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Shorter communication

Mindfulness-based stress reduction for patients with anxiety disorders: Evaluation in a randomized controlled trial

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ABSTRACT

The aim of this study was to investigate the effect of mindfulness-based stress reduction (MBSR) for patients with heterogeneous anxiety disorders. Seventy-six self-referred patients were randomized to MBSR or a waiting-list control condition. Eight participants did not complete the eight-week MBSR intervention. Treatment completers improved significantly on all outcome measures compared to controls. The completer sample showed medium to large effect sizes on measures of anxiety (Cohen's $d = 0.55–0.97$), and a large effect size for symptoms of depression (Cohen's $d = 0.97$). Intention-to-treat analyses yielded effect sizes in the small to moderate range (Cohen's $d = 0.32–0.76$). Gains were maintained at six months follow-up. The percentage of participants reaching recovered status was highest for symptom measures of depression and anxiety, and lower for worry and trait anxiety. Mediation analyses indicated that mindfulness fully mediated changes in acute anxiety symptoms, and partially mediated changes in worry and trait anxiety. However, the present study did not find evidence of temporal precedence for the proposed mediator. In the absence of true mediation and an active control condition, it cannot be ruled out that results are due to non-specific aspects of treatment. Despite these and other limitations, we conclude that MBSR is an effective treatment for anxiety disorders and related symptomatology.

Anxiety disorders include a diverse set of phenotypes, but there are also important shared psychological processes involved in the instigation and maintenance of the various disorders (Mansell, Harvey, Watkins, & Shafran, 2009). Such transdiagnostic processes include attentional biases to threat (Mathews & MacLeod, 2005), repetitive negative thinking (Ehring & Watkins, 2009), self-focused attention (Mor & Winquist, 2002), tension and hyper-arousal (Craske et al., 2009), avoidance behavior (Shear, Bjelland, Beesdo, Gloster, & Wittchen, 2007), and deficiencies in emotion regulation (Campbell-Sills & Barlow, 2007). These processes are all characterized by a reactive relationship to experience, that is, a tendency to negative self-absorption accompanied by widespread attempts to avoid, control or suppress internal events (Roemer, Erisman, & Orsillo, 2008). Consequently, it is of interest whether transdiagnostic interventions aimed at facilitating a less reactive relationship to experience can be helpful for patients suffering from anxiety disorders.

One potential avenue for the augmentation of the current treatment repertoire for anxiety disorders in this direction is the use of mindfulness-based interventions (MBIs). Mindfulness can be defined as "paying attention, in a particular way: on purpose, in the present moment, with acceptance" (Kabat-Zinn, 1994, p. 4). It is assumed that the intentional cultivation of this capacity in MBIs can reduce maladaptive efforts to control or remove anxiety. Instead, physiological arousal or negative thoughts can be seen as transient events, and will be allowed to fluctuate naturally without triggering secondary reactions to one's distress that might increase its intensity and duration (Roemer et al., 2008). The various exercises whereby mindfulness is cultivated can be understood as opportunities for exposure and desensitization to internal events that would habitually be avoided or suppressed, potentially enabling a more flexible stance to difficult experience (Baer, 2007).

Clinical trials of MBIs for anxiety disorders indicate that these interventions lead to substantial reduction in anxiety severity and comorbid symptomatology (Kim et al., 2009; Koszycki, Benger, Shlik, & Bradwejn, 2007; Lee et al., 2007). A recent systematic review and meta-analysis found MBIs to have within-group effect sizes in the large range when employed on clinical groups with anxiety symptoms (Hofmann, Sawyer, Witt, & Oh, 2010).

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The aim of the present study was to investigate the potential of MBSR as a transdiagnostic intervention by examining the effects of mindfulness-based stress reduction (MBSR) (Kabat-Zinn, 1990) for patients with panic disorder with or without agoraphobia (PD/AG), social anxiety disorder (SAD), and generalized anxiety disorder (GAD). We employed a randomized controlled design, comparing a treatment and a delayed-treatment waiting-list condition. To assess the clinical significance of the findings, indices of reliable change and clinical significance were calculated. We also examined whether self-reported trait mindfulness would act as a statistical mediator of any effects found on anxiety, worry, and depression.

Method

Participants

Patients were recruited through a newspaper advertisement soliciting for individuals with anxiety symptoms that were willing to take part in a clinical trial of a novel treatment for anxiety disorders. Inclusion criteria were that patients 1) be between 18 and 65 years, and 2) fulfill diagnostic criteria for either PD/AG, SAD, or GAD. Exclusion criteria were: 1) suicidality, 2) substance abuse and/or dependence, 3) severe mental disorder (psychosis or bipolar disorder), 4) other Axis I disorders as primary diagnosis, 5) use of anxiolytics, 6) deficits in impulse control as assessed by the MINI module for antisocial personality disorder, and 7) other concurrent treatment. These criteria allowed for the presence of comorbid Axis I symptomatology, provided that patients had anxiety disorder as a primary diagnosis. Concurrent SSRI or MAOI use was allowed provided a stable dosage $>$ 3 months and willingness not to alter dosage. Fig. 1 illustrates patient flow in the study.

Procedures

After a preliminary telephone screening, eligible participants ($n = 106$) met for clinical history taking and a structured clinical interview. Participants also completed self-report instruments for baseline assessment. For the diagnostic assessment, we used the Norwegian version of the Mini International Neuropsychiatric Interview [MINI] (Sheehan et al., 1998; Norwegian version Leiknes, Malt, Malt, & Leganger, 2007). The first author conducted the clinical history taking and administered the MINI.

Design

After diagnostic evaluation and intake assessment, patients were randomly assigned to a treatment group or a waiting-list control group. Recruitment and treatment was carried out in two separate cohorts. The waiting-list period lasted for the duration of the treatment period, and the control group entered active treatment after 8 weeks. Self-report measures for both groups were collected at baseline, at the start of treatment, midway through treatment and post-treatment. A follow-up assessment using the same measures was conducted 6 months after treatment.

Treatment

MBSR was delivered by the first author employing the protocol developed by Kabat-Zinn (1990). The intervention consists of three main components: 1) didactical material covering the concept of mindfulness, the psychology and physiology of stress and anxiety, and ways in which mindfulness can be implemented in everyday life to facilitate more adaptive responses to challenges and distress, 2) mindfulness exercises during the group meetings and as homework between sessions, and 3) discussion and sharing in pairs and in the larger group. The MBSR program includes eight weekly 2.5 h sessions, a half-day meditation retreat after class 6, daily home practice based on audio CDs with instruction, and a daily record keeping of mindfulness exercises. Formal mindfulness exercises include the body scan, sitting meditation with awareness of breath, and mindful movement. In keeping with the transdiagnostic nature of MBSR, the intervention was not specifically tailored to patients with anxiety diagnoses. Instead, symptoms of anxiety were framed as specific incidents of a ubiquitous tendency to experience distress as a function of relating to experience in a reactive manner.

Instruments

Beck Anxiety Inventory (BAI)

The BAI (Beck & Steer, 1993) is a 21-item scale that measures cognitive, somatic, and affective symptoms of anxiety. The Cronbach alpha coefficient was 0.87.

PennState Worry Questionnaire (PSWQ)

PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item measure assessing the key GAD symptom of excessive and uncontrollable worry. Crohnbach alpha was 0.85.

The SpielbergerState Trait Anxiety Inventory (STAI)

STAI (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) consists of two separate scales of 20 items each, measuring transient anxiety symptoms (state) and trait anxiety. Crohnbach alpha coefficients were 0.91 and 0.89, respectively.

Beck Depression Inventory (BDI-II)

BDI-II (Beck, Steer, & Brown, 1996) is a 21-item self-report scale for assessing depressive symptoms over the past 2 weeks. Cronbach alpha was 0.88.

Symptom Checklist 90 – Revised Edition (SCL-90-R)

SCL-90-R (Derogatis, 1992) is a 90-item questionnaire for measuring symptom load across a number of domains. A summary measure, the General Severity Index (GSI) is a measure of overall psychological distress. Cronbach alpha was 0.96.

Bergen Insomnia Scale (BIS)

BIS (Pallesen et al., 2008) measures sleep disturbances. The scale contains six items that correspond to the diagnostic criteria for insomnia in DSM-IV-TR (American Psychiatric Association, 2000). The BIS provides a total score on a continuous scale and a categorical score for the presence of insomnia. Cronbach alpha was 0.80.

Five-Factor Mindfulness Questionnaire (FFMQ)

FFMQ (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) is a self-report instrument measuring a trait-like general tendency to be mindful in daily life. It consists of 39 items assessing five facets of mindfulness: Observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience. In order to keep our analytic procedure as parsimonious as possible, we chose to use only the total score of the FFMQ in the present analyses. Cronbach alpha for the total mindfulness score was 0.90.

Practice log

Patients were asked to keep a daily log detailing the type of formal practice engaged in and the time spent on mindfulness training daily.

Ethics

The study was approved by the Regional Committee for Medical Research Ehics in Western Norway.

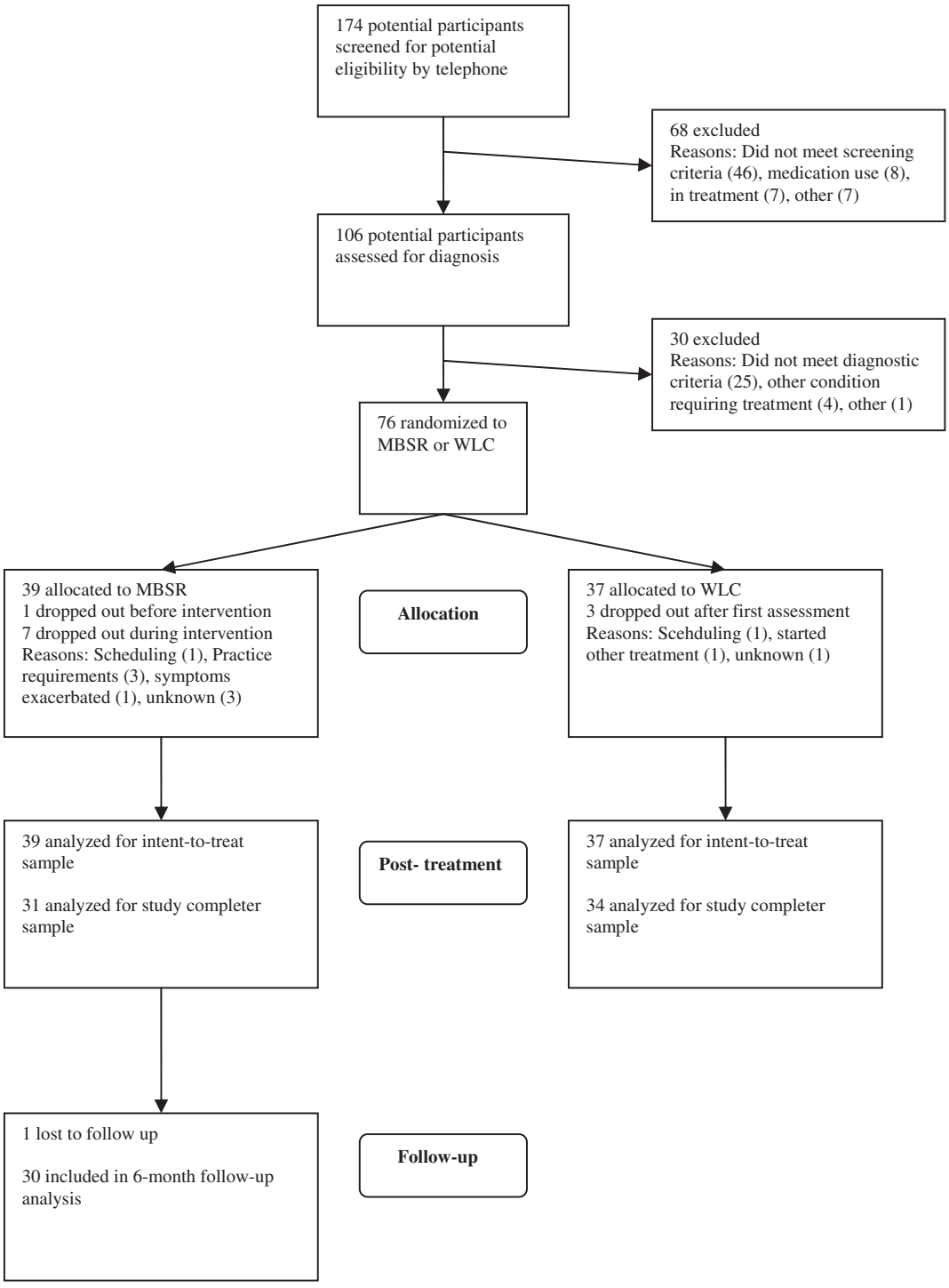

Fig. 1. Participant flow chart.

Results

Baseline characteristics

Patient characteristics and diagnostic information are presented in Tables 1 and 2. Thirty-eight participants (50%) in the sample had a primary diagnosis of PD/AG, 25 (32.9%) a primary diagnosis of SAD, and 13 (17.1%) a primary diagnosis of GAD. Thirty participants (39.5%) had a comorbid mood disorder, while 20 (26.3%) had at least one comorbid anxiety disorder. Independent samples *t*-tests and chi-square tests were used to compare the groups on demographic variables and outcome variables at baseline. At baseline there were no significant differences between the groups in age, gender, or education. The only significant difference between the treatment group and the waiting list was for self-reported years since onset of anxiety disorder ($t = -2.09$, $p = 0.04$). No significant baseline group differences were found for any of the outcome measures (Table 2), indicating that randomization was successful.

Table 1
Patient characteristics and diagnostic information.

	Total ($n = 76$)		MBSR ($n = 39$)		WLC ($n = 37$)	
	n	%	n	%	n	%
Gender (Female)	51	67.1	26	66.7	25	67.6
Age (M, SD)	42.5	11.3	41.4	11.0	43.5	11.6
Education (years)(M, SD)	15.3	3.2	15.6	3.2	15.0	3.2
Years since onset* (M, SD)	16.3	13.4	13.1	9.7	19.7	16.0
Marital status						
Single/divorced	23	30.3	12	30.8	11	29.7
Married/partner	53	69.7	27	69.2	26	70.3
Primary diagnosis						
Panic with or without AG	38	50	21	53.8	17	45.9
Social anxiety disorder	25	32.9	10	25.6	15	40.5
GAD	13	17.1	8	20.5	5	13.5
Comorbid mood disorder						
First episode depression	5	6.6	2	5.1	3	8.1
Recurrent depression	17	22.4	11	28.2	6	16.2
Dysthymia	8	10.5	3	7.7	5	13.5
Comorbid anxiety disorder[a]	20	26.3	13	33.3	7	18.9
Antidepressant medication	21	27.6	13	33.3	8	21.6
Insomnia	56	73.7	28	71.8	28	75.7

*$p < 0.05$ (between MBSR and WLC).
[a] For patients with a primary diagnosis of PD/AG, the most frequent comorbid anxiety disorder was GAD ($n = 5$). For patients with primary diagnosis of SAD or GAD, the most frequent comorbid anxiety disorder was GAD ($n = 5$) and PD/AG ($n = 3$), respectively.

Attrition and adherence to treatment

One patient randomized to MBSR did not start treatment. Of the 38 patients who started, seven (18%) terminated prematurely. One person dropped out of treatment due to scheduling problems, while three reported that they felt unable to comply with the practice requirements. One participant chose to leave the program due to symptom exacerbation during the first weeks of MBSR. No other adverse effects of participation were reported. For the remaining three participants reasons for discontinuing treatment are not known. The seven partcipants who dropped out during the intervention attended an average of three sessions.

Of the 31 treatment completers, five (16%) attended seven group meetings and 24 (77%) attended eight meetings (mean number of attendances = 7.6, SD = 0.84). Homework logs for at least five weeks were available for 27 of the 31 completers. Participants practiced mindfulness exercises on average 34 min a day, with mean scores ranging from 21 to 78 min. According to retrospective reports collected at follow-up, 84% reported that they had continued to practice mindfulness to some extent after the course. Sixteen per cent reported doing formal exercises daily, 24% 4–5 times a week and 32% 2–3 times a week.

Table 2
Means and standard deviations for the treatment groups at baseline.

	Total ($n = 76$)		MBSR ($n = 39$)		WLC ($n = 37$)	
	M	SD	M	SD	M	SD
BAI	19.2	9.0	20.4	9.4	18.0	8.5
PSWQ	62.8	9.7	63.3	11.2	62.3	8.0
STAI-state	41.0	8.9	40.5	9.2	41.5	8.6
STAI-trait	53.3	9.9	52.8	11.0	53.7	8.7
BDI-II	16.9	8.6	17.3	9.0	16.4	8.2
SCL-90-R (GSI)	1.3	0.5	1.3	0.6	1.3	0.5
BIS	17.7	9.5	17.3	9.5	17.7	9.5
FFMQ	115.2	18.7	114.4	20.6	116.0	16.7

Abbreviations: MBSR = Mindfulness-based stress reduction; WLC = Waiting-list control group; BAI = Beck Anxiety Inventory; PSWQ = Penn State Worry Questionnaire; STAI = State-Trait Anxiety Inventory; BDI = Beck Anxiety Inventory; SCL-90-R (GSI) = Global Severity Index of Symptom Checklist 90 – Revised; BIS = Bergen Insomnia Scale; FFMQ = Five-factor Mindfulness Questionnaire (total score).

Treatment effect – intention-to-treat sample

Treatment effects were analyzed using analysis of covariance (ANCOVA) comparing post-treatment/waiting-list scores of MBSR and WLC, using pre-treatment scores as covariates. ANCOVAs revealed significant group × time interactions for BAI, PSWQ, STAI-S, and STAI-T (Table 3). Significant effects were also found for BDI-II and the General Severity Index of SCL-90-R. For insomnia symptoms as measured by BIS, no difference in total score between the groups was found. There was a significant treatment effect on total mindfulness score on the FFMQ. Thus, the MBSR group differed significantly from the waiting-list group after treatment on all outcome measures except sleep disturbance.

Treatment effect – completer sample

Eight participants did not complete treatment. After removing these participants from the analysis, ANCOVAs showed MBSR to differ significantly from the waitlist group on all outcome variables (Table 4).

Follow-up

Thirty of 39 MBSR participants completed follow-up assessment after 6 months (Table 4). As the waiting-list control group had entered treatment at this point, between-group comparisons were not possible. Paired-samples *t*-tests were used to compare post-treatment values with 6-month follow-up values for the treatment group. There were no significant differences in any outcome scores from post-treatment to follow-up, indicating that treatment gains were maintained.

Clinical significance

Clinical significance was assessed according to criteria suggested by Jacobson and Truax (1991) for determining reliable clinical improvement and recovery. The proportion of patients meeting these criteria was calculated for the completer sample. In order to facilitate comparison of the present findings with those of other studies, standardized clinical significance criteria or criteria calculated for large samples of patients were used. The criteria were as follows: BAI: reliable change index = 10, cut-off point ≤ 10 (Westbrook & Kirk, 2005); STAI-Trait: reliable change index = 8, cut-point ≤ 45 (Fisher & Durham, 1999); PSWQ: reliable change index = 7, cut-off point ≤ 47 (Fisher, 2006); BDI-II: reliable change index = 8.46, cut-off point ≤ 14 (Seggar, Lambert, & Hansen, 2002). Percentages of participants who reached recovered (reliable and clinically significant change) and improved (reliable change only) status are presented in Table 5. The highest percentages of improvement were observed for BAI and BDI-II. A high percentage of participants (81%) had BAI scores in the clinical range prior to treatment, and 44% of these were categorized as recovered after treatment. The percentages of participants reaching recovered status for STAI-T and PSWQ were more modest (36% and 26%, respectively). However, the percentage of participants reaching *either* recovery or reliable improvement was similar across measures (64% for BAI, 68% for STAI-T, 65% for the PSWQ, and 65% for BDI-II). About two-thirds of participants showed at least some benefit from participation, while the remaining one-third was unchanged.

Table 3
Effect of treatment on outcome – ITT sample.

Variables	MBSR ($n = 39$)			WLC ($n = 37$)				
	M	SD	ES (within)	M	SD	ES (within)	F (1,74)	ES (between)
BAI								
Pre-treatment	20.4	9.4		18.0	8.5			
Post-treatment	12.2	10.5	0.82	15.5	10.1	0.26	6.3*	0.32
PSWQ								
Pre-treatment	63.3	11.2		62.3	8.0			
Post-treatment	54.5	13.4	0.71	61.1	10.2	0.13	13.5***	0.55
STAI-S								
Pre-treatment	40.5	9.2		41.5	8.6			
Post-treatment	36.5	12.6	0.36	45.7	11.7	−0.41	13.0**	0.76
STAI-T								
Pre-treatment	52.8	11.0		53.7	8.7			
Post-treatment	44.5	12.6	0.70	52.4	9.3	0.15	16.5***	0.71
BDI-II								
Pre-treatment	17.3	9.0		16.4	8.2			
Post-treatment	10.8	9.9	0.69	16.2	8.9	0.02	12.7**	0.58
SCL-90-R								
Pre-treatment	1.3	0.6		1.3	0.5			
Post-treatment	0.8	0.7	0.80	1.2	0.6	0.22	13.0**	0.57
BIS								
Pre-treatment	17.3	9.5		17.7	9.5			
Post-treatment	13.4	10.9	0.38	16.2	9.1	0.16	3.3	0.28
FFMQ								
Pre-treatment	114.4	20.6		116.0	16.7			
Post-treatment	125.7	22.3	0.53	114.4	16.3	−0.10	12.9**	0.58

BSR = Mindfulness-based stress reduction; WLC = Wait-list control group; resales we are wiling to do so. Abbreviations: ITT = Intention-to-treat; MBSR = Mindfulness-based stress reduction, WLC = Waiting-list Control; M = mean; SD = standard deviation; ES = effect size (Cohen's *d*); BAI = Beck Anxiety Inventory; PSWQ = Penn State Worry Questionnaire; STAI-S = State-trait Anciety Inventory-State; STAI-T = State-Trait Anxiety Inventory-Trait; BDI-II = Beck Depression Inventory; SCL-90-R = Symptom Checklist 90-R Global severity index; BIS = Bergen Insomnia Scale; FFMQ = Five-Factor Mindfulness Questionnaire (total score).
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

In the present sample, 28 participant in the MBSR group (71.8%) and 28 participants (75.7%) in the control group met diagnostic criteria for insomnia according to BIS. Post-treatment, 13 participants in the MBSR group (41.9%) and 23 participants in the control group (69.7%) met diagnostic criteria for insomnia. This indicates that MBSR is associated with a significant decrease in sleep problems compared to waiting-list controls ($\chi^2 = 5.00$, $p = 0.003$).

Mediation analyses

Separate mediation analyses were carried out to determine whether reductions in anxiety, worry and depression associated with MBSR participation were mediated by increases in mindfulness. We followed the causal steps model proposed by Baron and Kenny (1986), combined with a nonparametric bootstrapping procedure to test the statistical significance of the indirect or mediated effect (Preacher & Hayes, 2008).

A prerequisite for conclusively establishing mediation is that changes in the mediatior variable precede changes in the outcome variables. An independent sample *t*-test was used to determine whether there were changes in the proposed mediator variable from pre-treatment to mid-treatment. No significant change was found for the proposed mediator variable from pre- to mid-treatment in the MBSR sample ($t\,(30) = 0–1.93$, $p = 0.63$). This lack of temporal precedence means that we were unable to test for true meditation by using midpoint treatment data. We nevertheless chose to employ pre- to post changes to assess mediation. Admittedly, this is a weaker test, but could still provide an indication of whether changes in trait mindfulness from pre- to post-treatment could account for the observed outcome. To this end, change scores (post-test minus pre-test scores) were computed for BAI, PSWQ, BDI-II and FFMQ (Table 6). Significant effects were found for group on these outcome measures, as well as for the hypothesized mediating variable of trait mindfulness change score. Significant effects were observed for the mediating variable on BAI, PSWQ, STAI-T, and BDI-II. After controlling for the mediating variable, the effect of group was reduced to non-significance for BAI, indicating a mediating role for trait mindfulness on observed outcome. The 95% confidence interval generated by the bootstrapping procedure did not contain zero, showing this indirect effect to be significant. Thus, the association between treatment group and BAI scores dropped to non-significance when controlling for changes in trait mindfulness. Pre- to post changes in trait mindfulness can therefore be said to mediate the effect of MBSR on pre- to post changes in anxiety symptoms as measured by BAI.

For PSWQ, the effect of group was attenuated but remained significant when controlling for the changes in trait mindfulness. This indicates a partially mediating role of pre- to post changes in trait mindfulness on the effects of MBSR on symptoms of worry. This indirect effect is significant as indicated by the bootstrapping procedure. For STAI-T, a similar partial mediation was observed. We did not find a mediating effect of pre- to post changes in trait mindfulness on the observed changes in depression severity.

Discussion

The present study examined the effects of MBSR for patients with heterogeneous anxiety disorders. For the completer sample, effect sizes were in the moderate to large range (0.53–0.97). Gains were maintained at follow-up for all outcome measures. These findings indicate that mindfulness training has sustained beneficial effects on anxiety disorders and related symptomatology compared

Table 4
Effect of treatment on outcome – completer sample.

Variables	MBSR ($n = 31$)			WLC ($n = 34$)				
	M	SD	ES (within)	M	SD	ES (within)	F (1,63)	ES (between)
BAI								
Pre-treatment	20.6	9.4		18.7	8.4			
Post-treatment	10.4	10.0	1.05	16.0	10.4	0.29	10.54*	0.55
Follow-up[a]	12.3	10.1	−0.19					
PSWQ								
Pre-treatment	62.9	11.7		62.4	8.2			
Post-treatment	52.3	12.4	0.88	61.1	10.6	0.14	20.66***	0.76
Follow-up	52.2	12.8	0.01					
STAI-S								
Pre-treatment	40.9	9.1		46.6	9.4			
Post-treatment	35.3	12.6	0.51	46.9	11.4	−0.03	17.18***	0.97
Follow-up	36.5	12.6	−0.10					
STAI-T								
Pre-treatment	52.9	11.2		54.7	8.4			
Post-treatment	43.3	12.8	0.80	53.2	9.2	0.17	20.77***	0.89
Follow-up	42.3	11.8	0.08					
BDI-II								
Pre-treatment	17.3	9.3		17.3	7.9			
Post-treatment	8.5	9.1	0.96	17.1	8.6	0.02	25.0***	0.97
Follow-up	8.0	7.8	0.06					
SCL–90-R								
Pre-treatment	1.3	0.6		1.3	0.5			
Post-treatment	0.7	0.7	0.92	1.2	0.6	0.18	17.3***	0.77
Follow-up	0.7	0.6	0.02					
BIS								
Pre-treatment	17.4	9.7		18.2	9.7			
Post-treatment	11.5	10.3	0.59	16.7	9.3	0.16	7.5**	0.53
Follow-up	12.4	9.0	−0.09					
FFMQ								
Pre-treatment	113.8	21.6		114.8	16.6			
Post-treatment	128.2	22.3	0.66	113.0	16.3	0.11	19.1***	0.78
Follow-up	127.9	24.2	−0.01					

Abbreviations: MBSR = Mindfulness-based stress reduction, WLC = Waiting-list Control; M = mean; SD = standard deviation; ES = effect size (Cohen's *d*); BAI = Beck Anxiety Inventory; PSWQ = Penn State Worry Questionnaire; STAI-S = State-trait Anxiety Inventory-State; STAI-T = State-Trait Anxiety Inventory-Trait; BDI-II = Beck Depression Inventory; SCL-90-R = Symptom Checklist 90-R Global severity index; BIS = Bergen Insomnia Scale; FFMQ = Five-Factor Mindfulness Questionnaire (total score).
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
[a] Follow-up effect sizes are calculated from post-treatment to follow-up.

to a waiting-list control condition. In a more conservative estimate, ITT analyses showed significant improvement for the MBSR group relative to the waiting-list control group on all measures except continuous scores on sleep disturbance. Between-group effect sizes were in the moderate range for the ITT sample on most outcome measures (range: 0.32–0.76). This is a uniform trend, indicating a benefit of mindfulness training on the diverse clinical expression of anxiety disorders.

The decrease in STAI-T scores indicates that MBSR might affect the trait-like tendency to experience anxiety over time and across situations, as well as more acute symptoms as measured by STAI-S and BAI. The MBSR group showed a significant reduction in PSWQ scores relative to the control group, a finding in line with other studies showing that MBIs reduce negatively valenced repetitive thinking (Deyo, Wilson, Ong, & Koopman, 2009; Jain et al., 2007).

Table 5
Individual change data for completer sample ($n = 31$).

	BAI	STAI-T	PSWQ	BDI-II
In clinical range pre-treat	81% (25)	71% (22)	100% (31)	55% (17)
Recovered	44% (11)	36% (8)	26% (8)	53% (9)
Reliably improved	20% (5)	32% (7)	39% (12)	12% (2)
No change	36% (9)	32% (7)	36% (11)	35% (6)
Deteriorated	0	0	0	0

The finding that MBSR is associated with substantial reductions in insomnia as measured by categorical scores (presence or absence of diagnosis) is promising. It indicates that the relaxed awareness and attitude of "letting go" of mindfulness training could serve to counteract the psychological processes involved in the maintenance of sleep problems.

We found that participation in the MBSR course was associated with significant increases in trait mindfulness relative to the control condition. Mediation analyses using pre-post scores provided partial support for the mediating role of mindfulness on outcome. An important caveat must be noted: As there were no

Table 6
Results of mediator analyses.

	Effect of group		Effect of trait mindfulness		Effect of group controlled for mediator		95% confidence interval	
	β	p	β	p	β	p	Upper	Lower
FFMQ	−0.45	0.000						
BAI	0.39	0.001	−0.38	0.003	0.24	0.078	0.03	5.80
PSWQ	0.49	0.000	−0.52	0.000	0.28	0.025	0.67	6.49
STAI-T	0.49	0.000	−0.53	0.000	0.27	0.030	0.70	5.79
BDI-II	0.50	0.000	−0.26	0.039	0.45	0.001	−1.22	2.86

significant changes in FFMQ scores by mid-treatment, it could not be demonstrated that changes in mindfulness preceded changes in outcome variables. As such, the evidence of mediation is tentative rather than conclusive. Keeping that in mind, we note that indication of a mediating effect was strongest for the BAI, partial for scores of worry and trait anxiety, and absent for depression severity as measured by BDI-II.

Some limitations to the current study should be considered. First, the absence of an active comparison condition and the lack of conclusive evidence for mediation precludes any definite statements about the contribution of mindfulness training to the effects observed. We cannot exclude the possibility that effects may be due to non-specific factors, such as receiving attention, being part of a credible treatment program, or group-related factors.

A second limitation is the diagnostic procedure and the instruments employed. The use of a single assessor precluded a proper evaluation of the reliability and validity of the diagnostic procedure. Due to limited project resources, no diagnostic clinical interview was used to examine change in diagnostic status at post-treatment and follow-up. This constitutes an unfortunate study design flaw, as it led to the exclusive reliance on self-report measures. Consequently, we cannot exclude the possibility of social desirability effects or other response biases in the reporting of symptoms. It is also a significant limitation that apart from PSWQ (which measures key GAD symptoms), no diagnosis-specific questionnaire measures were used to assess PD or SAD. The reliance on general anxiety measures such as BAI and STAI runs the risk of not detecting changes in avoidance behaviors typically displayed by PD and SAD patients. It is therefore possible that patients in the trial were feeling less anxious as demonstrated by changes in BAI, but were still experiencing significant impairment due to continued avoidance of a variety of anxiety-provoking situations.

A third limitation is the lack of assessment of protocol adherence. Video recordings of sessions enabling ratings of adherence and competence by independent judges would make it possible to evaluate the integrity of the intervention. It is also recommended that two or more therapists conduct treatment in order to enhance internal validity.

Despite these limitations, the present findings have potential clinical implications. Although the effects obtained in this study are more modest than those typically found in clinical trials of disorder-specific treatments (e.g., Hofmann & Smits, 2008; Norton & Price, 2007), MBSR is likely to be effective for a number of patients with anxiety disorders. The transdiagnostic format of the intervention also entails some benefits that could lead MBSR to be considered. Transdiagnostic treatments are more practical for application in routine clinical practice where diagnosis and disorder-specific treatments are difficult to employ due to practical and logistical challenges. It may also be the case that transdiagnostic treatments requires less training for clinicians, as opposed to having to prove proficiency in numerous disorder-specific treatment protocols. Finally, MBSR might prove advantageous in terms of being a group treatment and thus being more cost-effective.

As a counterpoint to the transdiagnostic line of reasoning, it is possible that the failure to address particular cognitive or emotional maintaining factors could have led to MBSR being less efficacious for some participants. It might be that some features, such as catastrophic interpretations or modes of perceptual hypervigilance, are so ingrained that the patient would need further training in mindfulness, perhaps in individual therapy. Alternately, the addition of certain cognitive-behavioral techniques to an MBI could further help participants in disengaging from maladaptive patterns or biases in information processing. Such integration is the foundation of mindfulness-based cognitive therapy (MBCT), which in addition to the formal mindfulness exercises in MBSR features psychoeducational material and experiential exercises addressing the particular modes of cognitive reactivity involved in depressive relapse (Segal, Williams, & Teasdale, 2002). It is possible that the MBCT format tailored to address specific pathogenic forms of information processing could add therapeutic impact over and above that of MBSR for some patients with anxiety disorders.

It is currently unclear in which way the intervention can be most favorably added to current treatment options. It is possible that a subset of patients not responding to CBT for anxiety might profit from MBSR. Alternately, MBSR could be offered as a low-level option in a stepped care treatment model. Given the likelihod of anxiety disorders to recur after observed recovery, there is also a potential that MBSR could constitute a relapse-prevention strategy, akin to what is suggested by the NICE guidelines that currently recommend MBCT against depressive relapse (National Institute for Clinical Excellence, 2004).

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