Cogn Ther Res
DOI 10.1007/s10608-013-9586-4

ORIGINAL ARTICLE

Mindfulness Practice, Rumination and Clinical Outcome in Mindfulness-Based Treatment

Lance L. Hawley · Danielle Schwartz · Peter J. Bieling · Julie Irving · Kathleen Corcoran · Norman A. S. Farb · Adam K. Anderson · Zindel V. Segal

Abstract Mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR) are particularly effective treatment approaches in terms of alleviating depressive symptoms and preventing relapse once remission has been achieved. Although engaging in mindfulness practice is an essential element of both treatments; it is unclear whether informal or formal practices differentially impact on symptom alleviation. The current study utilizes a correlational design to examine data provided by thirty-two previously depressed, remitted outpatients who received either MBCT or MBSR treatment. Outpatients in the MBCT group received treatment as part of a previously published randomized efficacy trial (Segal et al. in Arch Gen Psychiatry 67:1256–1264, 2010), while those in the MBSR group received treatment as part of a separate, unpublished randomized clinical trial. Throughout treatment, clients reported on their use of formal and informal mindfulness practices. Results indicate that engaging in formal (but not informal) mindfulness practice was associated with decreased rumination, which was associated with symptom alleviation.

Keywords MBCT · MBSR · Mindfulness practice · Depression · Rumination · Distraction

Introduction

An increasing awareness exists among healthcare professionals that mindfulness-based approaches are particularly effective in terms of alleviating depressive symptoms and preventing relapse once remission has been achieved. Interventions such as mindfulness-based cognitive therapy (MBCT; Segal et al. 2002) and mindfulness-based stress reduction (MBSR; Kabat-Zinn 1982, 1990) have demonstrated significant clinical efficacy in the treatment of various clinical presentations, including mood disorders (e.g., Segal et al. 2010), treatment resistant depression (Eisendrath et al. 2008; Kenny and Williams 2007), and anxiety disorders (Hofmann et al. 2010; Evans et al. 2008; Kim et al. 2009), leading to significant improvements in psychological functioning. Meta-analyses indicate that successful MBCT treatment is associated with symptom reduction and up to 50 % reduction in depressive relapse risk (Hofmann et al. 2010; Piet and Hougaard 2011). Similarly, researchers who have examined the efficacy of MBSR treatment have demonstrated that MBSR treatment leads to reduced depressive symptoms (Sephton et al. 2007; Shapiro et al. 1998) and improvements in various indicators of psychological well-being (Grossman et al. 2004).

Although the clinical efficacy of mindfulness-based interventions have been well established, the mechanism by which mindfulness practice leads to symptom

L. L. Hawley (✉) · D. Schwartz · J. Irving · Z. V. Segal
Centre for Addiction and Mental Health, 100 Stokes Street, Toronto, ON M6J 1H4, Canada
e-mail: lance.hawley@camh.ca

L. L. Hawley · N. A. S. Farb · A. K. Anderson · Z. V. Segal
University of Toronto, Toronto, ON, Canada

P. J. Bieling
St. Joseph's Healthcare, Hamilton, ON, Canada

K. Corcoran
Stanford University, Palo Alto, CA, USA

A. K. Anderson
Rotman Research Institute, Baycrest, Toronto, ON, Canada

Published online: 08 October 2013

alleviation is not entirely clear. When clinicians discuss mindfulness concepts with their patients, they emphasize that engaging in regular mindfulness practice is essential in order to promote lasting clinical change. This view is supported by information-processing models which propose that mindfulness practice allows for the development of enhanced capacities for regulating emotion, cognition, and behavior (Segal et al. 2002; Shapiro et al. 2006). Both MBSR and MBCT emphasize the importance of daily mindfulness practice throughout treatment—prescribing between 45 and 60 min of daily practice over the course of 8 weeks (Kabat-Zinn 1990; Segal et al. 2002). In both treatments, participants engage in mindfulness exercises that are either formally or informally structured. In a formal practice, guidance is provided involving the nature and content of the practice (e.g., suggestions are made regarding posture, attitude, and how one directs their attention) for a specific period of time. During informal practices, individuals bring mindful awareness to routine experiences that occur throughout the day; these practices are less structured, and do not require a set length of time.

In MBCT and MBSR, the assigned mindfulness practices are identical; however, there are treatment elements which are unique to each intervention; the psychoeducational material presented differs, the therapists' guided inquiry process differs, and discussions involving symptom management approaches differ regarding how mindfulness practice plays a role in assisting individuals to maintain remission from depression. Despite these differences, both approaches emphasize the fundamental importance of engaging in daily mindfulness practice in order to encourage present moment experiential awareness.

Considering the level of commitment that is involved with mindfulness-based interventions, one could assume that there is a well-established association between the amount of time an individual engages in mindfulness practices and subsequent symptom alleviation. Unfortunately, this relationship remains somewhat unclear. For an extensive review of the mixed findings involving the relative impact of mindfulness practice in MBCT and MBSR, see Vettese et al. (2009). In brief, only eight of the twenty-four studies that the authors reviewed demonstrated support for the relationship between mindfulness home practice and clinical outcome. For example, Carmody and Baer (2008) reported that formal meditation practice during MBSR treatment was significantly related to improvement in depressive symptoms, well-being, and characteristics of mindfulness. In contrast, Bondolfi et al. (2010) demonstrated that the frequency of mindfulness practice (formal or informal) following MBCT treatment did not differ based on relapse status. Taken together, there remains some degree of uncertainty regarding how forms of meditation practice may influence treatment outcome.

One possibility is that mindfulness practice is only one element of a complex process that leads to symptom alleviation. It may be that there has been a failure to model the mediating steps between practice and outcome, which may account for the mixed findings described above. Several mechanisms have been proposed in order to clarify this relationship. According to information processing models of depression, vulnerable individuals who experience dysphoric affect may experience depressive relapse when problematic forms of thinking and feeling are reinstated (Segal et al. 2002). Two relevant forms of problematic thinking are termed rumination and distraction (Nolen-Hoeksema 1991). According to the Response Styles Theory of Depression, individuals who are vulnerable to experiencing depressive episodes typically respond to depressive affect by either engaging in rumination (defined as a problematic cognitive process in which individuals repetitively focus on symptoms of distress, and on their possible causes and consequences) or distraction (in which individuals divert their attention away from depressive experiences in order to change them into neutral or pleasant thoughts and actions). Although it is believed that distraction may temporarily alleviate feelings of dysphoria, engaging in rumination often prolongs and intensifies episodes of depression. These problematic modes of thinking are considered to be well established cognitive vulnerability factors for the onset, relapse and recurrence of depressive episodes (Robinson and Alloy 2003; Nolen-Hoeksema 2000). Several studies have provided evidence suggesting that individuals who experience symptom alleviation demonstrated decreased ruminative thinking following mindfulness training (e.g., Ramel et al. 2004). Decreased rumination has been associated with symptom alleviation (Kingston et al. 2007), and reduction of depression symptoms were mediated by decreased rumination following MBCT (Van Aalderen et al. 2012). Overall, these results suggest that mindfulness practice reduces mood symptoms only to the extent that it reduces a mediating cognitive pattern such as rumination or distraction. It may be that individuals who utilize mindfulness practices on a regular basis become better able to engage in effective attention regulation strategies when they experience dysphoric affect.

The purpose of the current study was to examine the possible mediating effects of rumination and distraction in the relationship between mindfulness practice (total, formal and informal) and depression symptom change. Data from two studies were combined; the first dataset involved data resulting from an 8 week MBSR program offered by St. Joseph's Healthcare, Toronto (the details of the study design are discussed below). The second dataset involved data provided by individuals receiving an 8 week MBCT intervention as part of a randomized clinical trial; an

overview of the study design for this second dataset has been reported in Segal et al. 2010. A brief description of each study is provided below. The present study considered three hypotheses, namely: (1) considering whether participation in mindfulness training (MBCT or MBSR) was associated with changes in rumination or distraction as measured by the RSQ, (2) determining whether the frequency of formal, informal or total mindfulness practice was related to decreased rumination or distraction; and (3) if support for this relationship was found, determining whether rumination or distraction would mediate the relationship between the type of mindfulness practice and any observed changes in depressive symptoms.

Methods

The study protocols were approved by the respective Research Ethics Boards at the Centre for Addiction and Mental Health (CAMH; for the Segal et al. 2010 study), and St. Joseph's Healthcare, Toronto. Research activities were monitored by a data safety monitoring board and all participants provided written consent prior to any research activity. Meditation practice data was obtained from individuals attending an MBCT group (Segal et al. 2010), and this was combined with data provided by individuals attending an MBSR group. The MBCT group comprised 18 individuals (mean age = 42.1), while the MBSR group included 14 individuals (mean age = 39.4). The MBCT group was comprised of individuals from a parent trial comparing maintenance antidepressant medication, medication taper plus MBCT, and medication taper plus placebo (PLA); details of the treatment protocol are provided in Segal et al. (2010). The MBSR group was comprised of individuals participating in a clinical trial offered by St. Joseph's Health Centre, Toronto.[1] Participants in both treatment conditions completed 8 week treatment protocols involving 2 hour treatment sessions, and they completed self-report information throughout treatment.

Participants and Study Flow

The Structured Clinical Interview for DSM-IV (SCID; First et al. 1995) was used to determine whether participants experienced a past diagnosis of Major Depressive Disorder (MDD) involving two or more previous depressive episodes (4th ed.; DSM-IV; American Psychiatric Association 1994). All participants between 18 and 65 years of age were accepted into the study if they experienced sustained clinical remission of their depressive symptoms (defined as a 50 % reduction in HRSD and HRSD $\leq$ 7 for 8 weeks). Participants were excluded if they had a current diagnosis of Bipolar Disorder, Substance Abuse Disorder, Post Traumatic Stress Disorder, Schizophrenia, Borderline Personality Disorder or a trial of ECT within the past 6 months. Further, they were excluded if they had any current meditation or yoga practice. All interviews conducted for the MBCT group were audiotaped. Interviewers' ratings of a subset of taped assessments using the 17-item HRSD yielded an intraclass correlation coefficient of 0.94 (n = 18), and the reliability of the major depressive episode diagnosis based on the SCID, in a subset of taped interviews, yielded a coefficient of 0.82 (n = 22). Diagnoses were also confirmed by an experienced research psychiatrist. For clients in the MBSR group, prospective participants attended a comprehensive clinical assessment provided by an experienced Master's level clinician, and diagnoses were confirmed by an experienced clinical psychologist prior to acceptance into the study.

Details regarding the study design and subject recruitment for the MBCT group are detailed in Segal et al. (2010).[2] In brief, depressed participants received pharmacotherapy treatment until they achieved symptom remission before being randomly assigned to maintenance antidepressant medication, medication taper and MBCT, or medication taper and placebo. Individuals attended 8 weekly 2 h MBCT group sessions. For the MBSR group, previously depressed, remitted participants attended an 8 week MBSR program, consisting of weekly 2 h sessions. The MBSR group was run at St. Joseph's Health Centre by Jim Bean, an MBSR teacher

[1] The MBSR group was recruited from one arm of a larger neuroimaging study comparing MBSR against a Progressive Muscle Relaxation active control group. Participants were right-handed adults recruited from a community based sample. Twenty-four participants fully remitted from unipolar depression were randomized into the two active-treatment groups, including the 14 MBSR group participants. Clinical history and remitted status were confirmed through assessment with an experienced clinical psychologist. All remitted patients had a history of one more past episodes of depression at the time of recruitment, with varied levels of ongoing antidepressant medication and psychotherapy. No participants had prior exposure to formal meditation or relaxation training, with the exception of some yoga classes in the past. MBSR participants attended an MBSR course led by experienced MBSR facilitators at the Centre for Addiction and Mental Health.

[2] In the MBCT condition, participants were excluded if they had a current diagnosis of Bipolar Disorder, Substance Abuse Disorder, Schizophrenia or Borderline Personality Disorder or a trial of ECT within the past 6 months, or currently practiced meditation more than once per week or yoga more than twice per week. A full description of inclusion and exclusion criteria, treatment fidelity, and study details can be found in Segal et al. (2010). In the MBSR condition, participants were excluded if they had a current diagnosis of Bipolar Disorder, Substance Abuse Disorder, Schizophrenia, Borderline Personality Disorder, Post Traumatic Stress Disorder, or any Eating Disorder. Further, they were excluded if they had any current meditation practice or if they engaged in yoga. Given that participants completed fMRI scans, they were excluded if they carried a surgically implanted metal device such as a pacemaker.

with over 15 years of experience running the program. Jim Bean is the co-founder, instructor and director of the Mindfulness-Based Stress Reduction Clinic at St. Joseph's Healthcare and at Toronto General Hospital. The clinic provides services to more than a hundred clients annually. Specific details of the MBSR treatment protocol are available in Kabat-Zinn (1982). For the MBCT group, three therapists (2 PhD-level clinical psychologists, 1 MA-level social worker) had taught the MBCT programs in their respective clinical workplaces and they each attended a 7 day MBCT training workshop taught by Dr. Zindel Segal. Further, MBCT sessions were videotaped and rated using the Mindfulness-Based Cognitive Therapy Adherence Scale, demonstrating good adherence.

Outcome measures included indicators of depressive symptoms (HRSD-21) and rumination and distraction (RSQ); these measures were administered pre-treatment. The RSQ was re-administered on session 8, and the HRSD-21 was re-administered approximately 2 weeks following session 8. Participants provided weekly ratings of mindfulness practice using the Mindfulness Homework Practice Form (HPQ), indicating the frequency and duration of their formal, informal and total mindfulness practice during treatment.

Outcome Measures

Hamilton Rating Scale for Depression, 21 Item Version

(HRSD-21; Hamilton 1960). Participants were assessed on the 21-item HRSD by clinical evaluators blind to treatment allocation. The HRSD was administered at the beginning of treatment (T1) and approximately 2 weeks after treatment session eight (T2). The HRSD is widely used in research as an indicator of depressive symptomology due to its high interrater reliability (.78) (Sotsky and Glass 1983), high internal reliability (.46 to .97), and high retest reliability (.81 to .98) Bagby et al. (2004).

Response Styles Questionnaire

(RSQ: Nolen-Hoeksema 1991). The RSQ is a self-report questionnaire measuring both distractive and ruminative response styles to depressed mood. The RSQ was administered at the beginning of treatment (T1) and on session eight (T2). The RSQ demonstrates adequate retest reliability and internal consistency Bagby et al. (2004).

Mindfulness Homework Practice Questionnaire (HPQ)

Participants completed weekly questionnaires indicating the frequency and duration of their mindfulness practices. This practice data was categorized further, depending on whether the assigned practice was formally structured (e.g., breath awareness, body scan, mindful yoga, sitting meditation, 3 min breathing space—regular) or informally structured (e.g., mindfulness of routine activities, 3 min breathing space—in response to stress, mindful walking.) The current study analyzed the cumulative frequency of each form of practice. The values of any missing data was considered zero, in order to avoid oversestimating practice frequency.

Data Analysis

The causal steps approach (Baron and Kenny 1986) to statistical bootstrapping (Hayes 2009; Preacher and Hayes 2008) was used to examine the potential mediating roles of rumination and distraction in the relationship between the frequency of homework practice (formal, informal, and total) and changes in depressive symptoms. Our analysis of treatment mediation was rooted in the conceptual approach advocated by Kraemer specifically for randomized controlled trials (Kraemer et al. 2008). SPSS 20 software was used; the meditational analysis utilized the INDIRECT macro and syntax developed by Dr. Andrew Hayes (Preacher and Hayes 2008). For the causal steps approach, multiple regression analyses were conducted using separate analyses. Bootstrapping was accomplished by taking 5,000 random samples of the original sample size from the data and calculating the indirect product for the mediator. Bootstrapping was used in addition to the causal steps approach as it has been proposed as a more powerful method of measuring mediation (Hayes 2009). Separate analyses were conducted for formal, informal, and total mindfulness practice. Consistent with Segal et al. (2006), standardized residualized change scores were computed for the mediating variables (rumination, distraction) and depression symptom change using a regression model in which Time 1 scores predicted Time 2 scores. The standardized residuals were then used in the analyses.[3]

[3] In order to demonstrate mediation, the RSQ subscales must be measured during treatment, be significantly altered by treatment, and must temporally precede the outcome—although two time points are used, this is the case with the current data since the RSQ is measured on treatment session eight while the HRSD is measured 2 weeks following session eight. Further, the mediator must also then show a main and/or interactive effect with treatment on outcome; (i.e., the mediator and/or interaction term in the regression should be significant) while treatment need not have a significant overall or main effect on outcome. A *main* effect of mediation is demonstrated when treatment significantly changes the mediator but the effect of the mediator on outcome does not significantly differ across treatment types. In contrast, an *interactive* mediation effect occurs when treatment not only significantly impacts on the mediator but also changes the relationship between the mediator and outcome such that it differs across treatments. In the current analysis, both the HRSD and the RSQ are measured at two time points; however, the T2 HRSD was typically administered at least 2 weeks after the T2 RSQ, so the T2 RSQ temporally precedes the T2 HRSD administration.

Table 1 Demographic characteristics of groups

Variable	MBCT (n = 18)	MBSR (n = 14)	Total (n = 32)
Gender: female (%)	59.1	50.0	60.0
White (%)	72.7	90.0	83.3
Age (years)	43.1 (10.3)	45.6 (11.4)	44.1 (10.8)
No. of prior episodes	4.0 (1.0)	2.6 (0.84)	3.6 (1.19)

Results

Participant Characteristics

Information on patient demographics is presented in Table 1. Participants had a mean age of 44.1 years at study entry and 60 % of the sample was female, with 16.7 % self-identified as a member of an ethnic/racial minority group. Potential differences between the two treatment groups were examined in all analyses; there were no significant differences in patient's demographic characteristics or for any scores on the self-report measures considered here, when comparing the MBCT and MBSR groups. However, participants in the MBCT group experienced a greater number of past depressive episodes than those in the MBSR group ($p = .001$); therefore, this variable was entered as a covariate in all analyses. When mediational analyses were conducted for each group separately, there were no differences based on group. Accordingly, both groups were combined for the final analyses and the number of past major depressive episodes was added as a covariate in all analyses. Table 2 displays the intercorrelations, means, and standard deviations for all measures.

Mediation Analysis

Results of the causal steps approach are presented first (see Fig. 1). When examining path *a* (involving the relationship between the independent variable and the mediator variables), the frequency of formal mindfulness practice was the only significant predictor of changes in rumination; the frequency of informal mindfulness practice and total mindfulness practice were non-significant. No significant associations were found between frequency of formal, informal, and total mindfulness practice, as related to distraction. Path *b*, examining the relationship between the mediator (rumination, distraction) and dependent variables (depression symptom change) when controlling for the independent variable, was significant for rumination across all three types of mindfulness practice, demonstrating that decreased rumination predicted decreased depressive symptoms. No significant associations were found between distraction and depressive symptom change. For path *c*, examining the associations between the independent and dependent variables, depressive symptom change was associated with both the frequency of formal mindfulness practice and total mindfulness practice. Informal mindfulness practice was not associated with depressive symptom change. Finally, for path *c*', the relationships between depressive symptom change and both formal mindfulness practice and informal mindfulness practice remained significant. Subgroup analyses indicated that the results of the mediation analyses in either group separately yielded

Table 2 Descriptive statistics and correlations among measures

	T1 HRSD	T2 HRSD	T1 RSQ-R	T2 RSQ-R	T1 RSQ-D	T2 RSQ-D	Formal Practice	Informal Practice	Total Practice
T1 HRSD	1. 00								
T2 HRSD	.39*	1.00							
T1 RSQ-R	−.04	−.16	1.00						
T2 RSQ-R	−.09	.51*	.24	1.00					
T1 RSQ-D	.27	.25	−.02	.10	1.00				
T2 RSQ-D	.14	.04	−.03	−.13	.43*	1.00			
Formal practice	−.43*	−.73**	−.28	−.27	−.17	−.25	1.00		
Informal practice	.34	−.10	.12	.05	.29	.19	.15	1.00	
Total practice	.13	−.37*	.21	−.08	.21	.05	.53**	.91**	1.00
M	2.57	4.40	36.37	36.83	23.47	23.54	34.47	38.82	74.47
SD	2.60	4.72	8.76	10.34	4.47	4.48	22.97	46.49	53.88

$N = 32$. T1 = Time 1 (Study Entry); T2 = Time 2 (Post Treatment); *HRSD* Hamilton Rating Scale for Depression, *RSQ-R* Response Style Questionnaire, Rumination, *RSQ-D* Response Style Questionnaire, Distraction

* $p < .01$; ** $p < .05$

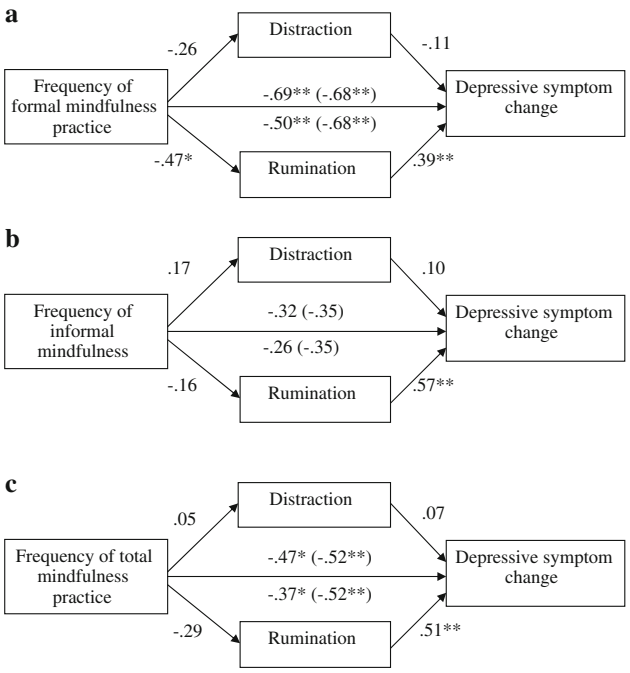

Fig. 1 Model depicting the direct and indirect effects of: **a** formal mindfulness practice, **b** informal mindfulness practice, and **c** total mindfulness practice on depressive symptoms, with rumination and distraction as mediators. Number of past major depressive episodes was included as a covariate in all analyses. Standardized regression coefficients are presented. The effect of homework practice on depressive symptom change when the mediator is not included in the model is shown in parentheses. $*p < .05$; $**p < .01$

similar significant effects as in the overall sample, with path coefficients remaining significant.[4]

Taken together, results of the causal steps approach did not support the mediating role of distraction in the relationship between the frequency of mindfulness practice and depressive symptom change. However, rumination did appear to partially mediate the relationship between formal mindfulness practice and depressive symptom change. When the mediator was included in the analyses, the direct effect, $\beta = -.68$, was reduced to $\beta = -.50$, indicating that the mediator accounted for 26.5 % of the standardized effect size of the relationship [(−.68)–(−.50)/(−.68)].

For bootstrapping analyses, only one mediational model was assessed—the indirect effect of formal mindfulness practice on depressive symptom change via rumination. This was determined as: (a) frequency of informal mindfulness practice and total mindfulness practice were not associated with distraction or rumination, and (b) formal mindfulness practice was not associated with distraction. Results of bootstrapping analyses provided further support for a significant indirect effect of formal homework practice on depressive symptom change via changes in rumination (Point estimate = −.03, SE = .02, 95 % CI [−.09, −.0003]).

Discussion

In order to better understand the relationship between mindfulness practice and relapse prevention, it is important to not only assess the scope of an individuals' practice, but also to consider what is being cultivated during this practice. One possibility is that individuals who engage in mindfulness practice may become better able to disengage from ruminative thought processes and become more experientially aware, and this process may help explain why symptom alleviation occurs. Theoretical explanations of mindfulness and vulnerability to depressive relapse provide a framework for understanding this process.

Utilizing a statistical mediation approach, we found that MBCT and MBSR participants' formal (but not informal, or total) mindfulness practice was associated with decreased rumination, which was, in turn, associated with significant reductions in depressive symptoms. Our results demonstrate that, during formal meditation practice, shifting one's attention to their present moment experience can help an individual to disengage from problematic ruminative thought processes. The very nature of rumination, which implies an expansive, self-evaluative, ineffective problem-solving orientation, is antithetical to mindfulness. Rumination can be considered as an attentional process which ultimately cultivates experiential avoidance. Shapiro et al. (2006) propose that the attitudinal qualities of acceptance, compassion and openness to the present moment which are cultivated in mindfulness practice may hold a particular benefit such that reactive self-judgments and criticisms are mitigated. As a result, the self-evaluative judgments which occur during rumination—in which an individual endlessly contemplates difficult questions such as "Why am I feeling this way?" and "What does this mean about me?" may loose their potency. This coincides with the differential activation hypothesis developed by Teasdale (1988), which proposes that reactivity is

[4] When examining each group separately, path *a* was significant for both groups; the frequency of formal mindfulness practice predicted changes in rumination although the coefficients differed (MBCT $a = -.49$, MBSR $a = -.44$). No significant associations were found between frequency of formal, informal, and total mindfulness practice, as related to distraction. Path *b*, examining the relationship between rumination and depression symptom change when controlling for the independent variable, was significant for both groups, demonstrating that decreased rumination predicted decreased depressive symptoms (MBCT $b = .43$, MBSR $b = .38$). For path *c*, depressive symptom change was associated with both the frequency of formal mindfulness practice and total mindfulness practice for both groups (MBCT $c = -.53$; MBSR $c = -.49$). Finally, for path *c*', the relationship between depressive symptom change and formal mindfulness practice remained significant for both groups (MBCT $c' = -.70$; MBSR $c' = -.65$).

heightened for individuals who have experienced several depressive episodes. These individuals are particularly vulnerable to symptom recurrence when they experience even mild, transient negative mood states, which may reactivate problematic thought patterns (i.e., rumination) that were present during previous episodes of depression and that serve to perpetuate dysphoria (Segal et al. 1996; Teasdale 2004).

The results did not support a significant mediational relationship between distraction and symptom alleviation. It is not entirely clear why this would occur, although several studies have found a similar pattern of results (e.g., Jain et al. 2007) in which rumination (but not distraction) has a mediational role in terms of symptom alleviation. This suggests that the benefits of mindfulness training are not merely due to a generalized tendency to reduce regulatory efforts involving attentional control, in which case distraction would also have been reduced with training. Instead, it appears that mindfulness selectively engages with ruminative habits and addresses the tendency to dwell on distressing, affectively charged thought processes. There may be a difference between the general attentional process of becoming aware of an experience (reducing distraction) in comparison to becoming experientially aware and cultivating the ability to disengage from a distressing cognitive pre-occupation (reducing rumination). The differential activation hypothesis predicts that negative thoughts will return when clients no longer engage in distraction, while mindfulness allows individuals to engage with (and thereby diminish) distressing thoughts. It is perhaps for this reason that studies directly comparing mindfulness, rumination and distraction have found some benefit to distraction but less efficacy compared to mindfulness (Broderick 2005).

Our findings did not support the direct relationship of informal mindfulness practice and associated changes on clinical outcome measures. This result is consistent with other researchers (e.g., Carmody and Baer 2008), who noted that it may be difficult for participants to recall and estimate the time they spend engaging in informal "everyday mindfulness" practices, due to the spontaneous nature of these practices. Compared to formal practices, informal practices are less structured, and they do not have a set length of time, which may lead to reporting biases (Bowen and Kurz 2012). However, the importance of engaging in informal practice should not be discounted; during these practices, mindfulness skills can become generalized, and they can be used strategically in order to allow an individual to better cope with difficult experiences. The ability to respond mindfully to stressful situations is likely an important factor for maintaining wellness for previously depressed individuals. This is consistent with diathesis-stress models of depressive relapse, in which individuals who are engage in suitable coping strategies in response to stress (perhaps, by using a strategy such as the responsive 3 min breathing space), are less likely to experience depressive relapse when experiencing dysphoric mood associated with problematic thinking patterns (i.e., rumination) (e.g., Monroe and Simons 1991). Regardless, adopting a more precise measurement of informal practice would be beneficial.

The current study holds several strengths; it is the first study to examine the relationship between specific forms of mindfulness practice and symptom alleviation, considering distraction and rumination as potential mediating factors. Vettese et al. (2009) have discussed the importance of including analyses of practice effects as they contribute to clinical change. The findings are consistent with existing theoretical frameworks for operationalizing the association of mindfulness strategies and depressive relapse (Shapiro et al. 2006; Teasdale et al. 1995). This study also has several limitations including the reliance upon self-report measures, and the lack of post-treatment follow-up data (for the MBSR condition), which does not allow us to speak conclusively to the impact of formal mindfulness practice following treatment. Furthermore, given the scarcity of practice data, there was a need to combine data from two clinical trials; although there were no significant differences among the outcome variables when comparing groups, this practice is not ideal. Several methodological differences occurred between the two treatment groups; inter-rater reliability estimates were not obtained for the MBSR condition as only one experienced clinician administered the clinical interviews. Given the small sample size of our combined dataset, it is possible that the generalizability of our findings may be impacted. Treatment adherence was measured, but treatment competence was not. Finally, mindfulness practice was measured using a previously employed, yet non-validated measure—the HPQ. The HPQ does not have established psychometric properties; it is merely a log in which individuals list the frequency and duration of their practice—there are no contextual items to consider.

Considering future directions, examining each component of the differential activation model would be of value by considering the temporal relationship of rumination and decentering (e.g., Allen et al. 2009; Beiling et al. 2012) and symptom alleviation during mindfulness training. Decentering involves the ability to shift one's attention away from identifying personally with thoughts and feelings, while rumination involves the tendency to directly focus on the causes, consequences and symptoms of distress. The temporal relationships of these variables could be clarified further by using a comprehensive diathesis stress model investigating whether the specific steps that have been proposed in the differential activation hypothesis occur in a

specified order, utilizing an appropriate statistical framework (e.g., Hawley et al. 2006, 2007). It would be valuable to understand the process by which a vulnerable individual who experiences a stressor consistent with their vulnerability domain, may engage in a mindfulness practice which either allows them to decenter (observing their thoughts and feelings as temporary, objective events in the mind) and/or become less ruminative, leading to subsequent symptom alleviation. Clarifying the specific chronology and interrelationship of these factors would allow for a more comprehensive understanding of this theoretical framework.

Acknowledgments This study was funded, in part, by Grant #066992 (R01: Dr. Segal) from the National Institute of Mental Health, Bethesda, MD. We thank the following colleagues for contributing to this research. Robert Cook, Lawrence Martin and Jennifer Brasch served as study psychiatrists. Shelly Ferris, Kate Szacun-Shimizu, and Karyn Hood served as study coordinators. Susan Woods and Theresa Casteels served as MBCT study therapists. Lori Hoar, Joanne Nault, Rebecca Pedersen and Zoe Laksman served as project interviewers, Bao Chau Du and Heidy Morales provided research support. Tom Buis and Andrew Pedersen provided programming and data analytic support. David Streiner provided statistical and study design consultation. Karen Brozina-Hawley assisted with proofreading and editing.

Conflict of interest None.

References

Allen, M., Bromley, A., Kuyken, W., & Sonnenberg, S. J. (2009). Participants' experiences of mindfulness-based cognitive therapy: "It changed me in just about every way possible". *Behavioural and Cognitive Psychotherapy, 37*, 413–430.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.

Bagby, M. R., Rector, N. A., Bacchiochi, J. R., & McBride, C. (2004a). The Stability of the Response Styles Questionnaire Rumination Scale in a sample of participants with major depression. *Cognitive Therapy and Research, 28*(4), 527–538.

Bagby, M. R., Ryder, A. G., Schuller, D. R., & Marshall, M. B. (2004b). The Hamilton Depression Rating Scale: Has the gold standard become a lead weight? *The American Journal of Psychiatry, 161*, 2163–2177.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173–1182.

Beiling, P. J., Hawley, L. L., Bloch, R. T., Corcoran, K. M., Levitan, R. D., Young, L. T., et al. (2012). Treatment-specific changes in decentering following mindfulness-based cognitive therapy versus antidepressant medication or placebo for Prevention of Depressive Relapse. *Journal of Consulting and Clinical Psychology, 80*(3), 365–372.

Bondolfi, G., Jermann, F., Van der Linden, M., Gex-Fabry, M., Bizzini, L., Rouget, B. W., et al. (2010). Depression relapse prophylaxis with mindfulness-based cognitive therapy: Replication and extension in the Swiss health care system. *Journal of Affective Disorders, 122*, 224–231.

Bowen, S., & Kurz, A. S. (2012). Between- session practice and therapeutic alliance as predictors of mindfulness after mindfulness-based relapse prevention. *Journal of Clinical Psychology, 68*(3), 236–245.

Broderick, P. C. (2005). Mindfulness and coping with dysphoric mood: Contrasts with rumination and distraction. *Cognitive Therapy and Research, 29*(5), 201–510.

Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine, 31*, 23–33.

Eisendrath, S. J., Delucchi, K., Bitner, R., Fenimore, P., Smit, M., & McLane, M. (2008). Mindfulness-based cognitive therapy for treatment-resistant depression: A pilot study. *Psychotherapy and Psychosomatics, 77*(5), 319–320.

Evans, S., Ferrando, S., Findler, M., Stowell, C., Smart, C., & Haglin, D. (2008). Mindfulness-based cognitive therapy for generalized anxiety disorder. *Journal of Anxiety Disorders, 22*, 716–721.

First, M. B., Spitzer, R. L., Gibbon, M. & Williams, J. B. W. (1995). *Structured Clinical Interview for DSM-IV Axis I Disorders (SCIDIP).* Washington, DC: American Psychiatric Press.

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research, 57*, 35–43.

Hamilton, M. (1960). A rating scale for depression. *Journal of Neurology, Neurosurgery and Psychiatry, 23*, 56–62.

Hawley, L. L., Moon-Ho, R. H., Zuroff, D. C., & Blatt, S. J. (2006). The relationship of perfectionism, depression and therapeutic Alliance during treatment for depression: Latent difference score analysis. *Journal of Consulting and Clinical Psychology, 74*(5), 930–942.

Hawley, L. L., Moon-Ho, R. H., Zuroff, D. C., & Blatt, S. J. (2007). Stress reactivity following the brief treatment for depression: Differential relapse in psychotherapy and pharmacotherapy. *Journal of Consulting and Clinical Psychology, 75*(2), 244–256.

Hayes, A. F. (2009). Beyond Bron and Knny: Statistical mediation analysis in the new millennium. *Communication Monographs, 76*(4), 408–420.

Hofmann, S. G., Sawyer, A. T., Witt, A. A., et al. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 78*, 169–183.

Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., et al. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioral Medicine, 33*(1), 11–21.

Kabat-Zinn, J. (1982). An out-patient program in behavioral medicine for chronic pain participants based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry, 4*, 33–47.

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Delacorte.

Kenny, M. A., & Williams, J. M. G. (2007). Treatment resistant depressed participants show a good response to mindfulness-based cognitive therapy. *Behaviour Research and Therapy, 45*, 617–625.

Kim, Y., Lee, S., Choi, T., Suh, S., Kim, B., Kim, C., et al. (2009). Effectiveness of mindfulness-based cognitive therapy as an adjuvant to pharmacotherapy in participants with panic disorder or generalized anxiety disorder. *Depression and Anxiety, 26*, 601–606.

Kingston, J., Chadwick, P., Meron, D., & Skinner, T. C. (2007). A pilot randomized control trial investigating the effect of mindfulness practice on pain tolerance, psychological well-being, and

physiological activity. *Journal of Psychosomatic Research, 62*, 297–300.

Kraemer, H. C., Kiernan, M., Essex, M., & Kupfer, D. J. (2008). How and why criteria defining moderators and mediators differ between the Baron & Kenny and MacArthur approaches. *Health Psychology, 27*(Suppl 2), S101–S108.

Monroe, S. M., & Simons, A. D. (1991). Diathesis-stress theories in the context of life stress research: Implications for the depressive disorders. *Psychological Bulletin, 110*, 406–425.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100*, 569–582.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*(3), 504–511.

Piet, J., & Hougaard, E. (2011). The effect of mindfulness-based cognitive therapy for prevention of relapse in recurrent major depressive disorder: A systematic review and meta-analysis. *Clinical Psychology Review, 31*, 1032–1040.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891.

Ramel, W., Goldin, P. R., Carmona, P. E., & McQuaid, J. R. (2004). The effects of mindfulness meditation on cognitive processes and affect in participants with past depression. *Cognitive Therapy and Research, 28*(4), 433–455.

Robinson, M. S., & Alloy, L. B. (2003). : Negative cognitive styles and stress-reactive rumination interact to predict depression: A prospective study. *Cognitive Therapy and Research, 27*, 275–291.

Segal, Z. V., Bieling, P. J., Young, T., MacQueen, G., Cooke, R., Martin, L., et al. (2010). Antidepressant monotherapy versus sequential pharmacotherapy and mindfulness-based cognitive therapy, or placebo, for relapse prophylaxis in recurrent depression. *Archives of General Psychiatry, 67*, 1256–1264.

Segal, Z. V., Kennedy, S., Gemar, M., Hood, K., Pedersen, R., & Buis, T. (2006). Cognitive reactivity to sad mood provocation and the prediction of depressive relapse. *Archives of General Psychiatry, 63*, 749–755.

Segal, Z. V., Williams, J. M., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse*. New York: Guilford Press.

Segal, Z. V., Williams, J. M., Teasdale, J. D., & Gemar, M. (1996). A cognitive science perspective on kindling and episode sensitization in recurrent affective disorder. *Psychological Medicine, 26*, 371–380.

Sephton, S., Salmon, P., Weissbecker, I., Ulmer, C., Floyd, A., Hoover, K., et al. (2007). Mindfulness meditation alleviates depressive symptoms in women with fibromyalgia: Results of randomized clinical trial. *Arthritis and Rheumatism, 57*, 77–85.

Shapiro, S., Carlson, L., Astin, J., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62*, 373–386.

Shapiro, S., Schwartz, G., & Bonner, G. (1998). Effects of a mindfulness-based stress reduction on medical and premedical students. *Journal of Behavioral Medicine, 21*, 581–599.

Sotsky, S., & Glass, D. (1983). *The Hamilton Rating Scale: A critical appraisal and modification for psychotherapy research*. Sheffield: Paper presented at the annual convention for the Society for Psychotherapy Research.

Teasdale, J. D. (1988). Cognitive vulnerability to persistent depression. *Cognition and Emotion, 2*, 247–274.

Teasdale, J.D. (2004). Mindfulness-based cognitive therapy. (pp. 270-289). J. Yiend (Ed). Cognition, emotion and psychopathology: Theoretical, empirical and clinical directions. viii, 312 pp. New York, NY, US: Cambridge University Press; US.

Teasdale, J. D., Segal, Z. V., & Williams, J. M. G. (1995). How does cognitive therapy prevent relapse and why should attentional control (mindfulness) training help? *Behaviour Research and Therapy, 33*, 25–39.

Van Aalderen, J. R., Donders, A. R. T., Giommi, F., Spinhoven, P., Barendregt, H. P., & Speckens, A. E. M. (2012). The efficacy of mindfulness-based cognitive therapy in recurrent depressed participants with and without a current depressive episode: A randomized controlled trial. *Psychological Medicine, 42*(5), 989–1001.

Vettese, L. C., Toneatto, T., Stea, J. N., Nguyen, L., & Wang, J. J. (2009). Do mindfulness meditation participants do their homework? And does it make a difference? A review of the empirical evidence. *Journal of Cognitive Psychotherapy, 23*(3), 198–225.