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REVIEW ARTICLE

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Mindfulness-Based Stress Reduction (MBSR) in Oncology

Rationale and Review

Michael J. Mackenzie,[1] *Linda E. Carlson*[1,2] and *Michael Speca*[1,2]

1 Department of Psychosocial Resources, Tom Baker Cancer Centre, Calgary, Alberta, Canada
2 Department of Oncology, University of Calgary, Calgary, Alberta, Canada

Contents

Abstract

The use of mindfulness-based stress reduction (MBSR) programmes has become increasingly common in many healthcare settings over the last decade. However, the use and indications for MBSR in an oncology setting has not been well explicated. This paper provides an overview of the psychosocial challenges of cancer diagnosis, treatment and recovery, followed by a description of how MBSR programs have and may be used with cancer populations. Existing research examining MBSR use with cancer populations is reviewed, and a discussion of further areas of research enquiry explored.

((Author: please reword your abstract so that it highlights, in an informative manner, specific important points addressed in the main body of the text rather than just describing the general areas covered in the manuscript. The journal style is to not cite references in the abstract so as to provide a discrete synopsis of the article. Thank you))

((Author: please read the entire manuscript carefully to ensure that accuracy has been maintained during editing. In particular, please ensure that all bolded text amendments/ additions are correct. Thank you))

It is well recognised that the diagnosis and subsequent treatment of cancer is an emotionally debilitating experience for many patients and their families.[1,2] Within the population of cancer patients, there is a growing interest in complementary therapies that stems from a desire to be proactive and take initiative in

personal care.[3,4] Of the complementary therapies, methods of promoting relaxation to regulate arousal and reduce distress, including mindfulness-based stress reduction (MBSR), have demonstrated some utility.[5,6]

Mindfulness has been described as non-elaborative, present-centred awareness in which each thought, feeling and/or sensation that arises in the attentional field is acknowledged and accepted non-judgementally as it is. The most frequently cited method of mindfulness training in clinical populations is the MBSR programme.[7,8] The MBSR programme was developed by Kabat-Zinn and colleagues **((Author: the cited reference and the next sentence only lists Kabat-Zinn – is 'and colleagues' here correct?))** in a behavioural medicine setting for populations with a wide range of chronic pain and stress-related disorders at the Stress Reduction Clinic of the University of Massachusetts Medical Centre **(Worcester, MA, USA) ((Author: please confirm that the added location details are correct))**.[8] In designing the programme, Kabat-Zinn[8] integrated mindfulness meditation and gentle Hatha yoga into a secular programme that could be taught to people with no previous meditation experience **who are** facing a variety of health issues.

1. Mindfulness-Based Stress Reduction (MBSR) in an Oncology Setting

Standard cancer treatments, which include surgery, radiotherapy, chemotherapy and hormone therapy, are designed to remove or kill tumour cells. Oncologists and other healthcare providers may also recommend treatment aimed at overall improvement of health and well-being.[4,9] Considering the high degree of emotional distress following a cancer diagnosis,[1] and the efficacy of MBSR in other medical populations,[10,11] it seemed logical to offer the MBSR programme to cancer patients at the Tom Baker Cancer Centre (TBCC) **[Calgary, Alberta, Canada] ((Author: please confirm that the added location details are correct))**.

The TBCC programme was modelled on the MBSR program at the Stress Reduction Clinic at the **University of** Massachusetts Medical Centre, as described by Kabat-Zinn.[8] Facilitators refer to Kabat-Zinn's *Full Catstrophe Living: **Using the Wisdom of Your Body and Mind to Face Stress, Pain and Illness***[8] and the *Mindfulness-Based Stress Reduction Professional Training Resource Manual* developed by Kabat-Zinn and Santorelli[12] as templates for the treatment protocol. In designing the TBCC MBSR programme for a cancer population, course content and structure were altered to reflect the life trajectories of participants.[13] Providing an MBSR intervention in an oncology setting also required familiarity with the special issues involved in therapy **for** cancer patients, including types of neoplasms, stages of disease, treatments available for each type of cancer,[14] as well as sensitivity about the limitations that may result, both physically and mentally, from these issues. Details of the TBCC MBSR intervention, including objectives, structure, components and content have previously been described.[6]

2. MBSR Research with Cancer Populations

Clinical treatment and wellness programmes based on MBSR have grown in number. Miller **et al.**[15] reported **that** training in mindfulness is related to positive psychological and physical well-being outcomes in a number of clinical populations. Mindfulness-based programmes have shown effectiveness as complementary treatment in trials involving patients **with** medical conditions including chronic pain, fibromyalgia, anxiety and panic disorders, psoriasis, depression **and** cancer**, and in** heterogeneous patient populations **((Author: rewording ok?))**.[11] In each instance, mindfulness meditation has been conceptualised as a form of stress management.[16]

In a 2002 review, Bishop[11] cautions that much published research in this area has been uncontrolled. Additionally, methodological problems including inappropriate or inadequate use of statistics, failure to control for concurrent treatments that might affect outcome variables, and arbitrary determination of clinical response are sometimes present. Overall, evidence does suggest MBSR is an effective approach; however, there is still a great deal to be **learnt** about this treatment modality. More serious investigation is warranted and strongly recommended.[11]

2.1 MBSR and Symptoms of Stress/Mood Disturbance in Cancer Outpatients

The objective of the randomised controlled trial conducted by Speca et al.[6] in 2000 **((Author: rewording ok?))** was to assess the effects of participation in a MBSR programme on symptoms of stress and mood disturbance in cancer outpatients, as measured by the Symptoms of Stress Inventory (SOSI)[17] and Profile of Mood States (POMS).[18] Patients' scores significantly decreased pre- to post-intervention, indicating less mood disturbance and fewer symptoms of stress. Changes in the wait-list control participants over this time period were minimal. More **((Author: ok to reword to "A higher level of"?))** home practice was associated with improvements in stress levels and total mood disturbance. Better attendance was also associated with greater decreases in stress symptoms, perhaps by allowing participants to benefit from the presence of others who were role-models of good coping and stress-reduction skills.[6]

Carlson et al.'s 2001 follow-up study[5] longitudinally followed a group of patients who completed the MBSR programme as part

of the previous randomised clinical trial, including follow-up for both the intervention and wait-list control groups. Here researchers **((Author: reword to "Carlson et al.'s study"?))** reported the findings of the 6-month follow-up assessment. **Patient** scores again significantly decreased, indicating less mood disturbance and fewer symptoms of stress. These improvements were maintained at the 6-month follow-up. This occurred in a diverse population of cancer outpatients with a variety of diagnoses and stages across a wide spectrum of ages for both **sexes**.[5]

2.2 Meditation, Hormones and Cancer

In a 1995 study, Massion and colleagues[19] tested the hypothesis that regular practice of mindfulness meditation is associated with increased physiological levels of the pineal hormone melatonin, which may be related to a variety of **biological** functions important in maintaining health and preventing disease, including breast and prostate cancer. Study results indicated **that** there was an effect for the women who meditated regularly. These results were consistent with the authors' hypothesis that the practice of meditation is associated with increased levels of melatonin.[19] Similarly, healthy consistent meditators **((Author: ok to reword to "Similarly, healthy people who regularly meditate"?))** produced higher levels of melatonin after a night-time meditation session than on a control night when they did not practice meditation.[20]

In light of these findings, the relevance of research implicating melatonin as potentially important in cancer incidence and progression is striking. Indeed, several clinical trials of melatonin administration found superior survival response in patients with advanced cancer[21] **ss well as a** higher tolerance of standard chemotherapy regimens **((Author: does this point relate to advanced cancer also?))**.[22] A recent review in the *Journal of Clinical Oncology* concluded that converging evidence points to antioxidant and oncostatic actions of melatonin and provides **the** rationale for large transnational research-based clinical trials of melatonin therapy for a wide variety of cancers.[23] Thus, the demonstration of the effects of meditation on melatonin may point to a natural way to modify this potentially important factor.

Another hormone of interest is the adrenally secreted stress hormone cortisol, which is regulated by the hypothalamic-pituitary-adrenal (HPA) axis. Cortisol levels have been identified as elevated in breast cancer patients,[24] and such abnormalities in diurnal cortisol secretion have prognostic value in predicting initial occurrences of breast cancer[25] and long-term survival in metastatic breast cancer patients.[26] Indeed, abnormal patterns of cortisol secretion have been reported in up to 75% of a sample of metastatic breast and ovarian cancer patients.[27] Decreases in cortisol levels have been reported in healthy subjects after meditation in several studies.[28]

A recent report by Carlson et al.[29] investigated the relationships between MBSR and levels of cortisol, dehydroepiandrosterone-sulfate (**DHEA-S; PB-008**) **((Author: please note that the abbreviation DHEAS has been changed to DHEA-S as per our house style. Please also confirm that the addition of "PB-008" as an alternative name for DHEA-S is correct. Thank you))** and melatonin in breast and prostate cancer patients. Improvements in quality of life were associated with decreases in afternoon cortisol levels, but not with morning or evening levels. Diurnal cortisol secretion patterns changed in that more extreme levels were attenuated, and patterns of secretion indicated a shift towards possibly healthier HPA axis functioning. No overall changes in DHEA-S or melatonin were found but nonsignificant shifts in DHEA-S patterns were consistent with healthier profiles for both men and women. The methodology of the melatonin assessment was not optimal in this study and, hence, further research into the effects of meditation on melatonin in cancer patients is warranted.

2.3 MBSR and Immune Function in Cancer Patients

The practice of meditation has been associated with immunological effects.[30,31] These findings are related to the field of psychoneuroimmunology. Interventions that alter the stress response are expected to be associated with characteristic and corresponding modifications in **psychoneuroimmunology** function.[32,33] **The 2003 study by Carlson et al.**[34] investigated relationships between an MBSR programme for early stage breast and prostate cancer patients and quality of life, mood states, stress symptoms, lymphocyte counts and cytokine production.

Significant improvements were seen in overall quality of life as measured by the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ C30),[35] **SOSI** and **POMS ((Author: rewording ok?))**. Although there were no significant changes in the overall number of lymphocytes or cell subsets, the changes in the immune profiles of these patients were consistent with a shift away from a depressive pattern to one more consistent with healthy immune function. This study was also the first to show changes in cancer-related cytokine production associated with programme participation.[34]

2.4 MBSR and Sleep Disturbance

Sleep disturbance is very common in cancer patients, with over 50% **having** symptoms of insomnia.[36] In a preliminary study, it was found that 40.7% of a sample of breast and prostate cancer patients initially reported sleep of poor quality.**((Author: cite reference**[34] **here?))** After completion of the MBSR programme,

this number improved dramatically with only 20% of the sample reporting poor-quality sleep and the remaining 80% reporting adequate or good sleep quality.[34] In another mixed group of cancer patients, Carlson **and Garland**[37] found a very high proportion with disordered sleep (approximately 85%). In this group, sleep disturbance was closely associated with levels of self-reported stress and mood disturbance, and sleep also improved dramatically when stress symptoms declined over the course of the MBSR programme **((Author: rewording ok?))**.[37] Shapiro and colleagues[38] also examined the efficacy of an MBSR intervention for women with breast cancer, specifically the effects of sleep complaints.[38] The authors hypothesised **that** MBSR would help reduce psychological distress, increase **the** ability to monitor negative cognitions and, thereby, decrease sleep disturbance. Analyses of the data indicated participation in the MBSR programme produced significant improvement on daily diary sleep quality measures but did not show significant improvement on sleep efficiency. Participants who reported greater mindfulness practice improved significantly more on the sleep quality measure most strongly associated with distress. The authors concluded that MBSR appears to be a promising intervention **for improving** the quality of sleep in woman with breast cancer whose sleep complaints are due to stress.

2.5 MBSR, Diet and Prostate Cancer

Epidemiological and laboratory evidence indicate that a Western diet is associated with an increased incidence of prostate cancer. Specific components of the diet, such as high saturated fat, low fibre and high meat content, may have clinical significance in the later stages of tumour promotion and progression. However, departure from the conventional North American **((Author: Western?))** diet is difficult to initiate and maintain. In the 2001 study by Saxe et al.,[39] the MBSR programme was combined with a low saturated fat, high-fibre, plant-based diet to determine the effect on the rate of change in prostate-specific antigen (PSA) in patients with biochemical recurrence after prostatectomy. This pilot study provided evidence that dietary change combined with mindfulness training significantly slowed the rate of increase in PSA in these men.[39] Whether the decrease was associated with the dietary changes or the MBSR practice is not currently known.

2.6 Mindfulness Scale Validation

Despite the growing body of clinical research **on** the use of MBSR there has, until recently, been no measure of the mindfulness construct and, subsequently, no way to assess whether MBSR interventions actually facilitate change in this quality of consciousness.[11,40] The 2003 study by Brown and Ryan[41] sought to develop a scale to measure mindfulness and its role in psychological well-being. The results of a clinical intervention study, as part of the overall scale validation, showed that higher levels of mindfulness were related to lower levels of both mood disturbance and stress before and after the MBSR intervention in a group of 58 cancer patients with mixed diagnoses. These results suggest that the Mindful Attention Awareness Scale (MAAS) **((Author: please confirm that we have correctly defined MAAS))** can reliably be applied to the study of well-being in cancer populations.[41]

Brown and Ryan[41] were able to demonstrate **that** changes in MAAS-measured mindfulness pre- to post-intervention were related to declines in mood disturbance and stress in a small sample of cancer patients in an MBSR programme. However, the MAAS was formally validated in non-clinical populations only. This left open the question as to whether MAAS-assessed mindfulness in clinical populations is comparable with that found in the populations in which the instrument was validated. This issue is important given the recognised need for a valid measure of mindfulness for use in clinical MBSR and related research.

Carlson and Brown[42] examined the MAAS in cancer outpatients, using matched community members as controls.[42] Higher MAAS scores were associated with lower mood disturbance and stress symptoms in cancer patients. The relationship found between these variables suggests lower levels of psychological well-being may be due, in part, to lower levels of mindfulness in both cancer and general populations. The MAAS appeared to have appropriate application in research examining the role of mindfulness in the psychological well-being of cancer patients, with or without comparisons to non-clinical controls.

3. Discussion and Future Research

Examining the use of the MBSR programme in the treatment of cancer patients points to the complex nature of the relationships between psychosocial factors and disease. In general, future research must incorporate methodological components that have become standards in the field. These include adequate control groups, sufficient power to detect treatment effects and consideration of clinical significance of findings.[40] **Sections 3.1 to 3.4 are** a discussion of additional areas that need to be considered within the broader context of MBSR research.

3.1 Patient Screening

Meditation practice is a rigorous and demanding discipline and, as it calls on the practitioner to devote time to formal practice daily and to the equally challenging task of incorporating the practice into everyday life, learning meditation under crisis conditions may

be difficult. The timing and context in which meditation is offered to cancer patients are extremely important in order to maximise the receptivity of patients who might benefit from its practice. Both provider and patient need to explore the appropriateness of the intervention, the degree of involvement it might require, and the potential benefits and costs associated with the approach. For some, meditation may be most helpful when treatments have ended and the patient is attempting to return to normal activities as a 'survivor' and to change **their** lifestyle to promote health.[43]

It will be important in future research to incorporate a more comprehensive screening protocol to determine programme suitability **((Author: reword to "… to determine the most suitable programme for each patient"?))**. Knowledge about levels of affective state and coping at baseline are essential for identifying and tailoring interventions to meet specific needs.[44,45] Healthcare professionals need to recognise the diverse needs of patients at different phases of their disease process to better meet the needs of patients with a cancer diagnosis.[46,47] Increased knowledge of psychosocial needs and coping difficulties would allow the precise targeting of psychosocial interventions to improve the quality of life of patients with cancer.[48]

There are also important questions concerning who might benefit from an MBSR programme. Pre-existing personality traits may influence recruitment, compliance and the ability to use meditation to ease stress and mood symptoms.[11] The effectiveness of the MBSR programme is likely to depend, at least in part, on how useful patients find the particular techniques within the programme structure. In all likelihood, the most useful aspects will vary from person to person depending on individual needs, background and personality.[49] Kabat-Zinn and colleagues'[49] **1997 study** concerning cognitive/somatic orientation in patients with anxiety disorders and their preference for different meditation techniques provides a beginning process of analysis in determining which components of the programme may be most useful within any given subgroup. Knowledge of these factors may help optimise MBSR programme adherence.

3.2 Dismantling Studies

Promising initial data suggests a need for basic research in order to determine active ingredients and mechanisms of action in mindfulness-based interventions.[50] In a multifaceted intervention it is difficult to isolate the mechanisms of action or specific techniques that may account for improvements. Whether the most effective components of the MBSR programme are meditation, yoga, social support, group processes, professional attention or other factors remain unknown.

Future research may be beneficially applied to pinpointing the most effective aspects of the intervention and helping to distinguish its effects from other programmes utilising similar techniques. However, based on cumulative evidence, it has been argued **that the variance** due to treatment differences among psychosocial treatments **is** small, that it is difficult if not impossible to identify specific programme elements that mediate outcomes and that such efforts are misdirected.[51] Even if efficacy research could establish the efficacy of specific elements of therapy, there is little reason to believe one set of specific elements is superior to another.[51] Indeed, the conclusions many psychotherapy researchers have reached after decades of process research is that "all have won and all must have prizes". Whether the same applies to the MBSR intervention remains to be investigated.

3.3 MBSR Facilitator Training

In the studies of mindfulness reported to date, none have included information about therapist training or measures of treatment fidelity.[10] This lack of attention underscores an area of controversy in the field; namely, how does the field train therapists to deliver mindfulness interventions competently?[10,40] Indeed, whether or not it is even necessary to have therapists who maintain their own practice or have received formal MBSR teacher training remains an open question, although some senior practitioners feel it is necessary.[52] Issues of training specific to delivery of MBSR in oncology settings have also not been investigated. For example, studies could investigate **((Author: ok to reword to "For example, a future area of study could be the investigation of…"?))** the usefulness of modifications of the model thought to be necessary to address cancer patients' specific needs.

3.4 Qualitative Research

Despite several studies, the linkages between empirical data suggesting that MBSR is an effective approach for working with cancer patients and the self-perceived effects of meditation by cancer patients are yet to be determined. What is now needed is an exploration of how meditation practice influences patients' lives and mediates their ability to work **((Author: 'live' or 'function' rather than 'work'?))** with their illness. Increased knowledge of patients' beliefs would inform the understanding of how to encourage positive lifestyle changes and reframe disease management in meaningful ways that give a greater sense of personal control.[53]

Social scientists and patient interest groups are now encouraging funding bodies involved in oncology research to give greater consideration to qualitative research, in part so that patients' opinions and experiences can be heard.[54] To take the opportunity

to explore patients' lived **((Author: ok to delete 'lived'?))** experience of meditation and how they have integrated it into their lives would provide useful information that could dictate potential future directions for research.[55] The self-perceptions and experiences of the patients would also contribute to the discourse on meditation in healthcare and the generation of theory.[55]

4. Summary

The desire to regain control after diagnosis with a chronic life-threatening illness such as cancer has been demonstrated to facilitate adaptation to illness. When patients feel some degree of control in their lives they interpret their situation as less threatening and, consequently, less stressful.[56] Mindfulness emphasises bringing awareness to all aspects of life experience, including physical illness, emotional turbulence and the activities of everyday living.[43] MBSR programmes allow patients to harness their experiences of unpleasant events, enabling them to develop a sense of greater control in the face of life's difficulties. In this context, cancer becomes an event rather than the defining characteristic of the patient.[57] The MBSR programme provides not only an efficacious treatment for distress but **also fits** within the patient's own framework of positive health behaviour **((Author: rewording ok?))**.[8]

Additionally, as part of an MBSR group, individuals have an opportunity to express personal feelings about their illness and share experiences regarding meditation practice. Emphasis is placed on living more fully in each moment and garnering supportive experiences from others regarding ways to handle the stresses faced in coping with cancer.[58] There is increasing evidence that patients who come together to gain knowledge about their illness, learn coping skills and/or share their common experiences show improvements in both psychological and physical symptoms.[59] In this capacity, mindfulness training may promote future recognition of early signs of a problem, at a time when application of previously learned skills are most likely to be effective in prevention.[10]

Enthusiasm for group psychosocial interventions, such as the MBSR programme, should be tempered by the recognition that scientific evidence supporting a relationship between psychological factors and cancer is in the developing stages. Although group psychosocial interventions can enhance coping and reduce distress, they are suggested as adjuncts to standard medical care.[43] This type of intervention is not an alternative or independent treatment for cancer or any other illness or disease.[45]

5. Conclusion ((Author: addition of heading here ok?))

The health promotion effects of MBSR appear to complement conventional biomedical treatment in a comprehensive approach to healing and the alleviation of human suffering **((Author: this is a very broad-sweeping statement. Should it be reworded to focus more on the topic of this article, i.e. "…alleviation of suffering in an oncology setting"?))**.[59] The growing presence of MBSR programmes in clinical settings attests to the practical benefits of meditation training and is an increasingly practical option for health providers.[43] These programmes have shown some efficacy as adjunct treatment in trials involving patients **with** many medical conditions, and the support for their use in cancer populations suggest potentially fruitful avenues for possible future research.

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((Author: please provide information, for publication in the acknowledgements section of the manuscript, on any potential conflicts of interest that the authors may have that are directly relevant to the contents of this manuscript.))

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Correspondence and offprints: Dr *Linda E. Carlson*, Department of Psychosocial Resources, ACB Holy Cross Site, 2202 2nd St. SW, Alberta, Calgary, Canada T2S 3C1 **((Author: please confirm that you are happy for us to publish your e-mail address))**.
E-mail: l.carlson@ucalgary.ca