automatic pilot" in addiction, mindfulness in high-risk situations, and balancing acceptance and action. Specifically, the first 3 weeks established a foundational awareness of physical, emotional, and cognitive phenomena. Additional sessions focused on mindfulness practices in the presence of relapse triggers and recognizing the role of thoughts in the relapse process. Final sessions emphasized balanced lifestyle, self-care and compassion, and social support. All sessions included 20- to 30-minute guided meditations, experiential skills-based practices, and discussion of practical applications.[44] Participants received handouts and audio-recorded mindfulness exercises for assigned homework and tracking sheets to monitor daily craving and mood.

The RP intervention[45,59] (n = 88) matched MBRP in time, format, size, location, and scope of assigned homework. Primary objectives included assessment of high-risk situations, cognitive and behavioral coping skills, problem solving, goal

setting, self-efficacy, and social support. Participants monitored daily craving and mood.

Treatment Adherence | Treatment adherence to RP and MBRP was established via weekly supervision and review of audio-recorded sessions. Competence for MBRP delivery was established by ratings of a randomly selected 50% of sessions from 8 MBRP cohorts, each rated by 2 of 3 independent raters (S.B., J.G., and N.C.). A 13-item competence scale, modeled on the Yale Adherence and Competence Scale,[60] Mindfulness-Based Cognitive Therapy Adherence Scale,[61] and a previously developed MBRP adherence and competence scale,[62] contained Likert-scale items (1, very poor, to 7, excellent) reflecting core processes described in the treatment manual.

Raters attended practice and review meetings until acceptable reliability was achieved, with regular recalibration sessions to prevent drift. Using 1-way random-effects models, interrater consistency was adequate for mean ratings of competence (intraclass correlation coefficient, 0.77), with mean (SD) competence rated between adequate and good (4.63 [0.42]).

Therapists | The TAU therapists were licensed chemical dependency counselors with varying professional degrees and outpatient aftercare experience. The MBRP therapists had doctoral degrees in clinical psychology (n = 4; including S.B., J.G., and N.C.), were in a doctoral training program (n = 1), or had master's degrees (n = 5). All had an established personal mindfulness practice, including attendance at intensive mindfulness meditation retreats. The RP therapists had doctoral degrees in clinical psychology (n = 6; including K.W. and S.E.C.), were in a doctoral training program (n = 1; including S.H.H.), or had master's degrees (n = 2). All study therapists had experience in cognitive-behavioral and group-based interventions and participated in a 2-day intensive training followed by ongoing training and weekly supervision with RP or MBRP experts.

Statistical Analysis

Intent-to-treat analyses were conducted using sample size–weighted orthogonal contrasts[2] between RP and MBRP vs TAU (contrast 1) and MBRP vs RP (contrast 2). Primary outcomes were time to first lapse to drug use or heavy drinking across the 12-month period following the end of the intervention and days of drug use and heavy drinking in the 90 days before follow-ups occurring 3, 6, and 12 months after the end of the intervention. Heavy drinking was defined as 4 or more drinks per occasion for women and 5 or more for men.[63] Covariates for all models included age, baseline severity of dependence, treatment hours, treatment history, and treatment site.

Cox proportional hazards regression modeling was used to assess treatment group differences in lapse to drug use and heavy drinking after controlling for covariates. Generalized linear models, specifically, negative binomial hurdle regression models, were used to examine associations between treatment group and drug use and heavy drinking days in the 90-day period before the 3-, 6-, and 12-month follow-up dates. The negative binomial hurdle model is useful when the outcome is a count (ie, days of use) and there is an inflation of zero

values,[64] and simultaneously estimates the count outcome as a logistic (eg, drug use vs no drug use, with the logistic portion predicting no drug use) and as a truncated count regression (eg, days of use). Parameters were estimated using maximum likelihood estimation, which provides the estimated variance-covariance matrix for the available data. Maximum likelihood is a preferred method for estimation when some data are missing, assuming that data are missing at random.[65]

Results

Descriptive Analyses
Participant characteristics are presented in Table 1. No significant treatment group differences were found on baseline demographic measures or abstinence status (defined as any drug or alcohol use) at baseline. There were, however, significant baseline differences on the SDS, with TAU participants reporting lower severity than RP or MBRP participants. We thus included baseline SDS scores as a covariate in all models. Regarding skills use, the majority of MBRP participants (88.3%) and all RP participants (100%) reported using skills taught in sessions at least once a week after completion of the course, and 67.6% of MBRP and 100% of RP participants gave similar reports at the 12-month follow-up.

Follow-up completion rates were not significantly different across treatment groups. Attrition analyses revealed that participants with missing data at the 12-month follow-up were significantly older ($P < .02$). Missing data at 3, 6, or 12 months were not significantly associated with other demographic measures or studied variables (eg, substance use) (all $P > .06$). Given these findings, we included age as a covariate predictor in all analyses. A previous study[23] found that treatment hours were significantly related to outcomes following MBRP. We thus included treatment hours and treatment history as covariates. Follow-up completion rates and drug use and heavy drinking at the 3-, 6-, and 12-month follow-ups are provided in **Table 2**.

Survival Analyses
Cox proportional hazards regression models were used to estimate hazard ratios for relapse to substance use and heavy drinking during the 12-month follow-up, with treatment group, age, treatment site, treatment history, treatment hours, and baseline SDS as covariates.

As evidenced by hazard ratios[3] (ie, risk of lapse given the treatment condition and other covariates) **(Table 3)**, nearly all covariates were significant predictors of each of the outcomes. Compared with TAU, the MBRP and RP groups showed a 54% decreased risk of relapse to drug use and a 59% decreased risk of relapse to heavy drinking. Compared with RP, the MBRP group showed a 21% increase in relapse risk to first drug use; the RP and MBRP groups did not differ significantly on time to the first heavy drinking day.

Generalized Linear Models
Results from the generalized linear models are provided in **Table 4**, and the main outcomes by treatment group are

Table 2. Outcome Variable Findings at Follow-up

Characteristic	TAU (n = 95)	RP (n = 88)	MBRP (n = 103)
Sample size % completed, No. (%)			
3 mo	82 (86.3)	80 (90.9)	95 (92.2)
6 mo	77 (81.1)	75 (85.2)	89 (86.4)
12 mo	76 (80.0)	72 (81.8)	83 (80.6)
Drug use days, TLFB, mean (SD)			
3 mo	5.23 (15.43)	2.09 (10.65)	3.92 (16.24)
6 mo	5.81 (19.11)	1.71 (10.77)	2.73 (12.00)
12 mo	4.63 (16.03)	6.09 (19.05)	3.06 (15.08)
Any drug use, TLFB, No. (%)			
3 mo	20 (21.0)	11 (12.5)	14 (13.6)
6 mo	20 (21.0)	7 (8.0)	10 (9.7)
12 mo	13 (13.7)	15 (17.0)	9 (8.7)
Heavy drinking days, TLFB, mean (SD)			
3 mo	2.64 (10.64)	2.13 (7.75)	1.99 (8.06)
6 mo	2.61 (9.93)	1.13 (5.96)	1.63 (8.53)
12 mo	4.65 (14.93)	3.89 (12.17)	1.44 (7.66)
Any heavy drinking, TLFB, No. (%)			
3 mo	19 (20.0)	18 (20.5)	12 (11.7)
6 mo	15 (15.8)	8 (9.1)	8 (7.8)
12 mo	19 (20.0)	17 (19.3)	8 (7.8)

Abbreviations: MBRP, mindfulness-based relapse prevention; RP, relapse prevention; TAU, treatment as usual; TLFB, Timeline Follow-back.

Table 3. Results From Cox Proportional Hazards Regression Models for Time to First Lapse

Covariate[a]	B (SE)	HR (95% CI for Hazard Odds)
Time to first drug use day		
Contrast 1: TAU (−) vs RP/MBRP (+)	−0.77 (0.05)[b]	0.46 (0.42-0.51)
Contrast 2: RP (−) vs MBRP (+)	0.19 (0.05)[b]	1.21 (1.10-1.33)
Age	−0.05 (0.002)[b]	0.95 (0.95-0.96)
Treatment history	−0.04 (0.01)[b]	0.96 (0.94-0.98)
SDS baseline	0.17 (0.005)[b]	1.18 (1.17-1.19)
Treatment hours	−0.05 (0.003)[b]	0.95 (0.95-0.96)
Treatment site, coded 0, 1	0.48 (0.04)[b]	1.61 (1.50-1.73)
Time to first heavy drinking day		
Contrast 1: TAU (−) vs RP/MBRP (+)	−0.89 (0.05)[b]	0.41 (0.37-0.46)
Contrast 2: RP (−) vs MBRP (+)	0.02 (0.06)	0.72 (0.91-1.15)
Age	0.01 (0.002)[b]	1.01 (1.01-1.02)
Treatment history	0.07 (0.01)[b]	1.08 (1.05-1.10)
SDS baseline	0.08 (0.006)[b]	1.08 (1.07-1.09)
Treatment hours	0.001 (0.003)	1.001 (0.99-1.01)
Treatment site, coded 0, 1	−0.71 (0.05)[b]	0.49 (0.45-0.54)

Abbreviations: B, unstandardized regression coefficient; HR, hazard ratio; MBRP, mindfulness-based relapse prevention; RP, relapse prevention; SDS, Severity of Dependence Scale; TAU, treatment as usual.

[a] Contrast 1 was coded with TAU as negative and RP/MBRP as positive; contrast 2 was coded with RP as negative and MBRP as positive.

[b] $P < .05$.

summarized here. There were no significant treatment group differences on drug use days, any drug use, heavy drinking days, or any heavy drinking at the 3-month follow-up.

6-Month Follow-up

For the censored count regression portion of the negative binomial hurdle model, there was a significant main effect of treatment contrast 1 on number of heavy drinking days. Among participants who drank heavily, RP and MBRP participants reported 31% fewer days of heavy drinking compared with those assigned to TAU. For the logistic portion of the model, RP and MBRP participants, as compared with TAU participants, had a significantly higher probability of abstinence from drug use and significantly higher probability of not engaging in heavy drinking. There were no significant differences between RP and MBRP at the 6-month follow-up.

12-Month Follow-up

At the 12-month follow-up, there was a significant main effect of treatment contrast 2 on number of drug use days (among those who used drugs) and probability of any heavy drinking. Among participants who reported substance use, the MBRP participants, compared with the RP participants, reported 31% fewer drug use days and a significantly higher probability of not engaging in any heavy drinking.

Discussion

To our knowledge, the present study was the first to assess the relative efficacy of MBRP, RP, and 12-step–oriented TAU programs on participants in an SUD aftercare program during a 1-year follow-up period. Across all 3 groups, the rates of substance use and heavy drinking were much lower compared with those of other SUD treatment studies.[66-68] This finding is consistent with previous research[32] conducted in the same treatment agency, which found substance use rates below 30% at

Table 4. Results From Negative Binomial Hurdle Models

Covariate[a]	Days of Use Among Those Who Used		Logistic Portion Predicting Nonuse and Nonheavy Drinking	
	B (SE)	IRR[b]	B (SE)	OR[b]
3-mo Drug use days				
Contrast 1: TAU (−) vs RP/MBRP (+)	−0.06 (0.18)	0.94	0.11 (0.12)	1.12
Contrast 2: RP (−) vs MBRP (+)	0.48 (0.25)	1.61	−0.02 (0.12)	0.98
Age	−0.07 (0.04)	0.94	0.01 (0.02)	1.01
Treatment history	0.06 (0.36)	1.06	−0.10 (0.09)	0.90
SDS baseline	−0.03 (0.18)	0.97	−0.06 (0.04)	0.94
Treatment hours	−0.002 (0.05)	0.99	0.07 (0.02)[c]	1.08[c]
Treatment site, coded 0, 1	−1.47 (1.15)	0.23	−0.58 (0.32)	0.56
6-mo Drug use days				
Contrast 1: TAU (−) vs RP/MBRP (+)	−0.44 (0.44)	0.65	0.24 (0.12)[c]	1.28[c]
Contrast 2: RP (−) vs MBRP (+)	0.52 (0.69)	1.68	−0.05 (0.18)	0.95
Age	−0.02 (0.15)	0.98	0.000 (0.02)	1.00
Treatment history	−0.25 (0.88)	0.78	−0.08 (0.09)	0.92
SDS baseline	0.21 (0.13)	1.23	−0.07 (0.04)	0.93
Treatment hours	−0.01 (0.06)	0.99	0.07 (0.03)[c]	1.08[c]
Treatment, coded 0, 1	−0.79 (0.80)	0.44	0.47 (0.35)	1.59
12-mo Drug use days				
Contrast 1 TAU (−) vs RP/MBRP (+)	−0.24 (0.15)	0.79	0.09 (0.16)	1.09
Contrast 2: RP (−) vs MBRP (+)	−0.37 (0.16)[c]	0.69[c]	0.21 (0.18)	1.24
Age	−0.09 (0.04)[c]	0.91[c]	0.02 (0.02)	1.02
Treatment history	−0.29 (0.28)	0.75	0.19 (0.17)	1.22
SDS baseline	0.11 (0.06)	1.12	−0.15 (0.09)	0.86
Treatment hours	−0.02 (0.02)	0.98	0.01 (0.02)	1.01
Treatment site, coded 0, 1	−0.25 (0.42)	0.78	0.30 (0.49)	1.35
3-mo Heavy drinking days				
Contrast 1: TAU (−) vs RP/MBRP (+)	0.33 (0.47)	1.40	0.12 (0.11)	1.12
Contrast 2: RP (−) vs MBRP (+)	−0.02 (0.30)	0.98	0.25 (0.15)	1.28
Age	−0.05 (0.02)[c]	0.95[c]	−0.03 (0.02)	0.97
Treatment history	0.49 (0.78)	1.64	−0.13 (0.12)	0.88
SDS baseline	−0.16 (0.31)	0.85	−0.04 (0.05)	0.96
Treatment hours	−0.20 (0.11)	0.82[c]	0.09 (0.02)[c]	1.09[c]
Treatment site, coded 0, 1	−1.81 (1.03)	0.16[c]	−1.03 (0.36)[c]	0.36[c]
6-mo Heavy drinking days				
Contrast 1: TAU (−) vs RP/MBRP (+)	−0.37 (0.09)[c]	0.69	0.23 (0.09)[c]	1.26[c]
Contrast 2: RP (−) vs MBRP (+)	0.57 (0.32)	1.78	−0.06 (0.19)	0.94
Age	−0.06 (0.04)	0.95	−0.01 (0.02)	0.99
Treatment history	−0.04 (0.23)	0.96	−0.04 (0.14)	0.97
SDS baseline	0.13 (0.12)	1.14	−0.03 (0.04)	0.97
Treatment hours	−0.04 (0.02)	0.96	0.02 (0.04)	1.02
Treatment site, coded 0, 1	0.21 (0.41)	1.23	−0.89 (0.61)	0.41
12-mo Heavy drinking days				
Contrast 1: TAU (−) vs RP/MBRP (+)	−0.04 (0.16)	0.97	0.17 (0.12)	1.19
Contrast 2: RP (−) vs MBRP (+)	0.37 (0.39)	1.45	0.43 (0.11)[c]	1.51[c]
Age	0.11 (0.04)[c]	1.11[c]	−0.01 (0.02)	0.99
Treatment history	−0.37 (0.20)	0.69	0.05 (0.15)	1.05
SDS baseline	0.31 (0.08)[c]	1.36[c]	0.03 (0.04)	1.03
Treatment hours	0.02 (0.02)	1.02	−0.004 (0.04)	0.99
Treatment site, coded 0, 1	1.13 (0.40)[c]	3.09[c]	−0.45 (0.38)	0.64

Abbreviations: B, unstandardized regression coefficient; IRR, incidence rate ratio; MBRP, mindfulness-based relapse prevention; OR, odds ratio; RP, relapse prevention; SDS, Severity of Dependence Scale; TAU, treatment as usual.

[a] Contrast 1 was coded with TAU as negative and RP/MBRP as positive; contrast 2 was coded with RP as negative and MBRP as positive.

[b] The IRR can be interpreted as percentage increase (above 1.0) or decrease (below 1.0) in heavy drinking or drug use days for a 1-unit increase in the predictor (with other predictors in the model held constant). The OR can be interpreted as the increase (above 1.0) or decrease (below 1.0) in the odds of not using or not engaging in heavy drinking (with other predictors in the model held constant).

[c] $P < .05$.

the 4-month follow-up. This may be the result of both continued participation in ongoing aftercare and urinalysis testing.

Between-group differences were not found at the 3-month follow-up. At the 6-month follow-up, however, both RP and MBRP participants had a significantly reduced risk of relapse to drug use and heavy drinking compared with TAU participants, with RP showing an advantage over MBRP in time to first drug use. Among participants reporting alcohol use, MBRP and

RP participants reported significantly fewer days of heavy drinking compared with TAU participants. At the 12-month follow-up, MBRP participants reported significantly fewer drug use days and higher probability of not engaging in heavy drinking compared with RP participants. These findings suggest that the treatments may be equally effective at 3 months' follow-up; both MBRP and RP, compared with TAU, blunt the probability and severity of relapses at the 6-month follow-up, with RP delaying time to first drug use; and MBRP may have a more enduring effect thereafter.

Such longer-term MBRP effects may be explained by the participants' improved ability to recognize and tolerate discomfort associated with craving or negative affect.[23,69-73] Although focus on modifying responses to distressing symptoms through acceptance-based practices has been studied in other populations,[74,75] it has been understudied in SUDs. The MBRP intervention integrates empirically tested cognitive behavioral and mindfulness-based approaches to increase awareness of individual internal and environmental events that precipitate relapse and alter responses to craving and negative affect via exposure-based processes facilitated through mindfulness practice. Continued practice over time can strengthen the ability to monitor and address factors contributing to an individual's well-being, thus supporting long-term outcomes. Previous studies have assessed mindfulness-based SUD treatment; however, only one smoking cessation trial[48] has compared mindfulness training with an empirically supported control condition. To our knowledge, the present study is the first to assess 12-month longitudinal outcomes of mindfulness meditation–based treatment vs an active evidence-based treatment for SUDs.

The following limitations are noteworthy. There were several differences between TAU and the active treatment groups, including therapist training and assignment of homework. However, RP and MBRP interventions were matched on time, structure, and therapist training, differing only in the intervention delivered, thus offering a rigorous test of MBRP. Another limitation is the self-report measures of main treatment outcomes and the limited urinalysis data, although research has shown[76,77] that self-reported substance use and urinalysis documentation are often not significantly different.

Conclusions

The present randomized trial offers evidence that RP and MBRP are beneficial aftercare interventions compared with typical 12-step aftercare treatment. In addition, MBRP resulted in significantly less drug use and a lower probability of any heavy drinking than RP at a 12-month follow-up. These findings suggest that MBRP may support longer term sustainability of treatment gains for individuals with substance-use disorders.

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