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The efficacy of mindfulness-based stress reduction in the treatment of sleep disturbance in women with breast cancer An exploratory study

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Abstract

Objective: The diagnosis of breast cancer, the most common type of cancer among American women, elicits greater distress than any other diagnosis regardless of prognosis. Therefore, the present study examined the efficacy of a stress reduction intervention for women with breast cancer. **Methods:** As part of a larger, randomized, controlled study of the effects on measures of stress of a mindfulness-based stress reduction (MBSR) intervention for women with breast cancer, the current analyses examined the effects on sleep complaints. **Results:** Analyses of the data indicated that both MBSR and a free choice (FC) control condition produced significant improvement on daily diary sleep quality measures though neither showed significant improvement on sleep-efficiency. Participants in the MBSR who reported greater mindfulness practice improved significantly more on the sleep quality measure most strongly associated with distress. **Conclusion:** MBSR appears to be a promising intervention to improve the quality of sleep in woman with breast cancer whose sleep complaints are due to stress. © 2003 Elsevier Science Inc. All rights reserved.

Keywords: Breast cancer; Mindfulness; Sleep; Stress reduction

Introduction

The diagnosis of breast cancer, the most common type of cancer among American women, elicits greater distress than any other diagnosis regardless of prognosis [1]. The literature has focused immensely on the effects of this distress on depression, anxiety, nausea, and pain [2–6]; however, the relationship between distress and sleep disturbance has received little attention. This is an important omission considering that sleep difficulties are among the most frequent consequences of cancer [7]. The literature indicates that between 31% and 54% of cancer patients report sleep difficulties [8,9]. Further, these difficulties continue several years after the diagnosis for a significant portion of breast cancer patients (i.e., 23% and 44%) [10,11].

There is a large literature on the relationship between stress and sleep disturbance. Important life events, such as the death of a loved one, retirement, and persistent health problems, have been shown to be related to sleep complaints [12]. Similarly, the literature on sleep disturbances following traumatic events, such as rape, war, fires, and hurricanes, has found that sleep disturbances are part and parcel of the posttraumatic symptoms [13]. Often the subjective sleep complaints are more severe and persistent than objective, sleep assessments.

Stress management interventions, including meditation, relaxation training, biofeedback, and multicomponent treatments have been shown to produce improvement in sleep complaints [14]. The present intervention was designed to help manage stress and thereby decrease concomitant sleep complaints. Mindfulness-based stress reduction (MBSR) was selected because of prior evidence of its effectiveness in reducing stress in a number of different populations, including patients with chronic pain [15], anxiety [16,17], and depression [18], and because of pilot research by the first two authors on its effectiveness in reducing stress, including worry and cognitive rumination, in insomniacs.

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The current study is part of a larger research project,[1] which examined the psychological, immunological, and sleep effects of a MBSR intervention for women with Stage II breast cancer as compared to a self-monitoring "control" condition. This article reports only the data on sleep. We hypothesized that MBSR would help reduce psychological distress, increase ability to monitor negative cognitions, and thereby decrease sleep disturbance. The specific hypotheses of the study were: (1) sleep complaints would be associated with psychological distress; (2) participants in the MBSR condition would demonstrate significantly greater reported sleep quality and efficiency as compared to the free choice (FC) control condition; and (3) within the MBSR group, improvement would be significantly associated with amount of mindfulness practice. Mindfulness is a skill, which is learned through practice. It makes sense, therefore, that the more one practices, the more adept s/he will become at using the mindfulness techniques, and the more she will benefit. There is a large literature that treatment adherence effects treatment outcome [19].

Method

Participants were recruited from the practices of all medical oncologists in the Tucson community. Inclusion criteria were (a) female, (b) age 18–80, (c) fluent in English, (d) no current diagnosis of mental illness,[2] (e) have a history of Stage II breast cancer,[3] (f) currently in remission, and (g) within 2-year posttreatment.[4] Since the focus of the overall project was on treating distress, there were no inclusion or exclusion criteria specifically focused on sleep.

Justification for stage of cancer. This study focused on women with Stage II breast cancer. Although not the most advanced stage of disease, women with Stage II breast cancer experience a great deal of distress due to their diagnosis, treatment, and the fear of breast cancer recurrence or metastasis. By restricting the study to a somewhat homogeneous sample, the number of confounding variables is reduced.

Justification for phase of treatment. Although breast cancer can cause distress at any moment after diagnosis, there appear to be peak periods throughout the patient's experience. It has been suggested that the period following completion of treatment can be a time of distress and anxiety [20]. At this time, women have completed treatment and now have to face the difficulty of waiting and doing "nothing." This seemed to be an ideal period to introduce stress reduction interventions.

The sample consisted of 63 women diagnosed with Stage II breast cancer who were cancer-free at the time of the study. The participants ranged in number of months post-treatment from 2 to 25 ($M = 13.4$, S.D. = 6.9). The women ranged in age from 38 to 77 years old ($M = 57$, S.D. = 9.7). Forty-seven women were married or in an equivalent relationship, 3 were divorced, 4 widowed, and 9 single. Women on average had two children ranging from zero to six children. Fifty-four of the women were non-Hispanic White, 5 Hispanic, and 2 African American ($n = 61$). Twelve women had completed graduate school, 19 were college graduates, and 31 high school graduates ($n = 62$). Thirteen women worked part time, 22 full-time, 19 were retired, and 9 were on disability.

Measures

Two weeks prior to the intervention, all participants completed a battery of self-report questionnaires including measures of quality of life, psychological distress, sense of control, anxiety, depression, sense of coherence, and worry. This battery of valid and reliable measures was chosen to specifically address psychological and psychosocial functioning. Further, they completed a sleep diary 1-week pre- and post-intervention and throughout the 6-week intervention. All of the variables were re-assessed 1-week post-intervention, 3-month post-intervention, and 9-month post-intervention.

Psychological measures

The psychological measures used included: Profile of Mood States Scale (POMS) [21], the Beck Depression Inventory (BDI) [22], the Penn State Worry Questionnaire (PENN) [23], the State-Trait Anxiety Inventory [24], the Functional Assessment of Cancer Treatment-Breast (FACIT-B) [25], the Shapiro Control Inventory (SCI) [26], and Sense of Coherence (SOC) [27].

Sleep diary

The use of daily sleep diaries is a staple of assessment procedures in insomnia outcome studies [28].[5] The sleep diary that we use includes entries for naps, sleep latency, number and duration of awakenings, total sleep, quality of sleep, feelings upon awakening, and whether or not the night in question was a typical night. Sleep efficiency and two ratings of sleep quality were calculated and averaged for each week from the daily sleep diaries. Sleep efficiency is a ratio of the time asleep divided by the total time in bed from

[1] National Institute of Health, National Cancer Institute, Bethesda, MD (Grant Number: 1 RO3 CA83342-01).

[2] Psychiatric health was determined through baseline interview with trained social worker.

[3] Stage of breast cancer was determined through review of patients' charts by an oncologist. Stage II breast cancer indicates the severity of breast cancer. Stage II breast cancer is defined as an early stage of breast cancer where the cancer has spread to the underarm lymph nodes and/or the tumor in the breast is 1–2 in. across (NCI).

[4] A 1-month flex period was allowed for the eligibility criteria. One participant greater than 24-month posttreatment was included (25-month posttreatment).

[5] see Ref. [28] for a similar diary.

the time the individual intended to sleep until the final awakening. This ratio includes both difficulties initiating and maintaining sleep such that the lower the ratio, the more time the individual is awake. The two measures of the patient's perception of sleep quality were 10-point daily ratings obtained upon arising on the items, "Rate the quality of your sleep last night." And "Rate how rested/refreshed you feel now."

Intervention

MBSR

The MBSR intervention consisted of six weekly 2-h sessions and one 6-h silent retreat. Participants received training in the following meditative practices (adapted from Kabat-Zinn [29]): (1) "Sitting Meditation" involving awareness of body sensations, thoughts, and emotions while continually returning the focus of attention to the breath; (2) "Body Scan," a progressive movement of attention through the body from toes to head observing any sensations in the different regions of the body; (3) "Hatha Yoga," which consists of stretches and postures designed to enhance greater awareness and to balance and strengthen the musculoskeletal system. Inherent in all these techniques is an emphasis on mindful breathing, continually bringing attention to the breath. A "loving kindness" meditation (directing compassionate attention to oneself and others) was also introduced. Further, didactic material was presented on the psychological and physiological effects of stress, and cognitive-behavioral coping tools were introduced as a means to cope with stress.

FC control group

The FC group was presented as an opportunity for participants to "freely choose," which stress management techniques to engage in each week (e.g., talking to a friend, exercise, and taking a warm bath). Participants received a workbook including support, resources available in the community, poetry, and a diary for journaling. Each day they were asked to monitor the stress management activities in which they engaged and to record the amount of time in a daily diary. They received no formal or structured intervention or instruction.

Statistical analyses

We constructed hierarchical regression models using SAS PROC GLM [30] with both linear and quadratic main effects and interactions over time to examine the study data. In creating these models, we were attempting to do three things: (1) examine the extent to which the treatment conditions differed significantly in producing change in the participants over time; (2) examine adherence to treatment (amount of stress management practiced); and (3) control for initial differences between groups [the premature disclosure effect (PDE)] in baseline levels of general distress.

Adherence to intervention

Because one of the central hypotheses was that adherence to treatment would affect change, we focused not only on assignment to group but also on individual adherence with treatment. Therefore, we constructed hierarchical regression models with random effects coefficients [31] in order to examine changes over time in outcome measures based upon these individual differences. In these models, we took into account several of the individual adherence measures (e.g., amount of mindfulness practice, amount of social support activities, amount of individual stress management activities) to try to understand why people in the same group had very discrepant outcomes.

Initial baseline differences between groups (PDE)

In a preliminary study of the baseline data from this experiment that was reported elsewhere [32], we found significant between-group baseline differences in our measures of depression, trait anxiety, worry, positive sense of control, quality of life, and sense of coherence. These differences were attributed to what we called the PDE of informing participants of their randomized assignment to either the experimental or control group prior to the collection of baseline data. From the six affected variables, we constructed a single unit-weighted factor scale for general psychosocial distress [33], reversing the scoring of the variables that were negatively associated with assignment to the experimental (MBSR) treatment (i.e., positive sense of control, quality of life, and sense of coherence). The Cronbach's α of this general distress factor was .91, indicating an excellent degree of internal consistency among the six indicators. Because of the PDE phenomenon, it was decided to treat the remainder of the analysis as quasi-experimental, essentially recasting it as a nonequivalent groups design, by statistically controlling all other longitudinal study variables for the general psychosocial distress factor on which initial differences had been detected. This corrective quasi-experimental procedure was implemented in the present study.

Because the causal relations between psychosocial distress and the sleep quality measures were presumed to be reciprocal rather than unidirectional, the sleep quality measures were statistically controlled for just the baseline levels of general psychosocial distress. It could not be presumed that subsequent changes in psychosocial distress were causally prior to sleep quality because sleep disturbance has been found to be a significant predictor of psychological distress [34].

Thus, any effects of our model predictors reported below should be interpreted as estimating the direct effects of the model predictors on the other outcome variables when any indirect effects mediated through the general distress factor have been statistically controlled. The total effect of each predictor would be computed as the sum of these direct effects with the indirect effects that might be mediated by general distress. For example, as reported in the previous paper [32], significant between-group baseline differences were found in the general distress factor. However, control-

ling for initial differences in general distress, no significant between-group baseline differences were found in any of the sleep outcome measures. This does not necessarily mean that no such differences were observed in other outcome measures, but instead that no differences were found that were not attributable to the baseline between-group differences in general distress.

Results

Participant attrition and adherence

Sixty-three women were randomized to either the MBSR or the FC condition (32 FC, 31 MBSR). One woman dropped from the FC condition before baseline assessment and before the study period began due to family constraints. One woman dropped from the MBSR condition before the study period began due to recurrence of her cancer. Fifty-four (86%) of the participants completed post-assessment data (28 FC, 26 MBSR). Forty-one (65%) completed the 3-month follow-up assessment (23 FC, 18 MBSR). Forty-nine (78%) completed the 9-month follow-up assessment (27 FC, 22 MBSR). Of the 30 women who began the MBSR program, 26 (84%) completed at least 4 of the 7 sessions and 24 (80%) completed 5 or more.

Sleep complaints

The average baseline sleep diary measures were 0.88 sleep efficiency, 6 h and 53 min total sleep and ratings of 6.1 out of 10 for feeling rested, and 6.6 out of 10 for quality of sleep. These baseline measures indicate a mild to moderate sleep problem.

Multiple regressions

Table 1 displays the coding for the different study variables used in the regression models. Tables 2–4 display the complete statistical results for the three hierarchical split-plot multiple regression models estimated, in the order in which each of the successive terms was tested. Individual subject characteristics (from BASELINE to SUSOCIAL) were tested as between-subjects factors; both the linear and quadratic effects of time (entered as continuous variables), as well as the interactions of these with all of the between-subjects factors, were tested as within-subjects factors. A significant interaction of a between-subjects factor with either the linear or quadratic effect of time indicates a significant difference in the time rate of change or acceleration on that variable for subjects having higher values on the individual or group characteristic indicated by the between-subjects factor.

Table 1
Key for predictor terms

BASELINE = baseline distress
GENERAL = general distress
ANXDEP = history of anxiety, depression, or both
AGE = age at entry of study
PARTNER = married or significant other
CHILDREN = number of children
MINORITY = member of a minority group
MOSLATX = number of months since last treatment
GROUP = experimental versus control group assignment
MBSRFREQ = average number of times per week of MBSR practice
MBSRDURA = average minutes per week of MBSR practice
MBSRFREE = average times per week of informal practice
SUINDIVI = average minutes/week of individual stress management
SUSOCIAL = average minutes/week of social stress management
T1 = linear effect of time
T1*T2 = the quadratic effect of time

Table 2
General linear model for sleep refresh

Predictor	*df*	*F*-value	Pr > *F*
BASELINE	1,34	15.25	0.001
ANXDEP	1,34	0.00	0.980
AGE	1,34	0.06	0.811
PARTNER	1,34	1.62	0.212
CHILDREN	1,34	0.44	0.514
MINORITY	1,34	0.30	0.585
MOSLATX	1,34	0.13	0.720
GROUP	1,34	0.20	0.658
MBSRFREQ	1,34	0.11	0.737
MBSRDURA	1,34	0.01	0.930
MBSRFREE	1,34	0.28	0.600
SUINDIVI	1,34	0.20	0.655
SUSOCIAL	1,34	0.81	0.374
T1	1,35	4.36	0.044
ANXDEP*T1	1,35	0.03	0.854
AGE*T1	1,35	2.46	0.126
PARTNER*T1	1,35	1.17	0.287
CHILDREN*T1	1,35	0.07	0.788
MINORITY*T1	1,35	0.05	0.829
MOSLATX*T1	1,35	0.24	0.630
GROUP*T1	1,35	0.44	0.513
MBSRFREQ*T1	1,35	0.93	0.340
MBSRDURA*T1	1,35	0.57	0.455
MBSRFREE*T1	1,35	7.02	0.012
SUINDIVI*T1	1,35	0.00	0.979
SUSOCIAL*T1	1,35	0.06	0.806
T1*T2	1,34	10.56	0.003
ANXDEP*T1*T2	1,34	0.07	0.798
AGE*T1*T2	1,34	6.55	0.015
PARTNER*T1*T2	1,34	1.80	0.189
CHILDREN*T1*T2	1,34	0.00	0.979
MINORITY*T1*T2	1,34	2.08	0.158
MOSLATX*T1*T2	1,34	0.24	0.627
GROUP*T1*T2	1,34	0.52	0.475
MBSRFREQ*T1*T2	1,34	2.16	0.151
MBSRDURA*T1*T2	1,34	0.06	0.812
MBSRFREE*T1*T2	1,34	8.37	0.007
SUINDIVI*T1*T2	1,34	1.67	0.205
SUSOCIAL*T1*T2	1,34	0.00	0.983

Outcomes of study hypotheses

When this pattern of results is compared with the three original study hypotheses, the following major findings emerge.

Table 3
General linear model for sleep efficiency

Predictor	*df*	*F*-value	Pr>*F*
BASELINE	1,34	0.35	0.560
ANXDEP	1,34	1.58	0.218
AGE	1,34	1.07	0.308
PARTNER	1,34	1.16	0.288
CHILDREN	1,34	0.40	0.531
MINORITY	1,34	0.28	0.601
MOSLATX	1,34	6.28	0.017
GROUP	1,34	0.29	0.595
MBSRFREQ	1,34	0.19	0.662
MBSRDURA	1,34	0.00	0.960
MBSRFREE	1,34	0.28	0.603
SUINDIVI	1,34	2.06	0.161
SUSOCIAL	1,34	1.28	0.266
T1	1,34	0.00	0.986
ANXDEP*T1	1,34	0.06	0.808
AGE*T1	1,34	1.14	0.293
PARTNER*T1	1,34	1.71	0.200
CHILDREN*T1	1,34	0.16	0.691
MINORITY*T1	1,34	0.06	0.806
MOSLATX*T1	1,34	0.27	0.608
GROUP*T1	1,34	0.01	0.929
MBSRFREQ*T1	1,34	0.21	0.648
MBSRDURA*T1	1,34	0.00	0.965
MBSRFREE*T1	1,34	0.00	0.974
SUINDIVI*T1	1,34	0.21	0.648
SUSOCIAL*T1	1,34	0.44	0.510
T1*T2	1,33	7.39	0.010
ANXDEP*T1*T2	1,33	1.98	0.169
AGE*T1*T2	1,33	0.15	0.701
PARTNER*T1*T2	1,33	0.01	0.927
CHILDREN*T1*T2	1,33	0.08	0.775
MINORITY*T1*T2	1,33	0.50	0.484
MOSLATX*T1*T2	1,33	4.64	0.039
GROUP*T1*T2	1,33	2.13	0.154
MBSRFREQ*T1*T2	1,33	0.96	0.335
MBSRDURA*T1*T2	1,33	0.88	0.354
MBSRFREE*T1*T2	1,33	0.39	0.535
SUINDIVI*T1*T2	1,33	0.45	0.509
SUSOCIAL*T1*T2	1,33	1.61	0.214

Hypothesis 1: Sleep efficiency was not significantly related to baseline distress. However, participants with greater baseline distress had *significantly lower* ($\beta = -.327$) average levels of sleep quality regardless of experimental condition. This means that participants with higher baseline distress levels reported lower sleep quality on average over the entire study period than those who had lower baseline distress scores. Furthermore, participants with greater baseline distress had *significantly lower* ($\beta = -.447$) average levels of feeling refreshed after sleep, regardless of experimental vs. control condition. This means that participants with higher baseline distress levels reported less feelings of being refreshed after sleep on average over the entire study period than those who had lower baseline distress scores.

Hypothesis 2: The linear main effect of time on sleep efficiency was nonsignificant. This indicated that, although on average there was a small amount of improvement in sleep efficiency after controlling for baseline distress, it was not significant, regardless of experimental condition. The mean sleep efficiency across both conditions was 0.890 at baseline and 0.915 after treatment. The linear main effect of time on degree of sleep quality was also nonsignificant. This indicated that sleep quality did not improve significantly when baseline distress was controlled, nor were there differences between experimental conditions. However, when baseline distress was controlled, the linear main effect of time on degree of feeling rested after sleep was *significant and negative* ($\beta = -1.678$). This indicated, on average, feelings of being refreshed decreased over time for most subjects, regardless of experimental condition.

Hypothesis 3: Sleep efficiency was not significantly related to amount of mindfulness practice. There was also no significant relationship between sleep quality and amount of mindfulness practice. Furthermore, within the MBSR group participants who practiced the informal mindfulness practices (bringing mindful awareness to routine daily activities) more did not have significantly lower average levels of feeling refreshed. This indicates

Table 4
General linear model for sleep quality

Predictor	*df*	*F*-value	Pr>*F*
BASELINE	1,34	9.70	0.004
ANXDEP	1,34	1.40	0.244
AGE	1,34	0.29	0.593
PARTNER	1,34	3.04	0.090
CHILDREN	1,34	2.47	0.125
MINORITY	1,34	0.15	0.696
MOSLATX	1,34	0.26	0.616
GROUP	1,34	0.37	0.545
MBSRFREQ	1,34	0.00	0.953
MBSRDURA	1,34	0.00	0.948
MBSRFREE	1,34	0.36	0.551
SUINDIVI	1,34	0.11	0.737
SUSOCIAL	1,34	2.18	0.149
T1	1,35	0.95	0.337
ANXDEP*T1	1,35	0.01	0.919
AGE*T1	1,35	0.00	0.981
PARTNER*T1	1,35	0.51	0.479
CHILDREN*T1	1,35	0.01	0.930
MINORITY*T1	1,35	0.26	0.615
MOSLATX*T1	1,35	0.95	0.336
GROUP*T1	1,35	0.58	0.451
MBSRFREQ*T1	1,35	0.30	0.587
MBSRDURA*T1	1,35	0.18	0.673
MBSRFREE*T1	1,35	0.01	0.940
SUINDIVI*T1	1,35	3.55	0.068
SUSOCIAL*T1	1,35	0.15	0.698
T1*T2	1,34	5.03	0.032
ANXDEP*T1*T2	1,34	0.00	0.969
AGE*T1*T2	1,34	0.95	0.336
PARTNER*T1*T2	1,34	0.12	0.735
CHILDREN*T1*T2	1,34	0.59	0.448
MINORITY*T1*T2	1,34	0.36	0.551
MOSLATX*T1*T2	1,34	0.01	0.908
GROUP*T1*T2	1,34	0.11	0.745
MBSRFREQ*T1*T2	1,34	0.26	0.616
MBSRDURA*T1*T2	1,34	0.04	0.845
MBSRFREE*T1*T2	1,34	1.23	0.275
SUINDIVI*T1*T2	1,34	0.02	0.899
SUSOCIAL*T1*T2	1,34	0.35	0.557

that there were no appreciable differences in average distress between those who practiced more compared to those who practiced less. However, the interaction of informal mindfulness practice with time was *significant and positive* (β=+.339). This indicated that informal mindfulness practice increased feelings of being rested over time.

Discussion

The three principle hypothesis of the current study predicted that (1) sleep functioning would be associated with psychological distress; (2) participants in the MBSR condition would demonstrate enhanced sleep functioning compared to the FC control condition; and (3) participants who practiced mindfulness meditation more would demonstrate significantly greater improvement. Our first hypothesis was confirmed. The data indicated that regardless of experimental condition, participants with greater psychological distress reported significantly decreased sleep quality on both sleep diary ratings. This finding supports previous research that insomnia is frequently associated with anxiety and depression [35]. However, no relationship was found between distress and sleep efficiency. These results are consistent with findings from the trauma literature in which stress was more related to general subjective measures such as the ratings of quality of sleep in the present study, than to highly specific sleep variables [13]. Our second hypothesis was not confirmed as we found no between group differences on any of the sleep measures. Both MBSR and the FC interventions produced improvement on the sleep quality measures, but not on sleep efficiency. In this study, the MBSR intervention was focused specifically on stress reduction and did not address sleep. Therefore, the extent to which there were improvements in sleep were the fortuitous consequences of helping the participants cope with stress more effectively. Interestingly, the supposed ''control'' condition produced the same changes in sleep quality as did MBSR. The FC control condition in retrospect had many active treatment features. These included frequent contact with friendly, empathic study personnel to complete all assessment measures and a rationale for participation that emphasized independence (''FC''). Alternative explanations for the observed improvements in sleep quality include general time-related improvements and nonspecific treatment effects associated with participation in the research study.

There was an important difference between the two conditions with respect to the role of outside practice on improvement. Our third hypothesis, that greater mindfulness practice would predict greater improvement was partially confirmed. Although being assigned to the MBSR did not in itself affect significant improvement, *practicing* the mindfulness techniques did. Participants in the MBSR group who engaged in more mindfulness practice reported greater feelings of being refreshed after sleep. Similar analyses were done for adherence to stress management activities (e.g., exercise, talking to a friend) for the FC condition and none were significant. This suggests that practicing mindfulness has a specific therapeutic effect that is not found by just attending the intervention.

This is a critical finding, suggesting that the mindfulness techniques are indeed beneficial; however, they must be practiced to have an effect. In spite of the fact that adherence was required for a significant treatment effect, the average rates of mindfulness practice, measured in weekly minutes, were relatively low. Even at peak compliance, the mean weekly rates translated into an average of 5 min of daily practice. This is below what is recommended for the optimal effectiveness of this technique. We can only speculate what the effect size of the MBSR treatment might have been had people actually adhered to the full treatment protocol and practiced closer to 30 min/day.

These findings have important implications for treatment in the real world. Randomly assigning people to a treatment condition, although desirable for the purpose of internal validity of causal inference, has disadvantages in terms of external validity. Because under real-world conditions, people normally self-select into treatment modalities that they find most suitable. If a participant is not willing or motivated to make the time to practice mindfulness, the intervention may not be effective. This finding points toward the importance of screening potential participants for MBSR treatment. Similar findings have been reported in other areas of clinical research. For example, in a recent study of a residential treatment program for homeless alcoholics, it was found that a scale measuring motivation, readiness, and suitability for treatment was a significant predictor of retention in and compliance with the rehabilitation program, and indirectly led to superior treatment outcomes for those clients that were sufficiently high on willingness to change [19].

Further, even if participants' are screened, and only the motivated and committed are given treatment, MBSR participants may require more time, attention and practice to successfully implement mindfulness practice into their daily lives. Booster sessions as well as increased time devoted to the importance of practice during the actual treatment sessions may increase the amount of practice.

Directions for future research

The current findings suggest the need for future research into the effects of MBSR on enhancing sleep for women with breast cancer. Although the findings of the present study did not confirm all of the original hypotheses, they do provide an initial step toward determining effective adjunctive treatments to enhance sleep for women with breast cancer. It is hoped that the findings of the present study will lead toward advancing the research program on sleep interventions for women with breast cancer.

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