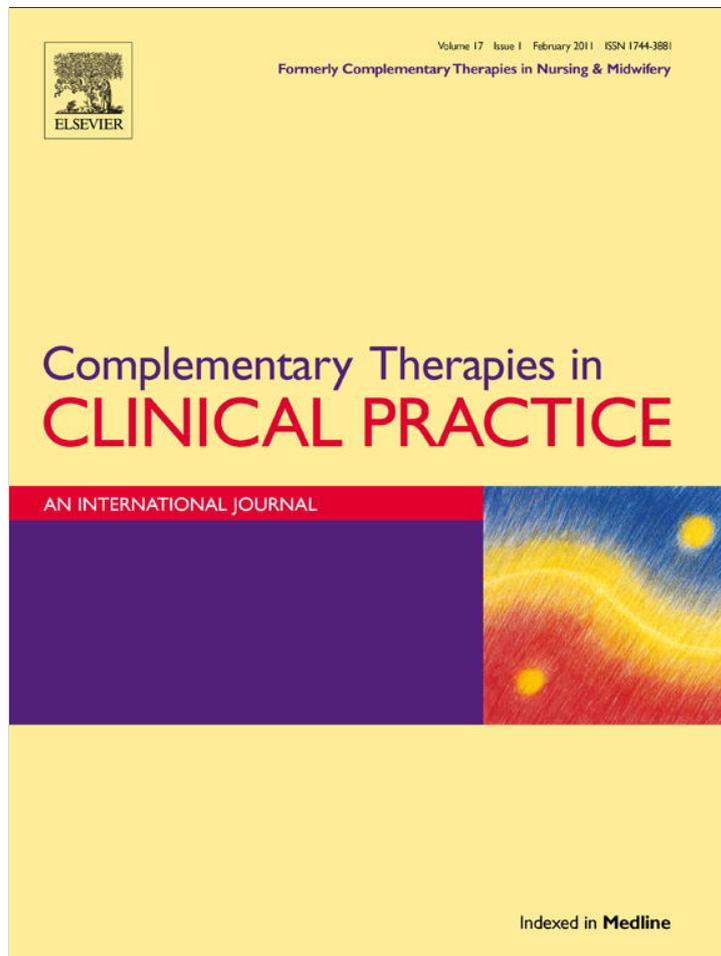


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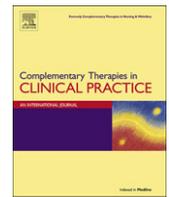
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Increased mindfulness – The active component of the mindfulness-based stress reduction program?

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While there is growing consensus that Mindfulness-Based Stress Reduction (MBSR) is an effective program for patients with a wide range of health problems, little is known with regard to the processes underlying benefits seen following the program. Herein we examined the relationship between increases in mindfulness and improvements in patient outcomes. We sought to determine if there was a relationship between the practice of various types of meditation taught during the program and post-MBSR results. Eighty-three chronic ill patients provided pre- and post-MBSR data. An increase in mindfulness was significantly related to reductions in depressive symptoms, stress, medical symptoms and an increase in overall sense of coherence. However, the relationship between practice and outcomes was less evident. Future research is needed to identify which factors lead to an increase in mindfulness.

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1. Introduction

The program entitled 'Mindfulness-Based Stress Reduction' (MBSR) was designed at the University of Massachusetts Medical Center¹ 30 years ago for patients with chronic pain and other illnesses. It shows promise with regard to helping patients live better with the stress inherent to living with a chronic disease.² While MBSR has become a program offered worldwide to various patient as well as non-clinical populations (e.g., health care professionals, employees, prisoners), the processes underlying the benefits are not yet fully understood. In the original 8-week program, patients commit to attending all classes, engaging in 45–60 min of practice per day, 6 days per week. There are other, usually shorter, MBSR programs described in the literature as well as different assignments for frequency/duration of home practice.³ How much class attendance, which mode of meditation, and what frequency or duration of meditation practice is required to accrue benefits, remain empirical questions. Such questions are important as patients often ask them, and some may be concerned about being able to find sufficient time to practice regularly. From another perspective, health care professionals may want to know how much practice to 'prescribe'.

Relatively little attention has been paid to the impact of the frequency, type, and duration of practice on outcomes. An impediment to elucidating this relationship stems from the difficulties related to measurement of meditation practice itself. This issue is complicated by the fact that patients are instructed to practice both formally and informally. When requested to self-monitor practice on a daily or weekly basis, what usually occurs is that some comply while others do not; and the latter may be the individuals who practice least. Another potential problem is that recording practice may alter the behaviours being observed. For example, when writing down how often one is mindful of daily activities (i.e., informal practice) a person may make a point to be more aware of eating, walking, answering the phone, etc. Furthermore, while frequency/duration of meditation practice can be documented, the 'essence' of the experience i.e., its quality may be missed with time-related measures (Santorelli, personal communication, 2006).

Rosenzweig et al.⁴ examined home practice in patients with chronic pain who were instructed to meditate 20–25 min per day; 79% completed the program, of these 42/99 kept home practice logs. On average, patients practiced 6 days per week for 20 min per practice. Adherence, measured in this way, was significantly correlated with improvements on somatization, general health, but not with changes in anxiety, depression, or body pain. Given that less than half (42.4%) of the patients keep logs and there was not a correction for multiple testing these findings should be viewed with caution. In contrast to Rosenzweig et al.⁴ who failed to find a relationship between meditation practice and changes in depression, Sephton et al.⁵ reported that fibromyalgia patients

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(a chronic pain condition) who practiced more often had lower scores on the somatic, albeit not cognitive, symptoms of depression following the MBSR program. In arthritis patients (another painful condition), Pradhan et al.⁶ examined relationships between both frequency/duration of practice and outcomes. While neither the overall amount of practice time nor the time spent on a specific type of practice was found to be significantly related to decreases in depressive symptoms or psychological distress, frequency was.

Of a relatively large clinical sample of patients ($N = 174$) who took MBSR at the University of Massachusetts Medical School, Carmody and Baer reported that 69.5% provided some or all of their home practice data.⁷ The average number of minutes spent practicing was between 31 and 35 for formal and between 11 and 15 min for informal practice per day. Formal practice was significantly correlated with some outcomes (e.g., psychological well-being, less stress), but informal practice was not. The authors⁷ ran a regression analysis confirming that the positive relationship between practice time and improvements on psychological symptoms was mediated by increases in mindfulness. This was also true for decreases in stress, but only a partial mediation effect was found for increases in psychological well-being. Perhaps informal meditation was not found to be related to any of the outcomes due to the way it was measured. Speca et al.⁸ found that attendance to classes predicted improvements in stress symptoms in cancer patients. While informal practice was not measured by Speca et al., Shapiro et al.⁹ found that informal, not formal, practice was related to sleep efficacy (i.e., feeling rested over time). Thus, there are mixed findings with regard to the importance of formal and informal practice for post-MBSR outcomes in various patient populations. Perhaps other aspects of the program (e.g., group discussions, instructor training) underlie benefits observed.¹⁰

An MBSR program was offered (please see www.mcgill.ca/wholepersoncare) to 83 patients who completed breast cancer treatment starting in the fall of 2006 through the winter of 2009 and to patients living with another type of chronic illness from the fall of 2008 through the fall of 2009. We combined these groups because they were both learning to live with the stressors inherent in having an illness and undergoing medical treatments. Our aims were to offer a service for these patients¹¹ and to elucidate some of the processes underlying benefits.¹² To date we have not examined the data pertaining to practice for these patients nor have we reported their views on which aspects of the MBSR program were helpful.

2. Methods

2.1. Procedures

Patients were recruited from university affiliated hospitals and community organizations using posters, pamphlets and e-mail distribution of flyers. They were referred by hospital staff or by health care professionals who had taken our course entitled, Mindful Medical Practice. In the week preceding the start of the program, patients completed questionnaires via computer administration and were interviewed by the course instructor (PLD) or a clinical psychology post-doctoral student to determine eligibility.

2.2. Patients

Patients were eligible to enroll if they were 18 years or older and had finished medical treatment for breast cancer or a chronic illness. Patients with a concurrent psychiatric disorder (e.g., borderline personality, alcoholism) were excluded because

meditation may be contraindicated for them or they may not have been able to participate fully. Patients who committed to attend at least 7/9 sessions were accepted into the program. Only a few patients did not enter the program, usually due to difficulty in making the time commitment or scheduling conflicts.

2.3. Mindfulness-based stress reduction (MBSR)

The MBSR program was provided by the same instructor (PLD) to groups of about 10–15 participants, who met weekly for 2.5 h classes for 8 consecutive weeks to learn mindfulness meditation and stress management techniques. They received a home practice manual and 4 CDs created by the instructor to teach the following meditation practices: body scan, sitting meditation, mindful yoga, and meditation involving visual imagery. At the end of each class, patients were asked to complete specific home practice exercises; these followed the sequence outlined in the original MBSR program (e.g., body scan during the first two weeks, yoga the following week, etc). Informal practice (awareness of breath; being mindful while engaging in various daily tasks) was also part of home practice. A silent retreat, 6 h in duration, was provided after week 6 to reinforce the meditation practices learned. Group discussions throughout the course focused on the practice itself and how it was being integrated into and influencing patients' daily lives. The program format and exercises followed the MBSR structure designed at the University of Massachusetts Medical School Centre for Mindfulness in Medicine, Health Care, and Society¹ where the instructor was trained.

2.4. Measures

2.4.1. Mindful attention awareness scale (MAAS)

Brown and Ryan¹³ developed the MAAS to reflect their view that mindfulness involves a present-centered attention to and awareness of all accessible experiences (i.e., internal and external events). It has been shown to be inversely related to rumination (preoccupation with the past and/or future events), reported physical symptoms, and somatization.¹⁴ One study (described in¹³) used this measure before and after a MBSR program for patients with cancer. It was found that higher MAAS scores were related to less distress and stress-related symptoms. Carlson and Brown¹⁵ examined the psychometric characteristics of this measure with cancer patients and found that it was valid and has a single factor structure.

2.4.2. Center for epidemiologic studies depression scale (CES-D)

This questionnaire is a screen for depression and was developed for use with community populations.¹⁶ Scores range from 0 to 60; a higher score indicates more symptoms consistent with clinical depression. For the population at large, a score of 16 or more indicates a positive screen for depression. The CES-D has been found to have very high internal consistency ($r = .85$ in the general population; $r = .90$ in a patient sample) and moderate test-retest reliability, with all but one correlation between .45 and .70 in these two samples.¹⁶

2.4.3. Medical symptom checklist (MSCL)

The MSCL is a checklist of medical symptoms that the patient has experienced in the past month.¹⁷ It consists of a number of physical (e.g., gastrointestinal, respiratory, pain) and psychosocial symptoms (e.g., difficulty relaxing, sexual problems). Higher scores are indicative of a greater number of symptoms. Using this questionnaire, research has demonstrated consistently that post-MBSR, there are significant reductions in symptoms for patients with various conditions.^{7,18,19}

2.4.4. Perceived stress scale (PSS)

This 10-item scale was developed to measure the extent to which respondents appraise situations in their life to be stressful during the past month.^{20,21} Each item is scored from 0 to 4. A global score is computed ranging from 0 to 40 with higher scores indicating greater perceived stress. This scale, designed for use in community samples, has been shown to have good internal validity and test-retest reliability.²¹

2.4.5. Sense of coherence (SOC)

The SOC is a 29-item questionnaire that assesses the extent to which a respondent views their internal and external environments as structured, predictable, and manageable.²² The Sense of Coherence questionnaire contains three subscales: Comprehensibility, which refers to when the social world is interpreted by the respondent as rational, structured, consistent, and predictable; Manageability, which involves the extent to which the respondent considers his or her coping resources to be available and adequate to deal with life's challenges; and Meaningfulness, which reflects whether a situation is viewed as challenging and worth making a commitment to cope with it. Respondents rate items on a 7-point Likert scale, with higher scores indicating greater degrees of comprehensibility, manageability, and/or meaningfulness. The SOC has good internal validity and good test-retest reliability. It has been used extensively in the study of health and well-being.²² In women, total scores on the SOC range from 100.50 (SD = 28.50) to 160.50 (SD = 17.10).²³

2.4.6. Follow-up MBSR survey

All patients completed a follow-up survey used at the University of Massachusetts Center for Mindfulness. The survey was completed at the end of the course and asks respondents to reflect upon their meditation practice without being asked a specific time frame (e.g., past two weeks). We selected questions from this survey pertaining to the frequency/duration of formal meditation and yoga practice as well as one type of informal practice i.e., 'awareness of breath'. For frequency of meditation, the response scale was: 1 = less than one time per week; 2 = less than three times per week; 3 = three times per week or more; 4 = everyday. For duration of meditation, the response scale was: 1 = less than 15 min; 2 = between 15 and 30 min; 3 = 30 min or longer. For yoga there was only a frequency measure, which used the same response scale as for meditation. For 'awareness of breath' there were two measures, frequency and usefulness. The response scale for frequency was: 1 = never; 2 = rarely; 3 = sometimes; 4 = often. The response scale for usefulness was: 1 = of no use; 2 = not very useful; 3 = somewhat useful; 4 = very useful. We also examined 10 questions pertaining to 'how useful and beneficial' patients found the various aspects of the MBSR program and practices (e.g., sitting meditation with a CD; large group discussions; awareness of breath) using a 1–10 rating scale in which 1 = no use and 10 = very useful. Finally, patients were asked to rate on a 1–10 scale "how important the MBSR program" was for them. Many added qualitative answers to the question, "What do you feel you got from the MBSR program?"

2.5. Statistical analyses

Descriptive statistics were used to characterize the patient sample and to summarize the follow-up survey data pertaining to practice and usefulness of various aspects of the course.

To determine whether changes in outcome variables were statistically significant from pre- to post-MBSR, paired sample *t*-tests were performed. To assess relative magnitude of the treatment effect for each outcome variable effect sizes were calculated;

Cohen's *d* values for effect size of .5–.8 are considered to be moderate and those over .8 are considered to be large.²⁴ Correlation coefficients were then computed to examine the associations between MAAS change scores and the outcome change scores. Finally, a series of ANOVAs were run to determine if formal and informal practice (meditation, yoga, and awareness of breath) as measured on the follow-up survey were related to outcomes.

3. Results

3.1. Patients

A total of 83 patients enrolled in the course and completed all questionnaires. As shown in Table 1, the average age was 54.2 years (SD = 12.9; range = 21–80 years); 94% were women. Fifty-eight (70%) had breast cancer; 30% had other types of chronic illness (e.g., prostate cancer, inflammatory bowel disease).

3.2. Attendance

The average number of MBSR classes attended was 8.34 (SD = 0.89); attendance was 92.6%.

3.3. Changes in outcomes pre- to post-MBSR

As seen in Table 2, results of paired sample *t*-tests revealed significant changes in all outcomes in the direction reflecting improvements. Effect sizes were generally in the moderate range.

3.4. Correlations between changes in mindfulness and outcomes

As seen in Table 3, the correlations between changes in mindfulness and all changes pre- to post-MBSR outcomes were highly significant: depressive symptoms ($r = -0.49, p < 0.0001$), perceived stress ($r = -0.51, p < 0.0001$), and medical symptoms ($r = -0.38, p < 0.0001$), and total sense of coherence ($r = 0.54, p < 0.0001$). These remained significant following correction for multiple testing (Bonferroni correction with $\alpha = 0.05$ and 25 tests yielded $p = 0.002$).

Table 1
Patient sociodemographic and illness characteristics.

Variables	
Sociodemographic	
Age, years (mean \pm SD) (range)	54.2 \pm 12.92 (21–80)
Sex	
Male	6.0%
Female	94.0%
Education	
High School	9.6%
College	16.9%
Bachelors	49.4%
Post-graduate	24.1%
Marital Status	
Married	60.4%
Single	24.5%
Other	15.1%
Illness	
Breast cancer	69.9%
Other cancers	8.4%
Inflammatory Bowel Disease	6.0%
Depression/anxiety	6.0%
Other	9.6%

Table 2
Impact of MBSR on outcome measures.

Variable scores	Pre-MBSR	Post-MBSR	Difference	d value	t value
	Mean (SD)	Mean (SD)			
CES-D	18.08 (10.19)	11.59 (9.00)	↓ 6.49	0.68	5.45*
PSS	19.80 (6.22)	14.99 (6.21)	↓ 4.81	0.77	6.99*
MAAS	3.81 (0.85)	4.27 (0.70)	↑ 0.45	-0.58	-6.58*
MSCL	22.99 (13.92)	15.41 (11.26)	↓ 7.58	0.60	6.42*
SOC (total)	130.08 (18.84)	138.99 (17.51)	↑ 8.90	-0.49	-5.48*

* $p < 0.001$.

CES-D = Center for Epidemiological Studies – Depressive Mood Scale.

PSS = Perceived Stress Scale.

MAAS = Mindful Attention Awareness Scale.

SOC = Orientation of Life Scale (Sense of Coherence).

↑ increase; = ↓ decrease.

3.5. Formal and informal practice

The average frequency for meditation practice was 3.09 (SD = 0.84), with a mean duration of 2.16 (SD = 0.66) indicating that patients meditated approximately 3 times per week or more, and did so between 15 and 30 min. As for yoga, patients averaged 2.63 (SD = 0.86) which indicates about 3 times per week. It is possible that patients alternated meditation and yoga (as is sometimes recommended) which, when combined, suggests that they may have practiced some form of meditation more or less on a daily basis. Our proxy variable for informal practice was 'awareness of breath'. On average, patients scored 3.69 (SD = 0.54) which falls in between 'frequently and sometimes', with a mean of 3.78 (SD = 0.54) on usefulness, i.e., it was viewed between 'somewhat to very useful'.

3.6. Practice and outcome relationships

A series of ANOVAs were run between practice (duration, frequency, usefulness) and the four outcome variables but given the number of tests run these analyses should be viewed as exploratory. There were significant relationships between the usefulness of awareness of breath and decreases in stress [$F(2,80) = 4.31$, $p = 0.017$], as well as increases in sense of coherence [$F(2,80) = 5.88$, $p < 0.005$]. There was a trend between frequency of awareness of breath and an increase in mindfulness ($p < 0.058$).

3.7. Usefulness of MBSR course components

In Table 4 patients' views regarding the usefulness of various aspects of the course are summarized. The results are presented in a ranked order such that awareness of breath scored the highest and the body scan without CD scored the lowest. The silent retreat day was ranked second. When asked to rate the MBSR course usefulness overall on a 0–10 scale, patients average score was 8.94 (SD = 1.49).

4. Discussion

The MBSR program consists of many components: patients learn various forms of formal and informal mindfulness, they share

Table 3
Correlation matrix for MAAS changes and outcome change scores.

	MAAS	CESD	PSS	MSCL	SOC total
MAAS		-0.49**	-0.51**	-0.38**	0.54**
CESD			0.74**	0.57**	-0.64**
PSS				0.52**	-0.64**
MSCL					-0.52**
SOC total					

** $p < 0.000$ level (2-tailed).

Table 4
Usefulness of MBSR course and its components.

	Mean*	SD
Overall rating of MBSR	8.94	1.49
Course components		
Awareness of breath	9.09	1.21
Silent retreat	8.33	1.79
Yoga with CD	8.28	2.22
Home exercises with workbook	8.10	1.92
Body scan with CD	7.98	2.36
Large group discussion	7.76	2.06
Sitting meditation with CD	7.75	2.21
Small group discussion	7.56	2.05
Sitting meditation without CD	7.11	2.63
Body scan without CD	6.50	2.64

* Rated on a 0–10 scale.

experiences on a weekly basis, spend 6 h in silence practicing together, and do a significant amount of 'homework'. During class, at least half of the time is spent in formal practice and the instructor may engage patients in periods of 'inquiry' that could lead to insights into patterns of reactivity. There are likely specific and nonspecific factors (e.g., instructor experience level, class discussions) that contribute to changes following the program.¹⁰ To date no one has conducted a 'dismantling' study to identify which aspects of the program are related to the benefits reported by patients. Herein we first asked, "Is an increase in mindfulness associated with improvements?" Subsequently we examined, "Are formal and informal mindfulness practices related to outcomes?" Finally, we explored which practices and aspects of the course were viewed as useful by a mixed sample of patients with chronic illnesses.

Consistent with other reports from clinical populations (e.g.,^{4,7,25,26}), increases in mindfulness were significantly related to decreases in depressive symptoms, perceived stress, medical symptoms, and increases in sense of coherence. Similar findings have been reported for non-clinical samples.^{27,28}

While attendance to our program was high it was not correlated with changes in mindfulness (data not shown). In contrast to Carmody and Baer,⁷ neither meditation nor yoga practice was significantly related to outcomes. The literature is inconsistent with regard to how practice influences outcomes – this may reflect the different definitions of practice, methods for measuring practice (e.g., daily logs, follow-up surveys), or actual variation across populations. Lengacher et al.²⁶ found that breast cancer patients who practiced meditation more (duration) during a 6-week version of the MBSR course tended ($p = 0.04$) to report less stress at the end of the program. In another study with cancer patients Speca et al.⁸ reported a significant correlation between number of classes attended and reductions in stress-related symptoms, but not between the duration of meditation practice and these changes. Given that the follow-up survey used herein is imprecise regarding what time period is covered, nor can one discern if more than one practice was carried out on a particular day (e.g., 20 min of yoga plus 20 min of the body scan) our negative results may be due to methods used. To our knowledge this survey has never been validated, and when one considers how the various types of practices are introduced (e.g., gradual increase in time spent in sitting meditation over the 8 weeks), it is likely that neither the frequency nor duration captures this adequately. In addition, more than 8 weeks may be required to develop a stable practice that impacts well-being. This latter notion is supported by Pradhan et al.,⁶ who found in a randomized clinical trial of arthritis patients that group differences were evident only at 6 months post-MBSR (85.7% of MBSR patients stated that they were still practicing meditation at that time).

Our measure of informal practice (awareness of breath) yielded significant findings for changes in stress and sense of coherence. Consistent with these results, awareness of breath was ranked highest as a useful component of the MBSR course. Clearly there is more to informal practice than awareness of breath. Over a decade ago, Salmon et al.²⁹ stated that informal practice can manifest in many ways such as: noticing the body while walking, being aware of thoughts and feelings while washing dishes, bringing attention to the breath upon awakening. It is not known if one should record minutes or frequency and how accurately this can be done. While Shapiro et al.²⁷ found that informal practice predicted less stress ($p = 0.05$) in undergraduate students who took the MBSR course informal practice was not explicitly defined.

It is conceivable that the quality of practice is as salient as quantity, but to date this issue has not been addressed. Given that the attitude one brings to meditation (e.g., critical versus kind, accepting) as well as the intention (e.g., reduce insomnia versus simply be present) are important factors to consider,³⁰ time-related measures may miss crucial aspects of the experience. Also, it is plausible that there are both intrapersonal (i.e., same person, different practice) and interpersonal differences regarding one's access to a state of mindfulness.

Even though the literature is clear about the importance of being mindful, it is not yet forthcoming with regard to what contributes to becoming more mindful in people who take the MBSR program. Shapiro et al.²⁷ found that while sitting meditation did not predict changes in mindfulness (using the MAAS) participating in the program did. In contrast, Carmody and Baer⁷ purported that the practice of formal, but not informal practice leads to increases in mindfulness, which in turn leads to symptom reduction. Two different measures of mindfulness were used across these studies;^{7,27} one included students whereas the other clinic patients – such differences may explain these divergent results. Furthermore, processes underlying changes may vary across individuals: some may learn more through inquiry, whereas others may learn through self-exploration.

Brown and Ryan³¹ point out that mindfulness meditation is also referred to as 'insight' meditation. Going beyond the sense of calm that comes with concentration meditation (e.g., focus on the breath or a mantra), the application of awareness both 'on and off the cushion,' one may gain clarity and the ability to respond to all that arises both within and outside the individual.¹ Reading patients' written comments from the survey which asked, 'What was of lasting value or importance in taking the MBSR program?' one gets a sense of what was gained: "What is 'is'; Accepting that I can't change and I am not responsible for everything."; "Awareness of how brave and courageous I really am."; "Accept myself way more than before; I am less prone to react. I feel a sense of unprecedented calm."; "More aware when I am unaware. More aware of my body in stressful situations."; "Trust my body and not be alienated from it."; "A return to my inner voice."; "Importance of breath when stressed."; "Importance of self-care."

These statements echo those we heard in focus group discussions conducted with some of the breast cancer patients in the beginning of this work.¹² Patients reported being able to weave awareness into everyday life; feeling worthy to live life fully; being better equipped to respond to stressors; and accept what is. Awareness of breath may have enabled people to slow down and size up a situation before reacting with old, ineffective patterns. Increases in their sense of coherence (which was significantly related to awareness of breath) may foster resilience and render individuals stress hardy. Changes in mindfulness may reflect 'reperceiving'³⁰ of the self in relation to the world. In a subset of this cohort (59 breast cancer patients) we found a significant correlation between changes in mindfulness and emotion-oriented coping

suggesting that when mindful the person is less inclined to catastrophize or ruminate.¹¹ As is evident from Table 4, many different aspects of the program were found to be useful and it is likely that a combination of these led to the benefits reported. For example, large and small group discussions (rated 7.76 and 7.56, respectively) appear important as well.¹⁰

In conclusion, while not having a control group precludes attributing pre- post-MBSR changes to the program we nonetheless note that changes in mindfulness were related to improvements. Follow-up data that go beyond the end of the program are needed to determine if these changes are maintained. Finally, developing a means of measuring informal practice more precisely is recommended.

Potential conflicts of interest

None declared.

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References

- Kabat-Zinn J. *Full catastrophe living: using the wisdom of your body and mind to face stress, pain and illness*. New York: Delacorte Press; 1990.
- Carmody J, Baer RA, Lykins LB, Olendzki N. An empirical study of the mechanisms of mindfulness in a mindfulness-based stress reduction program. *J Clin Psychol* 2009;**65**:613–26.
- Carmody J, Baer RA. How long does a mindfulness-based stress reduction program need to be? A review of class contact hours and effect sizes for psychological distress. *J Clin Psychol* 2009;**65**:627–38.
- Rosenzweig S, Greeson JM, Reibel DK, Green JS, Jasser SA, Beasley E. Mindfulness-based stress reduction for chronic pain conditions: variation in treatment outcomes and role of home meditation practice. *J Psychosom Res* 2010;**68**: 29–36.
- Sephton SE, Salmon P, Weissbecker I, Ulmer C, Floyd A, Hoover K, et al. Mindfulness meditation alleviates depressive symptoms in women with fibromyalgia: results of a randomized clinical trial. *Arthritis Rheum* 2007;**57**: 77–85.
- Pradhan EK, Baumgarten M, Langenberg P, Handwerker B, Gilpin AK, Magyari T, et al. Effect of mindfulness-based stress reduction in rheumatoid arthritis patients. *Arthritis Rheum* 2007;**57**:1134–42.
- Carmody J, Baer RA. Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *J Behav Med* 2008;**31**:23–33.
- Specia M, Carlson LE, Goodey E, Angen M. A randomized, wait-list controlled clinical trial: the effect of a mindfulness-based stress reduction program on mood and symptoms of stress in cancer outpatients. *Psychosom Med* 2000;**62**: 613–22.
- Shapiro SL, Bootzin RR, Figueroa AJ, Lopez AM, Schwartz GE. The efficacy of mindfulness-based stress reduction in the treatment of sleep disturbance in women with breast cancer: an exploratory study. *J Psychosom Res* 2003;**54**: 85–91.
- Imel Z, Baldwin S, Bonus K, Maccoon D. Beyond the individual: group effects in mindfulness-based stress reduction. *Psychother Res* 2008;**18**:735–42.
- Matousek RH, Dobkin PL. Weathering storms: a cohort study of how participation in a mindfulness-based stress reduction program benefits women after breast cancer treatment. *Current Oncology*, in press.
- Dobkin PL. Mindfulness-based stress reduction: what processes are at work? *Complement Ther Clin Pract* 2008;**14**:8–16.
- Brown KW, Ryan RM. The benefits of being present: mindfulness and its role in psychological well-being. *J Pers Soc Psychol* 2003;**84**:822–48.
- Jain S, Shapiro SL, Swanick S, Roesch SC, Mills PJ, Bell I, et al. A randomized controlled trial of mindfulness meditation versus relaxation training: effects on distress, positive states of mind, rumination, and distraction. *Ann Behav Med* 2007;**33**:11–21.

15. Carlson LE, Brown KW. Validation of the mindful attention awareness scale in a cancer population. *J Psychosom Res* 2005;**58**:29–33.
16. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;**1**:385–401.
17. Travis JW. *Wellness workbook for health professionals*. Mill Valley, CA: Wellness Resource Center; 1977.
18. Carmody J, Reed G, Kristeller J, Merriam P. Mindfulness, spirituality, and health-related symptoms. *J Psychosom Res* 2008;**64**:393–403.
19. Reibel DK, Greeson JM, Brainard GC, Rosenzweig S. Mindfulness-based stress reduction and health-related quality of life in a heterogeneous patient population. *Gen Hosp Psychiatry* 2001;**23**:183–92.
20. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;**24**:385–96.
21. Cohen S, Williamson GM. Perceived stress in a probability sample of the United States. In: Spacapan S, Oskamp S, editors. *The social psychology of health*. Newbury Park, CA: Sage; 1988.
22. Antonovsky A. *Unraveling the mystery of health: how people manage stress and stay well*. San Francisco: Jossey-Bass; 1987.
23. Antonovsky A. The structure and properties of the sense of coherence scale. *Soc Sci Med* 1993;**36**:725–33.
24. Cohen J. *Statistical power analysis for the behavioral sciences*. 2nd ed. Hillsdale, NJ: Erlbaum; 1988.
25. Nyklicek I, Kuijpers KF. Effects of mindfulness-based stress reduction intervention on psychological well-being and quality of life: is increased mindfulness indeed the mechanism? *Ann Behav Med* 2008;**35**:331–40.
26. Lengacher CA, Johnson-Mallard V, Post-White J, Moscoso MS, Jacobsen PB, Klein TW, et al. Randomized controlled trial of mindfulness-based stress reduction (MBSR) for survivors of breast cancer. *Psychooncology* 2009;**18**:1261–72.
27. Shapiro SL, Oman D, Thoresen CE, Plante TG, Flinders T. Cultivating mindfulness: effects on well-being. *J Clin Psychol* 2008;**64**:840–62.
28. Krasner MS, Epstein RM, Beckman H, Suchman AL, Chapman B, Mooney CJ, et al. Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *JAMA* 2009;**302**:1284–93.
29. Salmon PG, Santorelli SF, Kabat-Zinn J. Intervention elements promoting adherence to mindfulness-based stress reduction programs in the clinical behavioral medicine setting. In: Shumaker SA, Schron EB, Ockene JK, McBee WL, editors. *The handbook of health behavior change*. New York: Springer; 1998. p. 239–66.
30. Shapiro SL, Carlson LE, Astin JA, Freedman B. Mechanisms of mindfulness. *J Clin Psychol* 2006;**62**:373–86.
31. Brown KW, Ryan RM. Perils and promise in defining and measuring mindfulness: observations from experience. *Clin Psychol Sci Pract* 2004;**11**:242–8.